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Planting Corn Immediately After Anhydrous Ammonia Application, Am I in for Trouble?

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The weather conditions this spring have kept corn growers out of the field until this past week. A few growers are concerned about germination and seedling injury because they will be applying preplant anhydrous ammonia (NH_3) only a few hours before planting. The questions are: what should they do to prevent or minimize injury; and what should they expect the crop to look like?

To answer these questions, we'll look at University of Illinois research where corn was planted on top of NH_3 injection bands at a depth of 2 inches on a Flanagan silt loam (Colliver and Welch, 1970). In this study, there were three NH_3 injection depths (4, 7, and 10 inches), three dates of planting (0, 1, and 2 weeks after NH_3 application), and two nitrogen (N) application rates which are applicable to our current conditions (100 and 200 lb N/a). There was also a control treatment where no NH_3 was applied.

The 100 lb N/a rate showed no reduction in stand compared to the control 27 days after planting for any injection depth or date of planting. The 200 lb N/a rate showed significant stand reduction at a 4-inch NH_3 injection depth, but no stand reduction at the deeper depths when planted the day of NH_3 injection. Plant height was slightly stunted 41 days after planting when 100 lb N/a was injected the same day as planting at a 4- or 7-inch depth; if injected at 10 inches there was no stunting apparent. While, the 200 lb N/a showed severe, slight, and no stunting for the 4, 7, and 10 inch NH_3 injection depths, respectively. Overall depth of NH_3 injection was more important in reducing injury than was the amount of time between NH_3 application and planting.

Another observation in the Illinois study was phosphorus (P) deficiency even though the soil test was optimum (22 ppm Bray P). At 22 days after planting deficiency symptoms were greater at shallower injection depths and larger N application rates. The P deficiency likely occurred because the root system was restricted by ammonia toxicity. Remember, the results in this study are an extreme case because corn was planted directly on top of the NH_3 injection band.

To prevent or minimize injury when planting corn a few hours after NH_3 application:

1. Inject NH_3 at least 7 inches deep and perhaps as deep as 10 inches if possible.

2. Do not plant the corn row directly on top of the injection bands. Perhaps the best way to insure that a corn row is not directly on top the injection band is to apply the NH_3 at a slight angle relative to the corn rows. Some plants will end up on top of an injection band, but an entire row will not.

3. Lower N application rates will minimize risk of injury.

4. Ensure that the soil closes behind the knife openings to limit N loss and movement upwards towards the seed.

So are you in for trouble if you plant corn immediately following NH_3 application? The answer is no, as long as you follow the guidelines listed above. And as always, when working with NH_3 follow all safety precautions. ■

Corn Flea Beetle and Stewart's Disease: 2007 Areas at Risk in Wisconsin

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Due to a trend of warmer winters in the state, Stewart's Disease, also known as Stewart's Wilt, should now be on the radar for Wisconsin sweet corn and seed corn producers. Warmer winters increase the overwintering survival rate of corn flea beetle, the primary vector of the bacterium that causes the disease.

Corn flea beetles are small (1/16-inch long), shiny black beetles. They have enlarged hind legs enabling them to jump when disturbed. Corn flea beetles transfer Stewart's Disease from one plant to another. The beetles pick up the bacterium by feeding on infected plant material. Once picked up, the bacterium lives inside the corn flea beetle's gut for the rest of the beetle's life, infecting any plant the beetle feeds upon. Since the beetles overwinter as adults, *P. stewartii* can be transmitted to corn crops from one year to the next.

Corn flea beetle
Photo Credit: Purdue University
http://www.ppdl.purdue.edu/PPDL/expert/Corn_Flea_Beetle.html

Corn flea beetle on corn seedling
Photo Credit: University of Illinois
http://ipm.uiuc.edu/bulletin/article.php?id=217

Stewart's Disease is primarily a concern in sweet corn varieties and dent corn inbred seed production fields as some varieties and inbred lines are highly susceptible to Stewart's Disease. Therefore, planting resistant varieties is the most effective control measure. Many dent field corn hybrids have adequate partial resistance.

A higher survival rate of the vector increases risk of Stewart's Disease being transmitted to the next year's corn crop. The WI DATCP Pest Survey has reported a return of Stewarts Disease to Wisconsin after a 56-year absence. Although seed field inspections since 2000 have turned up only sporadic reports of Stewarts Disease, the reports do indicate that corn flea beetles and Stewart's Disease are undergoing range expansion northward with milder winters (WI DATCP 2007).

Stewart's Disease is caused by the bacterium *Pantoea stewartii*, formerly called *Erwinia stewartii*. The disease has two phases: a wilt phase and a leaf blight phase. The wilt phase generally occurs early in the season after corn flea beetles feed on young corn plants. Symptoms of disease transmission include linear water-soaked lesions, followed stunted plants with withered leaves (Esker and Nutter 2002). The leaf blight phase is more common after pollination but can occur at any point in the season (Pataky et al. 2005). In this phase, leaf lesions turn into brown, dead streaks in the leaves and leaf margins become wavy.

Corn seedling with Stewart's Disease
Photo Credit: D. Wysong, University of Nebraska
http://nu-distance.unl.edu/Homer/disease/agron/corn/CoStewWlt.html

Corn resistant (left) and susceptible (right) to Stewart's Disease.
Photo Credit: J.K. Pataky, University of Illinois, Department of Crop Sciences.

Corn flea beetle overwintering survival rate depends upon the severity of the winter. Two temperature-based indices are commonly used to estimate the level of risk of Stewart's Disease. Both models integrate the average monthly temperatures for December, January and February to predict corn flea beetle overwintering survival and probable occurrence of Stewart's Disease. The Iowa State Model assigns a risk level based on the sum of the mean monthly temperatures for December, January, and February (see Table 1).

Table 1. Iowa State Model for predicting Stewart's Disease risk based on overwintering survival of the primary vector, the corn flea beetle.

Sum of the Mean Monthly Temperatures (Dec, Jan, Feb) in Fahrenheit	Disease Risk
90° or above	High
85° - 90°	Moderate to High
80° - 85°	Moderate to Low
Less than 80°	Low

The Stevens-Boewe Index assigns an anticipated severity level of the damage caused by corn flea beetle feeding. It uses the average monthly temperature of December, January, and February to estimate the severity of early season wilt and late-season blight (see Table 2).

Table 2. Stevens-Bowe Index for predicting severity of Stewart's Disease based on overwintering survival of the primary vector, the corn flea beetle.

Average Monthly Temperature (Dec, Jan, Feb) in Fahrenheit	Severity of Early Season Wilt	Severity of Late Season Blight
33° or above	Severe	Severe
30° - 33°	Moderate	Moderate to Severe
27° - 30°	Light	Light to Moderate
Less than 27°	Absent or nearly so	A trace, at most

The WI DATCP Pest Survey recently reviewed the mean monthly temperatures (Dec. 2006, Jan. and Feb. 2007) for sites throughout Wisconsin and assessed both types of risk.

Using the more conservative Iowa State Model, the risk of Stewart's Disease occurring is high in SE Wisconsin (Kenosha); moderate to high across Southern WI (Milwaukee, Racine, Afton, Brodhead, Watertown, Dodgeville, and East Central WI (Manitowoc); and low to moderate for Northwest (Gordon, Madeline Island), North Central (Hurley, Wausau, Rhinelander), Northeast (Goodman, Florence, Antigo), West Central (Eau Claire, La Crosse, Jim Falls), Central (Hancock, Stevens Point, Marshfield) and East Central WI near Appleton, and Green Bay.

Using the Stevens-Boewe Index, a moderate level of damage is predicted near Kenosha, and a low level of damage is predicted for all other locations.

Scouting sweet corn and inbred seed corn fields for presence of corn flea beetles from seedling emergence to V5 stage is a good practice. Check your variety and/or inbred planted to confirm host plant resistance status. Leaf feeding injury is usually not severe enough to cause economic damage. However, if corn flea beetle numbers are high and corn is not growing vigorously due to beetle feeding, treatment thresholds are available. In commercial hybrid corn prior to V5, 50 percent of plants with severe feeding injury and five or more beetles per plant. In seed corn on susceptible hybrids, treatment can be justified if 10 percent of the plants inspected have severe feeding injury (long, white/silvery streaks on the corn leaf surface) and two or more beetles per plant (Munkvold 2001).

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Horseweed, Resistance, and Wind.

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Horseweed (or marestail) is the most widely distributed glyphosate-resistant weed in the U.S. After the initial confirmation in Delaware in 2001, glyphosate-resistant (GR) horseweed has been reported 15 states, including Illinois to our south and Nebraska to our southwest. The two sources for GR horseweed are either home-grown (i.e. resistance developed on a specific farm) or GR seed (or pollen) introduced from another field. The potential for horseweed seed to move from one farm to another or even from one county to another is an interesting question.

Horseweed Seed Facts

∗Single plants can produce over 200,000 seeds.

∗Very small seed (1/16 inch long) with pappus can be carried by wind.

∗Seeds are so light that they fall or settle at a rate of about 1 foot per second.

∗Seeds do not have dormancy and can germinate immediately after maturity.

∗Seeds can germinate under favorable conditions in the fall, spring or mid-summer.

Previous research had found that horseweed seeds may travel up to 1500 ft downwind from the mother plants. This distance of travel could easily move horseweed seed within a field, from a fence line into a field, or from one field in to an adjacent field. However, it would not account for horseweed seed moving longer distances to potentially spread glyphosate resistance.

Researchers in New York and Delaware wanted to determine if horseweed seed was capable of moving long distances in the wind. They described winds in the surface boundary layer, which are 2.5 times the height of the canopy or 15 feet if considering 6 ft tall horseweed. Winds above the surface boundary layer are called the planetary boundary layer (PBL), which generally have greater wind speeds. Winds in the PBL would be responsible for potential long distance seed movement.

To sample the PBL, the researchers flew specially modified RC planes with samplers downwind from a field with mature horseweed over a 3-day period. The 17 30-minute flights were at heights ranging from 128 to 460 ft above the ground. Remarkably, horseweed seed was collected in 13 of the 17 flights regardless of the height of the flight.

As a result of collecting horseweed seed at these heights, the researchers concluded that long distance seed movement is possible. If seeds were blown into the PBL in early afternoon, an 11 mph wind could move the seed 45 to 90 miles. Since winds in the PBL are often greater and frequently may exceed 40 mph, such wind could move horseweed seed over 300 miles. With this long distance dispersal of seed possible, it is also possible for more rapid or wide-scale introduction GR horseweed.

<u>What might this mean for Wisconsin?</u>

1. Horseweed is a common winter annual weed in many no-till fields in Wisconsin.

2. Glyphosate-resistant horseweed is certainly possible in Wisconsin, but GR horseweed has not been reported to date.

3. Glyphosate-resistant horseweed could develop in a field either from selecting for resistance in that field through repeated use of glyphosate or it could be introduced as GR seed.

4. Once GR horseweed is established in Wisconsin, the potential for movement beyond the initial infestation is possible via wind-borne seed.

5. The best defense against "home-grown" resistance or "wind-blown" resistance is a good offensive plan. Use a tank mix in your burndown herbicide program and treat the horseweed before it exceeds 4 to 6 inches in height. It is especially important to control horseweed before planting soybeans because in-crop options are limited. Effective burndown programs before soybeans on seedling or rosette stage horseweed include glyphosate + 2,4-D or Gramoxone + Sencor. On elongating horseweed less than 6 inches tall, the glyphosate rate should be increased to 1.1 lb ae/a and still tank mixed with 2,4-D or 2,4-D should be added to the Gramoxone + Sencor mix. Chlorimuron products (an ingredient in Synchrony and Canopy) or FirstRate can also improve glyphosate's control of horseweed.

Source: Shields, E.J., J.T. Dauer, M.J. VanGessel, and G. Neumann. 2006. Horseweed (Conyza canadensis) seed collected in the planetary boundary layer. Weed Science 54:1063-1067. ■