Soil Health Fact Sheets – Ocean County

Cropland Soil Quality

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What is Soil?

Soil is a natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface. It consists of mineral particles of different sizes (sand, silt, and clay), organic matter, water, air, and numerous living organisms. Soil has biological, chemical, and physical properties. It is not an inert, lifeless medium but rather a living matrix of solid, liquid, and gas, with microorganisms, earthworms, fungi, bacteria, insects, living and decayed organic matter, water, air, and nutrients, all engaged in a biological and chemical give-and-take of energy and elements.

What is Soil Quality?

Soil Quality is simply how well soil does what we want it to do. More specifically, soil quality is the capacity of a specific kind of soil to function, within natural or managed ecosystems, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation. For people active in production agriculture, it may mean highly productive land, sustaining or enhancing productivity, maximizing profits, or maintaining the soil resource for future generations. Soil Quality is the integration of the physical, chemical and biological properties of the soil.

What does Soil Quality Affect on Cropland?

- Regulating water – Quality soil helps control where rain, snowmelt, and irrigation water goes. Water and dissolved solutes flow less over the land and more into and through the soil.
- Sustaining plant and animal life - The diversity and productivity of living things depends on healthy soil.
- Filtering potential pollutants - The minerals and microbes in soil are responsible for filtering, buffering, degrading, immobilizing, and detoxifying organic and inorganic materials, including industrial and municipal by-products and atmospheric deposits.
- Cycling nutrients - Carbon, nitrogen, phosphorus, and many other nutrients are stored, transformed, and cycled through soil.

How are Soil Quality and Productive Cropland Related?

The profitable production of agronomic crops is nearly impossible without healthy soil. The reason for this is that all of the trademarks of a healthy soil: good soil organic matter levels, good water holding and infiltration capacity, earthworms and soil fauna, nutrient levels, and a proper pH level, all play into conditions that optimize crop production.

Crops need water, air, and nutrients all present in the proper amounts and in the proper chemical balance in order to thrive. It does not matter if the crop is tomatoes or wheat, soybeans or pumpkins; these soil quality parameters must be present.

How Can Soil Quality be Improved on Cropland?

There are several good, common sense methods to greatly improve soil quality in cropland.

Avoid compaction

Compaction results from too many tillage practices done at the same depth, sometimes when soil moisture conditions are not optimum. Compaction means more rainfall runs off the field, taking soil, fertilizers and pesticides. More irrigation is needed to offset the increased runoff. Some of this irrigation water runs off also, continuing the cycle. Less water

percolates deep into the soil so ground water supply is reduced.

Soil moisture at field work time is important. Soil that is too wet will compact to a greater degree and lose structure. When the pore space in soil is lost, there is less space for air and water, and plants are stressed. Roots are restricted and occurrence of diseases can increase.

Tillage reduction helps reduce compaction. Seedbed preparation may be accomplished with just the disk, or even less. 'No-till' farming is a way of planting a crop without tilling the soil. Instead, a narrow slot is cut through a cover crop or the residue left after harvest of the prior crop and the seed or transplant is placed in the slot. Fertilizer is also placed with the seed and the slot is closed. The result of no-till farming is that the soil surface is protected with erosion-resistant mulch that also conserves moisture and increases organic matter with all the associated benefits (see below).

Add organic matter

Organic matter is very important to healthy soil. A healthy soil erodes less because it can absorb and infiltrate more rainfall, and it is also more resistant to raindrop impact and runoff. A good soil should have 3-5 percent organic matter by dry weight (1). There are many ways that a farmer can increase organic matter:

1. Plant cover crops between the times when the field is producing crops. Make sure that there is always soil cover on the field.
2. Reduce tillage. Plant crops using no till or reduced till methods. Limit the plow.
3. Employ a crop rotation that incorporates some high residue annual crops like small grains or grain corn, or a grass or legume component, like clover or cool season grass.
4. Add natural organic wastes like leaves, grass clippings, or animal manures to the soil. Make sure any permits are secured when importing wastes.

Keep the soil covered

Cover crops and no till planting have one important thing in common-keeping a protective cover on the soil. Any time the soil is covered with living or dead vegetation, the erosive impact of raindrops is negated, and detachment and transport of soil particles (erosion) is greatly reduced. If soil is left bare erosion is usually widespread in low residue crops like vegetables, especially on sloping soils. There are a number of good covers that can be used in vegetable crops. The old standby is grain rye. It comes up quickly and provides a cover and protection. Others are annual ryegrass, sudangrass, oats, buckwheat, and legumes like clovers or hairy vetch (2). Some good information on cover crops can be found on the web at:

http://www.rcre.rutgers.edu/pubs/publication.asp?pid=FS849

http://www.attra.org/attra-pub/covercrop.html

http://www.agry.purdue.edu/ext/forages/publications/ay247.htm

Pest control

Integrated Pest Management (IPM) is the key concept to follow. Using non selective pesticides on set schedules can kill beneficial soil organisms such as earthworms or mycorrhizal fungi as well as the target pests. It is critically important to follow Rutgers Cooperative Extension IPM guidance including scouting, economic thresholds, and using natural and cultural methods as much as possible to control pests. Although a little more labor may be needed, the benefits to the soil and water, as well as increased yields over time are the likely paybacks. *Crop rotation* may be the single most beneficial practice you could do for improved pest control.

The Rutgers pest management website has excellent information: www.pestmanagement.rutgers.edu

Nutrient management

Use natural organic nutrient sources as much as possible to meet crop needs. Animal manures are often in excess with livestock producers and may be available for little or no cost. Composted manure is an even better choice, providing low levels of stable nutrients with less odor and pollution risk of fresh manure. Other natural sources like grass clippings, or food processing wastes may be available. Leaves are an excellent source of organic carbon, which improves the soil ecosystem. Crops may require a little extra nitrogen to meet crop need from another source, since leaves provide little nitrogen.

Whatever source you use, get a soil test every three years and follow crop specific nutrient recommendations.

Soil Chemistry and Characteristics

Important measurable soil characteristics are pH, soil organic matter level, bulk density, and cation exchange capacity. As a general guide, the following levels can help to indicate the relative quality of a soil for plant growth.

pH: It is also critical to maintain an optimum soil pH for the crops being produced. Proper pH maintenance provides benefits ranging from increased soil aggregation to better pesticide efficacy. Consult your soil test for the lime recommendation based on the desired crops. The recommendation depends upon the crops being grown. Although some crops such as blueberries do well in acidic soils, the optimal pH for most agronomic crops is 6.2-7.0.

Soil Organic Matter: sands 2%, loams 3-4%, silts/clays 5%

Bulk Density (the measurement of soil weight per unit volume): sands <1.6, loams <1.4, silts/clays <1.1 Mg/m^3

Cation Exchange Capacity (CEC- an estimate of the soil's capacity to attract and exchange nutrients): sands 3-5 meq/100g, loams 10-20 meq/1006, silts-clays 25-40 meq/100g.

A word about irrigation

Irrigation can be a source of pollution when done carelessly. Irrigation should be carefully scheduled and only done when soil moisture conditions warrant. Trickle irrigation is far more efficient than overhead, and should be considered whenever possible. By applying only what's necessary, water, soil and agrichemicals will be conserved. Excess irrigation water also can hasten decomposition of organic matter, which is undesirable over the long run.

Erosion control

As stated before, a healthier soil can handle more rainfall or irrigation water without eroding than a poorly managed soil. So, it follows that by having increased organic matter, using cover crops, rotating crops, reducing tillage and helping to maintain earthworm channels you will reduce the likelihood of degrading your soil. There are some additional common sense things that you can do:

1. Run your rows or beds across the slope or on the contour instead of up-and-down hill. This reduces runoff and also encourages water conservation. Mulch or establish cover crop between the beds.
2. Install 15-20 ft wide grass buffer strips across the slope in between sections of crop.
3. Install grass strips along headlands and turn rows at the row ends, running up and down hill.
4. Install grass filter strips at the bottom edge of fields.
5. Install terraces and grass waterways for more severe sheet and rill or gully erosion problems.
6. Plant cover crops between cropped periods.
7. Use no-till or reduced tillage planting method.

References

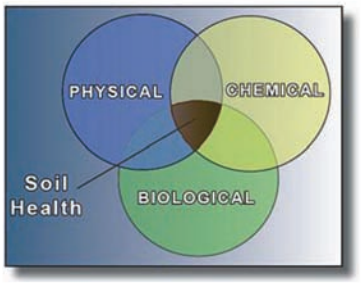
1. Brady, N.C. *The Nature and Properties of Soils*. MacMillan Publishing, New York, NY.

2. USDA CSREES *Managing Cover Crops Profitably, Third Edition.* Handbook Series Book # 9. Sustainable Agriculture Network, Beltsville, MD

Where can I get more information on Soil Health?

For additional information go to the following websites:

- www.soils.usda.gov/sqi
- www.soildistrict.org
- www.nj.nrcs.usda.gov



NRCS has a website dedicated to soil health.
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health

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