Maximize Crop Residues

by Matt Hagny

TECHNIQUE

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Crop residues are what make no-till go. Without adequate surface residues, the soil is susceptible to damage by raindrops, leading to surface sealing, erosion, and later a brick-like surface.

Because water infiltration is closely tied to surface cover (see graph), and because crop yields are largely determined by water availability, it should be obvious that maintaining surface residues is of utmost importance. Yet these residues are frequently called "trash" and regarded as if of little or no value. Even those who have embraced no-till as a permanent system are frequently guilty of not treating their residues with the necessary care.

Residue decomposes by both biological and chemical activity. The process happens more quickly when temperatures are warm (68 to 95° F reportedly 'optimum'[1]), and when moisture is available. Warmer, wetter regions have more difficulty maintaining surface residues and soil OM—for instance, it's a lot tougher to build surface residues in Oklahoma than in Manitoba, and more difficult in Brazil than in Argentina. Those warmer and more humid regions especially need to focus on growing more biomass and preserving it as long as possible.

Photo by Brian Lindley.

A thatch of residue lets the soil store more water, which is almost always a limiting factor in agriculture.

Residue standing decomposes more slowly than that which is lying on the soil surface—this is no different than wood fenceposts rotting at or just below the soil surface, but the portion sticking up in the air lasts much longer. Residue buried at a shallow depth (1 – 2 inches) also decomposes very quickly.

The no-tiller has begun the process of understanding that surface residues equate to moisture available to the crop during its growth cycle. Yet many no-till field operations result in more stubble destruction than they should. For instance, many no-tillers think it necessary or desirable to apply fertilizer subsurface with some type of applicator as a separate pass. Some buy or equip their planters or drills with additional openers to apply fertilizer. Some people use their air drills to place fertilizer during a separate pass. Other no-till producers lose too much residue during their seeding pass, or simply don't grow enough in the first place. Let's examine some of these issues in more detail.

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Fertilization

A separate pass with soil-engaging openers to apply fertilizer could result in destroying (burying, slicing and/or flattening) 10 to 50% of the residue either immediately or in a few weeks of accelerated decomposition. On the U.S. Plains or other regions where moisture is frequently a limiting factor, this residue loss has a high likelihood of translating into yield loss in the next crop. For instance, if abundant wheat stubble lets you store an additional 4 inches of water for growth of the next crop (+4 inches of transpiration),[2] and the other agronomy is proper (no

[1] D. Tanaka & V. Hoffman, 1994, Residue Reduction, in *Crop Residue Management To Reduce Erosion and Improve Soil Quality (Northern Great Plains)*, ed. W.C. Moldenhauer & A.L. Black, USDA-ARS.

[2] An 80 bu/a winter wheat crop may produce 7,000 lbs/a of straw. One study reports a value of 0.4 inch of additional water stored for every 900 lbs/a of wheat straw. So 7,000 lbs of straw would store an additional 3.1 inches of moisture. (B.W. Greb, 1983, Water conservation: Central Great Plains, in *Dryland Agriculture*, ed. H.E. Dregne & W. O. Willis, American Society of Agronomy.) Various studies from Texas to the Dakotas produce roughly similar numbers. Long-term no-till tends to be even more efficient due to improved structure with the result that precipitation moves away from the surface more quickly. (See also R. Ward, 2003, Drought Conditions Spur Additional Discussion, *WardLetter* [Feb. 2003], Ward Laboratories Inc. [Kearney, NE]. D.C. Nielsen, ca. 2002, Crop Rotation, Soil Water Content & Wheat Yields, *Conservation Tillage Fact Sheet #1-02*, USDA-ARS Central Great Plains Research Station, Akron, CO. P.W. Unger, E.G. Krenzer, Jr. & C.A. Norwood, 1994, Soil-Water Conservation, in *Crop Residue Management To Reduce Erosion and Improve Soil Quality [Southern Great Plains]*, ed. B.A. Stewart & W.C. Moldenhauer, USDA-ARS.)

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