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CARBON & sequestration & Strip TILL

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Starting back in first decade of this century the buzz words of carbon sequestration has been seen in articles, has become frequently spoken in the government FSA and USDA-NRCS offices to growers and espoused it is one of the methods to reduce carbon emissions or offset them. During this same period some of the Farm Bureau folks got quite involved and brokered deals to monitor soil organic matter (SOM) and for growers to involve these better conservation practices on the farm, they could store carbon by leaving the previous crop aftermath on the surface throughout the year. Zero tillage, direct seeding, No-Till, mulch till, and Strip-Till all somewhat differing practices on the tillage side of things prior to seeding offer the return of residues to the soil for slowed breakdown and slow release to the soil complex.

With these methods of returning and storing soil carbon, the potential to offset the losses across the globe due to burning carbon based fossil fuels at a ever advancing rate and carbon based gases being released into the atmosphere is becoming a reality. This we understand. Slash and burn methods in South America and parts of Africa have been a long time traditional way to clear forest for cropland wastes very valuable carbon material into the atmosphere. Scientists have announced quite loudly that these wasteful practices and preponderance of full width tillage in the countries that are coming of age are all negative. So much gloom and doom verbiage, I wonder if everyone that farms in the U.S. knows they are at times branded as the worst people on earth? As said back some time ago -- NOT!

Here in the States we have adopted better and wiser conservation measures to simplify and drastically reduce the types of pre-plant tillage which was inverting and burying prior year residues but exposing years and years of prior stored carbon and much of it was oxidizing away and above. Modelers and scientists have calculated that with practices such as Strip-Till and Direct Seeding growers can store tons of carbon in the surface 2 to 5 centimeters with the return and slow breakdown of crop aftermath. But what about all those roots, root exudates, lignin and cellulosic materials from 0 to 6 or 7 feet in places?

Here at Orthman Manufacturing, Inc we have observed rooting magnified with the conservation tillage strategy of Strip-Tillage due to a quicker start in the spring to maximize the number of roots expressed below ground. We have followed that up with observed soil pits to measure corn roots in a continual strip-till program that allows deeper expansion into the soil due to roots propensity to follow the cooler soil temperatures as the season heats deep into the soil profile. We know from studies accomplished at the University of Georgia (1999-2001) that corn is known to extend vertically at specific soil temperatures as well as its lateral root development. Gaining more root dimension in linear length we know that corn plants can accumulate more grams of dry matter below ground to depths mentioned above.

We have measured in eastern Colorado in loam and silt loam textured very deep soils under corn; 38,100+ linear inches of corn roots with deeper rooted corn hybrids, other not quite as prolific rooted hybrids we have measured 9,500 to 20,000 linear inches. The estimate for the grams of carbon materials is far and above the grams of material remaining after the ear of corn is harvested. It is our contention as we have exposed nearly a quarter mile of roots under one corn plant that was planted into a strip-tilled environment and precision fertilized we are gaining loads more soil carbon material than what is possible with full width (inversion) tillage systems every year. To give you for example, when we first started the strip-till methodology at Lexington, Nebraska in 2007 our soil samples from the first four inches was 2.1 to 2.3%. This spring

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when we sampled again, in very near proximity we had 2.7-3.1% SOM. We do not graze the corn stalks with cattle which can reduce corn residues by 50% on the soil surface. We leave our standing stalks 13 to 20 inches tall and we do not shred come spring. It is our contention that the longer and taller stalks keep winter winds from blowing residues away and off into the adjoining fields or barrow ditches. We have estimated tonnage of corn residues after harvest of 5.5T/acre to 7.8T/acre and very little of it leaving the property. Maintaining this quantity of aftermath has its concerns but we have more water stored, more carbon returning into the surface, increased population of microbes, and we have old roots decomposing slowly to become humus – the treats for those burrowing insects and soil microbes.

In our studies at the Irrigation Research Foundation which lies just north of Yuma, Colorado, we observed from 2001 to 2008 a change in SOM from 1.51% to 2.66% in 7 years with strip-tillage. Now remember that is only being measured in the upper 10 cm (4 inches) of the soil profile. It is also important to note the elevation at Yuma is 4100+ ft compared to Lexington at approximately 2300 ft above sea level. As observed in the high plains of Colorado the residues are reduced by UV during the winter months due to the non-cloudy winter days and lack of snow cover. Oxidation of the carbon materials remaining is evident.

Scientist Hulugalle in New South Wales, Australia made some sound measurements and reported this in **Agriculture Today**, April 2010 regarding what returns of carbon came from roots in two cropping systems. "We measured corn root growth in back-to-back corn and a cotton-corn rotation sown on one metre beds during the summers of 2007-08 and 2008-09".

"Total carbon added from corn roots averaged five tonnes per hectare per year with cotton-corn and 9.3t/ha/year with back-to-back corn."

Other measurements Hulugalle determined that corn on corn accumulated 770 g C m-2 yr-1 or for those of us here in the States that is 1.7lbs of carbon per 10.7 square feet per year or 0.16lb C/sq.ft. per year. This was published in a Short Report on the **Plant Root** website 2010.

Much of the research and determined rates of carbon storage here in the U.S. has looked at the surface layers of the soil. Some limited research has gone into determining how much soil carbon is stored with switchgrass, a near-permanent crop and the rate is quite high. These studies are part of the biofuels industry look at how the cellulosic material can be beneficial to ethanol production and as an ecologically sound system.

WHAT DOES THIS ALL MEAN AND WHERE DO WE GO FROM HERE?

At Orthman and as agronomists digging holes, we are measuring root dimensions, calculating root mass to determine how much of the soil volume has roots to absorb water and nutrients and believing that proper attention to growing crops such as corn with the strip-till methodology we can increase soil carbon storage each year. It has been our observations and measurements that as growers plant better hybrids that explore more of the soil profile they are storing carbon and not losing it to the atmosphere at any kind of an alarming rate. The same scientist in New South Wales said that carbon losses could be as much as 11% of the total in a corn on corn system and we do not know what the tillage type was in these trials. Our contention is, we are not inverting the soil even in the strip that is tilled which exposes old carbon sources to oxidation. Yes we do disturb the soil in a more vertical fashion; we leave 75% of the soil area undisturbed and move the other portion (of carbon based residues) where the strip is tilled to the middles to slowly breakdown. We acknowledge all the carbon material is vital to maintain soil life, return N-P-K-S and other nutrients and store carbon. I have observed in the near 1300 soil pits I have excavated across the United States, old root material in pores and root channels from previous years that appears as near microscopic granules at depths of 4 to 5 feet down. Especially in old alfalfa roots and sunflower roots at those kinds of depth, this stuff has to be good as gold to roots that may follow.

We also suggest with the strip-till system, growers improve the total carbon stored because of deeper roots, more number of roots which we have measured successfully for over 11 years now in Eastern Colorado and South Central Nebraska for 5 years. Farmers employing the strip-till approach to farming their ground can be sure they are doing their part to minimize CO2 emissions, sequester carbon, improve the soil-life system, and improve the health and vigor of their soils to produce crops for many, many years to come. All of us at Orthman Manufacturing are proud of the fact that we are doing what works and what is right for the country as well as making farmers more prosperous and conservation savvy.

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