

soil Quality Measurement

Soil Quality Kit – Guides for Educators



Soil quality integrates the physical, chemical, and biological components of soil and their interactions. Therefore, to capture the holistic nature of soil quality or health, all parameters in the kit should be measured. However, not all parameters have equal relevance to all soils and situations. For example, the EC test for salinity may not be useful in the eastern part of the U.S. where salinity is not a problem, but may be used to estimate nitrate-nitrogen. A minimum data set of soil properties, or indicators, from each of the three soil components are selected based on their ability to indicate the capacity of the soil to function for a specific land use, climate, and soil type. Indicators in the soil quality kit are selected primarily for agricultural soil quality assessments. The kit should be used as a screening tool to give the general trend or direction of soil quality—whether current management systems are maintaining, enhancing, or degrading the soil. Proper use of the kit and interpretation of results depends on how well the indicators are understood with respect to the land use and environmental goals.

There are two fundamental ways to assess soil quality:

1. Take measurements periodically over time to monitor changes or trends in soil quality; and
2. Compare measured values to a standard or reference soil condition.

By making use of the two ways of assessing soil quality, the kit can be used to:

- Make side-by-side comparisons of different soil management systems to determine their relative effects on soil quality;
- Take measurements on the same field over time to monitor trends in soil quality as affected by soil use and management;
- Compare problem areas in a field to the non-problem areas; and
- Compare measured values to a reference soil condition or to the natural ecosystem.

Field or Site Characterization

It is important to gain as much information about the area and soils as possible. Indicators of soil quality must be evaluated within the context of site and climatic characteristics. A “**Soil Quality Site Description**” recording sheet, located in the appendix, should be completed during the soil quality assessment. The following are items that should be considered when making an on-farm soil quality assessment:

Soil series - The soil series name can be found in the county soil survey.

Signs of erosion - Signs of erosion include gullies, rills, development of pedestals, exposed areas of subsoil, damage to plants caused by windblown materials, etc.

Management history - This item includes a description of past and present land and crop management; kind, amount, and method of fertilization; prior tillage; and land leveling.

Slope and topographical features of the field - Record percent slope at the sampling sites within the field, and note any hills, knolls, ridges, potholes, depressions, etc.

Location of the field and sampling areas - Record longitude and latitude (if GPS unit is available), a

description of the location (feet from landmarks), and a drawing of the field showing sampling areas.

Climatic information - This item includes precipitation and high and low average temperatures for each month (data from a county or watershed level will often be sufficient).

Location of environmentally sensitive areas - This item includes location of ponds, creeks, wetlands, or other environmentally fragile sites adjacent to the field.

Sampling Guidelines

Important: When, where, and how deep to sample and how many samples to take is dependent on the questions being asked or problems being addressed by the farm or land manager.

When to sample?

Timing of sampling is important, because soil properties vary within a season and with management operations, such as tillage. In general, for the overall assessment of soil quality, an **annual sampling of the field** is recommended. Sampling once a year will allow for the detection of long-term changes in soil quality. A good time of year to sample is when the climate is most stable and there have been no recent disturbances, such as after harvest or the end of the growing season.

Where to sample?

An important consideration in determining where to sample in a field is the variability of the area. Soil properties naturally vary across a field and even within the same soil type. Soil variability across a field is also affected by management operations. General field characteristics to consider are:

- Differences in soil type,
- Differences in management (crops, manure history, fertilizer, lime, irrigation, etc.)
- Wheel versus non-wheel tracked areas,
- Differences in crop growth,
- Salt affected versus non-salt affected areas,
- Eroded versus non-eroded areas,
- Differences in slope, and
- Wet versus non-wet areas (drainage).

Some general guidelines on selecting sampling sites are as follows:

- 1) For a general assessment of soil quality, select sample sites within a field that are representative of the field. Refer to soil maps of the area (Soil Survey) to identify soil type differences and variations within the map unit (Figure 1). A hand auger can be used to make a number of borings to establish locations of the most representative areas of the field.

- Row versus inter-row areas,

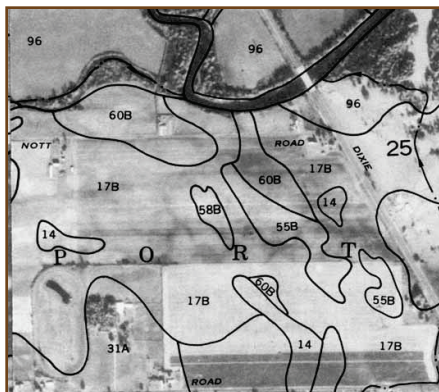


Figure 1.

- 2) For assessment of trouble spots within a field, sample areas that are representative of the trouble spots (Figure 2).



Figure 2.

- 3) When comparing management systems, make sure sites selected for comparison have the same soil type and located on the same topographical features in both fields. For example, if sites are measured in the wheel tracks in one field, wheel tracks sites should be selected in the comparison field.
- 4) When monitoring changes in soil quality over time, make sure the same sites within the field are measured at each sampling time. Also, try to take measurements at the same soil moisture conditions at each sampling time to reduce variability.

In some cases it might be helpful to compare sampling points if the field is sampled at different points across gradients of soil type, soil moisture, slope, or other factors rather than just at a fixed point (Figure 3).

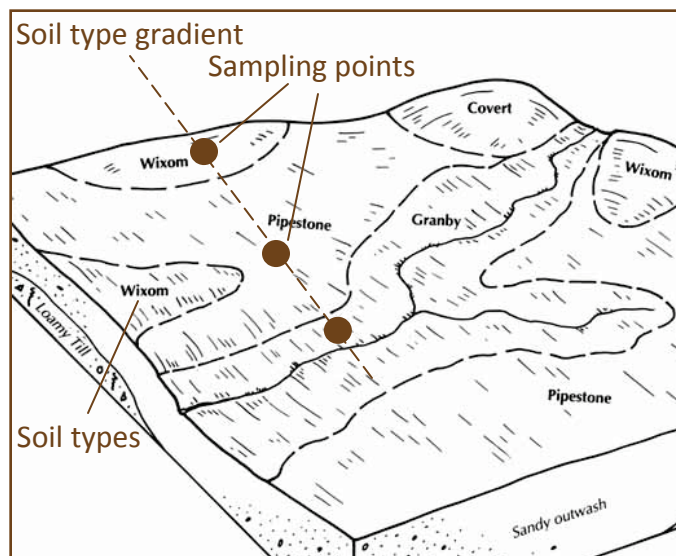


Figure 3.

How many samples?

The number of samples or measurements to take will depend on the variability of the field.

It is recommended that **a minimum of three samples or measurements** be collected on any one soil type and management combination. In general, the greater the variability of the field, more measurements is needed to get a representative value at the field scale. When measuring EC, pH, and soil phosphates and nitrates at the field scale, eight or nine sample cores from across the field could be bulked and mixed, and two subsamples from the mixed cores could be analyzed. When taking cores from across the field, stay away from areas that are distinctly different and are not representative of the field, such as farm lanes and field borders, fertilizer bands, areas within 150 feet of a gravel road, potholes, eroded spots, etc.