2008 On-Farm Corn Silage Foliar Fungicide Trials

Paul Esker, Greg Blonde, and Bryan Jensen, University of Wisconsin and UW-Extension
MFA Funded Proposal: "Effect of Foliar Fungicides on Silage Quality and Yield with On-Farm Trials"

Background

In 2007, a single field trial was established in Waupaca County, WI, to determine if there was an effect of an application of a strobilurin fungicide (Headline®) on silage quality and yield. In that trial, there was a 6% reduction in premature plant death, but there was no other statistical evidence of an effect of foliar fungicide applications, although there were trend results for measures such as dry matter tons (increased), Neutral Detergent Fiber (NDF) (lower percentage), milk per acre (increased), and stalk lodging (reduced). However, given that there were no conclusive results from this trial, further on-farm testing was proposed for 2008. Overall, the goal of this project was to determine if there is an effect of applying a foliar fungicide on corn silage yield and quality via on-farm foliar fungicide trials for corn silage.

This project had two primary objectives:

1. To determine the effect of foliar fungicides on corn silage yield and quality through on-farm demonstration and research plots.
2. To disseminate new information regarding the effect of foliar fungicides on silage corn to growers in Wisconsin and surrounding states.

Materials and Methods

A combination of on-farm small plot and large strip trials were used in 2008 (Figure 1). Both approaches have strengths and weaknesses. 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, we often receive the question that results from small plot trials do not represent the situation in grower production fields. Therefore, conducting large scale on-farm research helps to examine the situation when the previously mentioned variables are not singled out. In our on-farm trials, both approaches are considered vital and important steps to improving our ability to understand if and when the application of a foliar fungicide will be efficacious.

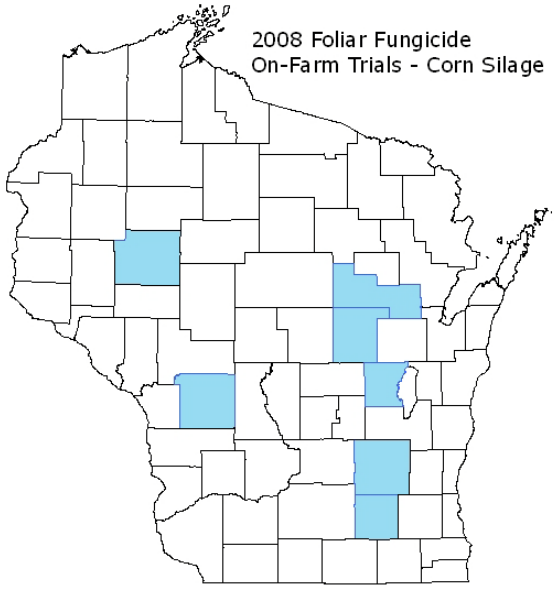

Figure 1. *Counties where on-farm (small plot and large strip) foliar fungicide trials for corn silage in Wisconsin were conducted during 2008.*

In 2008, large strip trials were conducted in Chippewa, Dodge, Jefferson (two trials), Shawano, Waupaca, and Winnebago counties using the host grower's production practices (tillage, hybrids, etc.) and replicated a minimum of two times (hybrid information in Table 1, following page).

Hybrids ranged in relative maturity from 93 to 112 days and in general, had good to excellent root and stalk strength ratings and a medium range disease package (i.e., ratings from 4-6, depending on hybrid and company) for diseases like gray leaf spot (*Cercospora zeae-maydis*), common rust (*Puccinia sorghi*), or anthracnose stalk rot (*Colletotrichum graminicola*). Fungicides were applied within the range of the current label rates for Headline® (6-12 ounces per acre) at the R1 stage (silking) of corn development.

Small plot foliar fungicide trials were conducted in Monroe County. In that trial, a combination of products was tested, including Headline® (6 ounces per acre), Stratego® (10 ounces per acre) and Quilt® (14 ounces per acre), applied at the R1 growth stage.

Table 1. Corn hybrids in the on-farm large strip trials.

County	Hybrid
Chippewa	Croplan DS93 RR
Dodge	Pioneer 33T57
Jefferson #1	Mycogen F697
Jefferson #2	Pioneer 34A89
Shawano	Pioneer 37Y17
Waupaca	Pioneer 35A29
Winnebago	Golden Harvest H-8535

For all trials (large strip and small plot), foliar diseases were assessed in the majority of plots prior to application and again in early September by estimating the % foliage disease from the time the trial was initiated until senescence. A stalk nudge test was conducted in early October by pushing 30 consecutive corn plants to a 45 degree angle and recording the number of lodged plants. A plant was considered lodged if it bent prior to reaching a 45 degree angle or if it was lodged prior to this test and anthracnose symptoms were present.

Forage quality was obtained by testing unfermented, frozen, fresh samples from each plot at the Marshfield Forage Testing Laboratory. This approach was used since not all trial participants and county agents were able to have access to food savers in order to obtain a fermented sample. Forage quality was calculated using the Milk2006 Corn Silage program, following the same NIR equation as that used for the University of Wisconsin Corn Agronomy corn silage variety trial program.

Two statistical analyses were conducted for trial data. For individual trials, an analysis of variance was conducted with the level of significance set to 10%. Mean comparisons for individual trials were conducted using Duncan's multiple range test. The second analysis was a combined analysis of all trial data (large strip trials) that was done using linear mixed model methodology. In this analysis, the level of significance was set to 10% and mean comparisons were based on Fisher's Protected LSD. Furthermore, sources of variation were compared by examining the covariance parameter estimates. From exploratory analyses, it was found that there were three sources of variation: county, farm*treatment*county, and the residual error.

Results

In 2008, disease levels were found to be very low across Wisconsin and the on-farm trial locations (< 5% severity). The primary diseases noted included common rust, anthracnose leaf blight and stalk rot, Northern corn leaf blight, Northern corn leaf spot. Stalk lodging ranged from 3% to 25% across the trials, but there were no obvious differences within individual trials between the untreated control and fungicide treated plots. From statistical analyses, there was no evidence of an effect of foliar fungicides on reducing the level of these different diseases.

Large strip trials: Table 1 lists a summary of individual trial analyses. Replication varied from 2 to 4 across the trials and results on a trial-by-trial basis were inconsistent in that there were no common measures that had similar results across the trials (see combined analysis for further information). In only one of the trials was there an increase in the milk per acre index (Chippewa County).

Small plot trials: In 2008, the small plot trials were affected by environmental conditions and as such, there were no results to report.

Combined State Level Analysis: The combined data analyses found that the highest source of variation was observed at the county scale across the different measures. One interpretation for this result in terms of management recommendations is that it becomes more difficult to make a "blanket" recommendation across a larger geographical area.

From the statistical analyses, there was no evidence of an effect of foliar fungicide treatment on the following components: (i) dry matter (tons), (ii) dry matter (%), (iii) silage moisture (%), (iv) crude protein (% DM), (v) neutral detergent fiber, (vi) NDFD (% NDF), (vii) starch, (viii) ash, (ix) fat (% DM), and (x) milk per ton. While there were some trend results ($0.20 > P > 0.10$) for wet yield (5-6% higher in the Headline treated plots and varying across locations), and milk per acre (8% higher in the Headline treated plots), results were not conclusive and require further testing. As evidence, there was wide variation across the trial locations for these different measures.

Table 2: Summary of results for on-farm long strip foliar fungicide trials for corn silage in Wisconsin in 2008. Analyses are shown for individual trial locations for specific measures of yield and quality components. Quality measures were obtained by submitting samples to the Marshfield Forage Testing laboratory for fresh samples.

Location (county)	Treatment (rate)	Wet Yield (T/A)[a]	DM Yield (TDM/A)	DM (%)	Silage moisture (%)	CP (% DM)	NDF (% DM)
Chippewa	UTC	20.5 a	6.1 a	29.6 a	70.4 a	8.1 a	41.3 a
	Headline (12 oz/A)	23.9 a	7.4 a	30.8 a	69.3 a	7.9 b	40.6 a
Dodge	UTC	17.5 a	6.1 a	54.7 a	45.3 a	6.1 a	38.1 a
	Headline (6 oz/A)	17.7 a	6.3 a	48.3 a	51.7 a	6.2 a	43.2 a
Jefferson #1	UTC	15.8 a	7.1 a	46.0 a	54.6 a	7.3 a	40.5 a
	Headline (6 oz/A)	14.6 a	6.3 b	43.0 a	56.5 a	7.8 a	40.0 a
Jefferson #2	UTC	14.2 a	5.7 a	39.8 a	60.2 a	6.6 a	43.1 a
	Headline (6 oz/A)	15.6 a	6.1 a	39.1 a	60.9 a	6.3 b	42.3 a
Shawano	UTC	10.9 a	3.7 a	34.0 a	66.0 a	8.0 a	46.1 a
	Headline (6 oz/A)	13.6 a	4.8 a	34.9 a	65.1 a	8.0 a	48.1 a
Waupaca	UTC	24.0 a	9.1 a	38.0 a	62.1 a	7.7 a	42.1 a
	Headline (6 oz/A)	22.9 b	9.4 a	41.2 a	58.8 a	8.0 a	39.6 a
Winnebago	UTC	20.3 b	7.9 a	38.7 a	61.4 a	7.1 a	40.7 a
	Headline (6 oz/A)	22.1 a	10.0 a	45.2 a	54.9 a	7.5 b	42.9 a

		NDFd (%NDF)	Starch (%DM)	Ash (%DM)	FAT (%DM)	Milk/T Index	Milk/A Index
Chippewa	UTC	65.1 b	30.1 a	3.5 a	2.4 a	3377 a	24892 b
	Headline (12 oz/A)	67.8 a	30.5 a	3.5 a	2.5 a	3386 a	20469 a
Dodge	UTC	63.5 a	40.1 a	2.4 a	11.8 b	3042 a	19292 a
	Headline (6 oz/A)	64.8 a	33.9 a	2.8 a	12.8 a	3066 a	18458 a
Jefferson #1	UTC	68.0 a	34.6 a	3.1 a	2.7 a	3208a	22816 a
	Headline (6 oz/A)	67.7 a	35.2 a	3.3 a	2.6 a	3247a	20561 a
Jefferson #2	UTC	71.9 a	31.9 a	2.6 a	2.5 a	3384 b	19118 a
	Headline (6 oz/A)	74.2 a	32.8 a	2.7 a	2.7 a	3453 a	20962 a
Shawano	UTC	69.7 a	26.4 a	3.5 a	2.2 a	3341 a	12075 a
	Headline (6 oz/A)	68.2 a	25.0 a	3.7 a	2.1 a	3211 a	15375 a
Waupaca	UTC	66.3 a	36.8 a	2.8 a	2.6 a	3308 a	30074 a
	Headline (6 oz/A)	66.2 a	38.2 a	2.8 a	2.8 a	3298 a	31024 a
Winnebago	UTC	73.0 a	33.8 a	3.4 a	2.6 a	3281 a	25722 a
	Headline (6 oz/A)	72.2 a	32.5 a	3.5 a	2.5 a	3071 a	30637 a

[a] Means within a column followed by the same letter are not significantly different (P=0.10, Duncan's Multiple Range Test).

Concluding Remarks

Since these trials commenced in 2007 we have observed only one trial where there has been either a higher milk per ton or milk per acre index (Chippewa County in 2008) with the application of a foliar fungicide.

Furthermore, when we examined the data across trials, the only consistent measure that was found at a trend result was for milk per acre. Based on discussions with researches in Dairy Science at UW-Madison, we are also working to understand the trend result for milk per acre index and determine if the calculation is being confounded by silage moisture).

Furthermore, our analyses found that the highest source of variation occurred at the farm (county) scale, meaning that the ability to make a single, wide scale recommendation is difficult as individual grower production practices (for example, corn hybrid, hybrid resistance, soil type, tillage, weed and insect management) can all influence silage quality and yield. This further emphasizes that the use of an integrated management program is the most appropriate approach. Lastly, disease pressure in 2008 in Wisconsin was generally low.

Acknowledgements

We thank all of our grower cooperators for participating in this trial. Furthermore, we thank the following UWEX County Agents who helped coordinate trials in their respective counties: Jerry Clark, Matt Hanson, Joe Bollman, Tom Anderson, Bill Halfman, and Nick Schneider. We thank the Midwest Forage Association for providing funding for this project as well as UW-Extension Team Forage. We also thank BASF, Syngenta, and Bayer CropScience for providing fungicide product for these trials.