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Corn disease update

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Introduction

The 2015 growing season was cooler and wetter than normal. Several foliar diseases were prevalent including northern corn leaf blight, eyespot, southern rust, Goss's leaf blight, and Physoderma brown spot. Towards the end of the season, stalk quality was poor across the whole state and standability issues occurred. The most prevalent stalk rot was anthracnose, but Physoderma stalk rot, Gibberella and Fusarium stalk rot were reported.

Northern corn leaf blight

The 2015 growing season was very favorable for northern corn leaf blight (NCLB). Weather conditions were conducive for infection and disease development; inoculum levels were high since the disease had been prevalent in 2014; and, some hybrids being grown in 2015 were very susceptible to the fungus, *Exserohilum turcicium*, which causes NCLB. Reports of the disease occurred before flowering. In southeast Iowa, severe epidemics were observed in some fields 10 days or more before VT.

Foliar fungicide efficacy trials were done on ISU Research and Demonstration farms at 6 locations in Iowa: Crawfordsville, Lewis, Ames, Kanawha, Sutherland and Nashua. Data regarding foliar disease management and yield was not available at the time this paper went to press but will be shared at the conference and online (http://crops.extension.iastate.edu/cropnews).

Physoderma brown spot and stalk rot

Physoderma brown spot and stalk rot is a re-emerging disease of corn in Iowa. It is caused by *Physoderma maydis*, a chytridiomycete which is the only class of fungi that produce zoospores - spores that have a flagellum (tail) and swim in free water. The pathogen survives as sporangia for 2 to 7 years in soil and crop debris. The sporangia are wind dispersed or splashed into the whorls of developing corn plants. When the whorls fill with water for an extended period of time, due to excessive rains or irrigation, the sporangia germinate and produce zoospores that swim and infect the meristematic tissue of the developing plants. Corn is most susceptible to infection between growth stages V5 to V9.

Symptoms

Symptoms of Physoderma brown spot are very characteristic. Infected leaves have numerous very small (approximately one-fourth inch diameter) round or oval spots that are yellowish to brown and usually occur in broad bands across the leaf. Dark purplish to black oval spots also occur on the midrib of the leaf, and may also occur on the stalk, leaf sheath and husks. Symptoms may be confused with eyespot, southern rust or purple leaf sheath, so look for the purplish oval spots. These purplish oval spots are filled with thousands of sporangia. Infection of nodes 6 and 7 may result in stalk rot. Physoderma stalk rot has been reported in Iowa for the past three years. Infected nodes are rotted and snap easily (http://dx.doi.org/10.1094/PHP-BR-15-0003ex) when gently pushed for example while walking across rows. Brown spot symptoms often are not visible on the leaves of plants affected with stalk rot. In fact, affected plants often look very healthy and have excellent yield potential.

Some hybrids appear to be more susceptible to infection by *P. maydis* than others. Moreover, the very wet conditions that occurred during June across most of the state likely increased risk of disease. Many fungicides are labeled for Physoderma brown spot management, but there are no publicly available data on application timing.

Effect of fungicides on Physoderma brown spot and stalk rot

A field trial was established to evaluate the effect of fungicides on Physoderma brown spot and stalk rot. A susceptible hybrid was planted and the whorl of plants at V5-V6 was inoculated with either infested residue or a suspension of sporangia. A non-inoculated control was included in the trial. Fungicide applications were made 24h prior to inoculation or 7 days after inoculation (Table 1). Overhead irrigation was used during the first 24 hours post inoculation to ensure the whorls of the plants remained wet. After that, almost 3" of precipitation were received over the next 7 days.

Table 1. Effect of foliar fungicide on the final incidence of Physoderma stalk rot.

Inoculum placed in whorl	Treatment		Mean stalk rot incidence (%)
	Product, rate	Timing	
Infested residue	Stratego YLD, 4oz/A	24h prior to inoculation	4.5
		7d after inoculation	0.3
	Priaxor, 5 oz/A	24h prior to inoculation	5.5
		7d after inoculation	4.3
	None	-	4
Sporangia suspension	Stratego YLD, 4oz/A	24h prior to inoculation	3
		7d after inoculation	3.3
	Priaxor, 5 oz/A	24h prior to inoculation	5.3
		7d after inoculation	3.0
	None	-	2.5
None	Stratego YLD, 4oz/A	24h prior to inoculation	0.3
		7d after inoculation	0.0
	Priaxor, 5 oz/A	24h prior to inoculation	0.3
		7d after inoculation	0.3
	None	-	0.0

Tar spot

Tar spot caused by *Phyllachora maydis* was reported from Indiana and Illinois in 2015. This disease is not common in North America and is usually restricted to the highlands of Central and South America where

it often occurs in a complex with another pathogen *Monographella maydis* (Chalkley, 2015). Symptoms arising from infection with *P. maydis* are black, scab-like spots on the leaf. Co-infection of the tar spots by *M. maydis* results in 'fish eye' symptoms – a tar spot surrounded by a necrotic halo. The necrosis expands and coalesces until entire leaves are blighted. Little damage or yield loss occurs with *P. maydis* infection alone, but yield losses of up to 30% have been reported with co-infections of *P. maydis* and *M. maydis* (Hock et al 1995).

Conditions that favor tar spot disease complex are cool 63-72F, 7 h of leaf wetness, and abundant precipitation.

Survival data of the two fungi is scarce. When symptomatic tissues were left outside from August through December at the research station in Mexico, very few conidia survived and percent germination was less than 5 percent after 126 days of exposure (Hock 1995). Consequently, we have no idea if *P. maydis* will survive in IL or IN and cause disease in 2016.

Agronomists and farmers are encouraged to send corn leaves with potential tar spot symptoms to the ISU Plant Insect and Disease Clinic.

Other foliar diseases

Goss 's leaf blight was prevalent in fields planted to hybrids that were rated susceptible to the disease. The bacterium that causes this disease, *Clavibacter michiganensis* subsp. *nebraskensis* (Cmn), has a wide host range. Recently Ikley et al (2015) demonstrated that several weeds are hosts of Cmn and thus a source of inoculum. Moreover, these alternate weeds likely enable the bacterium to become endemic to Iowa. Research from the Robertson lab has demonstrated that Cmn can be dispersed from point sources of inoculum such as a piece of Cmn-infested residue or an infected weed and colonize the leaves of corn seedlings season after emergence (Eggenberger et al 2016). This epiphytic population of Cmn on corn leaves gradually increases and disease occurs later in the season. Infection by epiphytic Cmn occurs via wounds or via natural plant openings such as the stomates (Mallowa et al 2016). Foliar products that reduce epiphytic populations may reduce the risk of Goss's leaf blight. Data from field trials evaluating foliar products will be shared at eth conference.

Eyespot and southern rest were also prevalent in Iowa during the 2015 growing season. Southern rust, although widespread, was never severe likely because temperatures were too cool.

Stalk rot and standability

Towards the end of the growing season, many cornfields throughout Iowa appeared to mature overnight. Since stalk integrity was poor, stalk and or crown rots were believe to be the cause. Stalk rot is often associated with stresses that reduce photosynthesis and therefore impact grainfill, e.g., foliar disease, overcast conditions, wet conditions, nutrient deficiencies, etc. However, stalk integrity also may be physically compromised when stored carbohydrates are remobilized from the stalk tissues to supply grainfill (Nielsen 2013)

In August and early September, there were several days when night temperatures fell below 50oF, followed by several days with high daytime temperatures. In addition, rainfall was abundant across much of the state causing periods of ponded and saturated soils. This excess rainfall potentially caused nitrogen leaching and deficiencies. These environmental stresses likely played a role in the sudden maturity of corn across the state in 2015.

In several fields, symptoms of anthracnose, Gibberella and Fusarium stalk rot were also present. The fungi that cause these diseases are endemic to Iowa and survive well in crop residue from one growing season to the next. Infection of corn plants occurs early in the growing season. During stressful periods, when the stalk tissues are compromised, these pathogens may get "the upper hand" and stalk rot ensues.

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