The Dollars and Cents of Residue Breakdown

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Q. Is there any difference in residue breakdown and nutrient availability between the Midwest and the arid west with irrigation?

A. Residue decay is a bigger challenge in any arid climate, even with irrigation. The decay process requires adequate moisture and heat in order to support the microbial populations, and dry spells between seasons when crops are not irrigated tend to diminish the sustainable level of activity among the decay organisms.

Q. Is "That damn BT corn" really the reason why farmer's residue won't decompose? Or is it really about soil microbial activity?

A. Although some university studies show little difference in the decay rates between Bt and non-Bt corn residue, farmers tell us that they find Bt corn stalks cause more trouble with tires and equipment and tend to decay slower. Bt corn does have more lignin than non-Bt corn, but it should decay over time, even if it takes a bit longer than non-Bt corn. The key to encouraging decomposition of Bt corn is to support the microbial populations.

Q. Is there a bottom line nitrogen that needs to stay in the soil for microorganism multiplication?

A. To decay a ton of corn residue, the microbial populations require about 13 pounds of available nitrogen. If the required amount of nitrogen is unavailable, the multiplication of the decay organisms is limited and the decay process takes longer to complete.

Q. Do you see major differences in residue breakdowns with the newer tillage styles. Vertical tillage? High speed tillage?

A. To begin, we know that tillage has both positive and negative impacts on the residue decay process. On the positive side, tillage operations help to mix the residue in the top 3-4 inches of soil where the much of the aerobic decay activity occurs, and tillage tools can break the residue and provide more locations for the microbes to form colonies in the stalks. On the negative side, tillage operations hinder the growth of beneficial microbe colonies, especially the fungal species that are important to residue decay. Consequently, the many studies that compare residue decay under tillage and no-tillage systems have found mixed results.

If you are using tillage, there are some advantages to the newer tillage styles. Many of the vertical tillage tools help to break the residue and encourage microbial colonization, and the high-speed tools can improve soil-residue contact.

Q. If we release all that N in the fall after harvest, it won't be there for the next crop the following spring/summer, will it?

A. The organic nitrogen in crop residues is mineralized by the soil bacteria and converted to the inorganic ammonium form, which may be immobilized by other microbes, captured by growing cover crops, or attached to soil particles and organic matter. The ammonium form of nitrogen is not water soluble and does not easily leach from the soil. Also, the nitrification process that converts ammonium-N to nitrate-N slows at low temperatures, so most of the nitrogen released from the crop residue in the fall or early spring will be available for the next crop.

Q. In your "Decay Rates by Residue Type" slide, what are you calling "Rye cover?" Is that Annual Ryegrass or Cereal Rye?

A. The decay rate presented in the slide is based on cereal rye, but the rate for annual rye or other small grain covers would be very similar as long as it is terminated at the same stage (about 6-8 inches). In general, the rate of decay for small grain cover crop residue depends on the size and stage of development at termination, and cover crops that are terminated later have more residue tonnage. Further, late-terminated residues will have proportionally more lignin and higher carbon-nitrogen ratios, which make the residue harder to decompose.

Q. What types of organisms are primarily responsible for cornstalk decay?

A. The most important decay organisms for cornstalks and other crop residues are beneficial fungal species, which initiate the decay process and do most of the breakdown work. Bacterial species are involved in some of the steps such as nutrient mineralization, but the fungal species are more important to the overall process. It is also important to note that there are hundreds of microbial species and sub-species that play particular roles in the residue decay process --- some are active early or late in the process while others are mainly active under specific environmental conditions (e.g., temperature, soil pH, etc.).