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Ag Labs Newsletter

Residue Decomposition

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Newsletter

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Residue Decomposition …A Foundation for Success

Want a quick barometer to judge how healthy your soil is? You may already have it. Just look at how quickly residue decomposes in your field. Residue decomposition is an instant indicator of how well soil biology is functioning and supported under your management. Sadly, many soils have almost lost the capacity to digest residue. It is not uncommon to find undigested corn leaves lasting six months to a year after working them into the soil, never mind the stalks and cobs. When you see this happen (relax it mostly occurs on neighbors' fields) you are observing a sick soil, desperately in need of life-support. If soils are so sick they struggle to digest plant residue, do you really think they are healthy enough to digest herbicide residues? NOT.

Undigested residue represents a tie up of nutrients that cannot be put to work growing your current crop or building up soil organic matter and even worse undigested residue sucks up available nitrogen thus depriving growing crops of the very thing they need to be productive. If that describes your situation you are left with two choices; either ignore it and let your crop take a hit in yield or compensate by applying extra nitrogen.

Another concern with undigested residue is the environment it provides to the molds and fungal disease organisms that produce mycotoxins. Mycotoxins are a whole 'nother can of worms best addressed in a separate article. Suffice it to say that mycotoxins matter and are strenuously to be avoided.

Crop residues are reservoir of nutrients just waiting to be recycled in your soil and put to good use. Residue contains atmospheric elements such as carbon, sulfur, and nitrogen combined with earth elements such as potassium, calcium, magnesium, phosphorus, and trace elements. If residue is properly digested prior to filling the next grain crop the nutrients can cycle much earlier and increase cash flow or in this case "nutrient flow." This would be very similar to a business that has a large number of customers paying on a net 45 basis now getting paid on a net 10 basis. This is a huge difference. Likewise, getting residue digested early allows for better use of nutrients by keeping them in motion every year.

A significant benefit of properly digesting residue is the production of humus in the soil. The key word here is **properly**—digestion must take place in an aerobic environment.

PRINCIPLES FOR CROP RESIDUE MANAGEMENT SUCCESS

The safest way to ensure an aerobic environment is to follow a good fall residue management plan and use light incorporation of residue in the aerobic zone of the soil. If residue is digested anaerobically, toxic formaldehyde-like compounds are produced that further "pickle" the residue. These compounds inhibit the aerobic microbes needed to digest residue. Need proof? Deep moldboard plowing of residue can be plowed up to the surface after two years with almost no decomposition. While I have no ax to grind with the use of the moldboard plow per se, I would say that a farmer needs to earn the right to use it. A soil with virtually no digestive capacity should not have deep placement of residue. Try to keep the residue in the top 3 inches.

Here are some difficulties that hinder residue digestion:

1. Genetics have been selected for high lignin content in the stalk. While this has greatly reduced greensnap, it has made the job of digestion that much harder

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2. B*t* corn repels microbial digestion. Since the B*t* toxin is systemic to the entire plant, the residue is similarly affected
3. Herbicide carryover in the soil hinders microbial processes—especially bacterial processes
4. Much of the residue is lacking in sugars and carbohydrates

Since the first three points are self-explanatory I want to focus a little more on the last point. In simple terms residue digestion is a two-step process. First fungal species predigested residue followed up by the thorough taking apart of the residue by the bacterial community. Bacteria do awesome work, but like people and animals, must get their sugars or energy from plants. When plants are growing they are continuously making sugars and sending a portion of them out of their roots as plant roots exudates. When plants, die, they are obviously not feeding soil biology with carbohydrates. So how are bacteria to survive? By feeding on the residue bacteria access stored up carbohydrates. When carbohydrates are very low in the residue bacterial food supply is reduced and so is their output—they just don't get as much digested.

Think about this; modern agriculture has given a very difficult job to the microbial digestion process in the soil. Nowhere is this truer than with corn residue.

MODERN AGRICULTURE HAS GIVEN A VERY DIFFICULT JOB TO THE MICROBIAL DIGESTION PROCESS IN THE SOIL.

- ✓ First, it's a hard job with high lignin content
- ✓ Second, microbial digestion is slowed by B*t* residue*†
- ✓ Third, it's a toxic environment due to pesticide residue accumulation
- ✓ Fourth, food supply of carbohydrates is low

Is it any wonder why we see a faltering digestive capacity of the soil? It is no surprise we continue to plow up residue buried 2, 3, and even 4 years ago. The good news is it doesn't have to be this way. Residue can be digested and the nutrients recycled by the next crop by following a good residue program and by including some light incorporation.

*Flores S, Saxena D, Stotzky G (2005) Transgenic Bt plants decompose less in soil than non-Bt plants. Soil Biol Biochem 37:1073–1082

†Impact of Bt Corn on Rhizospheric and Soil Eubacterial Communities and on Beneficial Mycorrhizal Symbiosis in Experimental Microcosms. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1287690/ Accessed on 8/25/10

The fall residue program is primarily a nutritional spray—Let's examine what it should accomplish.

Since residue decomposition is a biological process two cultural practices must be eliminated in order to support soil biology; reduce yearly application of potassium chloride to 25 pounds or less per acre, and totally eliminate anhydrous ammonia as a nitrogen source. Both practices are an offense to soil biology. It appears to me that their ultimate purpose is not so much as to provide a cheaper source of nitrogen and potassium but rather to set up an environment where weakened plants need "crop protection."

The fall residue program is primarily a nutritional spray to enhance residue digestion followed by light incorporation. Here is what the nutritional spray should accomplish:

- ✓ Narrow the C:N ratio
- ✓ Unleash the microbial workforce
- ✓ Sweeten the deal
- ✓ Provide additional support

Let's examine each of these in more detail.

Narrow the Carbon to Nitrogen Ratio

Just like various segments of light operate in specific frequency bands, or how blood must be maintained in a specific pH range to maintain life so bacteria require a specific carbon to nitrogen range they work in. Generally that range is anything less than 30:1. Anywhere from 30:1 to 20:1 is an optimum environment. Less than 20:1 results in the waste of nitrogen as it returns to the atmosphere as ammonia. The problem with most residue is that it is too wide a ratio. Corn is typically 70:1 and wheat straw is 80:1. Clearly nitrogen must be applied to narrow the ratio.

Unleash the Microbial Workforce

Since the native bacteria population is in such a negative environment is very helpful to apply a microbial product optimized for residue digestion. At International Ag Labs that product is Z-Hume.

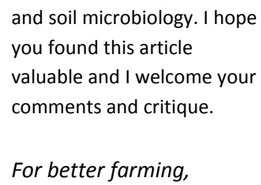
Sweeten the Deal

As alluded to earlier, bacteria must have a carbohydrates source in order to work. It is very easy to apply a syrup, dissolved sugar, or molasses to the spray program. Don't miss this point. It is critical to successful residue digestion.

Provide Additional Support

Certain nutrients further assist bacteria in performing their job. Chief among these are calcium and sulfur. Two products that supply these nutrients include liquid calcium nitrate and ammonium thiosulfate. In a highly toxic environment it may be necessary to provide auxiliary support to bacteria in the form of RL-37 and liquid B12. Here is what the spray would look like on a per acre basis a long with a suggested mixing order for corn or small grains. Spray 20 gallons per acre.

- 7 gallons water
- 5 pounds sugar or dextrose
- 10 gallons 28 or 32% UAN
- 1 gallon liquid calcium nitrate
- 1 gallon Thiosul
- 2 quarts Z-Hume
- 1 quart RL-37 -- optional but recommended in a glyphosate environment
- 30 mills liquid B12 -- optional



For soybean residue reduce the liquid nitrogen to 5 gallons and increase the water by 5 gallons. Once sprayed lightly disc or incorporate residue in the top 3 inches. If you are no-tilling try to spray the residue ahead of a rainstorm and roll the field in order to bring the crop stubble in better contact with the soil.

For further study about incorporating three foundational areas required for success in farming you may want to purchase **Foundations for Success**. In this course we look at crop physiology, soil agronomy, and soil microbiology. I hope you found this article valuable and I welcome your comments and critique.

For better farming,

Jon Frank