

# AGRONOMIC DESIGN INSIGHTS

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## CROP RESIDUE MANAGEMENT

Growers can improve yield potential by focusing on seven key agronomic aspects of the crop production cycle: **crop residue management**, soil tillage, seed bed conditions, seed placement accuracy, plant food availability, crop protection and harvest quality.

Crop residue decomposition is largely a biological process. The rate of decomposition increases with warm temperatures, adequate moisture and abundant **bacteria, fungi, insects, earthworms, bugs**, and other creatures to dig and digest. Minerals and nutrients are recycled back into the production of crops.

This fact sheet addresses crop residue management: the agronomic and economic benefits of utilizing residue in the soil; the challenges and opportunities associated with liberating the nutritive value of crop residue from today's tough hybrids; and how the right equipment can help producers maximize the cycling and availability of nutrients in residue and improve the soil's organic matter.

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## THE CROP RESIDUE MANAGEMENT CHALLENGE

*By Dr. Rob Zemenchik, Case IH Global Marketing Manager – Agronomy*

With commercial fertilizer prices on the rise in recent years, the nutrient value of crop residue has become both a significant economic and agronomic consideration.

Corn stalks, soybean stubble and wheat straw can be baled and sold for livestock feed or bedding or biofuel production. And some crops are harvested as forage or silage, reducing crop residue in the field.

In the Bt corn era, reduced decomposition time has emerged because of extended ear-fill periods that leave stay-green residues and fewer warm post-harvest days—all complicating crop residue management. In addition, increased lignin content of plant tissues expressed in some hybrids and



Agronomic Needs for Successful Stands



# THE CROP RESIDUE MANAGEMENT CHALLENGE [CONT.]

varieties slows decomposition as plants are tougher and healthier.

Increased ethanol production has encouraged a change in crop rotations toward more corn-on-corn, where carbon-to-nitrogen ratios are higher and decomposition rates slower. In more northern latitudes, residue decomposition also tends to slow with less heat. In addition, proposed cellulosic ethanol production removes significant portions of crop residues from the production system, raising serious questions about long-term soil organic matter levels, nitrogen fertilization requirements, and erosion potential.

All of these factors encourage more judicious management of crop residues than in the past, including the need to speed decomposition rates. Recent interest in cover crops as a strategy shows potential, but must also be evaluated in terms of competition for water and available heat units for crop development in northern latitudes.

**By sizing and mixing crop residue into the soil profile after harvest, producers can liberate vital nutrients and make them available during**



*In mulch tillage, crop residue reduces soil erosion from water and wind and protects the soil's future production capacity.*

**the next growing season. This can reduce the crop's dependency on purchased fertilizer, improve cash flow and profitability, improve the crop growing environment and, as a result, increase yield potential for the next season.**

Studies show that when optimally-sized residue is incorporated into the soil in the presence of sufficient oxygen, moisture and temperature, it will decompose and partly remain as stable organic matter. Such transformations enhance the soil's water and

nutrient holding capacity and buffer against changes in soil pH. Mechanically sizing and incorporating stalks helps this transformation and allows farmers to avoid operational and planting challenges the following spring. ■

## UNLOCKING THE NUTRITIVE VALUE OF RESIDUE

*By Tim Nix, Case IH Tillage Marketing Manager*

Nutrient values of corn crop stover are estimated to be as much as 175 pounds of potash ( $K_2O$ ) and 25 pounds of phosphorus per acre (see figure 1).

Another common measurement of crop residue's nutrient value is expressed as pounds per ton. The Ohio State University reports that a ton of wheat straw would provide approximately 11 pounds of nitrogen (N), 3 pounds of phosphate ( $P_2O_5$ ) and 20 pounds of  $K_2O$ . Michigan State University pegs the averages at 13 pounds of N, 3.3 pounds of  $P_2O_5$  and 23 pounds of  $K_2O$ . According to

the University of Arkansas, a ton of soybean stubble provides 12 pounds of N, 9 pounds of  $K_2O$  and 4 pounds of  $P_2O_5$  (see figure 2).

Determining the measureable return on investment of adequate residue management depends on the current market value of the nutrients in the crop residue. There's no good way to put a dollar value on the organic matter added to the soil – it's invaluable – but we can estimate a price for nutrients. For instance, if we assume N is 65 cents per pound, the nutrient value of N in soybean stubble is \$7.80 per ton (12 lbs. N/ton x \$0.65). ■

## MAINTAINING SOIL ORGANIC MATTER

*By Dr. Rob Zemenchik, Case IH Global Marketing Manager – Agronomy*

Corn residue can be a significant contributor in building soil organic matter. Soil-incorporated organic matter acts as a nutrient source for plants and microbes. That organic matter also behaves like a sponge.

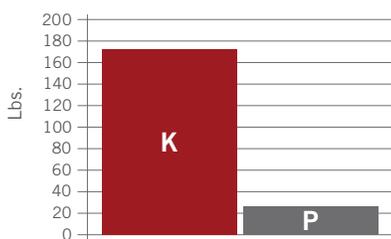
According to the *Journal of Soil and Water Conservation*, as organic matter content increases from 0.5 to 3 percent, available water capacity of the soil more than doubles. In a dry year on sandy soils, this can mean the difference between crop success and failure. In addition, as organic matter accumulates in the soil, the nutrient holding capacity of the soil increases for both macro- and micro-nutrients.

Recent research from the University of Illinois finds that a number of long-term studies indicating that no-till practices always build soil organic matter were wrong.

Both tillage and no-till cropping systems will reduce soil organic matter over time if growers don't manage the soil and the crop residue for higher yields. Good management practices include: Planting cover crops • Rotating crops • Fertilizing crops to increase plant growth above and below ground • Sizing and mixing crop residue. ■

*figure 1*

### Potential Nutrient Availability in Corn Residue



\*Based on 200 bu./ac. corn crop

*figure 2*

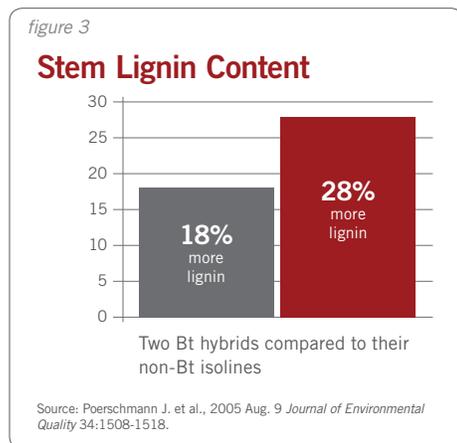
Crop Stubble	lbs N per ton of stubble	lbs $K_2O$ per ton of stubble	lbs $P_2O_5$ per ton of stubble
Rice	20	24	6
Corn	20	25	6
Soybean	12	9	4
Peanut	34	41	7

*Trenton Roberts, Research Assistant Professor, Crop, Soil & Environmental Sciences, University of Arkansas, September 11, 2012.*

# CHALLENGES POSED BY HYBRID VIGOR

Incorporating crop residue and encouraging decomposition has gotten more challenging as populations have increased and corn hybrids, in particular, have gotten stronger and more vigorous. While Bt corn hybrids are bred to stay greener longer – which helps the ear fill period and yield potential – they’re also higher in lignin (fiber). As a result, they tend to resist decomposition and can persist in the seed bed for several seasons.

Some studies show as much as a 20- to 30-percent increase in lignin in today’s stalks (see figure 3).



The potentially higher stem lignin content and wiry root crowns and root balls associated with Bt corn can all pose problems during planting the following spring if they haven’t been properly sized and mixed beforehand. Stand variability (see figure 4) results from uneven planting conditions, irregular in-row seed spacing and seed depth, and variable moisture and soil temperature levels.

In more than five years of extensive field research, Case IH found that up to 10 percent of seeds planted failed to emerge or develop a full ear at harvest if residue was not handled properly and the clods and valleys left behind were too big for a planter to work properly. This research was done in five states

at seven locations and included more than 2 million hand-collected data points.

Using advanced data mining techniques, the Case IH research team learned that by better managing residue, soil fracture and the size of holes and clods left behind, yield potential could be significantly improved. Large holes collect water, and in combination with large clods, they increase the variability of soil temperatures. The holes and clods make accurate seed placement at planting impossible, even with freeze-thaw cycles and subsequent field cultivator passes in the spring. Surface residue from corn can be especially problematic, as spring soils warm more slowly in the northern Corn Belt. ■

# EQUIPMENT CONSIDERATIONS WHEN MANAGING RESIDUE

By Nathan Weinkauf, Case IH Combine Marketing Manager

Managing residue starts at harvest and continues through planting or seeding the crop.

## Harvest Considerations

Consider combines with a range of residue management options to match each field’s needs, and headers that allow uniform feeding and residue distribution out the back.

In tough Bt corn crops, a chopping corn head will simultaneously harvest corn and chop the stalks. Processing above-ground plant parts starts the process of decomposition more quickly.

In comparison, soybean residues decompose quicker, but are more fragile and can be easily lost. Consider protecting the soil with some cover.

Wheat residue should be evenly spread at harvest. Uneven distribution will affect future wheat seeding performance and uniform stands.



Axial-Flow® combines offer the widest range of residue-management features on the market today. Growers can switch between eight residue management configurations, without tools, from the comfort of the cab.



Built to handle the tough residue associated with new crop genetics, the MagnaCut™ chopper delivers the finest stalk cut available in the heaviest crop conditions. MagnaCut choppers won the prestigious AE50 Award from the American Society of Agricultural and Biological Engineers.

# EQUIPMENT CONSIDERATIONS WHEN MANAGING RESIDUE [CONT.]

## Tillage Considerations

Primary tillage equipment can be designed to also manage residue:

- **Combination disk rippers** size and mix residue while shattering soil compaction.
- **Disk harrows** size and mix stalks and stubble, bury brush and level irrigated fields. They're also used for seedbed preparation, chemical incorporation and weed control.
- **Chisel plows** can handle moderately deep compaction, while leaving conservation residue cover to the soil.

A newer category of tillage implements, known as vertical tillage, slices through surface and near-surface residues, cutting up to 3-4 inches deep in the soil. This practice allows root crowns to be dislodged and sliced. **Vertical tillage tools** are used in spring and fall to slice and mix residue, remove surface soil crusts and weeds, and level the soil.

For spring tillage, **field cultivators** provide uniform soil distribution and leveling, as well as appropriate moisture, allowing

producers to plant earlier and extend the growing season.

For true no-till operations, the **planter** or **seeder** must be equipped to part and/or cut through the residue while precisely placing the seed in a wide range of crop residue conditions. ■



Named the No-Till Product of the Year two years in a row, the **Early Riser® planter** features leading edge, offset disk openers to slice through residue and maintain uniform seed placement in mulch-till or no-till. Case IH field trials show growers can expect 3-4 days earlier emergence and 6-10 percent net effective stand improvement compared to conventional planters<sup>1</sup>.



**Precision Disk™ 500 or 500T disk drills** will seed into a variety of tillage systems, from full till to no-till with few adjustments. These drills cut through the heaviest residue with 18-inch disks set at a 7-degree angle to easily slice open a high-quality seed trench.



Ideal for primary tillage, seedbed preparation or chemical incorporation, **True-Tandem™ disk harrows** provide straight, easy pulling, maximum pass coverage and level output — especially on rolling ground. The result is properly sized residue, thoroughly mixed soil and effectively incorporated chemicals.



**True-Tandem™ 330 Turbo and 335 VT vertical tillage equipment** incorporate residue and maximize nutrient availability using an exclusive blade design which is perfect for the pre-set gang angle. The low-concavity wavy, fluted blades size Bt corn stalks and break up corn root balls by better cutting and penetrating, and putting sized residue in contact with the soil.



With its Earth Metal 24- or 26-inch blade, the **Ecolo-Tiger® 875 disk ripper** reduces residue size, while the Tiger points fracture soil compaction under the hardpan. It's the most aggressive residue-sizing and mixing option on the market.

<sup>1</sup>Based on Case IH-collected data of more than 162,000 plant measurements taken on more than 20 sites in six states over four growing seasons.

**FIND OUT MORE:** Visit [www.Caseih.com/AgronomicDesign](http://www.Caseih.com/AgronomicDesign) to learn more about agronomic considerations.

