Review of the 2009 growing season from a plant pathologist's perspective

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From a plant pathologist perspective, 2009 was a great year for disease! The 2009 growing season was characterized by cool temperatures, thus growing degree days lagged behind normal. South east and east central Iowa received above average precipitation but western and northern Iowa were drier than normal.

Although several diseases of corn were prevalent in Iowa, they were not widespread across the state and were most often associated with susceptible hybrids. In central Iowa, eyespot became prevalent just prior to tasseling, while gray leaf spot was prevalent in southwest Iowa around tasseling time. Towards the end of the growing season, northern corn leaf blight developed rapidly in southeast Iowa, and was also present at higher than normal severities in central Iowa. The cool, wet conditions after tasseling in southeast Iowa favored the development of Diplodia ear rot, while in areas affected by hail, Gibberella and Fusarium ear rots were prevalent. Wet conditions delayed harvest and numerous reports of Cladosporium ear rot developing on ears in the field were received.

In soybeans, sudden death syndrome and white mold were prevalent. Although brown spot, frogeye leaf spot and Cercospora leaf blight were reported, the severity of these foliar diseases was low and likely did not affect yields.

Corn diseases

Eyespot

Eyespot occurs every growing season, however, in 2009, the disease developed rapidly on certain hybrids pre-tassel in central Iowa and it was not uncommon to see the disease throughout the canopy at tasseling. Severe infections early in the growing season can result in greater stalk rot as well as yield loss.

Eyespot, caused by the fungus ***Aureobasidium zeae***, which survives in corn residue. Under moist conditions spores are produced on the residue and splashed or blown by wind onto corn leaves. Germination and infection by the spores requires leaf wetness so rainy conditions or persistent dews result in disease outbreaks. The incubation period from infection until symptoms appear is about 9-10 days (Munkvold and Martinson).

Hybrids vary in their susceptibility to eyespot so growers should check with their seed dealer when making hybrid decisions for 2010. Fungicides are effective for eyespot management.

Gray Leaf Spot

Gray leaf spot was a concern in southwest Iowa during 2009. In some fields, numerous lesions on the ear leaf and leaves above were reported in mid-July just prior to tasseling. The disease was also highly prevalent in mid-July in Nebraska and Tamra Jackson, Extension Plant Pathologist at University of Nebraska – Lincoln, reported that this was slightly earlier than normal in that state, and the severity was increasing (Jackson, 2009). Gray leaf spot is usually more of a concern in southeast Iowa and we usually see a few lesions of the GLS on the lower leaves of the plant around mid to late July. Infections in June and early July were associated with the epidemics of GLS in Iowa in the mid 1990s.

Gray leaf spot is caused by the fungus ***Cercospora zeae-maydis***. The fungus survives in infested previous crop residue and produces spores early in the growing season. Gray leaf spot is a polycyclic disease thus multiple infection cycles can occur in a single season. Favorable conditions for infection of corn by ***C. zeae-maydis*** are temperatures ranging from 72 to 86F, free water on the leaf surface for 10 to 13 hours and relative humidity greater than 95% (Thorson and Martinson, 1993). The number of appressoria formed correlate with the number of hours at which RH is greater than 95% (Thorson and Martinson, 1993). An appressorium is a flattened, hyphal "pressing" organ, from which a minute infection peg grows and enters the host. If spores germinate and RH or temperature conditions become unfavorable for infection, the germinating mycelium can survive until conditions become favorable again. Paul and Munkvold (2005) went on to show that relative humidity followed by temperature also were important for sporulation and lesion expansion and continued development of the disease in the field. Favorable temperatures that occur in mid- to late season may result in the rapid increase in gray leaf spot severity.

Furthermore, when relative humidity is above 95% these expanding lesions serve as a source of inoculum for secondary infection. Thus, if high levels of infection occur early on in the season and conditions are favorable for rapid expansion of primary lesions, final gray leaf spot severity may be high (Paul and Munkvold, 2005).

The amount of yield loss due to gray leaf spot is related to growth stage at which the ear leaf is infected, weather conditions during grain fill, susceptibility of the hybrid, hybrid maturity, stalk rot severity and lodging, and hybrid yield potential. As a rough estimate, if 6 to 25% of the ear leaf is covered with GLS lesions at early dent (growth stage R5), expected yield loss may range from 2 to 10% (Jackson, 2009).

Hybrid resistance should be the basis of all GLS management programs. Crop rotation and some tillage will help reduce inoculum pressure. Foliar fungicide applications can also be used to manage GLS. The current threshold for deciding if a fungicide application is required is GLS lesions are present on the third leaf below the ear or higher at tasseling (VT) on 50% of the plants in the field (Munkvold, 1997). In addition, the following factors need to be considered:

- Susceptibility of the hybrid to GLS
- Anticipated weather conditions during grain fill
- Disease history of the field
- Previous crop history

Research is on going at Iowa State in collaboration with researcher at the University of Illinois, the University of Wisconsin-Madison and The Ohio State University to re-evaluate these guidelines with current hybrids and fungicide products.

Northern Leaf Blight

Towards the end of the growing season, northern leaf blight (NLB) developed in central and southern Iowa. The highest levels of NLB reports were from southeastern Iowa.

NLB is caused by the fungus ***Exserohilum (Helminthosporium) turcicum***. Favorable conditions for infection are 6 to 18 hours of leaf wetness and temperatures ranging from 65-80 F. Cool, wet (frequent rain and heavy dews) and cloudy weather favors disease development. Usually infections begin on the lower leaves and progress up the plant but in 2009, lesions were more prevalent in the upper leaf canopy. Thousands of spores can be produced on a single lesion within a week of infection, thus under favorable conditions NLB can develop rapidly as we saw in 2009.

The fungus survives as mycelia and conidia in infested corn residue thus the risk of disease increases in fields where NLB has previously occurred. In 2009 however, lesions were predominantly found in the upper canopy which suggests spores were wind blown from other sources such as neighboring fields. Crop rotation and some sort of tillage can be helpful at reducing inoculum since they encourage decomposition of infested residue.

The most effective way to manage NLB is planting resistant hybrids. Resistance to NLB may be multigenic or single-gene (Ht gene). A hybrid with Ht resistance to NLB can still be infected and have lesions but spore production is delayed. Most seed companies rate their hybrids for resistance to NLB.

Gibberella ear rot

Gibberella ear rot is more prevalent in cool and humid growing regions. The disease is favored by cool, wet weather immediately following silking. Such conditions were typical of the 2009 growing season.

Gibberella ear rot is caused by the fungus ***Gibberella zeae***. This same fungus causes Gibberella stalk rot. Furthermore, this fungus infects numerous small grains including wheat, barley, oat and rye and causes head scab. It is also known to infect species of ***Lycopersicon, Pisum, Trifolium*** and ***Solanum*** in addition to carnations and other ornamentals.

Gibberella ear rot is typically more prevalent where infested crop debris is allowed to overwinter. The fungus survives as perithecia, which are produced on infested debris. Spores of ***G. zeae*** are wind and rain splash disseminated from overwintering perithecia and infect the ear through silks. Infection may also occur though wounds caused by insects, birds or hail. Gibberella ear rot usually begins at the ear tip and progresses down the ear as a red or pink mold.

Mycotoxins, namely deoxynivalenol (DON or vomitoxin) and zearalenone, may be produced by ***G. zeae***. Although the presence of the fungus does not necessarily indicate mycotoxin contamination, all grain to be used for animal feed should be tested for mycotoxins.

Hybrids vary in their resistance to Gibberella ear rot. Furthermore, hybrids with ears that do not remain upright after maturity and have good ear dry down characteristics have less ear rot. Although managing crop residue may reduce inoculum levels within a field, airborne spores from distant fields can still be a source of inoculum. Fields should be scouted at R6 to determine the extent of ear rots. If greater than 10% of the ears have more than 20% mold, the field should be scheduled for an early harvest. Combine settings should be carefully adjusted to reduce damage to the grain since physical damage to the grain allows further invasion by mold fungi. Grain should be dried to around 15% to reduce further development of mold and mycotoxin contamination, and then cooled.

Diplodia ear rot

Diplodia ear rot is increasing in incidence in Iowa and throughout the Midwest. This is likely because of increased continuous corn acres and reduced tillage. Favorable weather conditions have also contributed to the increase in this disease. In 2009, fields with incidence of Diplodia-affected ears as high as 80% were reported from south east Iowa. Elsewhere incidence of affected ears was fairly low (1-2%).

Diplodia ear rot is caused by the fungus ***Stenocarpella maydis***. The fungus survives in infested corn residue as pycnidia. During wet weather, spores are extruded from the pycnida and are disseminated by rain splashes or wind. Spores that are deposited around the ear shank germinate, infect at the base of husks, and the fungus grows up into the cob and then into the kernels. Ears are most susceptible from beginning silk to 21-24 days afterwards when kernels have reached a moisture level of 75-90 percent. A decrease in 5 percent moisture of the kernels is associated with decrease of 22 percent incidence of ear rot. Resistance to infection occurs 28 days after midsilk when kernels are approximately 66 percent moisture. Colonization of infected ears by ***S. maydis*** will continue in the field if conditions are moist and can continue in storage if grain moisture is greater than 20 percent. Seed borne and infected seeds fail to germinate or succumb to seedling blight (Nyvall, R. 1999).

No mycotoxins have been associated with S. maydis-infected grain in the United States but toxin-producing strains of the fungus have been described in South Africa (Kellerman et al, 1993) and Argentina (Odriozola et al, 2005).

In fields where Diplodia ear rot was severe in 2009, the following management options should be followed. Although there are no hybrids with a high level of resistance to ear rot, hybrids do vary in their susceptibility to the disease and thus growers should talk with their seed dealer to identify suitable hybrids. Rotation reduces buildup of inoculum by allowing infested corn residue to decompose. In fields with moderate to high levels of Diplodia ear rot, rotation is strongly recommended for at least one year and preferably longer.

Remember this fungus can also cause stalk rot. Resistance of a corn hybrid to Diplodia stalk rot does not mean the hybrid has resistance to Diplodia ear rot since the two traits are inherited independently.

Cladosporium ear rot

Cladosporium ear rot is caused by ***Cladosporium herbarum*** and ***C. cladosporoides***. The disease is often associated with insect, hail or frost damage

Cladosporium ear rot is a minor disease of corn and there are no reports of economic losses due to this disease. Furthermore, no associated mycotoxin issues have been reported. If the percentage of damaged kernels is 5% or less, the grain is still acceptable as No. 2 corn. However, since corn ears can be infected with more than one ear rot simultaneously, mycotoxin contamination of grain should not be ruled out. All grain coming from fields suspected of being moldy should be tested for mycotoxins.

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