AGRONOMIC Spotlight
Technology Development by MONSANTO

Managing the Effects of Crop Residue in Continuous Corn

Crop residue in continuous corn can be difficult to manage. If residue is not dealt with, it can decrease seed to soil contact, emergence, and vigor. Residue can also tie up nitrogen (N) during much of the season making it unavailable to the corn crop. Additionally, residue can harbor disease pathogens. While the speed of residue degradation is heavily influenced by weather and the environment, there are actions that can be taken during and after harvest, as well as in the spring to help decrease the negative effects of excessive crop residue.

Negative Effects of Excessive Crop Residue

In recent years, crop residue in continuous corn has received increased attention as a discussion topic as well as an agronomic issue that requires different management techniques. Three of the main agronomic risks that can lead to potential yield loss if crop residue is not adequately managed include the following (Figure 1):

1) Excessive residue at planting can interfere with good seed to soil contact, leading to poor emergence and vigor.
2) Corn diseases such as gray leaf spot, Northern corn leaf blight, diplodia and anthracnose overwinter in corn residue.
3) If most of the residue decomposition is occurring during the growing season, the N required for decomposition can limit the N available for corn growth.

Basics of Residue Decomposition

In terms of N cycle, the process of breaking down or decomposition of residue involves immobilization and mineralization which both involve soil microbes (Figure 2). Immobilization is when N is tied up by soil microbes.

Factors that Can Affect Residue Management Strategies in Continuous Corn:

- More continuous corn acres
- Higher plant populations
- Healthier hybrids
- Insect protection traits that can contribute to improved stalk and root integrity
- Late harvest
- Nitrogen deficiency symptoms

Mineralization is the release of N that generally happens upon the death of the soil microbes. The soil microbes feed on the carbon (C) in crop residues and require N to do so. Soil microbes generally try and maintain a carbon to nitrogen (C/N) ratio of approximately 10:1. C/N ratios of crop residues vary greatly. Alfalfa, soybean, and other legumes generally have lower C/N ratios near 15:1 and mineralization often occurs quickly. Crop residues that have higher carbon to nitrogen (C/N) ratios generally take more time to decay and result in higher

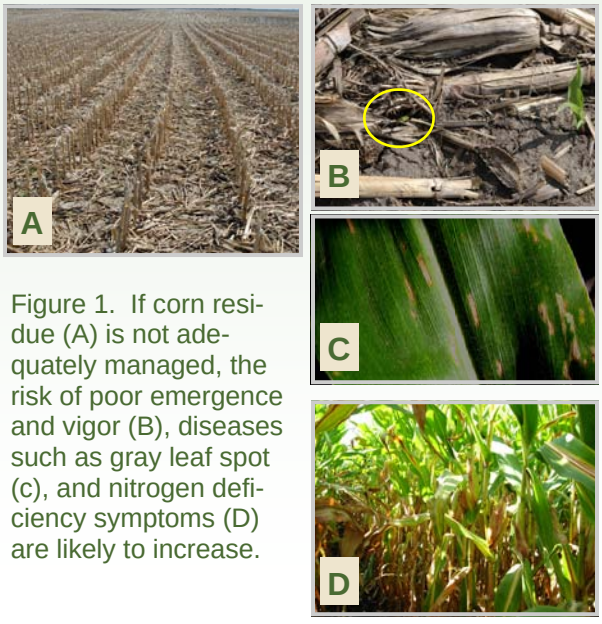
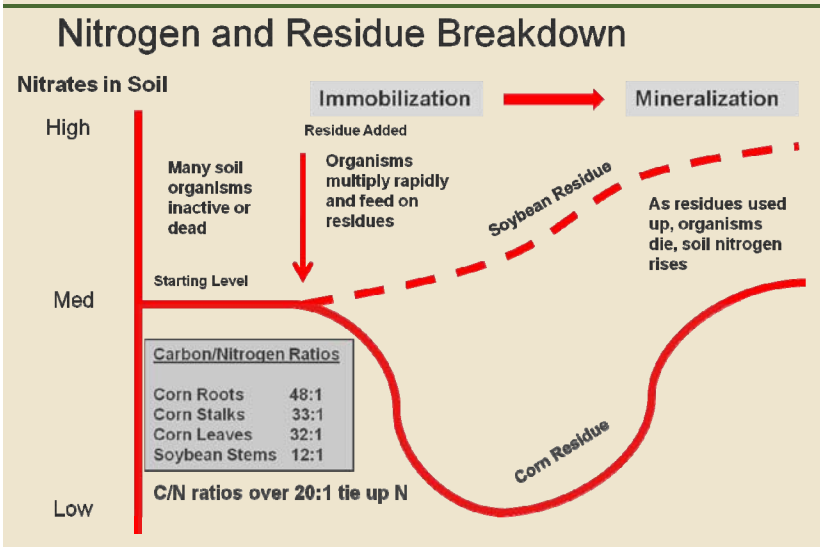


Figure 1. If corn residue (A) is not adequately managed, the risk of poor emergence and vigor (B), diseases such as gray leaf spot (c), and nitrogen deficiency symptoms (D) are likely to increase.

Figure 2. The interaction between available nitrogen and microbial activity that aids in decay of crop residue. (Adapted from Modern Corn and Soybean Production.)



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amounts of N being tied up by soil microbes. When the microbes break down residues that are high in carbon, such as corn, they can outcompete growing corn for available N in order to maintain their own preferred C/N ratio of 10:1. This immobilization of available N can result in nitrogen deficiency symptoms until the majority of the decomposition is complete and mineralization occurs as the microbes die and release the N back into the soil (Figure 2). Some of the conditions that favor decomposition of residue include time, warm moist weather, smaller pieces of residue, and maximizing the contact between residue and the soil.

Spreaders on combines and residue managers on planters are only a couple examples of tools available to help mitigate the negative effects of excessive residue in continuous corn.

Management Practices to Assist in Decomposing Residue and/or Improve the Ability of the Corn Crop to Overcome Challenges of Heavy Residue

- Harvest continuous corn fields first to help maximize the time and available warmer weather to aid microbial activity.
- Combine heads can be set to cut about a foot (or more) above the ground. Additionally, some are available that chop the residue as it is fed through the head.
- Combine spreaders can help distribute residue evenly.
- Chopping stalks into smaller pieces can aid in residue break down, but having a mat of residue may make planting more difficult.
- "Vertical" tillage, not subsoiling, but rather a tool comprised of discs with notches that runs parallel with the tractor can be used to 'mulch' residue.
- Aggressive tillage can help maximize contact of residue and soil. Doing tillage, aggressive or "vertical", as soon as possible after harvest can help take advantage of warmer weather and increased microbial activity. Often tillage can be done in the fall and the spring. Chisel plowing can leave approximately 50% to 80% of the residue on the soil surface. Fall chiseling followed by spring cultivation can leave between 18% to 41% residue on the soil surface. To prevent plugging or clogging, the implement should be set properly and the soil should not be too wet.
- Fall N applications to aid in decomposition are greatly debated. The concept is that applying N in the fall can help speed up the degradation of corn residue since N is the energy source for the soil microbes. However, research has not consistently shown a benefit to fall N applications intended to assist in decomposition. Some believe this lack of response to be real, due to N not being the limiting factor for decomposition at the time it was applied in the fall. Other potential limiting factors that might play a larger role than N might be cooler temperatures and or dry weather which can impede microbial activity. There are other people that believe the lack of response indicated in research is not reflective of what occurs in a field setting. They contend that the environmental conditions and variability that make N research difficult masked the benefits of fall N applications intended to break down residue. This debate is not likely to be settled in the near future. If considering this type of fall N application, consider leaving a check strip for comparison purposes.
- Higher N rates might be an option since much of the N normally applied may be immobilized by microbes for residue degradation during much of the growing season. The amount of additional N needed would depend on the other conditions that influence microbial degradation. For example, a corn crop that is following a late harvest, cold winter, and early planting season may benefit from more additional N compared to a corn crop that is following an early harvest, warm winter, and normal planting season.
- Planters can be equipped with row cleaners to move residue and enhance seed to soil contact.

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