Minnesota Board of Water & Soil Resources

Carbon Sequestration

Conservation Tillage

No-till and other conservation tillage practices have proven successful in controlling soil erosion and providing other benefits. But if carbon sequestration is the goal, conservation tillage alone is not the solution.

New research indicates that conservation tillage alone fails to sequester more carbon than traditional tillage. Using a cover crop along with conservation tillage is essential for carbon sequestration.

New research[1,2,3] utilizes deep soil samples and micrometeorological techniques to obtain a better understanding of carbon dynamics, whereas earlier research has relied solely on shallow soil sampling. Shallow sampling provides an incomplete assessment of carbon storage in agricultural soils.

Different tillage practices influence the vertical distribution of carbon in the soil. No-till maintains crop residues within the upper few inches of the soil surface, while conventional tillage buries residues deeper in the soil profile. Therefore, no-till results in more carbon storage in the surface soil, and conventional tillage results in more carbon storage in the subsurface soil.

However, looking at the entire soil profile (16 inches) demonstrates that soils under various tillage methods contain similar amounts of carbon -- no method of tillage has a clear advantage over another. Conservation tillage reduces disturbance to the soil and leaves crop residue on the soil surface, whereas conventional tillage buries crop residues. Therefore, when placement of crop residues in the soil profile and the amount of soil disturbance are taken into account, it appears the same amount of carbon is stored regardless of tillage practices.

While some research continues to recognize no-till as a means to sequester carbon, most states and other institutions are moving toward consensus and are accepting the new research. Understanding which practices improve carbon storage and which ones do not is necessary in order to maintain the integrity of voluntary carbon trading markets.

Store carbon using cover crops

Cover cropping, when used as a complimentary practice with no-till, sequesters carbon in agricultural soils. Cover crops are grasses, legumes and forbs planted to provide seasonal soil cover when the soil would otherwise be bare – i.e. before the main crop emerges in the spring or after fall harvest.

- **Carbon sequestration in no-till systems is accomplished by integrating cover crops into the system**
- **Cover crops sequester organic carbon through residue contributions on the soil surface and below ground.**
- **Planting in late summer allows perennial cover crops to generate substantial biomass throughout the fall and again in the spring. Rye is a good choice because it is more resistant to decay than other cover crops (oats or barley).**

Recent tillage surveys conducted in Minnesota show that farmers are using conservation tillage more frequently than in the past, particularly in corn and soybean rotations. Soil erosion control, water quality improvement, and lower production costs are a few of the many environmental and economic benefits associated with conservation tillage practices.

Issues of carbon sequestration notwithstanding, the Minnesota Board of Water and Soil Resources encourages the use of conservation tillage to protect soil quality, reduce soil erosion and improve local waterways.

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[1] Baker, J.M., T.E. Ochsner, R.T. Venterea and T.J. Griffis. 2007. Agriculture, Ecosystems & Environment 118(1-4): 1-5

[2] Dolan, M.S., C.E. Clapp, R.R. Allmaras, J.M. Baker, and J.A.E. Molina. 2006. Soil & Tillage Research. 89 (2): 221-231.

[3] Christopher, S.F. and R. Lal. 2009. Soil Science Society of America Journal 73(1): 207-216.