Making a Compost Pile

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What is Composting?

When you come right down to it, finished compost is no more that "rotted" (decomposed) organic matter that has been broken down by microorganisms to provide nutrients and humus to the soil. Composting is a natural process that began with the first plants on earth and has been going on ever since. Composting can be observed in every forest, meadow, swamp, and prairie. The modern practice of *composting is little more than speeding up and intensifying natural processes*. While we can provide recommendations for making compost, keep in mind that no matter what you do, no matter what organic material you use, you can expect to come up with reasonably good usable compost.

Why Compost?

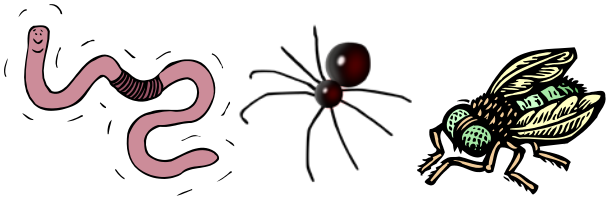
Composting is a way of using organic waste (plant residue, yard waste, animal manure, kitchen scraps, etc.) to create "free fertilizer". Instead of adding waste to landfills, composting results in creating a useful organic soil additive.

How Compost Helps Your Soil

Compost contains macronutrients such as nitrogen, phosphorus, and potassium as well as a variety of micronutrients. As microorganisms in the compost digest the compost, nutrients are released over time for use by the plants. The organic matter binds with soil particles (sand, silt, and clay) to improve soil structure. This improved structure means improved moisture holding capacity and more space for oxygen and root growth. Remember that roots do not grow through soil particles. They grow between particles so the looser the soil the easier it is for roots to grow and develop.

How Decomposition Works

Composting's lowest common denominators are the organisms that make the decomposition possible. Microorganisms (too small for us to see) including bacteria and fungi and macro organisms (large enough for us to see) including earthworms, insects, spiders, and nematodes are the digesting agents in compost. As the organic material is digested or decomposed the locked up nutrients are released.



What Do Compost Organisms Need

Macro and microorganisms need carbon (the energy source), nitrogen (a protein source), oxygen, and moisture. Carbon materials are plant materials like plant residue, leaves, straw, sawdust, corn/maize stalks, etc. Bulky plant material provides the food source for the microorganisms. Nitrogen sources serve as the protein source to help microorganisms break down the carbon material. Oxygen is needed to allow aerobic bacteria to grow and release energy while breaking down carbon compounds into carbon dioxide and water.

Moisture is also important in the decomposition process. Too little moisture slows decomposition and too much forces out the air, suffocating aerobic bacteria. Macro organisms such as earthworms, mites, grubs, and insects help the bacteria by ingesting and chewing the compost material into smaller pieces. The increased surface area helps the microbes as they continue the digestion process. Earthworm casings and excrement also add to the nutrients in the compost.

Composting Procedure

Let the organic matter that is available in your area guide you as you begin your composting experience. The ideal compost pile size is two meters x two meters x two meters. The minimum suggested size is one meter x one meter x one meter. A round compost bin can be made using wire fencing fastened to metal fence posts. A square bin can be made using shipping pallets covered with chicken wire. Carbon sources (plant material, preferably green), nitrogen sources (animal manure or legume plants), water, oxygen, warm temperatures, pressure provided by the weight of soil, and microorganisms are needed to make compost. The greater the variety of things in your compost pile, the better. The greater variety is likely

to result in more types of microorganisms and a balance of available nutrients. Also remember that a compost pile smaller than one meter x one meter x one meter will lack the mass and weight needed for the composting process to move forward.

Steps:

1. Foundation layer: start with a 15 to 20 cm (6” to 8”) layer of coarse material such as maize stalks, maize cobs, or small branches to allow oxygen to enter the bottom of the compost pile. If a shipping pallet is used on the bottom it becomes the foundation layer.

2. Veneer layer: a floor layer of material such as banana leaves, cabbage leaves, or newspapers that will keep fine material from blocking the air inlet in the foundation layer.

3. Next add 25 cm (10”) of green vegetation (carbon source) such as plant residue, dried grass, leaves, or anything that grows, and then water the layer with a hose or sprinkler can.

4. Add a 5 cm (2”) layer of a nitrogen source such as animal manure or legume plants. This layer is the fuel that gets the bacterial action going and starts the decomposition process.

5. Add a 5 cm (2”) layer of soil or termite mound to provide weight and pressure and a source of microorganisms to the compost pile.

6. Adding a layer of kitchen scraps, ashes, eggshells, etc. at any place in the compost heap will further enhance the inoculation of bacterial action in the compost heap. Do not use animal parts, blood, or animal fat as they will attract rodents and other animals**.**

7. Water each layer to moisten it as it is added to the compost pile.

8. Continue alternating layers of carbon and nitrogen sources until the heap is the desired height. Remember that soil layers will provide additional

bacteria and nitrogen as well as weighting down the compost pile.

Finish by mulching the top of the compost pile with dried plant material (maize stalks, grass, etc.).

9. The middle of the compost heap is where the greatest activity occurs and where the first compost will be ready to harvest. The temperature in the middle of the pile will reach 150 degrees F or 65 degrees C. The decomposition rate is affected by temperature, moisture, size and type of vegetation, and how often the pile is mixed or turned. Warm moist compost piles decompose quicker. Chopping plant material or running it through a shedder speeds up decomposition. The more often you turn the compost pile, the quicker it decomposes. Compost barrels may be turned every day. Most people will not take the time to turn the pile more than once every 2 to 4 weeks. A compost pile not turned at all will decompose in a year's time. Rather than harvest the entire compost pile at once, some people will harvest the middle of the compost heap and re-build the pile. If it doesn't rain, watering the pile once a week will

speed the decomposition. The compost that you harvest is sometimes called "black gold" because of its color and value in raising plants. Mature compost is loose, easily worked, and contains the nutrients that plants need. It holds needed moisture while at the same time allowing excess water to drain through the soil.

10. Farming God's Way Trainer's Reference Guide author Grant Dryden recommends turning the compost pile at three day intervals three times and then turning the pile four or five times at 10 day intervals. While the turning process is complete in two months, Dryden suggests allowing the compost to cure another four months prior to use. Good compost will be dark brown or black with crumbly structure and a sweet smell. Mature compost can be stored without losing nutrient value, but monitor its moisture level, not allowing it to become dry.

11. Digging a trench around the base of a compost pile will help direct excess water away from the pile.

12. The wet season, when plenty of green vegetation is available, is a great time to start compost piles.

Recommended Reading Resources:

"Let It Rot! The Gardener's Guide to Composting" By Stu Campbell

"All New Square Foot Gardening" By Mel Bartholomew

"Farming God's Way Trainer's Reference Guide" By Grant Dryden

JOIN OUR HUNGER FIGHTING TEAM

Where people use the techniques we teach for dry season farming, it is like an oasis in the desert. After attending a village workshop, Timothy said, "What you have taught me is more valuable than money. It will not only impact me but also my children and my grandchildren. May God bless you. Come again and again to teach us more."

One billion people go to bed hungry every night. Every six seconds a child somewhere in the world dies of hunger. Malnutrition contributes to more than half of all childhood deaths. We can make a difference! God can use our hearts, hands, talents, and resources to transform the lives of hungry people. We challenge you to join our "Hunger Fighting Team".

Your donation will help us impact families who need our help:

$15 will buy a drip irrigation kit for feeding a family

$300 will buy drip kits to feed 150 people

$1,000 will fund a village food sustainability workshop

$5,000 will establish a learning center with a demonstration farm

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VEGETABLE GARDENING OUTLINE

…Day 1

1. Plant Structure

   … To understand how a plant grows, it is important to understand and know the different parts of a plant and the job of each part.

   A. Roots
      - Absorb water and nutrients from the soil to feed the plant
      - Anchor the plant in the ground
      - If roots are damaged the whole plant suffers

   B. Stems
      - Supports all branches, leaves, flowers, and fruits
      - Deliver water and nutrients from the roots to the leaves
      - Damaged stems hinder the flow of nutrients

   C. Leaves
      - Utilize collected and transported water and nutrients
      - Manufacture food for the plants by a process called photosynthesis
        - Process requires sunlight, carbon dioxide (from the air), water, and chlorophyll
        - $6H_20 + 6C0_2$ + sunlight and chlorophyll – $C_6H_{12}0_6 + 60_2$

   D. Flowers
      - Reproductive part of the plant
      - Pollination can be aided by bees, insects, birds, and wind
      - Part of the plant that forms fruits and seed

   Note: In order for a plant to grow and produce, it needs:
      - Water
      - Nutrients
      - Sunlight
      - Air (carbon dioxide)

   Questions: 1. Which of these factors can we have some degree of control?
      Answer: water and nutrients
      2, How can we control plant growth factors?
      Answer: grow in a greenhouse

2. Soil Texture

… Soil has mineral matter, organic matter, and pore space (filled with a combination of air and water)

A. Sand
   - Largest size particle
   - Makes the soil loose
   - Helps with drainage
   - Increases the amount of air in the soil

B. Silt
   - Medium size particle
   - Helps the soil hold water and plant nutrients
   - Allows room for air space in the soil

C. Clay
   - Very small size particles
   - Makes the soil sticky when wet and hard when dry
   - Good at holding nutrients and water but limits air space in the soil

D. Ideal soil
   - 45% mineral matter (sand, silt, and clay)
   - 5% organic matter (compost and humus)
   - 50% pore space (half filled with air and half filled with water)

E. Five basic soil texture classes
   - Sandy soil
   - Sandy loam soil
   - Loam soil
   - Clay loam soil
   - Clay soil

3. Humus
   A. Contents
      - Organic materials such as plant residue, manure, and compost
      - Living micro-organisms that help decompose (breakdown) organic materials

   B. Why humus (organic matter) is important
      - Increases nutrient levels in the soil
      - Improves water holding capacity
      - Increases air content in the soil
      - Loosens the soil making it easier to hoe and resulting in increases root development and increased production of root crops

4. Garden Preparation
   … Loosen (double dig) and level the soil
   … Add organic matter/compost, ant hill soil, animal manure, or commercial fertilizer (if available)

5. Composting
   … Compost is simply a collection of organic matter that the action of micro-organisms decomposes to provide humus (organic matter) and nutrients to the soil

   A. Micro-organisms need:
      - Air
      - Water
      - Warmth
      - Food
        - Carbon sources (plant material)
        - Nitrogen sources (animal manure)

   B. Making a compost pile (MAP: Moisture, Air, Pressure)
      - 15 cm layer of branches or maize stalks (foundation layer that allows air to come into the pile)

- Veneer layer (banana leaves, cabbage leaves, newspapers to prevent mature compost from blocking the air flow at the base of the pile)
- 25 cm layer of carbon material (green or dried plant material)
- 5 cm layer of nitrogen source material (animal manure)
- Thin layer of soil or ant hill soil (to provide micro-organisms, weight, and pressure to the pile)
- Water each layer as it is added
- Repeat those layers to the desired height (2 meters if enough material is available)

6. Plant Nutrition

… Plants need 16 specific elements to grow. Since carbon, hydrogen, and oxygen are provided by air and water, that leaves 13 elements that must be present in the soil. The macro-nutrients needed in large amounts include nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur. Micro-nutrients, also referred to as trace elements, needed in small or trace amounts include iron, boron, manganese, copper, molybdenum, and chorine.

…Fertilizer analysis (i.e. 18-46-0) refers to N-P-K

A. Soil pH

- Measure of the acidity of the soil
- Range is from 0-14 with 7 being neutral
- Adding calcium and magnesium raises the pH making the soil more basic and less acid
- Adding sulfur, gypsum, or wood ash lowers the pH making the soil more acid
- Ideal pH varies with the crop to be raised but is usually 6.5 to 7.0
- Soil particles have a negative charge so they hold nutrient ions with a positive charge

B. Nitrogen ($N0_3^-$ and NH_4+)

- Promotes top growth of the plant
- Gives the plant a dark green color
- Most important for leaf crops and maize

- Nitrate form of nitrogen ($N0_3$) moves with soil water and can be washed through the soil (called leaching)
- Excess nitrogen results in continued vegetative growth and no reproductive growth (fruit and seed)
- Deficiency shows in light green or yellow color leaves
- Natural sources are manure, stalks, feathers, compost, and legumes

C. Phosphorus (P_20_5 phosphate DAP 18-46-0)

- Promotes root growth so it is important for new transplants, root crops, seedlings, and perennial vegetables
- Stays in the soil where it is placed until used by the plants (cannot be leached)
- Deficiency show in purple leaves
- Natural sources are banana leaves and sugar cane

D. Potassium (K_20 potash 0-0-60)

- Promotes strong stem development
- Important for fruit formation and production
- Stays in the soil where it is placed until used by the plants (cannot be leached)
- Deficiency show when the end and outside edges of the leaf turn brown
- Natural sources are banana plants, wood ash, and corn cobs

E. Natural or Organic Fertilizer vs Chemical/Commercial Fertilizer

- Nitrogen is the same chemical compound regardless of the source (NH_4 and NO_3) whether it comes from an organic or chemical/commercial fertilizer source
- Phosphate, the fertilizer form of phosphorus, is P_2O_5 regardless of the source organic or commercial fertilizer
- Potash, the fertilizer form of potassium, is K_2O whether from an organic or commercial fertilizer source
- Note: Most low-income farmers cannot afford commercial fertilizer. In addition to the cost disadvantage of commercial fertilizer in dry areas after several years of use, the fertilizer

salt content can build up in the soil. An advantage of commercial chemical fertilizer over organic fertilizer is that it does not contain weed seed and that it usually is more concentrated resulting in the need for less pounds per acre to increase yields.

7. Manure and Manure Tea

A. Animal manure

- Contains many nutrients needed by plants, but not necessarily in the amount they need
- Fresh chicken manure is best
- Animals that eat good quality feeds will produce manure with more nutrients
- Understand that fresh animal manure amounts should be limited as to not cause a chemical burn to the plants

B. Manure tea

- Place one to two liters of manure in a porous cloth (like a maize sack), add a large stone for weight, and then tie the sack ("tea bag") with a rope
- Lower the sack into a 20 liter bucket of water
- Cover the water container and let it stand for 1-3 days
- Remove the sack and spread the solids on your garden to add organic matter
- Dilute the liquid nutrient solution that remains 4 to 1 with water
- For leaf crops apply the solution weekly
- For fruit crops apply the solution every two weeks as you water
- For root crops and legumes apply one application per year
- Note: manure tea can be used with drip irrigation but be sure that any solids are filtered out of the solution before using it in a drip line Manure and Manure Tea

8. Green Manure (Cover crop… sometimes called compost crops)
   A. Purpose
      - Add nutrient to the soil; legumes are best because they take nitrogen from the air and fix it to nitrate that that plants can use
      - Add organic matter, loosen the soil, and improve the moisture holding capacity
      - Provides food for animals or vegetation that can used in composting
      - Protects the soil from the sun, wind, water, and erosion
      - Can be used to aid weed control around the garden, between planting beds, or in a fallow area.

   B. Possible Crops
      - Wheat, rye, barley, clover, alfalfa
      - Pigeon peas, fish beans, velvet beans, lablab bean, chickpeas, cow peas, vetch, fava beans