Soil Organic Matter

I. Benefits of Soil Organic Matter

Soil organic matter is the part of the soil that consists of plant and animal residues in various stages of decay. Organic matter, which helps to maintain or improve the physical condition of the soil, increases the soil’s capacity for water infiltration and water holding. Organic matter is a good source of plant nutrients. It also helps to hold nutrients already present in the soil, by keeping them from leaching down beyond the reach of plant roots and, sometimes, into groundwater.

Organic matter, an essential component of a healthy soil, is in a constant state of transition, continually breaking down and releasing finer, more-decomposed particles. Because of this process, organic matter is constantly being reduced and therefore in constant need of replacement. Managing soil organic matter should be a top priority on all farms.

II. Compost

Important Source of Organic Matter

Compost is an excellent source of organic matter and plant nutrients. It has been shown to benefit plants far beyond simply supplying them with nutrients. Compost can actually suppress the development of some soil-borne plant disease organisms. Some organic crop producers find that a solution of water, strained from compost, can protect plants from some foliar diseases.

A correctly made compost will have a pH near neutral (pH of 7). Its carbon to nitrogen ratio (C:N) will be about 15:1. Compost with these specifications will offer a well-balanced, slow-release...
supply of nutrients. The compost will be free of weed seeds and disease organisms, as the heat that the composting process generates kills them. A good compost will contain as much as one-fourth of its weight in microbes, dead and alive.

It is important that compost be made properly, as poorly made or unfinished composts can contain chemicals that are toxic to plants. Also, the high carbon content of materials that are not completely broken down can cause nitrogen to be unavailable for plant use. Many people have killed their landscape plants, and farmers have destroyed entire crops, by applying unseasoned (unfinished) compost. Unseasoned compost robs plants of nitrogen. Its acidic nature, which lowers soil pH, can kill plants by making other critical nutrients unavailable. Unseasoned compost also has a higher moisture level (50–70 percent) than seasoned compost, which makes the former difficult to handle.

Important Factors in Creating Good Compost

The carbon to nitrogen ratio of the initial raw materials that make up the compost pile should be around 30:1. The challenge comes from trying to blend the materials together so that the carbon level is not too high, and adequate nitrogen is present to feed the microbes. Try to develop a rough idea of the C:N ratios of the materials that you will likely use for composting on your farm. Undisturbed topsoil has a C:N ratio of 10:1; alfalfa, 13:1; rotted barnyard manure, 20:1; corn stalks, 60:1; straw, 80:1; and oak, 200:1. With these ratios in mind, you can develop a blend of materials to achieve the desired 30:1 ratio.

The best composts come from piles with a high degree of microbial activity. Temperature increase is the easiest sign of microbial activity to observe. Good, active piles heat to approximately 140 to 160 degrees F within the first 3 or 4 days. Particle size plays a critical role in microbial activity. Small particles increase the surface areas available to the microbes. However, if the material is ground into particles that are too small, the pile will pack down, which restricts airflow. Good airflow is essential for rapid heating and a sustained aerobic breakdown of the material.

Building your compost pile in an area that does not collect water helps airflow. A soggy pile does not breathe. The base of the pile should be a material that is coarse enough to allow air to rise through the center of the pile. Straw, or some comparable material, works well at the base. This material can also be used to form the base of subsequent layers throughout the pile.

Having an adequate volume of material in the pile is important to maintaining an optimum temperature for the pile's microbial activity. The size of the pile will directly influence its ability to sustain a temperature. Small piles will cool more rapidly than large piles. Compost piles that are 4 feet x 4 feet x 4 feet will do well.

Moisture is also important to sustaining the microbial breakdown of the pile. When building your pile, be sure to dampen each layer as it is completed, but do not overwater. If the center of the pile gets too dry, dampen it while turning the pile.

Since the breakdown of materials in the pile is dependent on microbes, it is beneficial to inoculate the pile with some microbes. Do this by sprinkling some finished compost or good topsoil over each layer as you build the pile.

It is important to understand that composting is a controlled process. Begin the process by carefully layering organic materials into a pile. Then, monitor the compost regularly for temperature and periodically turn the compost to maintain microbial activity. This controlled composting process can take as long as 12-18 months, depending on several factors including particle size, type of material, moisture level, aeration, temperature, and size of pile. Time you invest in controlled composting will be worth it as the end product is humus. In comparison, there are no guarantees that the uncontrolled process of tilling vegetable matter (green manure) into the soil will produce mostly humus; under this process some materials do not easily decompose.

Some good references are available on how to properly build a compost pile and what to look for when trouble-shooting problems. Contact your local Cooperative Extension
III. Green Manure Uses

Soil Improvements

Green manure describes a crop that is planted strictly for its ability to improve both the soil and the next crop planted. The benefits of using green manure crops have long been documented. Like a cover crop, green manure protects against soil erosion, helps to retain nutrients, suppresses weeds, cycles nutrients that might otherwise be unavailable to crops, and leaves nutrients in the soil for the crops that follow.

A leguminous green manure crop will provide nitrogen for the next crop. And since it is left in the field, a leguminous green manure crop will also help build up the soil organic matter (humus). Legumes make excellent green manures also because they have low carbon to nitrogen ratios and will break down rapidly in the soil.

Deep-rooted grasses, such as cereal rye, make excellent green manure crops because their roots can reach deeply into the soil to pull up leached nutrients and expand the root zone. Basically, these deep-rooted crops are living subsoilers, plants that expand the area of the soil that can support plant root growth.

Although green manure crops are excellent soil builders, they may not be a viable option on many small farms. Green manure crops that replace a market crop can be a strain on small-farm budgets, since planting green manure can eliminate income from a field for anywhere from 1 to 3 years, depending on the rotation system being followed. When acreage is limited, a producer might not have the luxury of allowing a field to remain fallow. Therefore, for the small farmer, planting a cover crop might offer a better alternative in most situations. However, if the cash flow limitation can be addressed, the use of green manure does provide the farm with a long-term indirect economic return. This can compensate for some of the direct loss of income.

Weed Suppression

Weed suppression is another benefit of green manure crops. They can out-compete the resident weed population, stealing their light, water, nutrients, and space. Also, some green manure crops will eliminate weeds through allelopathy, a form of natural chemical weed control. An allelopathic plant, such as cereal rye, can produce chemicals that inhibit the growth of other plants. Researching which crops have allelopathic properties could be beneficial to producers planning to use green manure crops.

Organic Matter Value

For the most part, green manure crops are used to build up soil organic matter. The benefits of organic matter to the overall health of the soil are significant. Organic matter adds stability to the soil, especially in relationship to important plant nutrients. Most plant nutrients will adhere to organic matter particles in the soil, which minimizes nutrient loss through leaching. Nutrients stay near plant roots where they can be utilized. Organic matter itself is made up of plant nutrients. Its gradual decomposition in the soil provides a slow release of valuable plant nutrients.

Green manure can be introduced into a rotation by overseeding or interseeding the new plant seeds into an existing crop. For example, a legume can be overseeded into a standing small grain crop in late winter. The legume will germinate and grow beneath the small grain canopy. When the small grain is harvested, the legume will already be established in the field. This process saves time, making a quick transition from one crop to another possible. This process also reduces possible environmental problems associated with barren soil in a field during the time between the end of harvest and the establishment of a cover crop.
References


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