# MANAGING CORN DISEASES IN WISCONSIN

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## Introduction

The 2014 field season was a bit of a challenge for corn growers in Wisconsin, to say the least. Growing conditions were poor, which made for a lot of challenges including diseases. On the top of that list in Wisconsin was Northern Corn Leaf blight (NCLB). A close second was Goss's Wilt. In 2015, NCLB again was a considerable issue along with reports of Goss's wilt and eyespot. NCLB hit the state hard anywhere from prior to the VT growth stage through to late reproductive growth stages. This likely resulted in some direct loss in yield, but also led to increased levels of stalk rot which caused lodging in some fields.

Goss's wilt is caused by the bacterium *Clavibacter michiganensis* subsp. *nebraskensis*. First visual symptoms usually appear as gray or yellow stripes on leaves that tend to follow the leaf veins. Often "freckles", or brown or green irregular spots, can be observed within the leaf lesions. Freckles are an excellent diagnostic symptom to confirm Goss's wilt. Vascular tissue, husks, and kernels can sometimes take on an orange hue. Occasionally, bacterial ooze or dried ooze can be observed on symptomatic leaves. Fungicides do not work for Goss's wilt, because this is caused by a bacterium, not a fungus. Management is preventative for Goss's wilt. Choose hybrids with the best possible resistance, manage excessive amounts of corn surface residue, and rotate crops. The longer the rotation between corn crops, the better. There are some foliar products being marketed for the control of Goss's wilt, but efficacy data indicate poor control of the disease.

Eyespot is caused by the fungus *Kabatiella zeae* and typically first develops as very small pen-tipped sized lesions that appear water-soaked. As the lesions mature they become larger (¼ inch in diameter) and more tan in the center and have a yellow halo. Lesions can be numerous and spread from the lower leaves to upper leaves. In severe cases, lesions may grow together and can cause defoliation and/or yield reduction. Eyespot is also favored by cool, wet, and frequently rainy conditions. No-till and continuous corn production systems can also increase the risk for eyespot, as the pathogen is borne on corn residue on the soil surface. Management should focus on the use of resistant hybrids and residue management. In-season management is available in the form of fungicides. However, severity has to reach high levels (>50%) before this disease begins to impact yield. When scouting, note the disease and keep track of the severity. Again, fungicides should be applied early in the epidemic and may not be cost effective for this disease alone.

NCLB is caused by a fungus called *Exserohilum turcicum*. The most diagnostic symptom of NCLB is the long, slender, cigar-shaped, gray-green to tan lesions that develop on leaves. NCLB often begins on the lower leaves and works it way to the top leaves. This disease is favored by cool, wet, rainy weather, which seemed to dominate both the 2014 and 2015 growing seasons in Wisconsin. Higher levels of disease might be expected in fields with a previous history of NCLB and/or fields that have been in continuous and no-till corn production. The pathogen over-winters in corn residue, therefore, the more residue on the soil surface the higher the risk for

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NCLB. Management should focus on using resistant hybrids and residue management. In-season management is available in the form of several fungicides that are labeled for NCLB. However, these fungicides should be applied at the early onset of the disease and only if the epidemic is expected to get worse. Often the best time to apply fungicides to field corn to maximize the benefits is near the VT/R1 growth stage. However, if NCLB is visible on leaves earlier than this time, a fungicide might be beneficial at those earlier stages. The only way to determine this is to scout frequently and keep an eye on the disease situation in your corn crop.

Since 2013 there have been active foliar fungicide trials located at the Arlington Agricultural research station. These trials are focused on control of fungal leaf diseases that occur naturally in Wisconsin. Data from these trials will be illustrated in the presentation. A subset of the data from 2015 is presented below.

## Materials and Methods

A fungicide evaluation trial was established at the Arlington Agricultural Research Station located in Arlington, WI in 2015. The corn hybrid 'DKC45-51RIB' was chosen for this study. Corn was planted on 1 May in a field consisting of a Plano silt loam soil (2 to 6% slopes) with a Joy silt loam intrusion (0 to 4% slopes). The experimental design was a randomized complete block with four replicates. Plots consisted of four 30-in. spaced rows, 20 ft long and 10 ft wide with 7-ft alleys between plots. Standard corn production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of two non-treated controls and 30 fungicide treatments. Pesticides were applied using a $CO_2$-pressurized backpack sprayer equipped with 8001 TurboJet flat fan nozzles calibrated to deliver 20 GPA. Pesticides were applied at growth stages V6, V8, VT, R1 or V6 and VT. Natural sources of pathogen inoculum were relied upon for disease. Eyespot was rated on 20 Aug. Northern corn leaf blight (NCLB) and greening on 1 Oct, stalk rot on 13 Oct. and lodging on 23 Oct. All foliar diseases were visually assessed by inspecting ear leaves on five plants in each plot with the aid of standardized area diagrams. Stalk rot was assessed on five plants in each plot at R6 by cutting stalks with a knife and rating using the Illinois 0 to 5 scale where 0=no stalk rot and 5=severe stalk rot with lodging. Greening was rated by assessing percent green foliage at R6 growth stage. Lodging was assessed at harvest by visually estimating the percent plants per plot leaning greater than 45 degrees from vertical. Yield was determined by harvesting the center two rows of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic Grain gauge. All foliar, greening, lodging, and yield data were analyzed using a mixed model analysis of variance (ANOVA; $P$=0.05). Means were separated using Fisher's test of least significant difference (LSD). Stalk rot data were analyzed using non-parametric analysis due to the ordinal nature of the ratings and reported as rank estimates.

## Results

Temperature and precipitation for the 2015 season were comparable to the 30-year average at this location. Severity of northern corn leaf blight (NCLB) and stalk rot was moderate to high in this trial (Table 1). Eyespot severity was low and insignificant. Severity of NCLB in plots treated with fungicide was not significantly reduced compared to at least one of the non-treated check plots. Plots treated with Quilt Xcel 2.2SE at the VT growth stage had significantly lower stalk rot severity than not treating. All other treatments had stalk rot severity comparable to the non-treated checks. Plots treated with Toguard EQ 4.29SC (VT), Equation 2.08SC (VT), Quilt Xcel 2.2SE (VT), and Quadris 2.08F (V6) + Quilt Xcel 2.2SE (VT) had significantly more greening than the non-treated checks. All other plots were comparable to not treating. There were no significant differences in lodging or yield among all treatments. Phytotoxicity was not observed for any treatment. Data from previous trials (2013 and 2014) will be combined with these data and summarized in the presentation.

Table 1. Disease severity, greening, lodging, and yield of dent corn treated with various foliar fungicides.

| Treatment and rate/A (crop growth stage at application)[z] | Eyespot severity (%)[y] | NCLB severity (%)[y,v] | Stalk rot Rank Estimate[x,v] | Greening effect (%)[w,v] | Lodging (%) | Yield (bu/a) |
|---|---|---|---|---|---|---|
| Non-treated check 1 | 1.5 | 32.5 bdf | 100.8 a | 9.4 d-i | 3.8 | 246.6 |
| Fortix 3.22SC 5 fl oz (V6) | 0.0 | 46.3 abc | 91.4 abd | 5.6 f-i | 3.1 | 258.6 |
| Fortix 3.22SC 5 fl oz (V6)[t] | 0.8 | 33.8 bdf | 91.4 abd | 6.9 f-i | 1.3 | 256.1 |
| Fortix 3.22SC 5 fl oz (V8)[t] | 0.1 | 36.3 bdf | 100.8 a | 5.6 f-i | 4.4 | 254.3 |
| Fortix 3.22SC 4 fl oz (VT)[t] | 0.2 | 36.3 bdf | 67.3 bde | 5.0 f-i | 1.9 | 255.3 |
| Fortix 3.22SC 5 fl oz (VT)[t] | 0.0 | 35.0 bdf | 84.0 abd | 15.6 b-i | 4.4 | 252.1 |
| Fortix 3.22SC 5 fl oz (V6)[t] | 0.0 | 40.2 af | 65.3 a-f | 12.5 b-i | 3.8 | 238.6 |
| Fortix 3.22SC 5 fl oz (VT)[t] | 0.3 | 22.5 f | 40.0 efg | 11.3 b-i | 0.6 | 251.0 |
| Fortix 3.22SC 5 fl oz (V6; VT)[t] | 0.0 | 37.5 bdf | 67.3 bde | 14.4 b-i | 3.1 | 243.4 |
| Headline AMP 1.68SC 10 fl oz (V6)[t] | 0.0 | 43.8 a-e | 49.4 d-g | 6.9 f-i | 3.1 | 257.6 |
| Headline AMP 1.68SC 10 fl oz (V8)[t] | 0.0 | 32.5 bdf | 84.0 abd | 5.0 f-i | 2.5 | 254.4 |
| Headline AMP 1.68SC 10 fl oz (VT)[t] | 0.8 | 36.3 bdf | 32.4 e-h | 21.9 abd | 1.3 | 243.8 |
| Topguard EQ 4.29SC 5 fl oz (V6)[t] | 0.1 | 25.0 ef | 98.8 ab | 10.0 b-i | 4.4 | 257.7 |
| Topguard EQ 4.29SC 5 fl oz (V8)[t] | 0.0 | 33.8 bdf | 74.6 a-e | 5.0 f-i | 0.0 | 254.2 |
| Topguard EQ 4.29SC 5 fl oz (VT)[t] | 0.0 | 23.8 f | 23.0 gh | 30.0 a | 6.9 | 240.6 |
| Equation 2.08SC 6 fl oz (V6)[t] | 0.0 | 25.0 ef | 93.4 ac | 7.5 e-i | 3.1 | 250.6 |
| Equation 2.08SC 6 fl oz (VT)[t] | 0.1 | 30.0 bf | 23.0 gh | 25.0 ac | 3.1 | 253.2 |
| Stratego YLD 500SC 4 fl oz (VT)[t] | 0.8 | 36.3 bdf | 32.4 e-h | 15.0 b-i | 0.6 | 248.0 |
| Stratego YLD 500SC 2 fl oz (V6)[t] | 0.0 | 43.8 a-e | 74.6 a-e | 5.0 f-i | 2.5 | 242.5 |
| Stratego YLD 500SC 2 fl oz (V6)[t] Stratego YLD 500SC 4 fl oz (VT) | 0.4 | 45.0 abc | 31.5 fgh | 21.3 abe | 1.3 | 247.8 |
| Quilt Xcel 2.2SE 10.5 fl oz (VT)[t] | 0.1 | 27.5 cf | 14.5 h | 23.8 ab | 3.1 | 261.3 |
| Aproach Prima 2.34SC 6.8 fl oz (VT) | 0.3 | 32.5 bdf | 76.6 abd | 18.1 ag | 1.3 | 259.3 |
| Priaxor 4.17SC 3 fl oz (V6)[t] | 0.0 | 48.8 ab | 69.3 a-g | 4.4 ghi | 1.3 | 255.0 |
| Priaxor 4.17SC 3 fl oz (V6)[t] Headline AMP 1.68SC 10 fl oz (VT)[t] | 0.1 | 27.5 cf | 23.0 gh | 17.5 ah | 1.3 | 255.0 |
| Tilt 3.6SE 4 fl oz (VT) | 0.4 | 45.0 abc | 57.9 def | 4.4 ghi | 1.3 | 246.5 |
| Domark 230ME 4 fl oz (VT) | 0.6 | 28.6 bf | 84.0 abd | 7.5 e-i | 3.8 | 236.2 |
| Quadris 2.08F 6 fl oz (V6)[t] Quilt Xcel 2.2SE 10.5 fl oz (VT)[t] | 0.1 | 28.8 cf | 49.4 d-g | 23.8 ab | 1.9 | 239.0 |
| Quadris 2.08SC 6 fl oz (V6) | 0.0 | 60.0 a | 91.4 abd | 9.4 d-i | 1.3 | 250.5 |
| Non-treated check 2 | 0.1 | 30.0 bf | 73.5 a-g | 3.8 hi | 2.5 | 240.4 |
| Stratego YLD 500SC 4 fl oz (V6)[t] | 0.4 | 50.0 ad | 91.4 abd | 3.1 i | 3.8 | 244.8 |
| Proline 480SC 5.7 fl oz (R1)[t] | 1.5 | 28.8 cf | 58.8 b-g | 21.3 abe | 1.3 | 249.7 |
| Stratego YLD 500SC 5 fl oz (R1)[t] | 0.2 | 27.5 cf | 49.4 d-g | 18.8 af | 0.0 | 257.2 |
| LSD (α=0.05) | ns[u] | 19.7 | 33.0 | 13.7 | ns[u] | ns[u] |

[z]Glyphosate herbicide applied to all plots at V6 growth stage.
[y]Foliar disease ratings were assessed on five ear leaves in each plot with the aid of a standard area diagram; means for each plot were used in the analysis.
[x]Stalk rot was assessed on five plants in each plot using the Illinois 1-5 scale where 0=no stalk rot and 5=severe stalk rot with lodging; means for each plot were used in the analysis.
[w]Greening effect determined by rating the percentage green foliage still present in each plot at early black layer.
[v]Means followed by the same letter are not significantly different based on Fisher's least significant difference (LSD; α=0.05)
[u]ns = no least significant difference (α=0.05).
[t]Treatments including the non-ionic surfactant Induce 90SL at 0.25% v/v.