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Corn Disease Update

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The harsh growing conditions during 2014 contributed to several disease problems in corn, in spite of the overall high yields across the state. The extended cold and wet conditions early in the season led to development of seedling diseases and crop stress. Then, in many parts of the state, repeated and unprecedented strong storms battered and wounded crops with multiple and widespread hail events, high winds, very heavy rain, and devastating tornadoes. Many fields were planted late or replanted, some more than once, further delaying the crop. Cool summer and fall conditions delayed maturity and led to early frost events that prematurely killed plants in some fields prior to black layer. These stresses during the season led to some complications at harvest time and could continue to affect stored corn as ear rot pathogens continue to grow as grain molds.

Seedling Diseases

The lengthy period of cool and wet soil conditions during the spring contributed to the development of seedling diseases in corn again in 2014 (and soybean – see the Soybean Disease Update for more information). The most common seedling diseases that were identified in samples submitted to the UNL Plant and Pest Diagnostic Clinic were those caused by *Pythium* and less frequently, *Fusarium* species.

Seedling diseases can be caused by any of several common soilborne organisms, such as *Pythium*, *Fusarium*, *Rhizoctonia* or plant parasitic nematodes. Seedling diseases are often difficult to diagnose because their symptoms are very similar and may be easily confused with those caused by other problems. Sometimes, diagnosis may be of limited value because management is often the same for several seedling diseases. Microscopic examination and other laboratory analyses of the diseased seedlings can often identify the cause(s) of the problems. Seedling diseases can be confused with insect injury, herbicide damage, planting problems, or environmental stresses that often have similar symptoms. For more information on differentiating early season chemical damage and seedling diseases, see the article, "Differentiating Chemical and Disease Symptoms in the Field" in the 2015 Crop Production Clinic proceedings. Some of the possible symptoms of seedling diseases are:

- Rotted seed prior to germination
- Rotted or discolored seedlings after germination prior to emergence
- Post-emergence seedling damping off
- Root decay

At least 14 species of *Pythium* have been previously identified that can cause seedling blight and root rot. These pathogens require excessive moisture because they produce motile swimming zoospores that infect plant roots. The pathogen overwinters in soil and infected plant debris by producing thick-walled oospores that can survive for several years in the absence of a suitable host or favorable weather conditions.

There are more than six *Fusarium* species that can cause seedling diseases and root rots, as well and several are common in Nebraska fields. Stressed plants due to weather extremes (temperature and moisture), herbicide damage, and physical injury are more prone to infection and disease caused by *Fusarium* species.

Some of our most common stalk rot diseases are caused by pathogens that also cause seedling diseases. Plants that survive the initial infections while they are seedlings, may eventually succumb to the stalk and crown rot diseases late in the season when plants begin to senesce.

Management

Unfortunately, resistance is not available for diseases caused by *Pythium* and *Fusarium*. Although improved field drainage can help reduce seedling disease severity, the most common method for disease management is with the use of seed treatment fungicides.

Most seed corn is already treated with more than one seed treatment fungicide, often an insecticide, and, sometimes with a nematicide option. These products can provide protection against some of the pathogens that cause seedling diseases. Several seed treatment fungicides are often included that vary in their modes of action and provide protection against a diversity of seedling pathogens. But, in spite of their activity, seedling diseases may still develop in corn, such as during extended periods of inclement weather or under severe pathogen pressure. You can minimize the likelihood of developing seedling diseases by planting seed at appropriate planting depths and soil conditions to support rapid plant growth and emergence.

Bacterial Diseases

The repeated and widespread wounding events across the state and subsequent development of bacterial diseases in corn were painful reminders that numerous species of pathogenic bacteria are common in our fields. Although some species can take advantage of natural openings in plants for infection routes, many of them opportunistically take advantage of wounds. Some of these diseases appeared simultaneously in the same fields and plants, such as Goss's bacterial wilt and blight and bacterial stalk rot.

Goss's Bacterial Wilt and Blight

Goss's bacterial wilt and leaf blight, or more commonly referred to as Goss's wilt, developed in many fields in 2014. The disease progressed rapidly in some fields following wounding events, and particularly so when plants were wounded during the seedling stages and leading to the early season systemic wilt phase of the disease. During mid- to late season, the more common leaf blight phase was developed and worsened in many fields across Nebraska and especially in areas that had repeated severe weather events. The bacteria causing Goss's wilt, *Clavibacter michiganensis* subsp. *nebraskensis*, are notorious for their ability to infect through wounds.

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 close together 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 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.

Goss's Wilt Management Strategies

- Plant resistant hybrids
- Rotate with nonhost crops, such as wheat, dry bean, soybean, or sunflower
- 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 Crop Watch at http://cropwatch.unl.edu/ or in the following UNL Extension publications:

Goss's Bacterial Wilt and Leaf Blight of Corn

Publication:
http://www.ianrpubs.unl.edu/sendIt/g1675.pdf

Video:
http://marketjournal.unl.edu/corndiseases

Literature Cited:

1. 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.

Bacterial Stalk Rot

In Nebraska, bacterial stalk rot is most commonly caused by the bacterial pathogen *Pectobacterium carotovorum* (formerly known as *Erwinia carotovora* subsp. *carotovora*). In 2014, more bacterial stalk rot was observed than in previous years, likely because of the wounding events that occurred in corn. Samples submitted to the UNL Plant & Pest Diagnostic Clinic also often tested positive for the pathogen causing Goss's bacterial wilt and blight. Co-infections with both pathogens are not uncommon due to their similar growing needs and opportunistic natures taking advantage of wounds. It can be difficult to distinguish between the bacterial stalk rot and the systemic wilt phase of Goss's bacterial wilt and blight as they also have similar symptoms and can progress and kill young plants rapidly. Both, and especially bacterial stalk rot, causes the development of darkened/discolored stalk tissue and overall plant decline. One of the most noted characteristics of the disease is a very offensive odor.

Northern Corn Leaf Blight

Northern corn leaf blight (NCLB) developed at higher incidence and severity in Nebraska, particularly in the eastern counties, than in recent years. Warm humid weather favors infection by the fungus, *Exserohilum turcicum*, which causes this disease. Weather conditions, including cloudy days, moderate temperatures (64-81°F), high humidity and frequent rainfall will favor further infection and spread of this and other fungal pathogens that survive in infected corn residue from recent years.

Like most other diseases caused by pathogens in plant residue, lesions may develop on the lower leaves first and continue to develop on leaves higher up the plant as long as conditions are favorable. NCLB tends to have larger, cigar-shaped lesions with rounded ends. These lesions can be confused with Goss's bacterial blight lesions. Fungal spores may develop on NCLB lesions making them appear darker and/or dusty, especially in the middles of lesions.

Management

Development and spread of NCLB prior to tasseling could reduce corn yield, particularly as lesions develop and expand, killing leaf area that's necessary for grain fill later. It is most important to protect leaves at the ear leaf and above that contribute the most to grain fill. In 2014, lesions developed on leaves 4-6 relatively early in the season on susceptible hybrids.

Foliar fungicides can be used to slow disease spread and protect uninfected leaf tissue in affected fields. Lesion development requires up to two weeks after infection occurs. Thus, it is possible that one to two leaves are already infected above the highest leaf on the plant that has recognizable lesions. To determine if a fungicide application is economical for you, consider the price of corn, yield potential, cost of treatment, and disease severity.

No treatment thresholds have been established for NCLB. However, you can assess your risk for developing yield-limiting disease severity by considering the high risk factors listed below. Having more of these risk factors will increase the likelihood of increasing severity of NCLB and getting a return on the cost of a fungicide application:

- Poor hybrid disease rating(s) for NCLB (consult seed catalog or company representatives for ratings)
- Development prior to tasseling
- Continuous corn
- History of NCLB
- Substantial corn residue
- Humid/wet weather forecast

In fields that were affected by NCLB, it will be important to consider this disease in the future when making corn hybrid selections, since the fungus can survive in infected residue. Hybrids with better ratings for NCLB resistance and other management decisions, especially crop rotation, tillage, etc. should be made a priority to reduce its severity in the future.

More Resources:

Additional information on NCLB and other diseases and their management can be found at the website Crop Watch at http://cropwatch.unl.edu/
or in the following:
Northern Corn Leaf Blight
Video: http://marketjournal.unl.edu/corndiseases

Stalk Rot Diseases

The crop stress created by the growing conditions in 2014 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.

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 weakened stalks, 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 likely 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. For more information on charcoal rot, see the article, "Charcoal rot: An Important Disease in 2014" in these 2015 CPC Proceedings.
- **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

There is nothing that can 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 prior to fields with lower incidence of stalk rot diseases 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

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

Additional information on these and other diseases can also be found at the website Crop Watch at
http://cropwatch.unl.edu/
under "Corn – Disease Management."