North Central Ohio Agronomy Report

Issue 14-09

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Dear Agricultural Producer:

Crop yields across the area continue to be excellent. Unfortunately, wet weather along with saturated soils have slowed harvest and negatively impacted corn grain quality.

Fertilizer prices for phosphorus (P) and potassium (K) have declined and create a better scenario for fall application of these nutrients prior to tillage. It is a good practice to mix P & K throughout soil profile in order to leverage maximum root development that will in turn maximize crop yields.

Finally, tillage will likely be necessary this fall to repair soils that are severely compacted.

Best regards,

Steve

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(Also, we thank **Howard Siegrist** for his aid with this newsletter)

http://agcrops.osu.edu
http://www.oardc.ohio-state.edu/ohiofieldcropdisease
http://www.ipm.iastate.edu
http://fcn.agonomy.psu.edu/farm
http://precisionage.osu.edu
http://www.ipm.uiuc.edu/bulletin
http://www.entim.purdue.edu/Entomology/ext/targets/newslett.htm

Corn Ear Rot and Potential Mycotoxin

Pierce Paul, Dennis Mills, Plant Pathology
Ohio State University Extension

We have had several reports of ear rot problems in corn. This disease is caused by one or more of several fungi capable of infecting, colonizing and damaging the ear. The most common members of the ear rot complex are Gibberella zeae (causes Gibberella ear rot), Stenocarpella maydis (causes Diplodia ear rot) and members of the genus Fusarium (causes Fusarium ear rot).

Gibberella ear rot, is the most common of the ear rots this year, however, we have also received reports of Diplodia ear rot in some fields. Diplodia causes a thick white mass of mold to grow on the ear, usually initiating from the base of the ear and growing toward the ear tip. Diplodia infections can begin before tassel emergence up to silking. With Gibberella ear rot, the fungus enters the ear tips through the silk channel. A visible white to pink mold covering the ear tip or more of the ears is characteristic of this disease. Gibberella ear rot is generally most severe when rain and wet weather is prevalent during the 7 to 10 days after silking.

The Gibberella ear rot fungus produces mycotoxins that are harmful to animals. These include deoxynivalenol (Vomitoxin) and zearalenone and T-2 toxin, all of which may cause health problems in livestock. Therefore, suspect grain should be tested for these mycotoxins by chemical analysis before being fed to animals. As a general rule do not feed any grain with 5% or more Gibberella moldy kernels. Hogs and young animals are particularly sensitive to these mycotoxins. Diplodia ear rot is less of a concern from a mycotoxin standpoint. There have been no reports of Diplodia producing mycotoxins that are harmful to animals in Ohio, but animals do refuse to eat grain with high levels of Diplodia-damaged kernels. Additionally, severely affected grain has low nutritional value.

Certain hybrids are more susceptible to one or more ear rots than others. Examine ears to determine the presence of ear molds. Make a note of which ear rots are present and hybrids that are most affected. Make future hybrid choices based on this information.

Growers are advised to follow certain harvest and storage guidelines to minimize problems associated with kernel rots and mycotoxin contamination:

1. Harvest at the correct moisture and adjust harvest equipment to minimize damage to kernels. Mold and mycotoxins tend to be higher in (machine or insect) damaged kernels.
2. Dry harvested grain to 15% moisture and below to prevent further mold development in storage.
3. Store dried grain at cool temperatures (36 to 44 F) in clean, dry bins. Moderate to high temperatures are favorable for fungal growth and toxin production.
4. Periodically check grain for mold, insects, and temperature.
5. If mold is found, send a grain sample for a mycotoxin analysis to determine if toxins are present and at what level. For more on moldy grain, mycotoxins, and mycotoxins sampling and analysis visit the following websites: http://www.oardc.ohiostate.edu/ohiofieldcropdisease/Mycotoxins/mycopagedefault.htm.

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General Crop Management:
Soil Sampling for pH and Nutrient Analysis
Cation Exchange Capacity
Liming Acid Soils to Improve Crop Production
Calcitic Versus Dolomitic Limestone
Applying Limestone
Accounting for Nitrogen
pH Changes Take Time

Corn and Soybean Field Guide
Purdue University Extension

Soil Sampling for pH and Nutrient Analysis*:* A good soil sample from relatively uniform areas of 26 acres or less can be obtained by taking 20 to 30 core samples (about 1 inch in diameter) in a random or zigzag fashion across a field. Larger acreages are usually subdivided into smaller ones. In non-uniform acreage subdivide the area based on difference in soil type and/or slope position. In soils where fertilizer has been banded, more soil cores are required to obtain a representative sample.

Individual cores should be crushed and mixed thoroughly before subsampling. The subsample should consist of about one pint of soil. Shipping moist samples to the laboratory is acceptable, but saturated soil samples should be air-dried or oven-dried (<120ºF) to moist before shipping. Avoid sample contamination, particularly by fertilizers, pesticides, manures, and ashes.

Soil samples in tilled land should be taken to a depth of 8 inches. In no-till or ridge-till, however, it may be necessary to take samples from depths of both 0 to 4 inches and 0 to 8 inches. Stratification of soil pH and nutrients may occur in these tillage systems, but may go undetected if only 0 to 8 inch sampling is used.

Current recommendations are based on sampling after harvest in the fall or before planting in the spring. If tracking trends in pH and soil nutrient levels over time, take samples at the same time each year because of seasonal variations in these levels. Most soils should be sampled at least every three or four years. However, soils with low buffer capacities (sand, loamy sand, sandy loam textures) should be sampled every one or two years because pH and nutrient content can change rapidly in these soil textures.

For more information on soil sampling, see Purdue Extension publication AY-281-W. Soil Sampling for P, K, and Lime Recommendations at www.ces.purdue.edu/extmedia/AY/AY-281.pdf .

Cation Exchange Capacity: Cation Exchange Capacity (CEC) is a measure of a soil's nutrient-holding capacity and resistance to change in pH. CEC usually increases as clay and organic matter content increase. The greater the CEC, the greater the soil's nutrient-holding capacity.

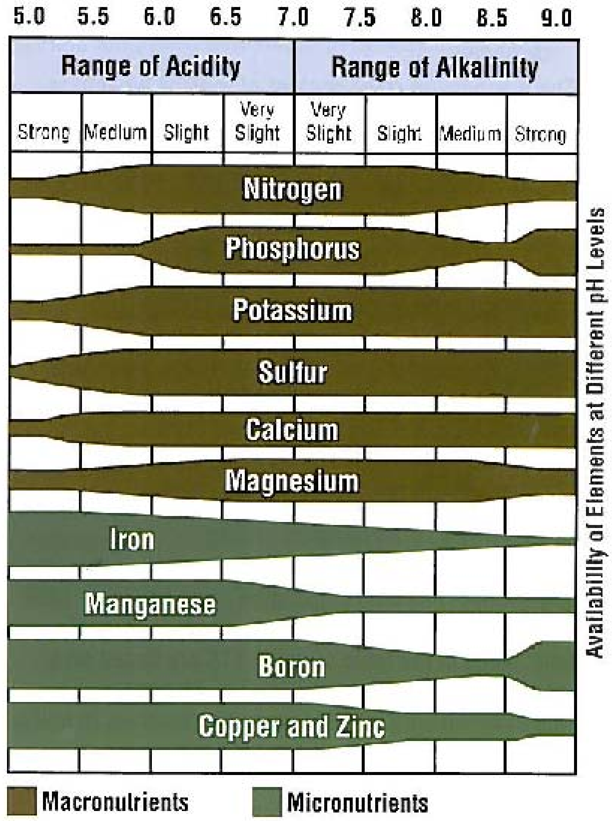
The CEC of organic soils (mucks and peats) greatly depend on pH. CEC increases greatly with increases in pH from 4.0 to 7.0. Values given are for pH 5.4 to 6.0.

The table provides approximate CEC ranges for several soil textures.

Soil Type	Approximate CEC Range meq/100g
Sand, loamy sand	1–4
Sandy loam	3–8
Silt loam	6–20
Silty clay loam	15–30
Clay	20–40
Muck and peat	30–80

For more information, see Purdue Extension publication AY238, Fundamentals of Soil Cation Exchange Capacity (CEC) at www.ces.purdue.edu/extmedia/AY/AY-238.html .

Availability of Elements to Plants at Different pH Levels for Mineral Soil:



Source: Adapted from D. Ankerman & R. Large, *Soil and Plant Analysis*. A & L Agricultural Laboratories, Inc.

Liming Acid Soils to Improve Crop Production:
Maintaining proper soil pH is essential to optimize crop production. Most soil pH levels are between 4 and 9. Soils with a pH below 7 are considered acidic, while those greater than 7 are considered alkaline. The availability of various nutrients in the soil are strongly influenced by soil pH (see following chart).

Soil pH Recommended for Various Crops on Various Soils

Crop	Mineral Soils with Subsoil pH		Organic Soils
	> 6.0	< 6.0	
Alfalfa	6.5	6.8[1]	5.3
Other forage legumes	6.0		
Corn		6.5	
Soybeans			
Small grains			
Other crops			

[1] Lime birdsfoot trefoil to pH 6.0.

Source: Adapted from Purdue Extension publication AY-9-32-W, *Tri-state Fertilizer Recommendations for Corn, Soybeans, Wheat, and Alfalfa*, www.ces.purdue.edu/extmedia/AY/AY-9-32.pdf.

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Plant Injury from Acid Soils – pH<5.5: In strongly acid soils (4.0 to 5.5), a condition called acid soil complex can limit crop growth. Some plants are more sensitive to acid soil complex than others, and the recommended soil pH levels differ for mineral and organic soils. In mineral soils, the subsoil pH modifies the recommended pH range. The pH of organic soils (>20 percent organic matter) should be maintained around 5.3.

Problems: Corn

- Beaded streaking of leaves and stunting
- Older leaves turn reddish purple and die
- Brittle, brown, and thickened roots
- Tall corn-short corn syndrome over field
- Slow Growth and spindly stalks

The photo to the right shows roots with proper nodulation (left) and roots with poor nodulation due to acidic soils.

Problems: Soybeans

- Decreased nodulation
- Stubby and thickened roots, few root branches
- Interveinal yellowing of young leaves
- Small leaves, downward puckering or cupping
- Mottling and browning of midribs

Causes:

- Low soil pH and pH variability in field
- Aluminum toxicity -symptoms on roots
- Manganese toxicity – symptoms on plant top-growth, particularly on soybean

High soil pH (>7) also can limit crop growth by reducing the availability of phosphorus and micronutrients (iron, manganese, zinc, and copper.)

Calcitic Versus Dolomitic Limestone: Limestone comes in two basic forms:

- Dolomitic limestone, which contains both calcium and magnesium carbonate.
- Calcitic limestone, which contains mostly calcium carbonate.

The magnesium (Mg) content of Indiana limestone varies from almost none, to as much as 14 percent – or 280 pounds per ton of limestone. Indiana limestone typically contains between 20 percent and 40 percent calcium (Ca) – or 400 to 800 pounds per ton.

Choose liming material based on the relative need for Ca and Mg, relative neutralizing value (RNV), and cost. If soil test Mg is less than 50 ppm or 100 pounds per acre (or anticipated to fall below this level before the next time lime is needed) apply a high Mg limestone. If exchangeable Ca is less than Mg, then use a high Ca/low Mg limestone. Otherwise, there should be no difference in agricultural limestone effectiveness based on Ca and Mg content.

$$RNV = \frac{[\%\ \text{passing 8 mesh} + \%\ \text{passing 60 mesh})/2] \times NV}{100}$$

Applying Limestone: Applying agricultural limestone will increase the pH of acidic soils. The lime application rates based on SMP buffer pH for mineral soils and soil pH for organic soils listed in the following table are based on a relative neutralizing value (RNV) of 65 percent. The rate at which agricultural limestone dissolves in soil is related to the size of the limestone particle or fineness. The percentage of liming material that can pass through 8 mesh and 60 mesh screens is an indication of its fineness. RNV accounts for fineness as well as the lime's neutralizing value (NV).

Accounting for Nitrogen: Nitrogen (N) is the largest source of acidity in Indiana cropland. Estimating lime needs based on the N source and rate is a good way to anticipate soil pH and long-term lime needs in noncalcareous soils.

pH changes Takes Time: Changing a soil's pH is a slow process, especially when the limestone is left on the soil surface. Correcting low pH before establishing a perennial crop or no-till system is highly recommended.

Applications to established crops should be made before there are dramatic decreases in soil pH. High lime rates (>4 tons per acre) should be applied in a split application: with half applied before plowing and the other half after.

Pounds of $CaCO_3$ and 65% Relative Neutralizing Value Agricultural Lime Needed to Neutralize the Acidity Created by Nitrogen Fertilizers

Pure Product	% N	Needed/100 lbs. Actual N	
		Pure $CaCO_3$	65% RNV Agricultural Lime
Ammonium Nitrate	34	180 lbs.	275 lbs.
Urea	46	180 lbs.	275 lbs.
Anhydrous Ammonia	82.5	180 lbs.	275 lbs.
N Solutions	28–32	180 lbs.	275 lbs.
Ammonium Sulfate	21	535 lbs.	825 lbs.

Do not apply more than 8 tons of limestone per acre in any season. If soil tests recommend more than 8 tons per acre, apply only 8 tons, then retest in two years to see if more lime is actually needed. Multiple applications and moderate rates foster uniformity of pH in the soil profile and field.

For more information on soil acidity and liming, see Purdue Extension publication AY-267-W, Soil Acidity and Liming of Indiana Soils at www.ces.purdue.edu/extmedia/AY/AY-267-W.html .

Recommended Limestone Rates for Field Crops (Tons)[1]

SMP[2] buffer pH	Mineral Soils Desired pH			Organic Soils	
	6.8	6.5	6.0	Current pH	Lime Rate
>7.1	0.0	0.0	0.0	5.2	0.0
7.0	0.0	0.0	0.0	5.1	0.7
6.9	0.0	0.0	0.0	5.0	1.3
6.8	1.4	1.2	1.0	4.9	2.0
6.7	2.4	2.1	1.7	4.8	2.6
6.6	3.4	3.0	2.4	4.7	3.2
6.5	4.5	3.8	3.1	4.6	3.9
6.4	5.5	4.7	3.9	4.5	4.5
6.3	6.5	5.6	4.6	4.4	5.1
6.2	7.5	6.5	5.3		

[1] Based on a Relative Neutralizing Value (RNV) of 65 percent and an 8-inch furrow slice weighing approximately 2,400,000 lbs./A.
[2] Shoemaker-McLean-Pratt.

Aboveground Crop Nutrient Content and Nutrient Removal in Harvested Portion

Weight per Unit of Production	Aboveground Nutrient Content[1]			Crop Removal in Harvested Portion		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Corn Grain (lbs./bu.)	1.33	0.57	1.33	0.75	0.37	0.27
Corn Silage (lbs./ton wet)				8.30	3.30	8.00
Soybeans (lbs./bu.)	5.40	1.07	2.37	4.00	0.80	1.40
Wheat (lbs./bu.)	1.88	0.68	2.03	1.50	0.63	0.37
Alfalfa (lbs./ton)	56	15	60	56	13	50
Grain Sorghum (lbs./cwt.)	1.37	0.59	1.91	0.84	0.39	0.39

[1] These values multiplied by yield = total amount of nutrients. Fertilizer recommendations may be higher or lower than crop uptake or removal depending on the soil nutrient contribution and the efficiency of fertilizer nutrient utilization.

Soil Compaction Threat Increased

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Farmers are eager to harvest soybeans and corn but the fields are very soggy after significant snow and rainfall over the past week. The compaction threat is therefore very considerable. As a minimum, a farmer should wait to access fields until no significant ruts are formed. However, it may be impractical to wait for some low-lying wet spots to dry out before venturing into harvest. If ruts are formed in these spots, it may be necessary to do some limited tillage to smooth the soil in the spring prior to planting. It is probably not a good idea to do tillage this fall prior to cover crop establishment due to suboptimal soil conditions for tillage. Rut formation is significantly reduced by using flotation tires or tracks due to their bigger footprint. Remember to inflate the flotation tires to their lowest permitted pressure to carry the load — Ohio State research showed that inflation pressure basically controlled the benefit of flotation tires. Contact your tire sales person about the proper inflation pressure for your tires.

Typically, rut formation is much more severe in tilled fields than in long-term no-till fields. This is due to the fact that the tilled soil has a loose consistency, while the no-till soil has a firm matrix interspersed with macro-pores. It is these macro-pores that explain the high water infiltration rates of no-till soils. You may be wondering if tillage will be needed next spring after harvest operations on no-till soils this fall. Our research has shown that, except if ruts are formed, there seems to be little benefit to tilling these fields. Localized tillage may be needed where ruts are formed, but it is usually disadvantageous to till the whole field because of the expense involved and the destruction of the no-till history of the field.

Finally, make sure you use designated traffic lanes to haul the grain out of the field to limit the impact you have on the most precious and amazing resource you have: The Soil!

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Harvesting, Handling, and Drying Corn with Ear Rots in 2009

Richard Stroshine, Professor, Agricultural and Biological Engineering Department
Purdue University Extension

During the 2009 harvest, growers have reported a significant amount of Diplodia and Gibberrella ear rot in Midwest corn fields. When ear rot is a problem, the corn should be harvested as soon as possible to stop the growth of the ear rot fungi. However, if the problem is severe, check with crop insurance providers regarding adjustments for the damage to the crop. Generally these assessments must be made on standing corn before it is harvested.

Keep in mind that enough drying capacity should be available to quickly dry the corn below 20%. This will ensure Diplodia or Gibberrella ear rots do not continue to grow on the corn when it is in the bin. When harvesting use the maximum capacity of the combine to remove fine material and shrunken, mold damaged kernels. The fine material should be removed because it promotes mold growth and interferes with aeration. Experiment with increasing the fan speed to determine whether this will separate some of the light, severely damaged kernels from the good kernels without removing too many good kernels. Increasing cylinder rpm's may break up more of the mold damaged kernels, which should be weaker. However, the higher rpm's will also inflict more damage on the good kernels making them more susceptible to mold growth during drying and storage. Incorporate a screen cleaner into your handling system to remove fine materials not removed by the combine before the corn is placed in the bin. The cleaner may also remove some of the smaller shriveled kernels that have been infected by ear rots.

The best strategy is to dry the corn as quickly as possible below 15% moisture. Once corn is below 20% moisture, there should be no significant growth of Diplodia and Gibberrella in the stored corn. Storage molds including Penicillium, Aspergillus, and Eurotium should not grow when moisture is below 15%, providing the grain is kept below 50°F. Drying to a slightly lower moisture of 14% will be more expensive but will also provide additional protection from mold growth. Do not mix corn with high levels of mold damage with good corn. The dried corn should be cooled below 50°F immediately after drying and eventually cooled to 32 to 35°F if it will be held into the winter. The corn should be marketed or fed to animals (see below) as soon as possible and should not be held until spring. Ethanol plants may reject corn with high levels of mold damage because it will reduce their yields and, if there are toxins present, those toxins can be concentrated by a factor of 3 in the co-products such as DDGS and WDG. These co-products are usually marketed as an animal feed ingredient. While the corn is in storage, keep it well aerated. Inspect the bins regularly so that problems can be detected early.

Before corn is fed to animals it should be tested for mycotoxins. Diplodia does not produce toxins. However, Gibberrella and other ear rots do produce toxins. For information on mycotoxins and testing for mycotoxins check on the website http://www.grainquality.org and choose "Extension Publications," then choose "Diseases and Mycotoxins" and, finally, look for publication BP-47. Some USDA grain inspectors, larger grain elevators, or feed processors have relatively simple and easy to use test kits that can be used for screening samples for mycotoxins. Care must be taken to obtain a representative sample for testing. Animal species differ in susceptibility to various toxins and younger animals are more sensitive. Consult animal science publications for information on feeding corn containing mycotoxins. Additional information on ear rots can be found on the "Diseases and Mycotoxins" tab on http://www.grainquality.org .

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In-Bin Drying of Corn in 2009

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The cool summer and poor conditions for field dry down have led to higher than normal harvest moistures for corn throughout the Midwest. Those producers with in-bin low temperature drying systems should use the layer drying procedure. In this approach the corn is harvested in intervals. Initially only enough shelled corn is harvested to fill the bin to a depth of about 3 to 4 feet. The fan is started as soon as enough corn is harvested to evenly cover the drying floor to a depth of 6 to 8 inches with wet corn. If the system is designed to deliver 1 cfm/bu when the bin is filled to a depth of 18 feet, the airflow through a 3 ft layer will be about 12.5 cfm/bu and the airflow through a 4 ft layer will be about 8.4 cfm/bu. This airflow should rapidly remove the moisture from the corn. The time required to dry this first layer will vary depending on the harvest moisture and ambient air conditions. It should be between 1 and 5 days. Monitor the moisture content of the top surface of the corn. When this top surface has dried uniformly to about 20% moisture, another layer can be added. Now there will be 6 to 8 feet in the bin and the airflow through the corn will be 4.7 to 3.2 cfm/bu. It will take longer to dry this second layer, unless the harvest moisture has dropped significantly during the time when the first layer was drying. This procedure is repeated for each successive layer until the bin is full. If more than one low temperature drying bin is available, the time interval between harvests can be reduced by placing a layer in each bin in succession.

Use of heat with low temperature dryers: To minimize drying costs, only use supplemental heat when it is needed. Later when the air relative humidity drops below 60% the bottom 1 to 2 ft. of corn in the bin will be over-dried. When the humidity increases to above 70% later, moisture will be added back to that dry layer. As the over dried corn picks up the moisture from the air, the relative humidity of the air will drop. By the time this air reaches the layer of wet grain, its relative humidity should be back down where it needs to be, below 60%. At the same time, the moisture of the over-dried layer at the bottom of the bin should increase, thereby at least partially correcting the over-drying problem. If there are more hours of relative humidity below 60% than there are hours above 60% in a 24 hour period, supplemental heat may not be needed. However, if a weather front moves through bringing rain and causing the air humidity to stay above 75% throughout the day, then supplemental heat should be used. If the air temperature is between 40 and 70°F and its relative humidity is 90%, increasing the air temperature by 10°F will decrease its relative humidity to 65%. If the initial relative humidity is 80% the 10°F temperature rise will decrease the relative humidity to 55%, and for an initial relative humidity of 70% the 10°F will decrease the air relative humidity to 50%. Supplemental heat can also be used when the daily high outside air temperatures drop below about 45°F or 50°F. At these lower air temperatures, the exchange of moisture between the corn and the air seems to slow down. Keep in mind that if the relative humidity of that 40°F air is below 60% or 70%, the bottom layers of corn will probably be over-dried. Relative humidity often drops during the day and increases at night. Therefore, using supplemental heat in the morning may also be a useful strategy.

Other options: When producers have access to a high temperature dryer or an in-bin batch drying system, it can be used to dry the corn to 19 to 20% before it is placed in the low temperature drying bin where the drying process is finished. High temperature drying is most efficient at the higher corn moistures, so the dryer capacity will be greater and the fuel cost per pound of water removed will be lower. Unless the grain temperature remains above 60°F after it comes out of the high temperature dryer, the mold growth in the 19 to 20% moisture corn will be very slow. If airflow is at least 1 cfm/bu when the bin is full, it should be possible to dry the corn to safe storage moisture before appreciable mold develops. However, the progress of the in-bin drying should be monitored closely and the grain mass should be inspected for signs of mold growth!

In-bin dryers with stirring: In-bin drying systems with stirring devices offer an advantage for wet drying years but they must be operated properly. The stirring almost (but not entirely) eliminates the problem with over-drying and allows supplemental heat to be used effectively because the over-dried kernels are mixed with the wetter kernels eliminating over-drying of portions of the bin. Often the stirrers cannot reach the corn at the very bottom of the bin. That means there will still be a layer of over-dried corn at the bottom. In addition, there is a ring around the outside of the bin that the stirring devices cannot reach. If these systems are used for very wet corn, that layer can begin to mold even when the rest of the corn is at a uniformly low moisture. One solution for the ring of wet corn is to unload the bin and thoroughly mix the corn as soon as the target average moisture has been reached. Drying with stirring is very inefficient once the average kernel moisture reaches 18%. Therefore, it is best to turn off the stirrers when average moisture reaches 18% and finish drying to the target moisture. Then the stirrers can be used for one final stirring to eliminate moisture variations. The producer that has additional drying bins can dry the corn to 18 to 20% moisture in their stirring system and then transfer the corn to another bin to complete drying without stirring.

Removing fine material: There are advantages of removing fine material from corn before it is placed in storage. The fine material is readily available source of nutrients on which molds can grow. Therefore, mold grows more rapidly in wet corn containing fines than in the same corn from which fines have been removed. In addition, the fine material will interfere with air movement through the corn giving uneven air distribution within the bin. That often results in high moisture pockets of grain where mold can develop. For more information on low temperature drying see Grain Quality Fact Sheet #5 Low Temperature Drying of the 1992 Corn Crop" at http://www.grainquality.org . Click on "Extension Publications" tab and then go to "Drying, Conditioning and Aeration."

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Soybean Quality Issues in 2009

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Storage Management

Grains have a shelf life just like any food product. Shelf life is primarily determined by moisture content and temperature. It is gradually used through the time before use, and each operation or storage regime consumes a portion of the life. The table below gives the storage life for corn and soybeans at varying moistures and temperatures. Soybeans respond like corn, but two a percentage point difference in moisture.

Some cautions in using the Table:

1. The numbers assume that temperatures are held constant – such as with aeration. Grain heats when it spoils, and gives off moisture. Unaerated grain will shorten its own shelf life through moisture and heat.
2. Immature soybeans will spoil faster than the Table indicates.
3. If grain is held at higher moisture, then dried, the storage time can be used up in the wet conditions. The dry grain will still experience hot spots or other problems in the summer.
4. Soybeans are difficult to recover once spoilage has started. The oil becomes rancid and oxidizes.

Maximum storage time (months) for corn and soybean*							
Corn temperature ° F	Moisture Content Corn *(top %)*, Soybean *(bottom%)*						
	13%, 11%	14%, 12%	15%, 13%	16%, 14%	17%, 15%	18%, 16%	24% N/A
40	150	61	29.0	15.0	9.4	6.1	1.3
50	84	34	16.0	8.9	5.3	3.4	0.5
60	47	19	9.2	5.0	3.0	1.9	0.3
70	26	11	5.2	2.8	1.7	1.1	0.2
80	15	6	2.9	1.6	0.9	0.9	0.06

*Based on 0.5% maximum dry matter loss—calculated on the basis of USDA research at Iowa State University. Corresponds to one grade number loss; 2-3% points in damaged seeds. Soybean approximated at 2% lower moisture than corn.

Every action taken after harvest affects the ultimate length of time grain can be stored and the quality at the time of use. Check combine settings between fields because FM and cracked seeds (splits) spoil much faster than whole, sound kernels. Grain that starts to heat or get moldy has essentially used its storage life. The goal of grain storage management is to reduce the rate at which the life is lost. Always get grain cool quickly and minimize variations.

Holding wet grain, especially without aeration, shortens shelf life considerably. Overnight storage of wet soybeans in a wagon or truck can have a marked effect on future storability. Always get wet grain into an aerated storage immediately.

Aeration Practice

Phase 1: Fall Cool Down

- Lower grain temperatures in a stepwise fashion
  - October 40-45 F
  - November 35-40 F
  - December 28-35 F

Phase 2: Winter Maintenance

- Maintain temperatures with intermittent aeration
  - January, February 28-35 F

Phase 3: Spring Holding

- Keep cold grain cold
  - Seal fans
  - Ventilate headspace intermittently

The last half of the soybean harvest is likely to be wet (over 14 percent moisture), with many reports of 18-20 percent soybeans. Soybeans dry more easily than corn so air alone, or heat no more than 120F will be adequate. Monitor drying frequently to prevent overdrying. The publication, Soybean Drying and Storage, PM 1636, has additional information. Wet soybeans should not be held in bunkers, piles, flat storages, sheds or other structures where airflow is not well distributed.

Be selective about what beans are placed in storage versus moved at harvest. Deliberately decide which bins are going to be kept into the summer. Remove the center core and use a grain distributor if possible. Check your grain at least every two weeks, with some way to take grain temperatures. If a slow rise is noted, aerate. If a hot spot starts, move the grain out. It is very difficult to control soybean spoilage once it has started. Oil rancidity becomes a major problem.

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Shrink and Soybean Analysis

Higher valued grain and higher moisture have increased the importance of shrink calculations. Regardless of the grain and starting moisture, the water shrink, per percentage point of moisture, will always be 100/(100-target moisture). The market targets are normally 15 percent for corn and 13 percent for soybeans which leads to 1.17 and 1.15 percent shrink per point respectively. Any additional deduction in the market shrink calculation is an allowance for material handling losses. For example, a shrink factor of 1.4 percent per point gives about 0.22 percent per point for handling loss. Typically a commercial elevator experiences about 1 percent overall handling loss and a good farm system about 0.5 percent overall handling loss. This does not include weight loss from spoilage if grain goes out of condition. Of course, accurate moisture tests are also needed to make shrink calculations work well. Check farm meters on 10-15 samples against the state inspected meter at the local elevator.

Grain elevators must post their shrink factors as the sum of water plus handling loss. Shrink calculations are important for warehouse receipts, loans, proven yield calculations, and inventory estimates. The general principle is to use a shrink rate that gives a reasonable estimate of the actual grain weight remaining after drying and handling operations. Consider the costs of drying, aeration and storage separately from weight shrink. Recently, shrink factors and price discounts for soybean moisture have increased because of the difficulty created by large amounts of wet soybeans. Producers and elevators alike normally allocate their drying and bins with the best aeration to corn. Large changes in operational strategy are needed to handle wet soybeans. Drying wet soybeans on-farm is likely to be profitable however, when compared to current 2-3 percent shrink/discounts per point.

Wrap-up

Wet soybeans will happen, especially in eastern Iowa. Patience will be important because the grain handling system is also facing a large, wet corn crop in the same areas. Soybeans can be dried with natural air and heated up about 120F; soybeans respond quickly to air conditions. On farm drying is likely to be profitable because the grain market does not have the capacity to handle both wet corn and wet soybeans.

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Control of Marestail in No-Till Soybeans

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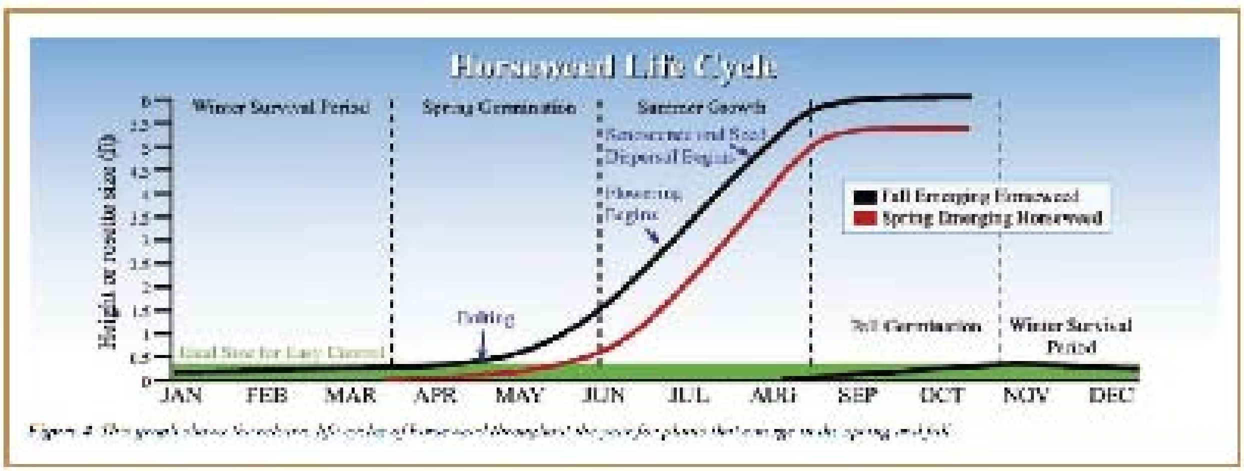
Marestail Biology

- Marestail (also known as horseweed) is one of the most problematic weeds in no-till soybeans in Ohio and Indiana.
- Marestail has two primary periods of emergence – from late summer into fall, and from late March through June. It is one of the first annual weeds to emerge in the spring and is present before crops are planted.
- Marestail plants remain in the low-growing rosette stage through late April, followed by stem elongation (bolting) and growth to an eventual height of 3 to 6 feet. Plants that emerge the previous fall will start stem elongation earlier than spring-emerging plants.
- Marestail competes with the soybeans during the growing season, reducing yield. It matures in late summer or early fall, late enough to interfere with soybean harvest.

Herbicide Activity and Resistance in Marestail

- Herbicide programs must consist of a burndown to ensure that the field is free of marestail at the time of soybean planting, and residual (PRE) herbicides to control marestail for another 6 to 8 weeks. Where marestail emerge between an early spring burndown and planting, additional burndown herbicide should be applied before soybeans emerge.

- Marestail is most readily controlled when in the rosette stage, and herbicides should always be applied before plant height exceeds 4 inches. Larger plants become difficult to control, even when not herbicide-resistant.
- Marestail populations with resistance to glyphosate or ALS inhibitors (e.g., Classic, FirstRate) are widespread throughout Ohio and Indiana, which increases the difficulty of control. Populations with multiple resistance, to both glyphosate and ALS inhibitors, have also been confirmed.
- Only a few POST soybean herbicides have activity on marestail – glyphosate, Ignite, chlorimuron (Classic), and FirstRate. POST herbicides are effective primarily when plants are newly emerged and several inches tall, and only in populations that are not herbicide-resistant, with the exception of Ignite in Liberty Link soybeans.



Key Points for Controlling Marestail in No-till Soybeans

- Do not plant into existing stands of marestail. Start weed free at the time of planting by using tillage or a preplant herbicide treatment of one of the following, applied when marestail plants are less than 4 inches tall.
  * 2,4-D ester plus glyphosate (1.5 lb. ae/A)
  * 2,4-D ester plus Gramoxone (3 to 4 pts./A) plus a metribuzin-containing herbicide
  * 2,4-D ester plus Ignite (29 to 36 oz./A) plus a metribuzin-containing herbicide
  * Sharpen (1 oz./A) plus either glyphosate or Ignite
- The burndown effectiveness of any of these can often be improved by including a residual herbicide that contains chlorimuron (e.g., Canopy, Valor XLT, and Envive) or cloransulam (e.g., Gangster, Sonic, and Authority First).

- Use the highest rate of a 2,4-D ester product that is allowed, based on the interval between application and soybean planting. For all 2,4-D ester products, rates up to 0.5 lb. active ingredient per acre must be applied at least 7 days before planting. Rates between 0.5 and 1.0 lb. should be applied at least 30 days before planting, with the exception of several products (e.g., E-99, Salvo, and Weedone 650) that allow these rates to be applied 15 days before planting.

- Where it is not possible to use 2,4-D ester, a combination of Sharpen plus either glyphosate or Ignite will effectively control emerged marestail prior to soybean emergence. A combination of Ignite (29 to 36 oz./A) and metribuzin (at least 0.38 lb. ai/A) is also usually effective. Other potentially effective options include combinations of glyphosate plus a herbicide containing chlorimuron or cloransulam (results can be variable depending upon size of the marestail and herbicide resistance).
- Include one or more of the following PRE herbicide(s) for residual control of marestail:

ALS-Sensitive Populations	ALS-Resistant Populations
Authority Assist Authority First Authority MTZ Canopy DF/EX Enlite Envive FirstRate Gangster metribuzin Python Sonic Spartan Synchrony Valor Valor XLT	Authority Assist Authority First Authority MTZ Enlite Envive Gangster metribuzin Sonic Spartan Valor Valor XLT

- Where POST treatments are needed, apply when marestail are less than 6" tall. The most effective POST treatment sin Roundup Ready soybeans include combinations of glyphosate plus Classic or FirstRate.

Consider Liberty Link Soybeans
Liberty Link soybeans are an effective tool for management of herbicide-resistant marestail populations. The most effective approach includes application of burndown and residual herbicides as indicated above, to ensure a weed free start at planting and residual control. This can be followed with one or tow POST applications of Ignite as needed to control later-emerging marestail, when plants are less than 6 inches tall. The current Ignite label allows use of Ignite in either the burndown or the POST treatments, but not both.

What About Fall Herbicide Treatments?
Residual herbicides are most effective and long-lasting when applied in the spring, not in the fall. Fall herbicide treatments can be used to manage emerged marestail, winter annuals, and dandelions, but should generally be followed by a spring preplant treatment that includes residual herbicides (in other words, don't substitute the fall treatment for a spring preplant treatment). Do not expect a fall herbicide treatment to adequately control marestail that emerges in May or June. Where a fall application is necessary, we suggest applying either: glyphosate + 2,4-D; or 2,4-D + a low rate of Canopy EX or Canopy DF. This should be followed with a spring preplant application of residual herbicide (plus 2,4-D, glyphosate, Gramoxone or Sharpen as needed).

Note on glyphosate rates. Glyphosate rates are shown here as "lbs. ae/A", or "pounds of acid equivalent per acre". The rate of "1.1 lb. ae/A" corresponds to: Roundup WEATHERMAX/PowerMAX – 33 oz./A; Touchdown Total/Duramax – 36 oz/A; all glyphosate products containing 3 lbs. glyphosate acid per gallon – 48 oz./A. See Table 23 in the Weed Control Guide for Ohio and Indiana" for more information http://www.btny.purdue.edu/Pubs/WS/WS-16 .

GPS-Guided Systems Open New Management Options for Corn Producers

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Purdue University Extension

Summary: In using the most precise automatic guidance system available (real-time kinematic or RTK), planting corn directly over preplant UAN bands (at all nitrogen [N] rates) increased plant N concentrations in whole plant samples taken approximately one month after seeding at each of three locations. Micronutrient concentrations of manganese (Mn) and/or zinc (Zn) also tended to be higher as corn rows were positioned closer to preplant UAN bands. Corn plant populations and grain yields were frequently reduced when corn rows were positioned directly over UAN bands at N rates of 100 or 200 lbs/A of N, but not when preplant N rates were 50 lbs/A or when corn rows were positioned 5 or 10 inches away from the higher preplant N rates. Starter fertilizer application had little effect on corn population, height or yield response to proximity of the preplant UAN bands, but starter did increase early-season heights and plant N and phosphorus (P) concentrations as expected. We conclude that RTK guidance is highly advantageous when planting no-till or tilled corn soon after preplant banded UAN application, and that the optimum corn row position for a "safe" response shortly after UAN application at high rates is at least 5 inches from and parallel to the UAN band.

Benefits include timeliness of field operations, less operator fatigue, reduction in input expenses (e.g., less overlap in seed and fertilizer applications), and the opportunity to achieve optimum positions of corn rows relative to nutrient bands.

Recent developments in GPS-guided automatic steering systems have opened up many new management options for corn producers. Automatic guidance devices have provided benefits in terms of improved timeliness of field operations, less operator fatigue, reductions in overlapping applications of pesticides and fertilizers, controlled traffic system opportunities, as well as reduction in capital expenses (such as the possible elimination of row markers on corn planters or the use of strip tillage tools that are only half to two-thirds of the corn planter width). The economic merits of automatic steering devices are still being debated as are the relative merits of automatic guidance systems with varying degrees of accuracy. Our interest in combining no-till and strip-till operations with fluid fertilizer banding grew over years of researching and promoting strip tillage and deep banding of fertilizer for high-yield corn production systems. The objectives of this three year research (2006 to 2008) were to:

- Determine the realistic joint benefits associated with automatic guidance systems for both UAN banding and planting systems in no-till corn
- Quantify the effects of various degrees of planter precision (relative to preplanting UAN bands) on corn nutrient uptake, growth, and yield
- Determine whether the combination of automatic guidance systems and preplant banded UAN application would circumvent the need for fluid starter applicators on corn planters.

West Lafayette: Over a three-year period (2006 to 2008), corn plant heights following preplant UAN application were most stunted in the corn rows planted directly over the UAN band at the N rate of 200 lbs/A (Table 1). Mean corn plant populations for 2006-2007 were not lowered dramatically by on-row planting at this location because of relatively moist soils—its high silt-plus-clay content and timely rains after planting. But there is some evidence of lower final stands with corn planted directly over the 50- and 200-lb/A N rates when starter fertilizer was present. All plant populations were reduced by soil crusting in 2007. Overall grain yields for the 3 years without starter were lowest when corn was planted 10 inches away from the UAN band at the low 50-lb/A N rate. However, when both preplant N and starter fertilizer were applied, overall grain yields were lowest with a zero-inch displacement of the corn rows from the UAN band at the 200-lb/A N rate. Corn yields with the latter treatment combination were similar to that following the treatment with starter but with no preplant UAN. The overall starter benefit was a yield gain of 4 bu/A and a reduction of 0.6 percent in mean grain moisture content at harvest. Highest corn yields occurred with the combination of corn planted 5 inches away from the 200-lb/A preplant N rate with starter fertilizer. The 3-year data confirm the benefits of a minimum displacement of the corn rows from high rates of recently applied preplant UAN.

Table 1. Corn response to preplant banded UAN application and RTK-guided corn row placement at West Lafayette, 2006-2008 †

Starter Fertilizer?	Preplant N rate and Placement	Stand 4 weeks ‡	Plant Height	Harvest Moisture	Yield @ 15.5%
		ppa	in	%	bu/A
None	0 pre-plant UAN	27111ab*	17.0d	22.3a	218.1a
	50 lbs on row	26763ab	19.5a	21.5c	218.8a
	50 lbs 5 inches	27798ab	19.6a	21.6bc	215.7ab
	50 lbs 10 inches	26833ab	18.7abc	21.9abc	207.2b
	100 lbs on row	27437ab	19.5a	21.69bc	214.3ab
	100 lbs 5 inches	27138ab	18.7abc	21.8abc	214.8ab
	100 lbs 10 inches	27243ab	18.7abc	21.4c	214.3ab
	200 lbs on row	27854a	18.0c	22.2ab	214.8ab
	200 lbs 5 inches	28048a	19.2ab	21.8abc	218.7a
	200 lbs 10 inches	26270b	18.4bc	21.9abc	216.1ab
	LSD (5%)	1561	1.0	0.6	10.0
Yes	0 pre-plant UAN	27076ab	21.5ab	21.4	215.96b
	50 lbs on row	25791b	22.0a	21.1	220.9ab
	50 lbs 5 inches	27687a	22.2a	21.0	217.0ab
	50 lbs 10 inches	26569ab	21.7ab	21.1	216.9ab
	100 lbs on row	26687ab	21.4ab	21.1	216.7ab
	100 lbs 5 inches	26694ab	21.9a	21.1	221.4ab
	100 lbs 10 inches	27027ab	22.1a	21.0	218.1ab
	200 lbs on row	25534b	20.7b	21.5	215.5b
	200 lbs 5 inches	27520a	21.7ab	21.2	226.7a
	200 lbs 10 inches	26277ab	21.5ab	21.3	225.3ab
	LSD (5%)	1626	1.1	0.7	10.2
None	Mean of 10 treat.	27250a	18.7b	21.8a	215.3b
Yes	Mean of 10 treat.	26686b	21.7a	21.2b	219.5a

† Averate of 6 replications
‡ Includes years 2006 and 2007 only.
* Means with the same letter are not significantly different.

Corn plant nutrient analyses over the last two years confirmed that plant N concentrations were highest when corn rows were planted directly over the preplant UAN bands at the 100-and 200-lb/A rates of N (Table 2). Lowest plant N concentrations occurred in the control plots that had no preplant UAN. The addition of 10-34-0 starter increased plant N and phosphorus (P) concentrations as expected. The starter influence on whole-plant N and P concentrations was strongest in the treatment with zero preplant UAN. Plant N, but not plant P concentrations, was affected by proximity of the corn rows to the UAN bands. In a somewhat odd development, plant potassium (K) concentrations were lowest with on row planting at the 200-lb/A N rate when there was no starter fertilizer, but plant K concentrations were highest for the same treatment when NP starter was present.

Table 2. Corn plant nutrient concentration response to preplant banded UAN application and RTK-guided row placement at West Lafayette, 2007-2008 †

Starter Fertilizer?	Preplant N rate and Placement	Nitrogen	Phosphorus	Potassium	Zinc	Manganese
		%	%	%	ppm	ppm
None	0 pre-plant UAN	3.55e ‡	0.36	4.02ab	33.9	39.6c
	50 lbs on row	4.64ab	0.38	3.49b	39.3	53.5abc
	50 lbs 5 inches	4.12cd	0.39	4.14a	33.7	62.5a
	50 lbs 10 inches	3.92d	0.39	3.69ab	35.1	45.4bc
	100 lbs on row	4.69ab	0.37	3.78ab	36.7	57.5ab
	100 lbs 5 inches	4.39bc	0.36	3.87ab	38.2	50.8abc
	100 lbs 10 inches	4.00d	0.37	3.87ab	36.6	47.5abc
	200 lbs on row	4.74a	0.37	3.55b	39.9	54.8abc
	200 lbs 5 inches	4.48ab	0.37	3.97ab	36.3	52.6abc
	200 lbs 10 inches	4.08cd	0.35	3.92ab	39.0	39.5c
	LSD (5%)	0.32	0.04	0.57	7.0	15.8
Yes	0 pre-plant UAN	4.11e	0.43	3.76ab	27.2b	37.6e
	50 lbs on row	4.59b	0.44	3.81ab	34.9a	54.1abc
	50 lbs 5 inches	4.49bc	0.43	3.86ab	31.6ab	45.0cde
	50 lbs 10 inches	4.22de	0.45	36.0ab	31.8ab	39.6de
	100 lbs on row	4.89a	0.44	3.97a	35.0a	58.4ab
	100 lbs 5 inches	4.55bc	0.44	3.67ab	32.2ab	50.7bc
	100 lbs 10 inches	4.32cde	0.44	3.51ab	33.2a	48.9bcd
	200 lbs on row	5.04a	0.46	3.99a	32.9a	62.6a
	200 lbs 5 inches	4.83a	0.45	3.73ab	34.5a	54.3abc
	200 lbs 10 inches	4.45bcd	0.46	3.35b	30.1ab	46.6cde
	LSD (5%)	0.24	.04	0.56	5.5	9.9
None	Mean of 10 treat.	4.3b	0.37b	3.8	36.9a	50.4
Yes	Mean of 10 treat.	4.5a	0.44a	3.7	32.3b	49.8

† Averate of 6 replications
‡ Means with the same letter are not significantly different.

Micronutrient concentrations were also affected by fertilizer treatments and planter positions. Plant Zinc (Zn) concentrations were significantly lower (i.e., about 4.6 ppm) in the presence of starter fertilizer. Plant Mn concentrations were lowest when no preplant UAN was applied or when the corn rows were positioned 10 inches away from the preplant N bands. It is possible that UAN band influences on localized soil pH may have had something to do with the variation in plant-available Mn concentrations at this location. Mean soil pH was about 6.5.

South of Lafayette: Corn plant establishment at this location was negatively affected by placing corn rows directly over some preplant UAN bands (Table 3). Considerable plant death occurred with on-row planting at N rates of 100 and 200 lbs/A, but not with on-row planting at the 50-lb/A rate. Less than 90 percent of the plants survived with on-row planting at an N rate of 100 lbs/A and less than 75 percent survived at the N rate of 200 lbs/A. The reduction in plant stand because of N toxicity was more dramatic in 2007 because of dry weather conditions prevailing after planting. Corn plants that did survive were somewhat shorter in the 200-lb/A N rate treatment relative to other row placement treatments. Plant populations were also lower when the corn rows were 5 inches away from the 200-lb/A N rate and no starter fertilizer was applied, but the same detrimental effect was not observed with starter.

Grain yields were dramatically affected by corn row position relative to the preplant UAN bands, but not by starter treatment (Table 3). At the 200-lb/A N rate, planting on-row with starter fertilizer reduced corn yields by an average of 34 bu/A relative to planting 5 inches from the preplant bands, and 41 bu/A relative to planting 10 inches from the preplant N bands. For the same 200-lb/A N rate, corn yield reductions with on-row planting were smaller after planting without starter (just 10 and 23 bu/A loss relative to the 5-inch and 10-inch row displacements). There was no significant effect of on-row planting on corn growth at the 50-lb/A N rate. The addition of starter fertilizer resulted in faster early growth, but no increase in final corn yields at this location. Overall soil test P at this location averaged 31 ppm and 23 ppm and soil test K was only 77 ppm and 116 ppm in 2007 and 2008, respectively.

Table 3. Corn plant nutrient concentration response to preplant banded UAN application and RTK-guided row placement south of Lafayette, 2007-2008 †

Starter Fertilizer?	Preplant N rate and Placement	Stand 4 weeks	Plant Height	Harvest Moisture	Yield @ 15.5%
		ppa	in	%	bu/A
None	0 pre-plant UAN	30479a	28.4ab	17.5a	212.7abc
	50 lbs on row	30813a	28.5ab	17.0ab	213.4abc
	50 lbs 5 inches	31250a	30.7a	16.7b	215.5ab
	50 lbs 10 inches	30917a	29.1ab	17.2ab	226.2a
	100 lbs on row	27042b	28.4ab	16.9ab	216.5ab
	100 lbs 5 inches	29771a	28.5ab	16.9ab	219.8ab
	100 lbs 10 inches	31104a	28.3ab	16.9ab	206.5bc
	200 lbs on row	22479c	26.8b	17.0ab	196.1c
	200 lbs 5 inches	27188b	27.2b	17.2ab	206.5bc
	200 lbs 10 inches	31208ab	28.2ab	17.1ab	219.0ab
	LSD (5%)	2370	2.6	0.6	17.4
Yes	0 pre-plant UAN	30792a	31.8abc	17.0ab	215.0ab
	50 lbs on row	30313a	32.6abc	16.9ab	212.6ab
	50 lbs 5 inches	30792a	33.4ab	16.6b	220.8a
	50 lbs 10 inches	30563	33.6a	16.9ab	220.2ab
	100 lbs on row	25479b	31.4abc	16.6b	204.7b
	100 lbs 5 inches	29667a	33.1ab	16.8ab	222.1a
	100 lbs 10 inches	31313a	33.6a	16.8ab	210.9ab
	200 lbs on row	20771c	30.2c	16.9ab	179.6c
	200 lbs 5 inches	30250a	30.9bc	16.9ab	213.6ab
	200 lbs 10 inches	30604a	32.3abc	17.1a	220.5ab
	LSD (5%)	2133	2.6	0.5	16.0
None	Mean of 10 treat.	29225	28.4b	17.0a	213.2
Yes	Mean of 10 treat.	29054	32.3a	16.8b	212.0

† Averate of 6 replications. Grain moisture and yield is average of 5 replications in 2008.
‡ Means with the same letter are not significantly different.

Whole plant nutrient analyses confirmed that plant N and P concentrations were significantly increased by starter fertilizer application as expected (Table 4). Plant N concentrations at this location were lowest when no preplant UAN was applied but plant N concentrations were not highest for the on-row planting situation following UAN application at high rates. In fact, there were no significant differences in plant N concentrations between the 0-and 5-in. displacements following any of the 3 preplant UAN rates. Thus, the N concentration results of Table 4 are in contrast to those at the West Lafayette site (Table 2) where plant N concentrations were highest following on-row planting.

Plant micronutrient concentrations were also affected by the various N and row placement treatments (Table 4). Plant Zn concentrations in the no-starter treatments were lowest without preplant UAN and highest when corn rows were positioned 5 inches away from the 200-lb/A N rate. Plant Mn concentrations were also lowest without preplant UAN and highest following the 200-lb/A N rate when the rows were either 0 or 5 inches away from the UAN bands. In general, higher N rates were beneficial to achieving higher Mn concentrations, though one could argue that Mn concentrations (>100 ppm) are of no advantage to corn performance.

Wanatah: It is important to emphasize that we did not split the treatments into a starter versus no starter comparison because of resource constraints in the three years of our study at this site. Corn plant establishment was very negatively affected by placing corn rows directly over all preplant UAN bands (Table 5). At the 50-lb/A N rate, plant populations were reduced by over 1,500 plants/A compared to either no UAN or UAN bands at least 5 inches from the row. At N rates of 100 and 200 lbs/A, plant populations were reduced by over 5,000 and 12,000 plants/A, respectively. Fewer than 65 percent of the plants survived at the 200-lb/A rate of N. At the same time, there was little detrimental impact to plant populations when corn rows were planted just 5 inches away from the UAN bands at even the higher N rate. Significant population reductions were observed when corn was planted directly over the UAN bands at the 100-and 200-lb/A N rates in all three years at this location.

Corn plants during the vegetative growth period were also stunted in all three on-row treatments (Table 5). Plant heights for on-row planting at 200 lbs/A were less than three-quarters as tall as those in comparable treatments planted 5 to 10 inches away. However, a slight reduction in plant height was observed for corn planted 5 versus 10 inches away from the UAN band at the 100-to 200-lb/A N rates (Table 5). In certain years, this marked suppression of early plant growth was exacerbated by dry conditions following planting at this location. Grain yields were dramatically affected by corn row position relative to the preplant UAN bands (Table 5). At the 100-lb/A N rate, planting on-row reduced corn yields by an average 20 bu/A relative to planting 10 inches from the preplant UAN bands. At the 200-lb/A rate of N, planting on-row reduced corn yields an average of 58 bu/A relative to planting 10 inches from the preplant bands. There was no significant negative effect of on-row planting on corn growth at the 50-lb/A rate of N. Grain moisture differences were small, but moisture levels were highest with on-row planting at the 100-and 200-lb/A rates of N relative to planting without any preplant N, and this probably reflected delayed development of these corn plants (Table 5).

Table 4. Corn plant nutrient concentration response to preplant banded UAN application and RTK-guided row placement south of Lafayette, 2007-2008 †

Starter Fertilizer?	Preplant N rate and Placement	Nitrogen	Phosphorus	Potassium	Zinc	Manganese
		%	%	%	ppm	ppm
None	0 pre-plant UAN	3.2c	0.30abc	3.3ab	27.8b	91.7c
	50 lbs on row	3.6abc	0.29bc	3.1ab	33.4ab	116.5bc
	50 lbs 5 inches	3.5abc	0.30abc	3.5a	31.7ab	112.2bc
	50 lbs 10 inches	4.0a	0.36a	3.2ab	29.4b	115.0bc
	100 lbs on row	3.8a	0.30abc	3.3ab	37.4ab	139.9ab
	100 lbs 5 inches	3.7ab	0.34ab	3.5a	35.2ab	122.5abc
	100 lbs 10 inches	3.3bc	0.29bc	3.0b	34.2ab	132.4ab
	200 lbs on row	3.7ab	0.27c	3.2ab	32.6ab	145.0ab
	200 lbs 5 inches	3.7ab	0.29bc	3.2ab	40.8a	155.8a
	200 lbs 10 inches	3.6abc	0.35ab	3.5a	33.1ab	128.1abc
	LSD (5%)	0.4	0.06	0.5	10.7	38.0
Yes	0 pre-plant UAN	3.7b	0.41ab	3.5a	25.3	98.7d
	50 lbs on row	3.8b	0.38bc	3.2ab	25.5	110.1bcd
	50 lbs 5 inches	3.9ab	0.43a	3.6a	30.0	107.7bcd
	50 lbs 10 inches	3.7b	0.40abc	3.2ab	23.5	89.5d
	100 lbs on row	3.9ab	0.39bc	3.1ab	28.8	129.4ab
	100 lbs 5 inches	3.9ab	0.44a	3.2a	32.6	126.9abc
	100 lbs 10 inches	3.7b	0.41ab	3.4a	28.7	102.9cd
	200 lbs on row	3.9ab	0.36c	2.8b	29.9	145.8a
	200 lbs 5 inches	4.4a	0.42ab	3.2ab	32.6	148.7a
	200 lbs 10 inches	3.9ab	0.44a	3.4a	31.9	125.3abc
	LSD (5%)	.03	.04	0.5	9.4	26.4
None	Mean of 10 treat.	3.6b	0.31b	3.3	33.6	126.0
Yes	Mean of 10 treat.	3.9a	0.41a	3.3	28.9	118.3

† Averate of 6 replications
‡ Means with the same letter are not significantly different.

Whole plant nutrient analyses over the three years confirmed that plant N concentrations were significantly increased by planting corn rows directly over the UAN fertilizer bands at all three N rates (Table 6).

Plant N concentrations at this location were lowest when no preplant UAN was applied, or when the UAN bands were 10 inches away from the corn row. Planting corn 5 inches away from the UAN band resulted in significantly higher plant N concentrations compared to planting 10 inches from the UAN planting 10 inches from the UAN band only for the 200-lb/A rate of N. These plan N concentration results are similar to those at the West Lafayette site (Table 2). Plant P concentrations were highest when corn rows were 5 inches away from the 50-lb/A rate of N, and plant K concentrations were highest when there was no preplant UAN, but tended to be lower with on-row planting versus 5 or 10 inches away following UAN banding. Plant micronutrient concentrations were also affected by the various N and row placement treatments (Table 6). Plant Zn concentrations were highest when corn was planted directly over the preplant UAN bands at all N rates and were significantly lower in the control treatment (i.e., no preplant N) or when corn rows were positioned farther away from the UAN band. Plant Mn concentrations were also lowest without preplant UAN and highest following the 50-, 100-and 200-lb/A rates of N when the rows were 0 inches away from the UAN bands. In general, preplant UAN resulted in both higher Zn and Mn concentrations, particularly when corn rows were planted directly over the UAN band. However, one could argue that Mn concentrations above 90 ppm are so much higher than the critical levels that these are not likely to result in superior corn plant growth.

Table 5. Corn response to preplant banded UAN application and RTK-guided corn row placement at Wanatah, 2006-2008†

Starter Fertilizer?	Preplant N rate and Placement	Stand 4 weeks	Plant Height	Harvest Moisture	Yield @ 15.5%
		ppa	in	%	bu/A
None	0 pre-plant UAN	33449ab‡	22.4bc	21.6d	200.9ab
	50 lbs on row	31972b	22.0c	21.9bcd	202.2ab
	50 lbs 5 inches	33694a	23.1abc	21.6d	203.7a
	50 lbs 10 inches	34326a	24.2a	21.5d	202.9ab
	100 lbs on row	28092c	20.3d	22.5ab	183.0c
	100 lbs 5 inches	33523ab	22.2c	21.8bcd	200.2ab
	100 lbs 10 inches	34000a	24.0a	21.5d	202.8ab
	200 lbs on row	20852d	16.0e	23.0a	143.4d
	200 lbs 5 inches	33791a	22.0c	22.4abc	193.6b
	200 lbs 10 inches	34018a	23.9ab	21.8cd	201.3ab
	LSD (5%)	1716	1.5	0.7	9.4
	Significance Level	.01	.01	.01	.01

† Average of 6 replications
‡ Values followed by different letters are significantly different at P=0.05.

Calendar of Events

Topic	Date	Time	Location	Additional Information
Pesticide New Applicator Training	January 21, 2010	3:00 P.M. to 5:00 P.M.	Crawford County Courthouse, Bucyrus	419-562-8731
Richland Agronomy Day with PAT credit	January 26, 2010	1:00 P.M. to 5:00 P.M.	Longview Center Mansfield (OSUE office address)	419-562-8731
Ashland Agronomy Day with PAT credit	January 28, 2010	1:00 P.M. to 5:00 P.M.	Ashland County Fairgrounds	419-562-8731
Crawford Agronomy Day with PAT credit	February 2, 2010	8:00 A.M. to 12 Noon	Crawford County Courthouse, Bucyrus	419-562-8731
Northern Ohio Crops Day	February 18, 2010	8:30 A.M. to 4:00 P.M.	Ole Zim's - Fremont	419-334-6340
Sandusky County PAT	March 9, 2010	9:00 A.M. to 12 Noon	Woodville – Luckey Farms	419-334-6340
Pesticide New Applicator Training	January 21, 2010	3:00 P.M. to 5:00 P.M.	Crawford County Courthouse, Bucyrus	419-562-8731
Ottawa County PAT	March 24, 2010	6:00 P.M. to 9:00 P.M.	OSU Extension Office, Oak Harbor	419-898-3631
Crawford County PAT Test	March 25, 2010	1:00 P.M. to 5:00 P.M.	Crawford County Courthouse, Bucyrus	1-800-282-1955
Crawford County PAT Session	March 25, 2010	6:00 P.M. - 10:00 P.M.	Crawford County Courthouse, Bucyrus	419-562-8731
Wood County PAT Test	March 25, 2010	9:00 A.M.	Junior Fair Building Bowling Green	419-354-9050
Wood County PAT	March 25, 2010	1:00 P.M. to 4:00 P.M.	Junior Fair Building Bowling Green	419-354-9050