Corn Foliar Fungicide Research Results, 2007-2008, University of Wisconsin

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Introduction

High corn market prices have generated considerable interest in the use of foliar fungicides as a means of enhancing corn yield.

Because sufficient data does not exist in Wisconsin to support the use of foliar fungicides in corn, staff at the University of Wisconsin Cooperative Extension Service and UW College of Agricultural and Life Sciences initiated a coordinated effort to generate data from replicated on-farm and small plot trials.

Comparisons of Small Plot and On-Farm Trials: Both small plot and on-farm strip trials have advantages and disadvantages. Some advantages of small plot research include the ability to control variables such as soil type/texture, drainage, soil compaction and pest interactions. It also allows the researcher to evaluate several different treatments in a small area. However, the value of large scale on-farm research is that the previously mentioned variables are not singled out and those results better represent "real world" scenarios. It is this combination of approaches that are important for improving the research process.

In order to address the questions about economical foliar fungicide use in corn, two approaches have been taken. Small scale, replicated plot studies have been conducted at the Arlington, Hancock, and Lancaster Agricultural Research Stations as well as on-farm trials during the 2007 and 2008 growing seasons. Secondly, large scale, on-farm research trials were conducted during the same years. Discussion of each type of plot will be kept separate because of the variation in experimental design.

Plot design

Large scale, on-farm strip trials. Large on-farm strip trials were conducted in Chippewa (2), Dane (3), Green Lake (3), Jefferson, La Crosse (3), Monroe, Ozaukee, Sheboygan (2), Washington and Waupaca counties. Plots were maintained using the individual grower's production practices and each plot was replicated 2-4 times. Quilt®(2007 only), and/or Headline® (2007 and 2008) were applied using labeled rates at each location and were applied using ground application equipment at the VT (2007) or R1 (2008) stage of corn development. Foliar disease ratings (% severity) were made prior to the application and also during early September to determine final disease levels. The incidence of stalk rot and stalk lodging was made in each plot at black layer using a stalk nudge test (early October).

Small scale research plots. On-farm small scale research trials were conducted during the 2008 growing season in La Crosse, Monroe, Pepin, and Trempeleau Counties (6 trials) using Headline® (6 ounces per acre), Stratego® (10 ounces per acre) and Quilt® (14 ounces per acre), all applied at the R1 growth stage. Small scale plots trials were also conducted at the University of Wisconsin Arlington, and Lancaster Agricultural Research Stations using Quilt® (14 ounces per acre), Stratego® (10 ounces per acre), Headline® (6 ounces per acre) and Evito® (2 or 3 ounces per acre).

Stratego® (10 ounces per acre) was also applied to corn at the V12, VT-R1 and R2 stages in research trials at the Arlington and Hancock Agricultural Research Stations to study the effect of previous crop history (plots planted after corn, soybean, or potatoes).

For the small scale research trials, all plots were a minimum of 10 feet wide and 50 feet long and were sprayed using a CO_2 powered backpack sprayer and hand harvested.

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Results

Large scale, on-farm strip trials.

2007 Results. Five of the eleven fields included more than one fungicide. As a result, there were 17 fungicide comparisons with the untreated check. Only one of the eleven locations had a statistically significant ($P < 0.10$) yield increase of 6.4 bu/a when a fungicide was applied. It was also noted that grain moisture was higher (0.9% increase) at this location in the plots treated with a foliar fungicide. However, the increase in yield would not have been enough to pay for the fungicide, application costs and additional drying costs based on 2007 market values of $4.00/bu corn, $6.00/a application costs, $20/a fungicide costs, and a drying cost of 5 cents/bushel for a yield of 161 bu/a. It was also noted that in this field trial, the average disease severity was 17% in the untreated check, compared to 7% in the fungicide treated plots.

Grain moisture was also inconsistently affected with the application of a foliar fungicide. In four trials, significantly higher grain moisture levels at harvest were found for those plots that received a foliar fungicide. The differences in grain moisture in those trials were 1.0%, 0.9%, 0.7% and 0.5%. The incidence of stalk lodging was also inconsistently affected with the application of a foliar fungicide. Of the seventeen possible product comparisons, 5 significantly reduced the percentage lodging, while in the other 13 comparisons, there was no evidence of an effect of foliar fungicides.

2008 Results. In seven of the nine trials, there was no evidence of a statistical yield advantage with the use of Headline®. In two trials in Green Lake County, however, a statistical yield advantage was found (24 and 5.6 bushel/a). In the trial that had a 24 bushel increase with the fungicide treatment, the disease severity level in the untreated check was 15% and included the following diseases: common rust, eyespot and Northern corn leaf blight. In the field trial where a 5.6 bushel advantage was found, the disease severity was 8% in the untreated check and included common rust, eyespot and Northern corn leaf blight. There was no evidence of a statistical difference for either grain moisture or stalk lodging in any of the nine trials.

Small Scale Research Plot Results. In the on-farm, small scale research trials, there was no evidence of a statistical yield advantage with the use of a fungicide in the six counties, nor was there evidence

of a difference between the different fungicide products (Headline, Quilt, Stratego). There was also no evidence of a difference in grain moisture among treatments. In the trials conducted at Arlington and Lancaster, there was no evidence of a yield difference or grain moisture with the application of foliar fungicides. Furthermore, there was no evidence of a difference in corn grain yield and moisture for trials conducted at Arlington and Hancock when corn was produced following corn, soybeans or potatoes, nor was there evidence that spray timing (V12, VT-R1, R2) affected grain.

Combined Analysis, 2007-2008 On-Farm Large Strip Trials. In order to improve our ability to make recommendations on a larger scale, a combined analysis has been conducted for on-farm, large scale trials. To date, there is no evidence of a statistical difference in grain yield or grain moisture across the trials. While there is evidence of a small increase in grain yield (3-4 bu/a) with the application of a foliar fungicide, this would require corn to be in the $6-9/bu range to cover the cost of an application and product.

Furthermore, these analyses have shown that the highest source of variation in trials is at the farm scale, indicating that other factors (e.g., hybrid resistance, soil type, farm management practices) may influence yield response.

Economic Considerations for Using a Foliar Fungicide

Currently, it is being estimated that the cost of spraying a foliar fungicide in 2009 will be in the $25-30/a range (application cost plus fungicide product cost). With the current corn commodity prices quite variable and hovering in the $3 to $4 per bushel range, Table 1 is provided to show the necessary return in bushels per acre needed to cover the cost of foliar fungicides at different application and fungicide costs as well as different corn commodity prices.

Table 1: Estimates on the number of bushels needed to cover the cost of a foliar fungicide application at different combinations of application and fungicide cost as well as different corn market values.

Application	Fungicide	Corn market value ($/bu)		
Cost	Cost	2	4	6
6	10	8.0	4.0	2.7
6	15	10.5	5.3	3.5
6	20	13.0	6.5	4.3
6	25	15.5	7.8	5.2
8	10	9.0	4.5	3.0
8	15	11.5	5.8	3.8
8	20	14.0	7.0	4.7
8	25	16.5	8.3	5.5
10	10	10.0	5.0	3.3
10	15	12.5	6.3	4.2
10	20	15.0	7.5	5.0
10	25	17.5	8.8	5.8
12	10	11.0	5.5	3.7
12	15	13.5	6.8	4.5
12	20	16.0	8.0	5.3
12	25	18.5	9.3	6.2

Recommendations for use of Foliar Fungicides on Corn in 2009

Results of these trials indicated that there were no consistent statistical yield benefit and an occasional negative impact on moisture when a foliar fungicide was applied. Significantly higher stalk lodging was observed in the untreated plots at several locations; however, this did not translate into a yield reduction and more work is needed to quantify economical return for a reduction in stalk rot incidence.

Ultimately, the best management tactic for reducing the risk of corn diseases is the use of an IPM strategy that starts with hybrid selection for resistance to specific corn diseases. In addition, growers considering other factors like crop rotation and residue management as part of the management program. The best results to date (both within Wisconsin and across the region) for use of foliar fungicides is when there has been higher levels of disease severity (> 5%). Furthermore, timely field scouting and an assessment of environmental conditions (relative humidity, leaf wetness and temperature) are necessary to determine if the need for a fungicide is warranted.

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Useful References

Field Crops Plant Pathology, UW-Madison and UW-Extension, http://www.uwex.edu/ces/croppathology

Wisconsin Crop Manager, University of Wisconsin Integrated Pest and Crop Management, http://ipcm.wisc.edu/wcm

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Summaries of the Wisconsin Corn Hybrid Performance Trials, http://corn.agronomy.wisc.edu