carolina farm stewardship association

Introduction: The Soil is Your Greatest Resource

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Enhancing soil quality is the foundation of organic agriculture and is the ultimate, never-ending challenge to organic growers. Soil is far more than a substrate for growing plants; it is a complex ecosystem that requires careful observation and site-specific management to realize its many potential services. To manage soil successfully, organic growers choose practices to increase organic matter, balance macro- and micronutrient levels using natural inputs, encourage beneficial soil microorganisms, reduce erosion, and minimize soil disturbance. These principles are central for promoting biologically active, resilient soils that are capable of reaching their full potential on your farm.

Soil is your greatest resource as a grower and the importance of improving it cannot be overemphasized. In this section of the handbook, you will find publications that outline practical strategies for implementing organic soil building principles and nutrient management.

Building Your Soil

Consider these suggestions:

1. **Understand what you are working with; test your soils regularly**.
   Do not assume that a piece of land, whether it has lain fallow or been in recent conventional production, is ready to grow organic produce! Take time to understand nutrient deficiencies or excesses, pH, cation exchange capacity (CEC) and other characteristics of the soil. It would best to do this well in advance of the first growing season so that you can begin implementing practices to prepare your soil for a crop. If you haven't already, begin testing your soils at a qualified laboratory on a regular basis (every spring and fall, annually, biannually). This is sound advice for any farm, but particularly if you plan to certify since regular soil testing will be expected by any certifying agent. Be sure to take representative soil samples from each of your distinct fields or growing areas and to follow the lab instructions. If possible, it is best to consistently use the same lab so that results from year to year are easy to compare.

   North Carolina farmers can have their soil tested for free by the NCDA&CS. Soil sampling boxes can be obtained from any Cooperative Extension office and mailed directly to the facility. For more information, visit their website: http://www.ncagr.gov/agronomi/sthome.htm.

   South Carolina residents can have their soil analyzed for a small fee by Clemson University's Agricultural Service Laboratory. You can find instruction on their website: http://www.clemson.edu/public/regulatory/ag_svc_lab/index.html.

For each field you sample, you will be asked what crop you intend to grow. The soil analysis will come with fertilizer/lime recommendations specific to the crop you have designated, but they are written for conventional growers. To better understand how to translate this information for your fertility inputs, consult the following documents in this handbook:

Soil Fertility on Organic Farms, Baldwin
How to Convert an Inorganic Fertilizer Recommendation to an Organic One, McLaurin and Reeves

There are a number of alternative labs that specialize in soil analysis and recommendations for organic growers. ATTRA maintains a database of some labs that offer these services: https://attra.ncat.org/attra-pub/soil_testing/

2. **Be proactive about increasing organic matter**.
   Organic growers seem so obsessed with organic matter. So, what's the big deal and why is increasing it so important?

   In lieu of synthetic fertilizers, organic growers primarily rely on plant and animal materials – organic matter – as the source of crop nutrients. With the help of soil microorganisms, the breakdown of organic matter yields plant available macro- and micronutrients. But increasing the organic matter level in soil does so much more than provide plants with needed nutrients. It can also:
   - increase soil porosity and water holding capacity, making it easier for crop roots to grow and tolerate drought conditions.
   - become home to innumerable microorganisms that play a vital role in nutrient cycling, produce growth promoting compounds, and aid in disease organism suppression.
   - can detoxify substances present in the soil that are harmful to plant growth.
   - make soil more stable and less susceptible to erosion.

   In short, building organic matter is fundamental to organic farming systems and provides a suite of intrinsic benefits.

3. **Plan your use of cover crops.**
   Your first consideration for increasing organic matter (and soil fertility) should be cover crops—those that are grown specifically for their benefits to the soil. Choosing which cover crops to grow depends on your production needs for a given field. Many growers will plant a mixture of cover crop species for their unique benefits. Legumes fix nitrogen and are generally grown to boost levels of available nitrogen for a following cash crop. Grain cover crops add substantial biomass to the soil that is high in carbon and breaks down more slowly if killed when the crop fully matures. Cover crops with deep roots can mine minerals from the subsoil and when they break down, they make nutrients available to the following cash crop.

   For detailed information on the benefits and management challenges of cover crops, consult the following resources. They also provide valuable information on regionally-suited cover crop varieties:

   Cover Crops for Organic Farms, Baldwin & Creamer
   Cover Crops: Seed Suppliers and Information Resources, Schonbeck
   SARE book—*Managing Cover Crops Profitably*, Clark

4. Be aware regulations for using manure and compost.

Animal manure and compost can both be excellent sources of organic matter and nutrient inputs for your soil. Be aware that there are important regulations in the NOP Final Rule concerning the use of both raw manure and compost (see the excerpts at the end of this document). Become familiar with them and plan accordingly.

Raw manure, when applied to land where crops are grown for human consumption, must be incorporated into the soil within a certain number of days before the first crop harvest. The limit is 90 days for crops that do not have contact with the soil or soil particles and 120 days for those that do.

Compost must meet very specific parameters to be considered "finished." It must be made with feedstocks that have a carbon-to-nitrogen ratio between 25:1 and 40:1, reach specific temperature parameters and be actively turned if made in a windrow system. If you plan to purchase bulk compost from a company or another farmer, be sure that you check with your certifying agent so that they can determine if the composting process and feedstock meet NOP standards.

For additional tips on composting, the use of manure and overall soil nutrient management, take a look at these resources:

Practical Nutrient Management for Organic Vegetable Crops, Schonbeck
Composting on Organic Farms, Baldwin & Greenfield
Using Organic Nutrient Sources, Sanchez & Richard

5. **Develop a crop rotation plan.**

This is your first line of defense against numerous pests, weeds and diseases that affect specific host crops. Crop rotation is also essential to careful nutrient management. Planning can become fairly complicated, however, particularly on small, diversified farms with a limited land base. Many organic growers attempt to rotate by family, growing crops that are closely related in the same field or rotational block. Additionally, it is important to know which crops are heavy nutrient feeders (ex: collards, squash, tomatoes, onions, lettuce) verses light feeders (ex: mustard, radish, garlic, sweet potatoes, chard). Consider the rooting depth of various crops as well. Heavy vs. light feeders and shallow vs. deep rooting crops do not necessarily fall into easy family groupings and add an additional dimension to successful crop rotation planning.

Spend some time mapping out potential rotational block units and the sequence of crops you plant. The longer and more diverse your crop rotation is, the better your chances of moderating nutrient cycling and breaking up pest and disease lifecycles. Many organic growers aim for a minimum of a 3 year rotation, while others accommodate a 7-10 year rotation. If possible, it is best to include fallow periods where soil building cover crops are planted in succession for the entire growing season. As a general rule, the smaller the ratio of cash crop years to fallow years in your rotation, the greater your potential accumulation of organic matter and improved soil tilth. If you have access to a large land base and can afford to, consider leaving 1/3 to 1/2 in cover crop while only actively growing cash crops on the rest. If you raise livestock on the farm, including grazing will increase the diversity and flexibility of your rotation.

The time you invest in your rotation is well worth it; a challenge that will require considerable tweaking over time as you balance the management of soil fertility, pests, and what produce

your markets can absorb. For an in-depth look at rotation, read the following resources in this handbook:

Crop Rotation on Organic Farms, Baldwin
Cover Crops and Crop Rotation, Hitt & Roos
SARE book— *Crop Rotations on Organic Farms: A Planning Manual,* Mohler & Johnson

From the NOP

Following is an excerpt from the NOP Final Rule regarding soil fertility standards:

§ 205.203 Soil fertility and crop nutrient management practice standard.

(a) The producer must select and implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion.

(b) The producer must manage crop nutrients and soil fertility through rotations, cover crops, and the application of plant and animal materials.

(c) The producer must manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances. Animal and plant materials include:

(1) Raw animal manure, which must be composted unless it is:

(i) Applied to land used for a crop not intended for human consumption;

(ii) Incorporated into the soil not less than 120 days prior to the harvest of a product whose edible portion has direct contact with the soil surface or soil particles; or

(iii) Incorporated into the soil not less than 90 days prior to the harvest of a product whose edible portion does not have direct contact with the soil surface or soil particles;

(2) Composted plant and animal materials produced through a process that:

(i) Established an initial C:N ratio of between 25:1 and 40:1; and

(ii) Maintained a temperature of between 131 °F and 170 °F for 3 days using an in-vessel or static aerated pile system; or

(iii) Maintained a temperature of between 131 °F and 170 °F for 15 days using a windrow composting system, during which period, the materials must be turned a minimum of five times.

(3) Uncomposted plant materials.

(d) A producer may manage crop nutrients and soil fertility to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances by applying:

(1) A crop nutrient or soil amendment included on the National List of synthetic substances allowed for use in organic crop production;

(2) A mined substance of low solubility;

(3) A mined substance of high solubility: Provided, That, the substance is used in compliance with the conditions established on the National List of nonsynthetic materials prohibited for crop production;

(4) Ash obtained from the burning of a plant or animal material, except as prohibited in paragraph (e) of this section: Provided, That, the material burned has not been treated or combined with a prohibited substance or the ash is not included on the National List of nonsynthetic substances prohibited for use in organic crop production; and

(5) A plant or animal material that has been chemically altered by a manufacturing process: Provided, That, the material is included on the National List of synthetic substances allowed for use in organic crop production established in § 205.601.

(e) The producer must not use:

(1) Any fertilizer or composted plant and animal material that contains a synthetic substance not included on the National List of synthetic substances allowed for use in organic crop production;

(2) Sewage sludge (biosolids) as defined in 40 CFR part 503; and (3) Burning as a means of disposal for crop residues produced on the operation: Except, That, burning may be used to suppress the spread of disease or to stimulate seed germination.

Following is an excerpt from the NOP Final Rule regarding crop rotation standards:

§ 205.205 Crop rotation practice standard.

The producer must implement a crop rotation including but not limited to sod, cover crops, green manure crops, and catch crops that provide the following functions that are applicable to the operation:

(a) Maintain or improve soil organic matter content;
(b) Provide for pest management in annual and perennial crops;
(c) Manage deficient or excess plant nutrients; and
(d) Provide erosion control.