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Corn Disease Update

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Goss's Bacterial Wilt and Blight

Goss's Bacterial Wilt and Leaf Blight, or more commonly referred to as Goss's wilt, was prevalent early in the 2012 growing season, but disease progression slowed, presumably due to the extreme heat and drought through most of the state. Goss's wilt was prevalent in the 1970s and 1980s, but only developed sporadically from the late 1980s until 2006. Around 2006, the disease reemerged in western Nebraska, northeast Colorado, and southeast Wyoming. From there, the disease appeared to quickly progress eastward and in 2008 it was first reported in Indiana (Ruhl et al., 2008). The disease has also been documented as far south as the northern panhandle of Texas, and as far north as North Dakota (Korus et al., 2011) in the U.S. and two provinces of Canada, Ontario and Manitoba.

Symptoms

As the name implies, there are two phases of the disease. The wilt phase usually occurs following early season wounding (e.g. sandblasting, hail, high winds, or heavy rainfall). The wilt phase is usually most severe when plants are injured when nodes are stacked beneath the soil line during the early vegetative stages V3-V5 (Suparyono and Pataky 1989). Stand reductions around V4 have been reported to be as high as 30% when the systemic wilt phase was severe. The wilt phase is caused by a buildup of bacteria in the vascular bundles, which reduces the plant's ability to transfer water, thus causing the plant to wilt and die. The wilt phase can also occur when plants are larger, but disease occurrence is usually not as severe (Suparyono and Pataky 1989). The wilt phase was confirmed in June 2012 in York County, which was especially early further east than normal during recent years in Nebraska.

The second and more common phase of the disease is leaf blight. Leaf blighting caused by this disease is also most commonly seen in association with the wounding events as previously described. Leaf blighting often is accompanied by water soaked lesions with discontinuous water soaked spots, often called freckles, along the lesion margin. The lesions run parallel to the veins, but are not confined between veins. Shiny bacterial exudate or "ooze" may also be observed on mature lesions giving it a glossy or wet appearance.

2011 Survey results

In 2011, a survey was initiated to begin to understand which agronomic factors and environmental conditions had the most impact on disease development. More than 500 surveys were returned from eight states and were accompanied by 486 leaf samples. The two statistical analyses used identified several factors that could have a significant impact on the development and severity of Goss's wilt in the Corn Belt.

The top five factors associated with the development of Goss's wilt are:

1. planting population density
2. Goss's wilt rating for the hybrid (assigned by the seed company)
3. crop rotation sequence
4. planting date
5. percentage of residue cover

This study confirmed that the best way to avoid Goss's wilt in a field is to plant a resistant hybrid. It also showed that crop rotation and percent residue cover affected the ability of the pathogen to infect in subsequent years. Since the pathogen is residue-borne, planting continuous corn, or leaving large amount of infected corn residue on the soil surface increased the likelihood that the sample tested positive for Goss's wilt. The other two factors associated with Goss's wilt development were planting population and planting date. Future research efforts will need to be made on these two topics before any recommendations can be made to better understand their impact on disease development and to better manage for Goss's wilt.

New alternate hosts identified

In greenhouse trials, 3 previously unconfirmed hosts of Goss's wilt were confirmed during the spring of 2012. Green foxtail was the only foxtail species previously identified as a host to the Goss's wilt bacteria (Schuster, 1975). Research conducted in the greenhouse showed that yellow foxtail, bristly foxtail, and giant foxtail are also hosts, in addition to green foxtail, and could be providing a reservoir of bacterial inoculum. Symptoms on these foxtail species were similar to those observed for the leaf blight phase of the disease on susceptible corn hybrids.

Other known hosts include eastern gama grass, barnyard grass, sudangrass, grain sorghum, teosinte, and volunteer corn.

Goss's Wilt Management Strategies

- Plant resistant hybrids
- Rotate with nonhost crops, such as wheat or soybean
- When practical, reduce the amount of residue, if planting into infected corn residue
- Control alternate hosts, such as volunteer corn, foxtail species, and other known alternate hosts

More Resources

Additional information on these and other diseases and their management can be found at the website Plant Disease Central at http://pdc.unl.edu/ or in the following UNL Extension publications:

Goss's Bacterial Wilt and Leaf Blight of Corn
http://www.ianrpubs.unl.edu/sendIt/g1675.pdf

Literature Cited

1. Korus, K. A., Timmerman, A. D., French-Monar, R. D., and Jackson, T. A. 2011. First report of Goss's bacterial wilt and leaf blight *(Clavibacter michiganense* subsp. *nebraskensis)* of corn in Texas. Plant Disease 95:73.

2. Ruhl, G., Wise, K., Creswell, A., Leonberger, A. and Speers, C. 2009. First report of Goss's wilt and leaf blight on corn caused by *Clavibacter michiganense* subsp. *nebraskensis* in Indiana. Plant Disease 93:841.

3. Schuster, M.L. 1975. Leaf freckles and wilt of corn incited by *Corynebacterium nebraskense* Schuster, Hoff, Mandel, Lazar 1972. Agricultural Experiment Station. IANR University Nebraska Lincoln Research Bulletin 270. 40pp.

4. Suparyono and Pataky, J. K. 1989. Influence of host resistance and growth stage at the time of inoculation on Stewart's wilt and Goss's wilt development and sweet corn yield. Plant Disease 73:339-345.

Aspergillus Ear Rot and
Aflatoxin Contaminated Grain

The drought conditions of 2012 had severe impacts on Nebraska corn. In addition to reductions in test weight and overall yield, secondary problems developed in some corn fields as a result of these conditions. Drought and high temperatures promote development of the disease Aspergillus ear rot. The fungi that cause this disease (most commonly caused by *Aspergillus flavus*) can produce aflatoxin. Aflatoxin is one of many in a group of chemicals, known as mycotoxins, that are produced by fungi (molds). Mycotoxins, such as aflatoxin, can be toxic to animal and human consumers and at certain concentrations can lead to dockage or rejection of grain at elevators.

Mycotoxins are common and can be safely consumed at low concentrations. The concentration of aflatoxin that is considered safe for consumption depends upon the age and species of the animal consumer. An abbreviated summary listing the Action Levels identified by the FDA for aflatoxin is listed in Table 1.

Table 1. FDA Action Levels for Aflatoxin in Feed and Food

Consumer	Action Level in parts per billion (ppb)
Finishing (feedlot) beef cattle	300
Finishing swine of 100 pounds or greater	200
Breeding beef cattle, breeding swine, or mature poultry	100
Immature animals and dairy cattle	20
For animal species or uses not otherwise specified, or when the intended use is not known	20
Humans	20

Action Levels were established by the U. S. Food and Drug Association (FDA) for Aflatoxin are available at: http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/ChemicalContaminantsandPesticides/ucm077969.htm#afla

Testing for Aflatoxin

Corn harvested from fields where there was Aspergillus ear rot should be tested for aflatoxin prior to use, sale, or storage. Corn is at higher risk for Aspergillus ear rot if it was grown under drought-stressed conditions or if injury occurred to the kernels. The concentration of aflatoxin in a sample can be determined by laboratory testing. The U.S. Grain Inspection, Packers and Stockyards Administration (GIPSA) certifies some laboratories for aflatoxin testing. A list of laboratories certified for aflatoxin testing in the Nebraska region is below.

Accurate lab test results for aflatoxin depend greatly on the quality of the sample that is collected and methods used by laboratories conducting tests. The test results are only applicable to the sample that is submitted, so it is very important to collect an adequate and representative sample for the best results. Refer to the publication, **Sampling and Analyzing Feed for Fungal (Mold) Toxins (Mycotoxins)** (link below) for recommendations on how to collect and submit a high quality sample for the most accurate mycotoxin analysis. In addition, you should contact and submit samples to a laboratory that is certified by the Federal Grain Inspection Service (FGIS) and Grain Inspection, Packers & Stockyards Administration (GIPSA) for mycotoxin analysis. A list of GIPSA-certified laboratories in and near Nebraska is below:

- Fremont Grain Inspection. 603 East Dodge St., Fremont, 402-721-1270; email fgid@neb.rr.com
- Hastings Grain Inspection, 306 E. Park St., Hastings, 402-462-4254; email Hastings at hgihast@hastingsgrain.com; email Grand Island office at hginsp@hastingsgrain.com
- Kansas Grain Inspection Service, 517 13th Ave., Sidney, Nebr., 308-254-3975
- Lincoln Inspection Service, 505 Garfield St., Lincoln, 402-435-4386; email lismf@neb.rr.com
- Omaha Grain Inspection Service, 2525 South 13th St., 402-341-6739; omahagrain@gmail.com
- Sioux CIty Inspection and Weighing Service, 840 Clark St., Sioux City, Iowa, 712-255-8073; email tomd@scigrain.com

The complete list of laboratories certified by GIPSA for aflatoxin testing can be found at: http://www.gipsa.usda.gov/fgis/svc_provid/providers.html

Black (ultraviolet) lights have been used by some grain elevators and individuals in an effort to detect fluorescence as a method for rapid screening of grain samples. This practice is NOT recommended when making decisions about aflatoxin contamination in loads of grain. The component that produces fluorescence under black light is called kojic acid. Although kojic acid is produced by the same fungus that produces aflatoxin, its presence is not an indicator of aflatoxin and might lead to false positive results and unnecessary rejection of grain.

High risk factors for aflatoxin contamination in corn:

- Drought-damaged fields, including rainfed (dryland) fields and non-irrigated pivot corners
- Fields or areas with higher incidence of corn ear feeding insects, such as the corn ear worm
- Grain damaged before or during harvest or after harvest while in storage

Scouting for Aspergillus Ear Rot

Ear rot diseases and aflatoxin are not evenly distributed across fields or in the grain, so scouting and/or sampling should include a substantial portion, at least several acres. And, the presence of visible fungus in kernels does not always correlate well with the presence of aflatoxin, nor does the absence of visible fungal growth necessarily indicate the absence of aflatoxin.

- Open husks to view a large number of ears
- Look for the presence of dusty yellow-green to olive-green spores, especially on the surface of damaged kernels or ear tips
- Pay special attention to corn in higher risk areas

Harvest and Storage

If fields have documented Aspergillus ear rot and/or risk of aflatoxin contamination, it is recommended that you harvest and keep grain separate from other grain at less risk, such as irrigated fields. Storage of affected grain is not recommended because ear rot diseases and mycotoxins can continue to accumulate during storage. If storage is necessary, cooling and drying grain to less than 15% moisture within 48 hours of harvest will help to slow fungal growth and aflatoxin production. Grain intended to be stored for longer periods of time should be dried to less than 13% moisture.

Based on aflatoxin test results from the Lincoln Inspection Service, only about half of the samples submitted had detectable concentrations of aflatoxin. And, only a low percentage of samples had aflatoxin concentrations of more than 20 ppb.

For more information, refer to the list of publications below or to the article in these Proceedings entitled, "Grain Storage Management to Minimize Mold and Mycotoxins."

More Resources

Plant Disease Profiles #3: Ear Rot Diseases and Grain Molds
http://www.ianrpubs.unl.edu/sendIt/ec1901.pdf

Sampling and Analyzing Feed for Fungal (Mold) Toxins (Mycotoxins)
http://www.ianrpubs.unl.edu/sendIt/g1515.pdf

Understanding Fungal (Mold) Toxins (Mycotoxins)
http://www.ianrpubs.unl.edu/sendIt/g1513.pdf

Use of Feed Contaminated with Fungal (Mold) Toxins (Mycotoxins)
http://www.ianrpubs.unl.edu/sendIt/g1514.pdf

Stalk Rot Diseases

The crop stress created by the harsh growing conditions in 2012 led to the development of stalk rot diseases and lodging that slowed harvest progress in some areas.

Weakened stalks became evident in some of the corn still waiting to be harvested across the state late this past fall. The high winds in October 2012 led to lodging in corn where some stalks were weakened by stalk rot diseases and other problems. Crop stress during the 2012 growing season contributed to the development of some stalk rot diseases.

Scouting for Stalk Rot Diseases

Affected plants often have stalks that are hollow and easily crushed by hand or bent using the "push or pinch" test. Stalk rots can occur at any point in the stalk from the crown at/below the soil line all the way to the tassel. Rotting that occurs at an upper node and kills only the upper plant parts is referred to as "top rot" and does not necessarily cause lodging of the whole plant. However, degradation of the stalk below the ear can lead to plant lodging and losses during harvest.

Scouting for Stalk Rot Diseases

Walking through a field, randomly select a minimum of 100 plants representing a large portion of the field. To test for stalk rot you may choose to PUSH the plant tops away from you approximately 30° from vertical. If plants fail to snap back to vertical, then the stalk has been compromised by stalk rot. An alternative method is to use the PINCH test to evaluate plants for stalk rots. Pinch or squeeze the plants at one of the lowest internodes above the brace roots. If the stalks crush easily by hand, then their integrity is reduced by stalk rot and they are prone to lodging. If more than 10% of plants exhibit stalk rot symptoms, then harvesting that field should be a priority over other fields that are at less risk in order to reduce the chance of plant lodging and the potential for yield loss.

There are several fungi that are common in our production fields that can cause stalk rot diseases. Some of the most common stalk rot diseases this year are listed below:

- **Charcoal rot** is one of the few diseases that are more common during drought conditions, and so, is more likely to affect non-irrigated crops. The disease is characterized by the presence of many minute black round structures inside the stalk that can give it a gray to black appearance (hence the name). In addition, the fungus that causes charcoal rot, *Macrophomina phaseolina*, has a wide host range and can cause the same disease in several crops, including soybean, sorghum, and alfalfa.

- **Fusarium stalk rot** is especially common during damp conditions, but may occur anywhere, including in irrigated fields this year. The pathogen, *Fusarium verticillioides*, can sometimes be visible as white fungal growth on the outside of stalks at the nodes. Eventually, the disease may cause discoloration of the inside of stalks to pink or salmon.

- **Anthracnose stalk rot** can also cause a leaf disease and is a common cause of top rots in corn. In more advanced stages the disease can cause the development of black lesions visible on the outside of the stalk and is caused by the fungus *Colletotrichum graminicola.*

Management

Usually, there is nothing to be done to stop stalk rot development once it is identified in the field. In most cases, stalks will continue to degrade over time further weakening them. But, you can work to minimize your losses by identifying which fields have the worst stalk rot diseases and adjust the harvest order of those fields. Consider harvesting those fields that are heavily impacted by stalk rots first to minimize losses after lodging.

More Resources

For more information on stalk rot diseases of corn, see the UNL Extension publications:

Corn Disease Profiles II: Stalk Rot Diseases
http://www.ianrpubs.unl.edu/sendIt/ec1868.pdf

Common Stalk Rot Diseases of Corn
http://www.ianrpubs.unl.edu/sendIt/ec1898.pdf

Crop Watch
http://cropwatch.unl.edu/

If you are in doubt about the identity of a disease or cause of another plant problem, you may submit a sample to the UNL Plant and Pest Diagnostic Clinic (P&PDC) for diagnosis. For more information about these and other plant diseases or for submission forms for the P&PDC and submission instructions, visit the **Plant Disease Central** website at:
http://pdc.unl.edu/