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Effect of Fungicides on Southern Rust of Corn

E.A. Adee and S. Duncan

Introduction

The decision to apply fungicides to corn is not an easy decision in Kansas, especially when grain prices are low. Numerous factors determine what diseases are present, and whether the plants will be defoliated enough to reduce yield. Correctly identifying the disease, knowing what environmental conditions favor the development of an epidemic, and knowing the hybrid's resistance to the diseases can be known before making the decision. However, knowing if the conditions will be favorable for the spread of the disease up the plant is very unpredictable. A situation like a 'perfect storm' for foliar diseases defoliating corn occurred in 2017. Southern rust was present at tasseling, much earlier than most years, and it had the ability to spread quickly in the relatively cool (80 to 90°F) and wet conditions that occurred in August. Additionally, many of the corn hybrids didn't have high levels of resistance to southern rust.

Procedures

A fungicide trial that included multiple entries from different companies as well as timing of application on corn was conducted in 2017 at Kansas State University's Kansas River Valley (KRV) experiment fields, near Rossville, KS. The study was under sprinkler irrigation in corn for a third straight year. Nitrogen fertilizer was applied at recommended levels. Pioneer 1192AM (Pioneer Hi-Bred, Johnston, IA) was planted in 30 in. rows at 36,000 seeds/a on April 26. The plots were 10-ft wide (4 rows) × 30-ft long. Twelve rows were left untreated for the check plots. The experimental design was a randomized complete block with at least 4 replications for each treatment. The irrigation scheduling was to promote foliar disease, and was assisted by the KanSched2 irrigation scheduling program, www.bae.ksu.edu/mobileirrigationlab/kansched2.

The fungicide treatments were applied with a CO₂ backpack sprayer equipped with Spraying Systems TJ 8002VS nozzles, 30 psi, 19 gal/a to the middle two rows of a 4-row plot. The fungicides applied included Headline AMP (BASF, Research Triangle Park, NC) at 10 oz/a, and Stratego YLD (Bayer CropScience, Research Triangle Park, NC) at 4 oz/a at tasseling (July 5). There were several other treatments of proprietary fungicides, with strobilurin, strobilurin and conazole, or proprietary combinations included in the trial (data not shown).

Data Collection and Analysis

Foliar disease severity was quantified at R5 (dent), evaluating the severity of foliar disease from 2 leaves below the ear leaf and above as a percent of the leaf area with

symptoms in the middle two rows of each plot. Gray leaf spot (GLS), *Cercospora zea-maydis*, was the predominant leaf disease at ear leaf and below at dent, with some southern rust (*Puccinia polysora*). In subsequent ratings, every 5 to 7 days, southern rust became much more severe as it progressed up to the top leaves. Area Under Disease Progress Curve (AUDPC) was calculated based on the accumulated severity of the disease over time. There were very few plants that expressed symptoms of top dieback, caused by *Colletotrichum graminicola*. The middle two rows of the plots were harvested for yield, and yields were calculated from plot weights adjusted to 15.5% grain moisture.

Results

The level of foliar disease rated at dent stage on August 1 was fairly typical to many fungicide trials for corn at KRV in most years (Table 1). Generally, due to heat and lower humidity typically experienced in Kansas in August, epidemics of foliar disease have difficulty in progressing much above the ear leaf before grain fill is complete at black layer, generally less than 3 weeks after dent. However, the grain fill period in August 2017 was much cooler and wetter than normal (Table 2). A reduced number of Growing Degree Units (GDU) accumulated, which slowed the rate of grain fill and extended the fill period by more than a week. Additionally, August was much wetter than average, and the combination of cooler and wetter weather for Kansas was ideal for southern rust to become established on the upper leaves of the plants. The longer grain fill period is very favorable for higher yields, but there is also more time for a disease to have an impact on the yields.

As a result of the extended grain fill period, 4 disease ratings were taken, compared to 2 for most years. With the conditions very favorable to the development of disease and the presence of abundant southern rust spores, the degree of defoliation of corn reached levels not seen very often in Kansas. The fungicides applied at tasseling (VT) reduced the amount of foliar defoliation, primarily due to southern rust (Table 1). More importantly, yields with the fungicide application at VT increased 7 to 9%, or nearly 20 bu/a. Clearly, the application of fungicide at VT was a good investment in 2017, as the cost of fungicide application is typically covered by a 6 to 8 bu/a yield increase.

Conclusions

1. Foliar diseases, such as southern rust, can defoliate a corn plant relatively quickly, given the right environmental conditions.
2. The combination of cooler and wetter conditions through the later part of the grain fill period contributed to significant yield loss in corn due to defoliation by foliar diseases.
3. The cooler/wetter August is not normal in Kansas. Therefore, scouting fields, knowing the hybrids' resistance to diseases present at tasseling, and observing environmental factors that favor the development of foliar diseases will continue to be necessary to increase the chance that foliar fungicide application on corn is a good investment.

Table 1. Effectiveness of fungicide application on foliar diseases and influence on corn yield at the Kansas River Valley Experiment Field, Rossville in 2017

| Treatment | Timing | Foliar disease, | Foliar disease, | AUDPC ³ | Yield |
|-----------------------|----------------|-----------------------|------------------------|--------------------|-------|
| | | August 1 ¹ | August 22 ² | | |
| | | ----- % ----- | | | bu/a |
| Headline AMP, 10 oz/a | Tasseling (VT) | 1.8 b ⁴ | 24 c | 188 b | 236 a |
| Stratego YLD, 4 oz/a | VT | 2.3 b | 31 c | 208 b | 238 a |
| Untreated check | | 5.2 a | 75 a | 794 a | 217 a |

¹Percent of leaf area defoliated by foliar disease from 2 leaves below the ear leaf and up, primarily gray leaf spot.

²Percent of leaf area defoliated by foliar disease from 2 leaves below the ear leaf and up, predominantly southern rust.

³Area Under Disease Progress Curve (AUDPC), a unitless number derived from the accumulated disease severity over time.

⁴Means followed by the same letter are not significantly different at alpha = 0.05.

Table 2. Monthly averages for weather 2017 and 30 years at KRV-Rossville¹

| Month | GDU ² | Average | GDU | Rainfall | Average | Rainfall |
|--------|------------------|---------|-----------|----------|-----------------|-----------|
| | | GDU | departure | | rainfall | departure |
| | | | | | ----- in. ----- | |
| June | 708 | 658 | 50 | 6.49 | 4.64 | 1.85 |
| July | 824 | 810 | 15 | 2.82 | 2.97 | -0.15 |
| August | 649 | 779 | -130 | 4.12 | 1.90 | 2.22 |

¹Weather data source: Kansas State University Weather Data Library, <http://mesonet.k-state.edu/>.

²Growing degree unit (GDU) for corn.