Managing Soil Fertility in an Organic System

Soil Fertility
Soil fertility refers to soil’s ability to sustain agricultural plant growth. Well managed and biologically active soils provide needed nutrients, adequate water-holding capacity, and physical support for healthy plant growth. Healthy and functioning soil is the foundation of a successful organic production system and preserves the viability of a farm’s most important resource. While the science of soil management is extremely complex with differing recommendations, here are a few agreed-upon principles that every organic farmer should understand.

Soil Organic Matter
Soil organic matter is the fraction of the soil that consists of biological residues of plant, animal, and microorganisms in various stages of decomposition. As this organic matter decomposes, it creates humus, a very stable, dark brown/black material that’s rich in nutrients vital for healthy plant growth.

Organic matter and humus provide readily available and slowly released nutrients, hold and retain moisture, reduce erosion and runoff by increasing aeration and improving structure, and build biological resiliency against pests and diseases. It takes a lot of organic materials to maintain soil organic matter and even more to increase it. So apply organic materials to fields often.

The percentage of soil organic matter in a field typically correlates with how productive that field will be for annual or perennial crop production. Actively managing soil organic matter is one of the primary considerations for the organic producer. You can build and maintain soil organic matter by:

- adding fresh and composted animal manures;
- diversifying annual crop rotations with perennial crops like forage legumes, pasture, etc.;
- using cover crops in an annual crop rotation;
- minimizing compaction, erosion, and periods when your soil is bare.

Soil organic matter can be depleted over time by overreliance on tillage, soil erosion, and removal of plant material from the field through harvest of grain, forage, or vegetable crops. It’s important to consistently add organic material back into the soil to maintain fertility, tilth, biological activity, and soil structure.

Synthetic Fertility
Although cover crops and green manures are gaining popularity in conventional farming systems, many non-organic operations rely heavily on synthetic and mined sources of nitrogen (N), phosphorous (P), and potassium (K)—the three most important macronutrients for healthy plant growth. These consistent applications of chemical fertilizers reduce the soil’s natural fertility. Harvesting plant material from a field year after year without replacing organic matter depletes nutrients from the soil and compromises the soil microbiome. Good soil structure relies on a healthy microbial population, providing aeration and water absorption, nutrient cycling, and reducing the impact of harmful pests and diseases.

In short, an overreliance on synthetic inputs at the expense of building stable, biologically active soil creates a domino effect of negative consequences including erosion, nutrient-loading in waterways, and poor soil structure with diminished capacity for nutrient- and water-retention—not to mention higher input costs to maintain productivity.
Soil Fertility Best Practices

Soil Testing
Good management is key to creating and sustaining healthy soils to grow healthy crops. A comprehensive soil test is a must to find out what’s going on in your soil. What micro- and macro-nutrients are available? What is your soil pH? How much organic matter is present? A relatively inexpensive soil test can answer these questions and more. Annual soil testing can help you see major imbalances or deficiencies and whether you’re headed in the right direction with your management. Keep in mind an accurate soil test depends on adequate sampling, timing, and lab procedures. Most soil tests will give you guidelines for improving your soil fertility for particular crops. Use this as a starting place as you learn more about soil fertility and the unique characteristics of your farm’s soil.

N-P-K
Nitrogen (N), phosphorous (P), and potassium (K) play important roles in crop production. If any of these essential nutrients is lacking—regardless of other nutrient availability—your plants will not thrive. Nitrogen particularly needs management, as it is highly mobile and can leach out of the soil or release into the air as a gas. Managing all of these nutrients to meet plant needs without creating runoff concerns is an important piece of organic crop management.

N Credits
Nitrogen is so important that many farmers use nitrogen credits as the basis for their soil fertility plan. A “nitrogen credit” is how much N you can attribute to a field based on the crop that was planted there previously and worked into the soil. Some legume cover crops, such as hairy vetch, can supply as much as 100 lb. per acre of N—enough for most vegetable crops.

There are many resources online to help you determine how much N a particular cover crop will provide to the subsequent crop. The Midwest Cover Crops Council offers an online selector tool at mccc.msu.edu/selector-tool.

Compost and Manure
Compost and manure are often the cornerstone of an organic system. Not only do they provide readily available nutrients, but also aid in building organic matter. The National Organic Standards (NOS) require special handling for compost and manure, particularly if it is raw. Compost can come from plant/animal material, and must be composted to NOS standards. If it doesn’t meet NOS standards, it must be handled as raw manure, which means it must be applied at least 90–120 before harvest (depending on the potential for contact between the edible portion of the plant and the soil). Many resources can help you learn how to create compost. Just make sure you’re following the temperature, turn, and time requirements of the NOS if you plan to apply the finished product as compost in an organic system.

Cover Crops and Green Manure
Cover crops, a mainstay of organic systems, are gaining popularity across agriculture systems due to their many obvious benefits. A cover crop is a non-cash crop grown between cash crops to protect the soil from wind and water erosion, increase organic matter, feed soil microbiology, compete with weeds, break cycles of pests and diseases, and improve fertility. Green manures are cover crops grown specifically for fertility purposes. They are most often legumes, which form a symbiotic relationship with bacteria that fix atmospheric nitrogen to make it available to plants.

Liquid Organic Fertilizers
Liquid fertilizers, such as fish emulsion, kelp emulsion, and compost tea, give quick, readily absorbed nutrients to plants. Many farmers use liquid fertilizers during transplanting to minimize transplant shock, and others use it as a foliar spray for a quick boost for plants during the growing season. Liquid fertilizers do not add organic matter to the soil, however. They should be used in conjunction with practices that can provide that function—such as compost, manure, and cover cropping.

Conclusion
This fact sheet scratches the surface of the complex interconnections between soil health, plant productivity, and environmental resilience. There are many schools of thought on how it should be measured and managed. The main thing to remember is that building and maintaining soil organic matter is critical to the success of any organic farming system. In general, the more organic matter you can add to your soils every year, the better—it’s possible to increase your soil organic matter content in as little as 3-5 years of careful management. Keep in mind that even organic forms of fertility can leach and pollute waterways while overreliance on organic practices like tillage can degrade your soil resource over time. Feeding and protecting your soil will insulate you from extremes and maintain productivity over the long-term.

To get started on the path to healthier soil, take a soil test, follow the recommendations, and use cover crops and compost to build your soil. Along the way, learn as much as you can about soil from other farmers, universities, nonprofit organizations like MOSES, and other resources. Apply your knowledge and start learning what works best for your land.

MOSES Organic Specialists can answer your questions about certification or organic growing practices. See our FAQ answers at mosesorganic.org/ask, submit a question, or call us at 715-778-5775.