Should I apply nitrogen to break down corn residue?

How many pounds of residue is produced for each bushel of corn harvested and what is crop residue composed of?

Nearly 50 pounds of residue is produced for each bushel of corn harvested. Crop residue is composed of lignin, cellulose, hemicellulose, and nutrients.

Does tillage affect crop residue breakdown?

Laboratory and field studies demonstrated no significant differences in the decomposition or percent residue that remained among strip-tillage, deep-tillage, and no-till systems.

What role do soil microorganisms play in the residue breakdown process?

Soil microorganisms break down crop residue to obtain nutrients for their growth and development, thereby immobilizing the nutrients and converting them to a form that is more available to plants.

How does the N cycle facilitate the residue decomposition process?

Within the N cycle, the residue decomposition process relies on immobilization and mineralization; microbes are involved in both processes. In the immobilization process, N is consumed by microbes. Mineralization is the release of N that generally happens upon the death of soil microbes. Nitrogen within residue is tied up (immobilized) until decomposition is complete and is released by soil microbes through mineralization.

What role does the carbon to nitrogen (C: N) ratio play during residue decomposition?

The C:N ratio will indicate how quickly the residue can be decomposed by microorganisms and N is released. C:N ratios greatly vary among crop residues. Alfalfa, soybean, and other legumes have lower C:N ratios near 20:1, which usually results in quicker mineralization. However, corn has a higher C:N ratio (70:1), which takes more time to decay, and results in higher N amounts required by microbes to decompose the residue. Soil microbes try to maintain a C:N ratio of around 10:1. If not taken into account, the microbe requirement for N can compete with the next season's corn crop.

What is "ugly corn syndrome"?

This situation is familiar to many corn growers with continuous corn operations. Under these circumstances a buildup of organic matter from multiple years of corn-on-corn production can result in the C:N ratio being more than double the optimal ratio for microbes to decompose the crop residue. The microbes then have to use the available soil N for their metabolism. This results in a lack of plant-available N, which causes corn seedlings from emergence to the V3-V4 stage to turn yellow. Even if a grower has applied N during the previous fall or at spring planting, soil microbes are able to out-compete seedling corn plants for N whenever excess C is present. The heavy residue will cause soil to be colder and wetter than areas of less residue, which would also cause young corn to be chlorotic.

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// Are there any measures to prevent "ugly corn syndrome"?

1. One strategy is to bale corn stalks for winter cow feed. But this is only practical for row crop farmers that have cows.
2. Another strategy is to apply more N to meet the needs of both the soil microbes and the seedling corn. A common approach in the Corn Belt is to broadcast 10-15 gallons/acre of 28% UAN on corn residue after harvest, with the idea that extra N will facilitate rapid microbial activity and decomposition of the corn residue.

Remember that the most important factor for residue decomposition is temperature and not the amount of available N, so applying more N isn't necessarily the best way to avoid N immobilization and ensure that the plants will have the N they need in the spring.

// How crucial is soil biological health for the crop residue breakdown process?

In healthy soil, crop residue is being processed rapidly. In fact, if earthworms are numerous, the residue may disappear too quickly. Established practices to stimulate soil health are: use continuous no-tillage; use a diverse crop rotation; use cover crops during fallow periods; and return organic materials, such as crop residue, manure, and compost, to the soil.

// Do environmental factors affect the residue decomposition process?

Moisture and temperature play an important role in residue decomposition. Some conditions that advance the decomposition of residue include warm, moist conditions, smaller residue pieces, and maximizing contact between residue and the soil.

// How crucial is fall N application for residue decomposition?

During the immobilization process, N deficiency symptoms can develop; however, research has not consistently shown a benefit to fall N application intended to assist in residue decomposition. The effectiveness of fall N applications is related to timing and temperatures and/or moisture conditions. Higher rates of spring-applied N may be applied since the N from the typical rate may be immobilized by microbes for residue decomposition during the growing season. An additional challenge for fall-applied N for residue decomposition is the risk of the N being deleterious to the environment. If planning this type of fall N application, consider leaving a check strip for comparison purposes. The residue is the place, where many of the fungal disease reside and sporulate from later infecting the next corn crop and residue provides a really great place for many insects to reside such as stinkbug and many others.

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