

## Southwest North Dakota Soil Health Demonstration Fall Tour

by Jon Stika

Following are my notes from the recent tour of the Southwest North Dakota Soil Health Demonstration held on September 16<sup>th</sup> for more information go to: <http://www.swndsoilhealth.mandakzerotill.org>

Shawn Krance, Project Manager presented the history and purpose of the demonstration project and described the crops that were currently growing and cover crops that were planted after early harvested crops.

Gabe Brown has been using no-till for sixteen years and cover crops for almost as long to improve soil quality, reduce input costs, increase production and provide forage for his livestock. Gabe does not use disc markers on his planter because they cause soil disturbance that result in weed production.



Gabe Brown speaks to the tour participants while Ken Miller waits to add his part to the presentation.

Every production decision made on the Brown Ranch revolves around improving soil quality. Improving soil quality increases the available water holding capacity of the soil to assure crop production during droughts as well as years with average annual

precipitation of seventeen inches. Original soil organic matter levels in Gabe's cropland fields were 1.7% and are now 4.0%. Soil Foodweb analysis results show a total fungi to total bacteria ratio of 1.5 (1.0 is a good goal) which is part of the reason Gabe's soils cycle nutrients and generate over 200 pounds per acre of plant available nitrogen without the use of commercial fertilizer.

Gabe has reduced his input of commercial fertilizer by 90% and use of herbicides by 75%. This growing season Gabe harvested 72 bushel per acre spring wheat on fields that have not had commercial fertilizer or manure applied to them this year or the year prior. Gabe attributes the reduction in herbicide use to crop rotation diversity, better soil structure, good fungi to bacteria balance in the soil and no spikes in the amount of available nitrogen from applications of commercial fertilizer to disrupt plant – soil foodweb relationships.



A cover crop mix growing in triticale stubble

This past June, Gabe received 12 inches of rain at his ranch in a little over 5 hours. Gabe reported that the first 8 inches of rain infiltrated and absorbed into the soil before any runoff occurred. The runoff did not erode any soil because it was all covered and anchored with growing crops and previous crop residue. A day after the rain event,

Gabe said he could have driven a tractor or sprayer across the fields without sinking in.

Gabe and Ken Miller also stressed the need to keep the soil covered to create the best environment for soil microbes by keeping the soil cool and moist. This also provides the cover and food for soil microarthropods. Gabe and Ken said to increase diversity in the soil by including crop species in cover crop mixes that are not already part of a typical crop rotation. Tailor cover crop mixes to accomplish goals of residue management and nutrient cycling. Root structure, biomass production and carbon:nitrogen ratios are important considerations for selecting species to include in a cover crop.



Emerging multi-species cover crop following oat/pea cut for hay on field four of the Soil Health Demonstration.

Gabe suggested that we imitate nature with the least amount of soil disturbance and the greatest plant diversity on cropland. Diverse mixtures of species in cover crops provide the greatest production, even during drought. In 2008 Gabe produced 114 bushels per acre of dry land corn on both halves of a field that was split between no commercial fertilizer applied and 100 pound of actual nitrogen applied. The fertilizer did not produce any crop yield response; the soil was fully capable of providing all the fertility the corn crop needed without additional fertilizer.

Ron Wiederholt, Nutrient Management Specialist with the NDSU Carrington Research and Extension Center presented information about using livestock manure as a source of crop fertilizer. Ron said that if managed properly, manure can provide the sole source of fertility for a given crop.

Manure improves soil physical properties to increase water infiltration and water holding capacity. Manure feeds soil biology and increases soil biologic carbon and enzyme activity in the soil to increase nutrient cycling. Ron compared the biologic activity of manure decomposition to the type of activity that occurs in the rhizosphere of living plant roots. The crop response to manure application typically exceeds what would be expected from the nutrient analysis of the manure; suggesting that the increased biologic activity is also providing for plant growth needs.

Ron also mentioned that weed pressure after manure application is often a result of the enzymes in manure activating weed seeds already present in the soil; not because of weed seeds that might be present in the manure itself.

Greta Gramig, NDSU Assistant Professor in the Plant Science Dept. discussed weed seed predation. Greta described how birds, insects and rodents eat weed seeds from crop fields. Because no-till fields have more crop residue cover they provide better habitat for insects that eat weed seeds. She also said that cropland fields with greater crop rotation diversity and actively growing multi-species cover crops also had a greater diversity and resident populations of insects that consumed weed seeds.

Mark Liebig, ARS Soil Scientist presented information on research currently being conducted at Mandan on changes in soil carbon associated with no-till, crop rotation and use of cover crops and grazing systems.

Jon Stika presented information on feeding the “underground herd” of soil microbes to increase nutrient cycling.

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