



# Organic Matter and Soil Amendments



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# What is organic matter and amendment?

**Organic matter:** includes plants and animals that are alive, dead, or in some stage of decomposition.

**Organic amendments:** are materials applied to or mixed into the topsoil to change or change soil properties and improve plant growth. For example, compost improves soil structure and lime increases soil pH. Most soil amendments supply some plant nutrients and some compost and manure products double as fertilizers with a guaranteed nutrient analysis.

# Soil conditioners

- Any materials contain limited amounts of nutrients, but are managed primarily for their beneficial impact on the biological, physical or chemical nature of soil.
- They can also be used as a plant growth medium,
- Examples are: bone meal, peat, compost, coir, manure, straw, vermiculite, sulphur, lime, blood meal, compost tea, and sphagnum moss.
- Typically they have high levels of organic matter and have a carbon to nitrogen ratio greater than 30 to 1.

# Benefits of organic matter

- Improves soils high in clay or sand.
- Retain more moisture
- Contain a reservoir of nutrients that are slowly released over time
- OM improves soil aeration, water drainage, root growth, and biological activity.
- Organic matter is measured by weight, not volume.
- Make the soils are loose, easy to prepare for planting seeds and plants and have a large number of earthworms.

# Sources of soil amendments

- **On-Farm sources:** include bedding, compost, crop residue, manure, silage juice, spoiled feed, wash water, spent soilless, media, and spent nutrient solution.
- **Off-Farm sources:** these are usually purchased and include chemical fertilizers, chemical conditioners such as lime, soilless media constituents such as perlite, manure from other farms, compost, wood waste, and non-agricultural wastes such as municipal biosolids.

# Benefits of soil amendments

- Soil amendments are applied to or mixed into the topsoil to improve soil properties and plant growth.
- **Practice sustainable gardening by using no-cost or low-cost amendments** such as locally available manure and compost and "home-grown" compost, leaves, grass clippings, cover crops, and kitchen scraps.
- pH adjusters (lime and sulfur).

# Common soil amendments and sources of organic matter

- **Biochar:**

- This is a relatively new soil amendment. biochar's effects on soil carbon storage, soil reclamation, and improving the nutrient and water retention of soils.
- Biochar is charred organic matter, made by burning biomass such as wood waste and agricultural residues in the absence of oxygen (pyrolysis).
- The end product is a fine-grained charcoal that is stable (resists further decomposition), porous, and variable depending on the feedstock and the process used.
- Although low in nutrients, biochar can hold nutrients that might otherwise be lost to leaching or runoff.
- Commercial products are available for gardeners and farmers but their value, relative to the many other ways of increasing soil organic matter, has not yet been established.



- **Compost:** [Home-made compost](#) or purchased compost can be added at any time of year and can be used as a top-dressing or mulch during the growing season.
- Plant-based composts have an N-P-K analysis of approximately 1.0-0.5-1.0. Only 5%-10% of the N (nitrogen) is mineralized (plant-available) in the year of application. Most of the K (potassium) and a small percentage of the P (phosphorus) are available in the first year.
- Manure-based composts are higher in nutrients and more of the N and P is in an inorganic, plant-available form.

Commercial composts are made from a wide variety of organic materials such as agricultural and food wastes, animal manure, grass clippings, and leaves.

# Compost and how to make it in short time

## What is Composting?

Composting is a controlled, aerobic (oxygen-required) process that converts organic materials into a nutrient-rich soil amendment or mulch through natural decomposition. The end product is compost – a dark, crumbly, earthy-smelling material. Microorganisms feed on the materials added to the compost pile during the composting process. They use carbon and nitrogen to grow and reproduce, water to digest materials, and oxygen to breathe.

- At the simplest level, composting requires gathering a mix of "greens" (green waste) and "browns" (brown waste). Greens are materials rich in nitrogen, such as leaves, grass, and food scraps. Browns are woody materials rich in carbon, such as stalks, paper, and wood chips. The materials break down into humus in a process taking months. Composting can be a multistep, closely monitored process with measured inputs of water, air, and carbon- and nitrogen-rich materials.
- The decomposition process is aided by shredding the plant matter, adding water, and ensuring proper aeration by regularly turning the mixture in a process using open piles or "windrows". Fungi, earthworms, and other detritivores further break up the organic material. Aerobic bacteria and fungi manage the chemical process by converting the inputs into heat, carbon dioxide, and ammonium ions.

# Advantages of Composting

- Improves plant growth and health.
- Provides plant nutrients in a stable organic form.
- Increases plant rooting depth.
- Improves physical, biological, and chemical soil properties.
- Reduces erosion.
- Conserves water.
- Mulch reduces weed germination and moderates soil temperature.
- Stores Carbon: Composting aids in carbon sequestration, the process of capturing and storing carbon dioxide from the atmosphere.

# Disadvantages of Composting

- It Can Be Smelly
- Composting Can Attract Pests
- Space Requirement
- Time and Effort

# Role of organisms in composting process

- Organisms can break down organic matter in compost if provided with the correct mixture of water, oxygen, carbon, and nitrogen.
- They fall into two broad categories: chemical decomposers, which perform chemical processes on the organic waste, and physical decomposers, which process the waste into smaller pieces through methods such as grinding, tearing, chewing, and digesting.

# The ingredients for composting include a proper balance of the following materials:

- **Carbon-rich materials** (“browns”) can include dry leaves, plant stalks, and twigs. The carbon-rich materials provide food for the microorganisms to consume and digest.
- **Nitrogen-rich materials** (“greens”) include grass clippings and food scraps. The nitrogen-rich materials heat up the pile to create ideal conditions for the material to breakdown.
- Water (moisture).
- Air (oxygen).

- **Compost tea:**

Made by "steeping" compost in a bucket of water (5 parts water to 1 part compost by volume) for 1-3 days, then straining and applying the liquid to plants. Make compost tea using plant-based compost or vermicompost (worm compost). Do not use compost made from animal manure. Compost tea is low in a wide range of nutrients and good for fertilizing seedlings and transplants.



- **Manure:** Animal manure has a higher plant-available nutrient content than plant-based or manure-based compost. Poultry, sheep, and rabbit manure are higher in nutrients than cow or horse manure.
- Horse manure, even if "aged," may contain many viable weed seeds.
- Lightly incorporate manure into soil to prevent nutrients from washing away or volatilizing.
- Never add dog or cat manure to your compost pile or vegetable garden soil.
- Bagged manure products are usually composted or dehydrated (17% moisture) and often carry an N-P-K fertilizer guarantee on their label.

# Types of manure

- **1. Animal manure**
- For example horses, cattle, sheep, chickens, turkeys, rabbits, and guano from seabirds and bats all have different properties. For instance, sheep manure is high in nitrogen and potash. Horses mainly eat grass and a few weeds so horse manure can contain grass and weed seeds, as horses do not digest seeds the way that cattle do. Cattle manure is a good source of nitrogen as well as organic carbon.



## 2. Green manure

Green manures are crops grown specifically for building and maintaining soil fertility and structure, though they may also have other functions. They are normally incorporated back into the soil, either directly, or after removal and composting.



# **Example of Green Manure crops**

## **1. Non- Leguminous crops**

mainly serve to act as green manure cover crops and enrich the soil with organic material. Examples of Non-leguminous crops include; (Buckwheat, Chicory, Mustard, Turnips, Ryegrass, Oats, Barley, Phacelia).

## **2. Leguminous**

Leguminous crops have the ability to fix nitrogen into the soil, as they contain nitrogen fixing bacteria in them. Examples of Leguminous crops include; ( Alfalfa, Peas, Beans, Soybeans, Vetches, Lupins, clovers).

## **Advantages of green manure:**

1. Provision of nutrients and organic material back to the soil
2. Improve Soil Structure
3. Prevents Soil Erosion and Nutrient Leaching
4. Weed Suppression
5. Habitat for Pollinators and Natural Predators
6. Supports Beneficial Microorganism in Soil
7. Interrupts Pest and Disease life-cycles

## **Disadvantages of green manure:**

- 1-Over-fixation of Nutrients.
2. Expensive sometimes.
- 3.The manures are reported to provide fewer nutrients to plants, and they are unable to provide high-yielding crops.
4. Good planning of plantation needed.

- **Mycorrhizae:**

Beneficial fungi that occur naturally in soil and grow symbiotically on plant roots (ectomycorrhiza) or in plant roots (endomycorrhiza). It's estimated that 80% of all land plants on Earth are colonized by endomycorrhiza.

- They extend the root system by sending out tiny filaments to forage for water and nutrients used by plants.
- They have been shown to also help plants fend off pathogens. Some crops, like blueberry, rely heavily on mycorrhizae for nutrient uptake.
- These fungi are prevalent in Maryland soils.
- Research does not show any benefit to garden plants when mycorrhizae are purchased and applied to soil. This is especially true when plant nutrients and soil moisture are plentiful, and also because commercial mixes contain a narrow subset of mycorrhizal species.

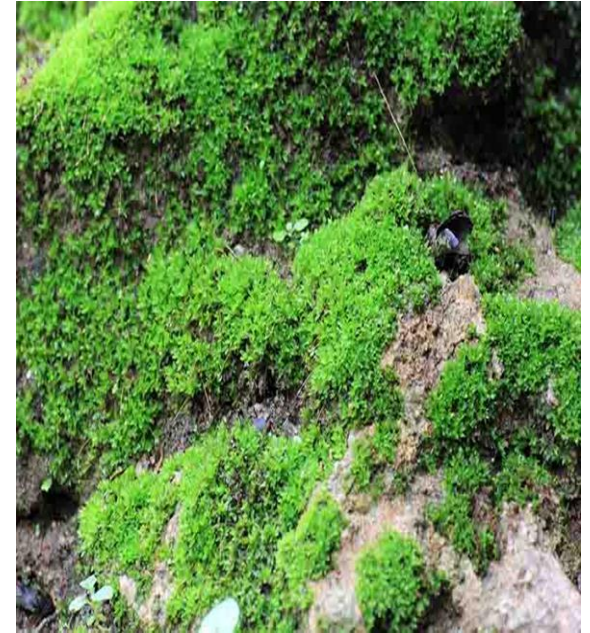


- **Peat moss:**

- Peat partially composted moss mined from prehistoric non-renewable bogs. Peat moss is light and porous, absorbing 10-20 times its weight in water. It contains little nutrient value, but has a high nutrient-holding capacity. Harvesting peat releases CO<sub>2</sub>, a greenhouse gas contributing to [climate change](#). More sustainable options like compost and pine bark fines should be substituted when possible.

# Peat moss

- **Peat** is the product created from organic matters that submerged into the bogs.
- Peat can be formed from different materials, but a large percentage of the peat harvested is composed of **sphagnum moss**. And hence the name **peat moss**.
- Meanwhile, **sphagnum moss** is a plant grown on the surface layer above of the peatland, soil or a swamp. It thrives in cold and wet weather. As time goes by, the old parts sink into the lower layer. The process of decomposition takes place very slowly in the oxygen-less layer. But it is patient, and over a long period of millenniums, a thick layer of dead homogeneous material named peat moss is formed.





# Benefits of Peat Moss

- **Absorbs and retains water**

Peat moss can hold several times its weight in water. It helps soil retain moisture longer.

- **Prevents soil compaction**

Peat moss is lightweight and has a loose texture, so it doesn't get compacted over time as heavy soil does. When soil becomes compacted, water and nutrients can't get through to your plants' roots. Your plants can die as a result.

- **Holds soil nutrients**

Peat moss helps prevent this nutrient loss. Just like it holds water, it holds onto those nutrients better than soil does on its own.

- **Free of bacteria, fungi, and weed seeds**

peat moss is completely sterile, it's free of bacteria, [fungi](#), and [weed seeds](#).

- **Lasts several years**

The process of peat moss decomposing takes place in a bog, underwater, without oxygen. In these anaerobic (oxygen-less) conditions, peat moss takes centuries to break down.

- **Perfect for acid-loving plants**

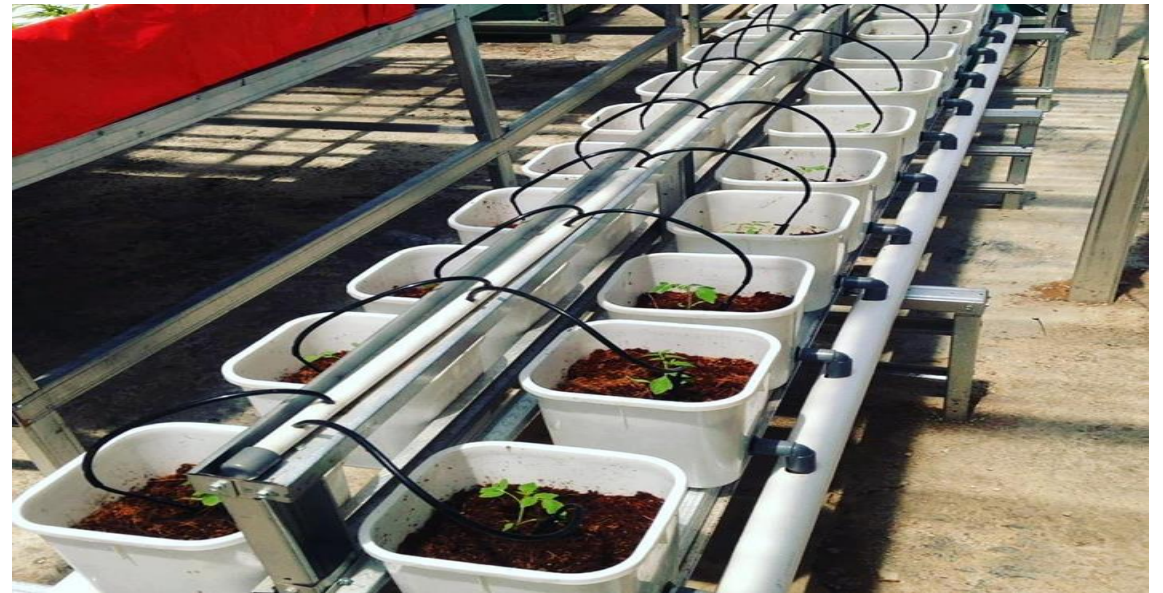
Peat moss is acidic, and adding it to your soil will make the soil more acidic, too. That's great news for any plants that thrive at an acidic pH.

# Downsides of Peat Moss

- **Expensive:** Peat moss costs much more per square foot than traditional soil.
- **Dryness issue:** Even though peat moss can hold water well up to 10 times of its weight and is a great supplement to the soil. But when it becomes completely dry, it takes a long time to get the moisture.
- **Too acidic for some plants:** Peat moss can make the soil too acidic for plants that need an alkaline or neutral soil pH. Before using peat moss in your garden, find out if your plants can tolerate acidic soil. Otherwise, you might end up killing them.
- **Non-renewable resource:** As explained, the process of decomposing the peat moss take even thousands of years. So it's really considered as non-renewable and not eco-friendly. That's the main reasons that many environmental-aware growers are going away from it, and finding an alternative.

# Peat Moss can be used for/as

- Soil amendment
- Growing acid-loving plants
- Hydroponic growing
- Seed starting



- **Wood ashes:**

- Ashes from wood and pellet stoves contain large amounts of **potash (10%)** and **calcium carbonate (25%)**. For liming purposes, two pounds of wood ash is equivalent to approximately one pound of calcitic limestone or dolomitic limestone. Use ashes based on soil test results and don't exceed 2 kg./1,00 sq. m. per year. Apply wood ashes in the fall or winter. Dispose of excess ashes in the trash, not the compost bin.



# Liquid organic fertilizers

- Nutrient rich materials is soaked in water for several days or weeks to undergo fermentation. Frequent stirring encourages microbial activities in liquid manures. The resulting liquid can either be used as a foliar fertilizer or application to the soil.
- **Advantages of liquid fertilizer:**
  - 1. The plant can absorb about 20 times fast through the leaves than applied through soil.
  - 2. The application of manure cannot full fill the nutrient requirement of crops. Therefore, for additional supply of nutrients.
  - 3. Liquid organic manure has long shelf life, easy to dissolve in water and it is rapidly up taken by plants compared to solid organic fertilizer.
  - 4. Fast, easy and easy to prepare.



Liquid organic fertilizers



# Benefit of using soil amendment

- Reduces alkalinity of soil and Improved soil drainage
- Increases the organic content of soil
- Helps balance the mineral content of the soil
- Lessens the amount of irrigation
- Provides more water and nutrients for timely plant recovery when faced with windy conditions, hail damage and damage caused by rapid temperature shifts
- Plants have improved immune systems that enable them to fight off diseases and predators, they are stronger, rather than weaker under extreme conditions

# Factors to consider when choosing amendments

**There are at least four factors to consider in selecting a soil amendment:**

- How long the amendment will last in the soil
- Soil texture
- Soil salinity and plant sensitivities to salts, and
- Salt content and pH of the amendment.

Laboratory tests can determine the salt content, pH and organic matter of organic amendments.

**BEST FOR** *You*

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*Thank you*



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