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Fungicide use on corn
Alison Robertson, professor and Extension crop plant pathologist, Plant Pathology and Microbiology, Iowa State University

Introduction
Over the past decade, the use of foliar fungicides on hybrid corn has become more commonplace. Reasons for this include increased foliar disease, new fungicides becoming available, and promoted plant health benefits. Both the public and private sector have done small plot and on-farm field trials evaluating the effect of foliar fungicides on disease severity and yield.

At Iowa State University (ISU), the Robertson Lab has conducted small plot trials at the ISU Research Farms around the state for the past several years. These trials serve to (i) compare products, and (ii) the timing of application on disease severity and yield. In addition to these efficacy trials, the lab has also evaluated the effect of fungicides on standability of corn.

Small plot fungicide efficacy trials (2010-2017)
Small plot trials were established at the following ISU Research Farms: Northwest Research Farm (NWRF), Sutherland; Northern Research Farm (NRF), Kanawha; Northeast Research Farm (NERF), Nashua; Armstrong Research Farm (SWRF), Lewis; Southeast Research Farm (SERF), Crawfordsville; and the Agricultural Engineering and Agronomy Farm (AEA), Boone. The respective farm managers chose the hybrids. Farm staff was responsible for field preparation, fungicide application and harvest. A randomized complete block design with 4 to 6 replications was used. Fungicides were applied at growth stage V5-V6, growth stage VT-R1, or at both growth stage V5-V6 and VT-R1. In 2017, applications at growth stage V12 were evaluated. Only commercial products were evaluated each year, and for each product, fungicide rate and application timing were consistent with company recommendations. Foliar disease was visually assessed in each year at growth stage R5. The percent of canopy diseased in each plot was estimated. Yield and grain moisture were collected for each plot.

Weather conditions in each growing season varied considerably, and consequently disease prevalence and severity also varied. Moreover, hybrid genetics played a role in disease development. The 2010 growing season was extremely wet and Goss’s wilt was the most prevalent disease in Iowa. Low northern corn leaf blight and common rust severity were observed in the trials. The 2012 and 2013 growing seasons were hot and dry conditions and foliar disease severity in the trials was very low. Cooler and wetter than usual conditions in 2014 and 2015, together widespread use of susceptible germplasm, resulted in an epidemic of northern corn leaf blight (NCLB) across Iowa. Up to to 30 percent of the canopy was blighted at R5 in some of the fungicide trials. More normal precipitation and temperatures occurred in 2011 and 2016. Grey leaf spot, common rust and northern leaf blight were all present in these years although severity was low (less than 10 percent). The 2017 growing season was hot and humid with little precipitation through vegetative and early reproductive growth throughout most of Iowa; the northern and northeastern part of the state received frequent and above normal precipitation. Grey leaf spot (GLS) was prevalent at all locations.

In general, fungicide applications at growth stage V5-V6 had little effect on disease severity. Applications of fungicide at VT-R1 reduced disease. A benefit of an application of fungicide at V5-V6 plus VT-R1 on disease was detected in only one year at only one location (2014; at NERF), where severe northern corn leaf was present. In 2017, an application of fungicide at V12 reduced GLS more than an application at R1 at 4 of the 6 locations.

Mean yield response to a fungicide application varied by year and application timing (Table 1). In general,
yield response was greater an application of a fungicide at VT-R1. In 2014 and 2015, the mean yield response with an application of fungicide at V5-V6 plus VT-R1 was greater than an application made at VT-R1 alone. This was likely due to severe northern leaf blight that developed in the trials.

Table 1. Mean yield response (bu/acre) of corn to a foliar fungicide application at either growth stage V5-V6, VT-R1 or both at 4 to 6 locations in Iowa from 2010-2016. N = number of data points for each mean.

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<td>4.5</td>
<td>-2.4</td>
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Small plot versus on-farm trials

The yield response data of fungicide applications applied at VT-R1 in small plot trials done by the Robertson Lab at outlying ISU research farms were compared with on-farm trial data generated by the Iowa Soybean Association (ISA) On-Farm Network from 2010 through 2016. Only data that compared a fungicide application applied at VT-R1 and an untreated control in the ISA data were downloaded from On-Farm Network® database (www.iasoybeans.com/onlinedb/).

Data were comparable in all years except for 2010 and 2014 (Figure 1). In 2010, the mean yield response of trials done by the On-Farm Network® was over 6 bu/acre while no yield response was seen in the ISU small plot trials. In 2014, the yield response in the ISU trials was over 8 bu/acre compared to 1 bu/acre in the On-Farm Network® data. Severe northern corn leaf blight (NCLB) occurred on hybrids that were ranked low for resistance to NCLB in the ISU trials and this likely contributed to the greater yield response. No data on disease severity was available for the On-Farm Network® trials.

![Figure 1](image-url)
Effect of fungicide on standability

Some farmers have observed improved standability when the crop has been sprayed with a fungicide. The objective of these trials was to collect replicated data to evaluate this observation. Trials were established at the following outlying ISU Research Farms: NWRF, NRF, NERF, SWRF, SERF and AEA in 2016 and 2017. A 2 x 5 factorial in a randomized complete block design with 4 replications was used. Plots were either sprayed with a fungicide at tasseling or not sprayed. The plots were harvested at weekly intervals over 5 weeks starting at approximately 20-23% moisture. Foliar disease severity was assessed at dent. Immediately prior to harvest, the push test was done on 100 consecutive plants and the percent of plants lodged calculated.

In 2016, no fungicide by harvest date interaction was detected. In general, percent lodging increased as harvest date got later. Percent lodging was lower in the fungicide treated plots compared to the plots where no fungicide was applied (Figure 2).

Figure 2. Comparison of lodging between plots sprayed with a fungicide and those left unsprayed at four ISU research farms in 2016.

It is unlikely that the fungicide directly reduced stalk rot disease in these trials. We propose that maintaining the health of the canopy after physiological maturity contributes to photosynthates being stored in the stalk. Consequently, cellular senescence caused by carbohydrate deficiency is delayed and therefore decay of the stalks by stalk rot fungi (Dodds, 1980).

Despite the positive effect of fungicides on standability, ISU still recommends that fungicides be only used to manage foliar disease. Resistance to fungicide products used in corn production in Iowa has been reported from the southern United States and it is in our best interest to use these tools judiciously to ensure their effectiveness.

References