Soil Quality—What's Really Going on Under Your Residue?

Charles Atkinson
1520 Kansas Ave.
Great Bend, KS 67530
(620) 792-3346
charles.atkinson@ks.usda.gov

Atkinson is a soil conservationist with the USDA Natural Resources Conservation Service in Barton County. He has been working with NRCS for 18 years working with producers to protect their natural resources with emphasis on no-till. He helped area producers establish the Golden Belt Residue Management Alliance, and he serves an advisor to No-Till no the Plains, Inc. His goal is to help producers to establish more intense crop rotations to reduce soil erosion, improve soil and water quality, and enhance the quality of life. He assisted his father in converting their southeast Kansas farm to no-till with a crop rotation of wheat, sorghum, soybean & alfalfa. Also, he is working with relay cropping of soybeans in growing wheat. Charles is a member of the Kansas Soybean Association and Kansas Fair Association. He received the 2002 Kansas Young Leader award from the Kansas Soybean Association and was nominated to the Kansas Fairs Association Hall of Fame, January 2002. Charles holds a BS degree in Agronomy from Kansas State University.

Soil Quality—What's Really Going on Under Your Residue?

Introduction: Soil quality is simply the capacity of a soil to function. Physical, chemical and biological properties and processes within the living and dynamic soil body are all considered important to the soils ability to function. When a producer deals with the quality of the soil the producer is basically studying the integration of the physical, chemical and biological components of the soil and it's interactions.

Assessment of the soil should be considered a process through which soil resources are evaluated on the basis of the soil function and change in response to a specific natural or introduced stress, or management practice.

1. The Soil

a. Is living

b. Made of different size particles

c. Organic Matter

d. Numerous species of living organisms

2. Soil Quality

a. Is important to support crop production

b. Reduces on & off site erosion

c. Improves nutrient efficiencies

d. Insures sustainability for future use

3. Indicators used to determine Soil Quality

a. Visual

i. Change in soil color

ii. Ephemeral erosion

iii. Weed species

Iv. Plant response

V. Ponding

vi. Deposition

b. Physical

i. Topsoil Depth

ii. Porosity

iii. Aggregate Stability

iv. Texture

v. Crusting

vi. Compaction

c. Chemical

i. pH

ii. Organic Matter

iii. Nutrient Cycling

iv. Cation Exchange

d. Biological

i. Micro/Macro-organisms

ii. Earthworm populations

iii. Soil Respiration

iv. Micro Decomposition of Organic Matter

4. Aggregate Stability

a. An aggregate consist of several soil particles bound together

b. Aggregate Stability is a measure of a soils particles capability to with stand external forces

c. Stable Aggregates improve Soil Quality by:

i. Decreasing soil erodibility

ii. Improving Air & Water movement

iii. Improving physical environment for root growth

5. Soil Compaction

a. Problems

i. Weak soil structure

ii. Restricted plant rooting

iii. Flattened, Turned or Stubby plant roots

iv. Slow water infiltration

b. Solution

i. Crop Rotation

1. Grass Roots vs. Tap Roots

ii. Fracture Compaction

2. Timing Critical

iii. Investigation

3. Site by Site inspection is critical

c. Prevention – be aware of:

i. Traffic patterns

ii. Soil too wet

iii. Weight distribution

6. Organic Matter - It's the glue that holds it all together

a. Factors that influence OM

i. Climate

ii. Soil Texture

iii. Management practices

1 Crop Rotations

a. Mono Culture decrease OM

b. Burning Residue decrease OM

c. Crop Rotations increase OM

d. Improves Tilth of soil

2. Field Operations

a. Tillage reduce aggregate stability

b. Tillage decreases soil OM

c. Tillage could aid in breaking of compaction layer

b. Tillage Effects on OM

i. Plowing increases the decomposition of Organic Matter

ii. No-Till preserves the OM and improves Soil Quality

7. Comparison of No-Till (NT) and Intensive Tillage (IT) Systems

Yield (Non-Drought) NT = IT

Yield (Drought) NT > IT

Yield (Severe Drought) NT $\geq$ IT

Residue Decomposition NT < IT

Organic Matter NT > IT

Soil Moisture NT > IT

Total Soil N (Upper Layer) NT > IT

8. Making the Move

a. Know your soil

b. Become an Effective Manager

c. Time (BE PATIENT)

i. Benefits 3-5 years

d. Know the Difference

i. No-Till Farming

ii. No-Till Planting

Just as with water, air, or any other natural resource, soil quality is difficult, at best, to measure. Any assessment must distinguish between inherent or natural differences caused by how the soil was formed and changes resulting from land use and management practices.

There are two fundamental ways to assess the quality of the soil: Take measurements periodically over time to monitor change or trends in the soil quality. Compare values to a standard or reference soil condition. By making use of these two fundamentals, you are now able to make side-by-side comparisons of different soil management systems to determine their relative effects on the soil, take measurements on the same field to monitor trends, and compare problem area's.

Soil quality is not rocket science, nor does it take a rocket scientist to figure out that the soil is alive and ever changing. Researchers and farmers are constantly searching for ways to improve agricultural production. Monitoring and understanding soil quality is just in its infancy. As we learn more and more about our natural resources and how they interact with one another we should become even more effective production managers.