

University of Wisconsin and UW-Extension Corn Foliar Fungicide Research Results, 2007-2011

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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 third party, unbiased Wisconsin data did not exist 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 large and small plot replicated on-farm trials.

Comparisons of Small Plot and On-Farm Trials:

Both small plot and large 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 may better represent “real world” scenarios although care should be taken to minimize the potential for confounding effects. It is this combination of approaches that are important for improving the research process.

In Wisconsin, both small plot and large strip on-farm research trials have been used to examine the questions regarding the use and need for foliar fungicides in corn. Both types of trials commenced in 2007 and have occurred on an annual basis. In this report, the discussion will be done by the different types of plot design because of the differences in trial types and also variation across trials. However, we have not noticed any major differences in results between the small and large scale on-farm research trials. In this report, data that was not obtained, or was not obtained at a plot level is either listed as N/A (not available) or is listed but was not statistically analyzed.

Plot design

Large scale, on-farm strip trials.

Large, on-farm strip trials were conducted in several Wisconsin counties as highlighted in Tables 3-7. Plots were maintained using the individual grower production practices and each plot had treatments replicated from two to four times. In each trial, comparisons were made either

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between a single fungicide and the untreated check or multiple products (2007 only). Fungicides that have been tested include: Headline, Quilt, Quilt Xcel and Stratego YLD. Fungicides were applied within the labeled rates and applications were made using ground application equipment. Applications were made at either the VT (2007), R1 (2008-2011) or V5 (2011) crop stages. Foliar disease ratings (measured as the percentage severity) were made to determine disease levels periodically during the growing season. At black layer, the percentage stalk lodging was also obtained using a stalk nudge test (2007-2011) and stalk rot ratings (2009-2011) based on the University of Illinois (0-5) Stalk Rot Rating Scale (Table 1). In 2011, data obtained using the stalk nudge test were not included in either the large or small scale research plot data. The reason for this is there was a high incidence of lodging due to the presence of European corn borer damage. Evidence of this damage was obtained when using the stalk rot rating scale since that method requires splitting corn stalks, thus providing a method to differentiate European corn borer damage and stalk rot damage.

Table 1. Written description of the University of Illinois (0-5) stalk rot rating scale.

Rating	Description
0	No visible discoloration of the internal below ear stalk nodes.
1	Internal discoloration at the stalk nodes below the ear.
2	Internal discoloration at the stalk node and in the pith below the ear.
3	Pith separation occurring below the ear.
4	Complete discoloration and decay of the pith between at least two nodes below the ear, but stalk still standing.
5	Stalk lodged below the ear due to stalk rot.

Small scale research plots.

On-farm small plot research trials were conducted from the 2007 to 2011 growing seasons at several locations in the western portion of Wisconsin (Tables 8-12). In these trials across the years, there have been different questions asked including: (i) what is the effect of different active ingredients within a site and (ii) what has been the impact of using an active ingredient at different fungicide timings? Products examined across trials have included: Headline, Headline AMP, Quilt, Quilt Xcel Stratego and Stratego YLD, all applied at the recommended labeled rates. Application timings were either at R1 or V5 (2011 only). An R3 (2009 only) application was also applied at the La Crosse and Monroe County #1 during the 2008 growing season. Foliar disease, stalk nudge and stalk health ratings were made at similar timings as have been accomplished in the large scale plot trials. For the small plot research trials, all plots were a minimum of 4 rows wide and 30-50 feet long and were sprayed using a CO₂ powered backpack sprayer and were hand harvested. These plots were all conducted in grower's field using grower management practices except for the applications of the fungicides.

Results

Large scale, on-farm strip trial.

2007 Results (Table 3). Three of the eight fields included more than one fungicide. As a result, there were 11 fungicide comparisons with the untreated check. In only one of the eight trials was there a significant increase in grain yield (Dane County #2, $P < 0.10$, +7 bu/A with fungicide application). However, it was also noted that grain moisture was higher (0.9% increase) at this location in the plots treated with a foliar fungicide and the increase in yield would not have been enough to pay for the fungicide + application costs as well as the 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. In terms of fungicide efficacy, there were differences noted between fungicide treated and the untreated check. In the untreated check, disease severity was 17%, while it was 7% in the fungicide treated plots.

Overall, grain moisture was inconsistently affected with the application of a foliar fungicide. In three trials, there was a higher grain moisture level at harvest in plots that had received a foliar fungicide (0.9%, 0.7% and 0.5%, respectively). The incidence of stalk lodging (represented as the percentage lodged) was also inconsistently affected with the application of a foliar fungicide. Of the eleven possible product comparisons, 2 products significantly reduced the percentage lodging, while in the other 9 comparisons, there was no evidence of an effect of foliar fungicides.

2008 Results (Table 4).

In six of the nine trials, there was no evidence of a statistical yield advantage with the use of Headline. In two trials conducted in Green Lake County, there was a statistical yield advantage with the application of fungicide (+24 and +6 bu/A, respectively). In the trial that had a +24 bu/A 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 there was a +6 bu/A yield increase, disease severity was 8% in the untreated check and included common rust, eyespot and Northern corn leaf blight. In the La Crosse #2 trial, there was +10 bu/A difference between the Headline treated and the untreated check. This was one of the few trials where we saw a significant difference in grain yield in the absence of higher disease severity.

2009 Results (Table 5). Results from 2009 indicated that only in the Waupaca County trial was there a yield advantage with the application of a foliar fungicide (+15 bu/A). In this trial, there was also a non-statistical increase in grain moisture (+1.2%) in the fungicide treated plots. Across all other parameters (pre and post application disease severity, stalk nudge test, top die back and stalk health) measured there was no evidence of a statistical difference between treated and untreated plots.

2010 Results (Table 6). There was no evidence in the three large scale strip trials in 2010 that there was a difference in grain yield. There was however, a significant different difference in post-spray disease severity between the untreated check (14%) and Quilt Xcel (4%) at the Washington County site. Grain moisture and test weight were not available by replicate at the Clark and Dodge County plot. At Washington County, grain moisture was significantly higher in the Quilt Xcel treated plot by 0.7%.

2011 Results (Table 7). There was no evidence of positive differences in yield when using a foliar fungicide applied at either the V5 or R1 stage of crop development. There was, however, a 4% yield reduction when Stratego YLD was applied during V5 at the Dodge County #1 site and a 7% reduction when Stratego YLD was applied at R1 at the Washington County site. There were no statistical differences for test weight but percentage grain moisture was negatively affected by Stratego YLD applied during V5 at the Chippewa County site. The only statistical difference noted for disease control was at the preharvest foliar disease for Clark and Dodge County #1 sites. At the Clark County plot both application timings of Stratego YLD had significantly lower disease severity by 4 percentage points (8 % in the untreated check vs. 4% in the fungicide treated) . At the Dodge County #1 site the R1 timing of Stratego YLD had lower disease severity than the V5 timing, however, there was no evidence that the disease severity in either application timing was different from the untreated control.

Small Scale Research Plot Results

2007 Results (Table 8) There were no statistical differences in yield or % stalk lodging at the Monroe County sites. There was, however, a significant increase in grain moisture with Quilt compared to the untreated check at the Monroe County #1 site.

2008 Results (Table 9). In these small scale, on-farm research trials, there was no evidence of a statistical yield advantage with the use of a fungicide in any trial. In fact, in the Pepin County trial, there was a +28 bu/A difference for the untreated check compared to plots that had been sprayed with Headline. Grain moisture was not statistically affected by the use of a fungicide. Test weight was statistically affected. However, these results were inconsistent.

2009 Results (Table 10). There was no evidence of a difference in grain yield with the R1 or R3 fungicide applications of Headline and R1 applications of Quilt or Stratego. While there were differences among treatments for grain moisture in the Monroe County trials, there was no clear trend with regards to those results.

2010 Results (Table 11). There was no statistical difference in yield or test weight. There were inconsistent differences noted in grain moisture. Quilt Xcel significantly increased moisture at the Monroe County site #1 by 1.5 %. However, both Quilt Xcel and Stratego YLD reduced grain moisture by 2.9% and 3.7%, respectively, at Pepin County.

2011 Results (Table 12). In the La Crosse County trial, yield in plots receiving Headline at V5 was 13 bu/A lower than the other treatments. There were differences in grain moisture in plots receiving Headline AMP at V5 compared to other treatments except Quadris (R5) and Quilt Xcel (R1). Overall, disease intensity was moderate in the La Crosse County trial, and there was evidence that all three fungicides applied at R1 reduced the disease severity based on disease assessments made at R5.

In the Monroe County trial, there was no evidence of an effect of foliar fungicide product or application timing on yield and disease severity. Overall, this site would be classified as having low disease intensity. Stratego YLD (V5) had significantly higher grain moisture than the

untreated check and Headline AMP (V5). However, this treatment was not significantly different from the other fungicide treatments and/or timings. All fungicides applied at V5 had significantly lower test weight than the untreated check.

Economic Considerations for Using a Foliar Fungicide

Currently, the estimated cost of applying a foliar fungicide in corn remains in the \$20-30/A range (application cost plus fungicide product cost), depending on product. With the current corn commodity prices quite variable, Figure 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 2. 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 Cost	Fungicide Cost	Corn market value (\$/bu)		
		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

Since the inception of the on-farm foliar fungicide trials in Wisconsin in 2007, results across years and locations have not found a consistent statistical yield benefit with the application of a foliar fungicide. While there were higher levels of stalk lodging observed in the untreated plots at several locations over the years, this did not translate into a yield reduction and more work is needed to quantify economical return for a reduction in stalk rot incidence.

Overall, the highest source of variation from our analyses has been observed at the farm scale, indicating that other factors (e.g., hybrid resistance, soil type, farm management practices) may

influence yield response more than the use of a foliar fungicide. 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 should consider other factors like crop rotation and residue management as part of their management program.

Currently, we have seen the best yield response to a foliar fungicide application (both within Wisconsin and across the region) when disease severity has been higher (> 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

Grau, C., Esker, P. Ballweg, M., Clark, J., Fischer, D., Hargrave, C., Halfman, B., Huntzicker, S., and Jensen, B. 2008. University of Wisconsin's corn foliar fungicide trial results. Pages 60-66 in: Proceedings of the 2008 Wisconsin Fertilizer, Aglime, and Pest Management Conference, Madison, WI.

Esker, P., Ballweg, M., Blonde, G., Bollman, J., Clark, J., Fischer, D., Hargrave, C., Huntzicker, S., and Jensen, B. 2009. Summary of the 2008 strip trials for foliar fungicide use in corn. Pages 51-54 in: Proceedings of the 2009 Wisconsin Crop Management Conference, Madison, WI.

Esker, Paul, Ballweg, M., Cropp, B., Halfman, B., Halopka, R., Hanson, M., Huntzicker, Steve., Zander, J., Sturgis, P., 2010 On Farm Corn Foliar Fungicide Trial Results. Pages 105-109. Proceedings of the 2011 Wisconsin Crop Management Conference, Madison, WI.

Paul Esker, Mike Ballweg, Jerry Clark, Bill Halfman, Richard Halopka, Matt Hanson, Steve Huntzicker, Richard Proost, Bryan Jensen. 2011 University of Wisconsin and UW-Extension Corn Foliar Fungicide Research: Results for V5 and R1 Application Timings. Pages 142-145. Proceedings of the 2012 Wisconsin Crop Management Conference, Madison, WI

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Large Scale Research Plots (Tables 3-7)

Table 3. Results of Large Scale On-Farm Corn Foliar Fungicide Trials, 2007.

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^{c d}	% lodged Stalks ^b	Ave. % diseased foliar pre-application ^e	Ave. % diseased foliage-September ^e
Chippewa	Untreated Check	42 a	24.9	54.3	31 a	3	33
	Quilt @ 14	46 a	23.8	55.7	24 a		23
Dane #1	Untreated Check	183 a	17.8 b	N/A	12 a	3	3
	Quilt @ 14	191 a	18.5 a	N/A	3 a		3
Dane #2	Untreated Check	155 b	16.7 b	57.8	9 a	3	17
	Quilt @ 14	162 a	17.6 a	56.8	6 a		7
Green Lake	Untreated Check	145 a	21.0 a	N/A	2 a	1	7
	Quilt @ 10	154 a	21.0 a	N/A	0 a		8
La Crosse	Untreated Check	234 a	17.5 a	N/A	13 a	2	5
	Headline @ 10	243 a	17.6 a	N/A	10 a		5
Ozaukee	Untreated Check	173 a	29.6 a	51.3	53 a	<1	10
	Headline @ 9	169 a	31.9 a	50.5	42 a		8
	Quilt @ 14	172 a	30.1 a	51.8	41 a		5
Sheboygan	Untreated Check	164 a	16.4 ab	56.0	76 a	<1	7
	Headline @ 9	168 a	16.2 b	56.5	52 b		4
	Quilt @ 14	166 a	16.6 a	56.3	43 b		5
Washington	Untreated Check	202 a	16.7 b	55.6	40 a	<1	22
	Headline @ 9	202 a	17.2 a	55.4	3 a		15
	Quilt @ 14	202 a	16.6 b	55.5	25 a		12

^a Fungicide followed by the application rate in ounces per acre.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c For test weight, values represent a combined sample for treated or untreated plots.

^d N/A = Not Available

^e For pre-spray and post-spray ratings, disease(s) was rated as single value across treated or untreated plots

Table 4. Results of Large Scale On-Farm Corn Foliar Fungicide Trials, 2008.

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^{bcd}	% lodged Stalks ^b	Ave. % diseased foliar pre-application ^e	Ave. % diseased foliage-September ^e
Chippewa	Untreated Check	187 a	N/A	N/A	3 a	3	10
	Headline @12	186 a	N/A	N/A	4 a		10
Dane	Untreated Check	205 a	24.3 a	N/A	N/A	N/A	N/A
	Headline @ 6	209 a	25.5 a	N/A	N/A		N/A
Green Lake #1	Untreated Check	167 a	17.0 a	54.7	0 a	< 1	15
	Headline @ 6	191 b	18.1 a	54.5	0 a		15
Green Lake #2	Untreated Check	207 a	20.2 a	53.7	0 a	< 1	8
	Headline @ 6	213 b	21.0 a	53.0	0 a		4
Jefferson	Untreated Check	164 a	24.0 a	N/A	N/A	N/A	N/A
	Headline @ 6	160 a	24.5 a	N/A	N/A		N/A
La Crosse #1	Untreated Check	146 a	16.0 a	N/A	11 a	1	10
	Headline @ 6	160 a	16.4 a	N/A	9 a		5
La Crosse #2	Untreated Check	218 a	21.9 a	N/A	10 a	1	2
	Headline @ 6	228 b	21.8 a	N/A	6 a		5
Sheboygan	Untreated Check	154 a	23.1 a	51.3 a	11 a	< 1	2
	Headline @ 12	158 a	22.9 a	52.3 a	10 a		1
Waupaca	Untreated Check	169 a	35.4 a	51.8 a	N/A	N/A	N/A
	Headline @ 6	171 a	33.0 a	52.3 a	N/A		N/A

^a Fungicide followed by the application rate in ounces per acre.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c For test weight, values represent a combined sample for treated or untreated plots unless noted by letter designation as previously described where statistical comparisons could be made on replicated test weight values.

^d N/A = Not Available

^e For pre-spray and post-spray ratings, disease(s) was rated as single value across treated or untreated plots unless noted by letter designation as previously described where statistical comparisons could be made on replicated disease ratings.

Table 5. Results of Large Scale On-Farm Corn Foliar Fungicide Trials, 2009.

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^c	% lodged Stalks ^b	Ave. Stalk Health Rating ^b	Ave. % diseased foliar pre-application ^e	Ave. % diseased foliage-September ^e
Dodge	Untreated Check	213 a	21.3 a	N/A	0.3 a	0.3 a	0	1
	Headline @ 6	222 a	21.4 a	N/A	0 a	0 a		1
Sheboygan	Untreated Check	159 a	30.2	46.0	7 a	0 a	1	3
	Headline @ 6	150 a	30.1	46.7	9 a	0 a		0
Washington	Untreated Check	166 a	22.5	50.0	12 a	1 a	1	5
	Headline @ 6	164 a	22.9	50.1	15 a	1 a		2
Columbia	Untreated Check	190 a	20.5	N/A	1 a	0 a	1	1
	Quilt @ 14	188 a	20.6	N/A	1 a	0 a		1
Waupaca	Untreated Check	167.6 b	31.4 a	50.0 a	29 a	2 a	0	20 a
	Headline @ 6	183.2 a	32.6 a	50.1 a	21 a	2 a		18 a

^a Fungicide followed by the application rate in ounces per acre.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c For test weight, values represent a combined sample for treated or untreated plots.

^d N/A = Not Available

^e For pre-spray and post-spray ratings, disease(s) was rated as single value across treated or untreated plots unless noted by letter designation as previously described where statistical comparisons could be made on replicated disease ratings.

Table 6. Results of Large Scale On-Farm Corn Foliar Fungicide Trials, 2010.

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^c	% lodged Stalks ^b	Ave. Stalk Health Rating ^{bc}	Ave. % diseased foliar pre-application ^e	Ave. % diseased foliage-September ^e
Clark	Untreated Check	177 a	N/A	N/A	0 a	0.1 a	<1	6 a
	Stratego YLD @ 5	182 a	N/A	N/A	1 a	0.2 a		11 a
Dodge	Untreated Check	200 a	N/A	N/A	N/A	N/A	N/A	N/A
	Quilt Xcel @ 10.5	203 a	N/A	N/A	N/A	N/A		N/A
Washington	Untreated Check	154 a	18.0 b	55.1 a	0 a	1.7 a	<1	14 a
	Quilt Xcel @ 10.5	157 a	18.7 a	54.9 a	0 a	1.1 a		4 b

^a Treatments are list with their respective rates in oz/A.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c N/A = Not available.

^d For pre-spray and post-spray ratings, disease(s) was rated as single value across treated or untreated plots unless noted by letter designation as previously described where statistical comparisons could be made on replicated disease ratings.

Table 7. Results of Large Scale On-Farm Corn Foliar Fungicide Trials, 2011.

County	Treatment ^a	crop stage	Yield ^b	Grain Moisture % ^b	Test weight #/Bu. ^{b, c}	Ave. stalk health rating ^{b, c}	Ave. # tassels showing premature death/30 ^b	Ave % Disease severity ratings @ V5 ^b	Ave % Disease severity ratings @ R1 ^b	Ave % Disease severity ratings on Sept. 9 ^b
Chippewa	UTC	-	163 a	16.3 ab	56.0 a	N/A	1.3 a	5.0 a	8 a	8 a
	Stratego YLD @ 2.5	V5	161 a	16.3 b	56.7 a	N/A	2.7 a	5.0 a	5 a	8 a
	Streatgo YLD @ 5.0	R1	160 a	16.6 a	56.0 a	N/A	3.0	5.0 a	7	8 a
Clark	UTC	-	176 a	21.3 a	51.7 a	0.3 a	n/a	0 a	1 a	8 a
	Stratego YLD @ 2.5	V5	177 a	20.8 a	52.7 a	0 a	n/a	0 a	1 a	4 b
	Streatgo YLD@ 5.0	R1	171 a	21.3 a	52.4 a	0.3 a	n	0 a	1 a	5 b
Dodge #1	UTC	-	236 a	18.8 a	N/A	0.5 a	0 a	0 a	1 a	2 ab
	Stratego YLD @ 2.5	V5	226 b	18.7 a	N/A	0.5 a	0 a	0 a	1 a	3 a
	Streatgo YLD@ 5.0	R1	240 a	18.5 a	N/A	0.5 a	0 a	0 a	1 a	2 b
Dodge #2	UTC	-	219 a	21.4 a	55.0 a	0.5 a	0 a	0 a	1 a	3 a
	Stratego YLD @ 2.5	V5	215 a	21.1 a	55.0 a	0.5 a	0 a	0 a	1 a	3 a
	Streatgo YLD@ 5.0	R1	218 a	21.1 a	55.0 a	0.5 a	0 a	0 a	1 a	3 a
Washington	UTC	-	164 a	19.7 a	55.6 a	0.0 a	0.20 a	1.0 a	1 a	2 a
	Stratego YLD @ 2.5	V5	166 a	19.6 a	55.7 a	0.0 a	0.05 a	1.0 a	1 a	1 a
	Streatgo YLD @ 5.0	R1	153 b	19.8 a	55.0 b	0.3 a	0 a	1.0 a	1 a	2 a

^a Treatments are list with their respective rates in oz/A.

^b means within a column for a location that are followed by the same letter are not significantly different (P=0.10, Duncan's New Multiple Range Test)

^c N/A = Not available.

Small Scale Research Plots (Tables 8-12)

Table 8 Results of small scale research plots, 2007

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^d	% lodged Stalks ^b	Ave. % diseased foliar pre-application ^d	Ave. % diseased foliage-September ^d
Monroe County #1	UTC	140 a	17.2 b	N/A	49 a	2	22
	Quilt @ 12	144 a	18.5 a		39 a		12
	Headline @ 12	143 a	17.5 ab		31 a		15
Monroe County #2	UTC	130 a	20.0 a	N/A	54 a	1	8
	Quilt @ 12	136 a	21.0 a		49 a		3

^a Fungicide followed by the application rate in ounces per acre.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c N/A = Not Available

^d For pre-spray and post-spray ratings, disease(s) was rated as single value across treated or untreated plots unless noted by letter designation as previously described where statistical comparisons could be made on replicated disease ratings.

Table 9. Results of small scale research plots, 2008

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^{bc} _d	% lodged Stalks ^b	Ave. % diseased foliar pre-application ^d	Ave. % diseased foliage-September ^{cd}
Monroe #2	Untreated Check	183 a	25.7 a	50.2 a	7 a	1	1
	Quilt @ 14	186 a	24.4 a	50.2 a	9 a		1
	Stratego @ 10	184 a	25.2 a	48.9 b	11 a		1
	Headline @ 6	191 a	25.2 a	48.1 b	6 a		1
Monroe #2	Untreated Check	184 a	26.5 a	52.2 b	4 b	1	1
	Quilt @ 14	186 a	22.4 a	53.3 ab	9 a		1
	Stratego @ 10	190 a	24.5 a	53.0 ab	6 b		1
	Headline @ 6	179 a	22.6 a	54.1 a	6 b		1
Pepin	Untreated Check	227 a	22.8 a	53.8 a	19 b	1	1
	Quilt @ 14	216 ab	22.2 a	53.1 a	22 ab		2
	Stratego @ 10	212 ab	23.9 a	51.5 b	20 ab		3
	Headline @ 6	199 b	23.0 a	52.6 ab	24 a		3
Trempealeau	Untreated Check	137 a	19.2 a	53.5 a	15 a	<1	N/A
	Quilt @ 14	107 a	21.3 a	51.4 b	20 a		N/A
	Stratego @ 10	135 a	20.2 a	52.6 ab	17 a		N/A
	Headline @ 6	123 a	21.0 a	51.7 b	23 a		N/A
La Crosse	Untreated Check	217 a	21.6 a	54.3 a	6 a	1	4
	Quilt @ 14	225 a	20.4 a	54.8 a	7 a		2
	Stratego @ 10	217 a	21.2 a	53.8 a	5 a		3
	Headline @ 6	217 a	21.6 a	54.3 a	2 b		2

^a Fungicide followed by the application rate in ounces per acre.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c N/A = Not Available

^d For pre-spray and post-spray ratings, disease(s) was rated as single value across treated or untreated plots unless noted by letter designation as previously described where statistical comparisons could be made on replicated disease ratings.

Table 10. Results of small scale research plots, 2009

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^c	% lodged Stalks ^b	Ave. Stalk Health Rating ^b	Ave. % diseased foliar pre-application ^d	Ave. % diseased foliage-September ^{cd}
Buffalo	Untreated Check	155 a	25.1 a	N/A	25 a	0.33 a	1	8
	Headline @ 6	156 a	25.9 a	N/A	19 a	0.1 a		6
	Quilt Xcel @ 14	153 a	25.5 a	N/A	26 a	0 a		4
	Stratego @ 10	162 a	25.7 a	N/A	19 a	0 a		3
La Crosse	Untreated Check	166 a	30.0 a	N/A	1 a	0 a	< 1	7
	Headline @ 6	166 a	29.7 a	N/A	1 a	0 a		7
	Quilt Xcel @ 14	134 a	30.9 a	N/A	1 a	0 a		5
	Stratego @ 10	171 a	30.5 a	N/A	1 a	0 a		5
	Headline @ 6 at R3	164 a	30.6 a	N/A	1 a	0 a		5
Pepin	Untreated Check	170 a	26.2 a	N/A	8 a	0.67 a	1.0	N/A
	Headline @ 6	175 a	26.4 a	N/A	5 a	0 a		N/A
	Quilt Xcel @ 14	160 a	26.5 a	N/A	10 a	0.13 a		N/A
	Stratego @ 10	170 a	25.5 a	N/A	10 a	0.13 a		N/A
Monroe #1	Untreated Check	137 a	32.4 b	N/A	23 a	0 a	<1	5.
	Headline @ 6	136 a	33.3 b	N/A	23 a	0 a		4
	Quilt Xcel @ 14	135 a	34.8 a	N/A	20 a	0 a		2
	Stratego @ 10	138 a	32.0 b	N/A	19 a	0 a		3
	Headline @ 6 at R3	140 a	32.6 b	N/A	21 a	0 a		4
Monroe #2	Untreated Check	137 a	29.9 a	N/A	19 a	0 a	<1	1
	Headline @ 6	146 a	30.2 a	N/A	15 b	0 a		1
	Quilt Xcel @ 14	140 a	29.7 ab	N/A	12 c	0 a		1
	Stratego @ 10	144 a	28.4 b	N/A	13 c	0 a		1

^a Fungicide followed by the application rate in ounces per acre.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c N/A = Not Available

^d For pre-spray and post-spray ratings, disease(s) was rated as single value across treated or untreated plots unless noted by letter designation as previously described where statistical comparisons could be made on replicated disease ratings.

Table 11. Results of small scale research plots, 2010

Location (county)	Treatment ^a	Yield ^b	% Grain Moisture ^b	Test Weight ^b _{c d}	% lodged Stalks ^b	Ave. Stalk Health Ratings ^b	Ave. % diseased foliar pre-application ^d	Ave. % diseased foliage-September ^{bd}
Monroe 1	Untreated Check	157 a	23.0 b	53.3 a	0 a	1.3 a	<1	1 a
	Headline AMP @ 10	159 a	23.6 ab	53.7 a	0 a	0.8 a		1 a
	Quilt Xcel @ 10.5	163 a	24.5 a	53.3 a	0 a	0.7 a		1 a
	Stratego YLD @ 5	162 a	22.6 b	54.0 a	0 a	0.9 a		1 a
Monroe 2	Untreated Check	151 a	23.5 a	52.0 a	0 a	0.7 a	<1	4 a
	Headline AMP @ 10	163 a	23.9 a	51.0 a	0 a	0.6 a		4 a
	Quilt Xcel @ 10.5	157 a	23.9 a	51.0 a	0 a	0.4 a		3 a
	Stratego YLD @ 5	154 a	23.7 a	51.3 a	0 a	0.7 a		3 a
La Crosse	Untreated Check	165 a	22.9 a	52.0 a	0 a	1.0 a	<1	8 a
	Headline AMP @ 10	163 a	24.8 a	53.3 a	0 a	0.9 a		6 a
	Quilt Xcel @ 10.5	157 a	24.3 a	52.5 a	0 a	1.2 a		7 a
	Stratego YLD @ 5	154 a	24.3 a	52.7 a	0 a	1.3 a		7 a
Pepin	Untreated Check	152 a	27.2 a	50.8 a	0 a	0.8 a	<1	N/A
	Headline AMP @ 10	141 a	25.4 ab	51.5 a	0 a	0.7 a		N/A
	Quilt Xcel @ 10.5	152 a	24.3 b	50.9 a	0 a	1.05 a		N/A
	Stratego YLD @ 5	138 a	23.5 b	51.4 a	0 a	1.0 a		N/A
Trempealeau	Untreated Check	145 a	30.0 a	51.3 a	0 a	0 a	<1	25 a
	Headline AMP @ 10	150 a	29.7 a	50.8 a	0 a	0.1 a		25 a
	Quilt Xcel @ 10.5	151 a	31.0 a	49.8 a	0 a	0 a		25 a
	Stratego YLD @ 5	141 a	29.9 a	50.3 a	0 a	0 a		25 a

^a Treatments are list with their respective rates in oz/A.

^b Means followed by the same letter within each trial are not statistically different from one another based on Duncan's multiple range test ($P=0.10$).

^c N/A = Not available.

^d For pre-spray ratings, disease(s) was rated as single value across treated or untreated plots.

Table 12. Results of small scale research plots, 2011

County	Treatment ^a	Growth stage	Yield (bu/A) ^b	Grain moisture (%) ^b	Test weight (lb/bu) ^b	Stalk Health rating (0-5) ^b	Disease severity V5 (%) ^b	Disease severity R1 (%) ^b	Disease severity R5 (%) ^b
La Crosse	UTC	-	168 ab	21.1 ab	54.0 a	0.4 a	0 a	1 a	10 b
	Headline @ 6.0	V5	155 c	20.7 b	54.3 a	0.4 a	0 a	1 a	10 b
	Headline AMP @ 10.0	R1	174 a	22.6 a	54.3 a	0.4 a	0 a	1 a	5 c
	Quadris @ 6.0	V5	162 bc	20.2 b	54.3 a	0.4 a	0 a	1 a	12 b
	Quilt Xcel @ 10.5	R1	163 abc	22.3 a	54.0 a	0.4 a	0 a	1 a	7 c
	Stratego YLD @ 2.5	V5	167 ab	19.9 b	54.3 a	0.4 a	0 a	1 a	15 a
	Stratego YLD @ 5.0	R1	171 ab	19.8 b	54.3 a	0.4 a	0 a	1 a	5 c
Monroe	UTC	-	140 a	21.8 b	54.3 a	0.7 a	0 a	0 a	1 a
	Headline @ 6.0	V5	132 a	22.6 ab	52.7 c	0.9 a	0 a	0 a	1 a
	Headline AMP @ 10.0	R1	130 a	21.9 b	54.0 ab	0.9 a	0 a	0 a	1 a
	Quadris @ 6.0	V5	124 a	23.3 ab	53.0 b	1.1 a	0 a	0 a	1 a
	Quilt Xcel @ 10.5	R1	135 a	23.5 ab	54.0 ab	0.9 a	0 a	0 a	1 a
	Stratego YLD @ 2.5	V5	124 a	24.4 a	53.0 bc	0.9 a	0 a	0 a	1 a
	Stratego YLD @ 5.0	R1	133 a	22.3 ab	54.3 a	0.7 a	0 a	0 a	1 a

^a Treatments are list with their respective rates in oz/A.

^b Means within a column for a given location that are followed by the same letter are not significantly different ($P = 0.10$, Duncan's New Multiple Range Test).