Wisconsin Field Crops Pathology Fungicide Tests Summary

2016

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Leptosphaerulina leaf spot; *Leptosphaerulina briosiana*
Spring black stem and leaf spot; *Phoma medicaginis*
Stemphylium leaf spot; *Stemphylium spp.*

The trial was established at the Arlington Agricultural Research Station located in Arlington, WI. The alfalfa cultivar '55V50' was seeded on 1 May 2013 in a field with a Plano silt loam soil (0 to 2% slopes). The experimental design was a randomized complete block with four replicates. Plots were 40 ft long and 10 ft wide. Standard alfalfa production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control and six fungicide treatments. Fungicides were applied using a CO_2-pressurized backpack sprayer equipped with 8002XR TurboJet flat fan nozzles calibrated to deliver 20 GPA at 30 psi. Fungicides were applied after each cutting of alfalfa once plants had reached a height of 6 in. Dates of fungicide application were 22 Apr, 1 Jun, and 28 Jun. Natural sources of pathogen inoculum were relied upon for disease. Disease severity and defoliation was evaluated at harvest for all three crops by visually estimating both parameters with the aid of standard area diagrams. A small-plot harvester was used to cut a 31-in wide by 37.4 ft long area of each plot to determine wet yield. A subsample of alfalfa was also collected from each replicate (~0.50 lb.), weighed, then dried and weighed again to determine dry matter yield. Harvest was performed on 20 May, 20 Jun, and 19 Jul. All disease, defoliation, and yield data were analyzed using a mixed model analysis of variance. Means were separated using the test of least significant difference (LSD; α=0.05). Disease data was rated for Spring black stem for the first crop and a mix of Leptosphaerulina and Stemphylium leaf spot for the second and third crop. Yield was reported as the total annual yield from three harvests.

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Wet conditions were observed late in the summer at this location. There was no significant difference in disease severity from plots treated with Serenade ASO compared to the non-treated control. Plots treated with all other products averaged significantly less disease severity than the non-treated control. There was no significant difference in average defoliation and total annual yield. Phytotoxicity was not observed for any treatment.

Table 1. Season-long average disease severity, average defoliation, and total dry-matter yield for alfalfa treated with fungicide or not treated with fungicide in Wisconsin in 2016.

Treatment and rate/A (crop harvest spray application)	Leaf Spot Average Severity (Crop 1-3)$^{y, x}$	Average Defoliation (%)^{y}	Dry Matter Yield (Tons/a)^{w}
Non-treated Check	3.4 a	0.6	4.7
Serenade ASO 32.00 fl oz (Crops 1-3)	3.0 a	0.6	4.4
Aproach 2.08SC 9.00 fl oz^{z} (Crops 1-3)	1.5 b	0.2	4.2
Headline 2.09SC 6.00 fl oz^{z} (Crops 1-3)	1.4 b	0.2	4.9
Aproach 2.08SC 6.00 fl oz^{z} (Crops 1-3) Fontelis 1.67SC 16.00 fl oz^{z} (Crop 2)	1.1 b	0.0	4.7
Aproach 2.08SC 6.00 fl oz^{z} (Crops 1-3)	1.0 b	0.2	4.5
Quadris 2.08SC 6.00 fl oz^{z} (Crops 1-3)	0.8 b	0.0	4.6
LSD (α=0.05)	1.0	ns^{v}	ns^{v}

^{z}Induce 90% SL (Non-ionic surfactant) at 0.25% v/v was added to the fungicide treatment
^{y}Values are based on the average disease severity or defoliation prior to harvest on 20 May, 20 Jun, and 19 Jul
^{x}Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05)
^{w}Total annual yield based on harvests on 20 May, 20 Jun, and 19 Jul.
^{v}ns = no least significant difference (α=0.05)

Evaluation of foliar fungicide applications in reduced-lignin alfalfa systems in Wisconsin, 2016

ALFALFA (*Medicago sativa* 'DKA44-16RR' and 'HarvXtra')
Leptosphaerulina leaf spot*;* *Leptosphaerulina briosiana*
Spring black stem and leaf spot; *Phoma medicaginis*
Stemphylium leaf spot; *Stemphylium spp.*

In 2015, an alfalfa research trial was established at the Arlington Agricultural Research Station in Arlington, WI. Two cultivars of alfalfa (DKA44-16RR - Conventional Roundup Ready®; HarvXtra – Reduced-lignin, Roundup Ready ®) were sprayed with seven fungicide treatments and compared to a non-treated control. Yield, quality, and return on investment of the treatments were evaluated under two cutting duration schemes (30-day vs. 40-day) for both cultivars. Results of the entire study can be found at: http://fyi.uwex.edu/fieldcroppathology/files/2015/11/2015-DLS-MFA-FINAL-REPORT.pdf. In the 2015 study (seeding year), both cultivars responded to fungicide in a similar way (second crop specifically). In the 30-day cutting duration, fungicide application resulted in little discernable difference in disease level, defoliation, or quality compared to not treating with fungicide. Return on investment (ROI) calculations indicated that no positive return was achieved if the hay was sold, or was kept on the farm and fed to dairy cows, for the 30-day duration of cut. For the 40-day duration, significant differences in fungicide treatments were identified for disease levels, defoliation, and quality compared to the non-treated controls. These differences resulted in positive ROI (using the Milk 2006 model) for the second crop where the fungicides Headline® and Quadris® were used, under the scenario where hay would be kept on the farm and fed to dairy cows. If hay was sold, no positive ROI was identified for either treatment for this crop.

Considering these results, we continued this study in a second year using the same established stand of alfalfa. We investigated the 1st, 2nd, and 3rd crops in 2016. We considered these three crops together in this analysis to examine success of using fungicide in a 30-day cutting interval system, or a 40-day cutting interval system.

The objectives of this project are:

1. Assess the utility of applying fungicides (labeled and non-labeled) to an <u>ESTABLISHED STAND</u> of reduced-lignin alfalfa by evaluating foliar disease pressure, defoliation, yield, and quality for both 30-day and 40-day cutting intervals for the combined 1st, 2nd, and 3rd crop.
2. Determine the return of investment (ROI), using hay price and milk price, when various fungicides (labeled products) were applied to conventional or reduced-lignin alfalfa.

A field trial was previously established at the Arlington Agricultural Research Station (AARS) located in Columbia and Dane Counties in Wisconsin in spring of 2015. Two alfalfa varieties, one conventional variety and one reduced-lignin variety, were seeded on April, 17 2015. Plots were 10 feet wide and 20 feet long. In 2016, seven fungicide treatments (same treatments as in the 2015 trial) were applied to both alfalfa varieties using a 10-foot wide hand-held boom attached to a CO_2 pressurized backpack sprayer at a rate of 20 GPA. Fungicides were applied to each crop when alfalfa was six inches tall. Details of the fungicide treatments can be found in Table 2. A non-treated control was also included for a total of eight treatments. Treatments for the first crop were applied on April 22, 2016. On May 20, 2016 first crop (30-day cutting interval) was conducted by using a 30-inch wide small plot flail chopper to harvest one strip from one 5-ft section of each plot (randomly chosen section). Dry-matter yield, foliar disease severity, defoliation and forage quality samples were collected at the time of harvest. Eleven days later (May 31, 2016), another 30-inch wide strip was harvested (40-day cutting interval) from the other 5-ft section of each plot. All yield, quality, and disease data were again collected. All remaining alfalfa was then removed from the entire trial on June 2, 2016. Thus, the second crop was established. Fungicide treatments were applied to the second crop on June 13, 2016. The second crop 30-day cutting interval was conducted on July 1, 2016 while the 40-day cutting interval was conducted on July 11, 2016. All procedures and data acquisition were conducted in the same manner as on the first crop and the field was cleared on July 11 to establish the third crop. A third application of fungicide was applied on July 19, 2016. The third crop 30-day cutting interval was conducted on August 11, 2016 while the 40-day cutting interval was conducted on August 22, 2016. All procedures and data acquisition were conducted as described previously.

The experimental design was a split-split plot with 4 replicates. Alfalfa variety was considered the whole plot, fungicide treatment the sub-plot, and cutting treatment the sub-sub plot. All yield, quality, and disease data were compiled together for the entire season (e.g. average disease severity for the season, average season defoliation, total yield, etc.) and analyzed using standard mixed-model analysis of variance and means separated for treatment effects within each variety using the test of least significant difference.

Applying fungicide over the course of the three crops resulted in significant (P<0.01) reductions in average severity for both alfalfa cultivars in the 30-day cutting interval (Table 3) and DKA44-16RR in the 40-day cutting interval (Table 4). There was no significant difference in average disease severity among fungicide treatments or the non-treated control for HarvXtra subjected to the 40-day cutting interval. Typically, Priaxor and Quadris treatments offered the most significant reduction in foliar disease severity compared to the non-treated control, where differences in disease were observed.

While differences in disease severity were detected among fungicide treatments for both cultivars for the 30-day cutting interval, this did not result in a significant difference (P>0.05) in defoliation during this cutting interval (Table 3). For the 40-day cutting interval, a significant (P=0.04) reduction in average defoliation was observed for all fungicide treatments compared to the non-treated control for both cultivars (Table 4).

Significant difference (P<0.05) in dry-matter yield was observed among all treatments for both cultivars subjected to both cutting intervals (Tables 3 and 4). For the 30-day cutting interval Priaxor and Fontelis alone provided the highest yield, while Priaxor and Quadris applications resulted in the highest yields for the 40-day cutting interval.

Interestingly, application of fungicide did not provide a significant (P>0.05) increase in RFQ over the non-treated control for either cultivar subjected to 30-day or 40-day cutting intervals (Tables 3 and 4). However, for the 40-day cutting interval, HarvXtra provided significantly higher (P=0.02) RFQ values compared to DKA44-16RR regardless of fungicide treatment. No differences in RFQ were noted between cultivars for the 30-day cutting interval.

Application of fungicide did not result in a significant (P>0.05) increase in total milk production over the non-treated control for either cultivar subjected to the 30-day cutting interval (Table 3). For the 40-day cutting interval, application of fungicide did result in significant (P<0.01) increases in total milk production for both cultivars. However, the HarvXtra cultivar tended to give marginally higher (P=0.08) total milk production for the 40-day cutting interval. For DKA44-16RR subjected to the 40-day cutting interval, Priaxor resulted in the highest overall milk production (Table 4). For HarvXtra subjected to the 40-day cutting interval, highest milk production was achieved with Quadris fungicide followed by alfalfa treated with Priaxor fungicide.

Using hay pricing to calculate return on investment (ROI), Headline, Priaxor and Quadris fungicide used on either cultivar subjected to the 30-day cutting interval generally resulted in negative ROI (Table 5). Two exceptions were identified where Priaxor provided a slight positive ROI for DKA44-16RR subjected to the 40-day cutting interval, while Quadris provided a positive ROI for the HarvXtra cultivar subjected to the 40-day cutting interval.

Using milk pricing resulted in a larger number of positive ROI cases. For DKA44-16RR subjected to the 30-day cutting interval, both Priaxor and Quadris provided positive ROI estimates (Table 6). No positive ROI estimates were observed for HarvXtra subjected to the 30-day cutting interval. Using milk pricing to calculate ROI for the 40-day cutting interval resulted in positive ROI for both cultivars and all fungicides except for Headline applied to DKA44-16RR (Table 6).

Previous research where fungicide has been applied to alfalfa in Wisconsin has resulted in infrequent cases where fungicide resulted in a significant increase in yield or a positive return on investment, because subjecting alfalfa to timely cutting (e.g. 30-day cutting intervals) usually results in plants with low foliar disease, undetectable defoliation, and extremely high quality. Plants under this optimal production system typically don't respond to fungicide application, or respond infrequently.

Subjecting alfalfa stands to longer cutting intervals (e.g. 40-day cutting interval) results in more disease pressure, detectable defoliation, and an inherent reduction in overall quality. Applying fungicide to alfalfa stands subjected to these longer cutting intervals appears to result in a higher likelihood of positive ROI. Combining reduced-lignin alfalfa with fungicide application on alfalfa stands subjected to long cutting durations may further increase the likelihood and magnitude of positive ROI in Wisconsin.

Table 2. Fungicide treatments applied to both conventional and reduced-lignin alfalfa on an established stand in Wisconsin, 2016.

Fungicide Product (active ingredient)	**Rate per acre**
Aproach (picoxystrobin)[1,2]	6 fl oz
Aproach (picoxystrobin)[1,2]	12 fl oz
Fontelis (penthiopyrad)	1.5 pt
Aproach (picoxystrobin)[1] + Fontelis (penthiopyrad)	6 fl oz + 14 fl oz
Priaxor (pyraclostrobin + fluxapyroxad)[2]	4 fl oz
Headline (pyraclostrobin)[2]	6 fl oz
Quadris (azoxystrobin)[2]	6 fl oz

[1]Denotes an ‘experimental’ treatment, not yet labeled for use on alfalfa in Wisconsin in 2016

[2]Treatment included the adjuvant, Induce 90 SL, at 0.3% v/v.

Table 3. Season-long average disease severity, average defoliation, total dry-matter yield, RFQ, and total estimated milk production of conventional or reduced-lignin alfalfa treated with fungicide or not treated and harvested on a 30-day cutting interval in Wisconsin in 2016.

	DKA44-16RR					HarvXtra				
	Disease Severity (%)[a,f]	Defoliation (%)[b]	Total Yield (Tons/a)[c,f]	RFQ[d]	Total Milk Production (lbs/a)[e]	Disease Severity (%)[a,f]	Defoliation (%)[b]	Total Yield (Tons/a)[c,f]	RFQ[d]	Total Milk Production (lbs/a)[e]
Priaxor (4 fl oz)	2.7 c	0.2	2.9 a	212.8	9441.6	2.8 c	0.5	2.9 ab	227.8	9561.9
Fontelis (1.5 pt)	5.2 b	1.1	2.8 ab	208.8	9144.0	3.5 bc	0.4	2.9 a	224.6	9684.2
Quadris (6 fl oz)	5.7 ab	1.2	2.8 ab	209.5	9030.5	5.0 ac	0.4	2.7 bc	219.0	8890.0
Aproach (12 fl oz) + Fontelis (14 fl oz)	4.4 bc	1.0	2.8 ab	209.2	8958.5	4.5 ac	0.5	2.7 bc	222.3	8982.2
Aproach (12 fl oz)	5.8 a	1.1	2.8 ab	212.4	8923.0	4.5 ac	0.9	2.7 bc	229.8	9072.4
Headline (6 fl oz)	4.8 bc	0.6	2.8 ab	208.8	8872.6	4.9 ac	1.0	2.8 ac	221.3	9305.6
Non-treated	7.9 a	2.8	2.6 b	216.9	8710.8	6.7 a	0.9	2.8 ac	217.6	9419.3
Aproach (6 fl oz)	5.6 b	0.7	2.7 b	208.2	8526.4	5.7 ab	1.2	2.6 c	229.3	8930.6
Pr>F	<0.01	ns	0.04	ns	ns	<0.01	ns	0.04	ns	ns

[a]Average disease severity of crops 1-3.
[b]Average defoliation of crops 1-3.
[c]Total dry-matter yield for crops 1-3.
[d]Average RFQ of crops 1-3.
[e]Total milk production of crops 1-3 as estimated by the Milk 2006 model.
[f]Means with the same letter are not significantly different based on the test of least significant difference (LSD) at P=0.05.

Table 4. Season-long average disease severity, average defoliation, total dry-matter yield, RFQ, and total estimated milk production of conventional or reduced-lignin alfalfa treated with fungicide or not treated and harvested on a 40-day cutting interval in Wisconsin in 2016.

	DKA44-16RR					HarvXtra				
	Disease Severity (%)[a,f]	Defoliation (%)[b,f]	Total Yield (Tons/a)[c,f]	RFQ[d]	Total Milk Production (lbs/a)[e,f]	Disease Severity (%)[a]	Defoliation (%)[b,f]	Total Yield (Tons/a)[c,f]	RFQ[d]	Total Milk Production (lbs/a)[e,f]
Quadris (6 fl oz)	12.3 bc	12.9 bc	2.8 bc	137.3	7103.2 b	12.4	12.1 ab	3.0 a	164.0	8606.0 a
Priaxor (4 fl oz)	8.2 c	7.3 c	3.0 a	140.0	7836.7 a	9.7	10.2 b	3.0 a	158.9	8431.2 ab
Aproach (12 fl oz) + Fontelis (14 fl oz)	15.2 b	14.8 b	2.7 bc	137.3	6926.4 b	13.5	12.3 ab	2.9 ab	159.2	8142.8 abc
Aproach (12 fl oz)	11.8 bc	12.3 bc	2.7 bc	142.3	7072.0 b	10.8	12.5 ab	2.9 ab	160.7	8087.5 abc
Headline (6 fl oz)	14.3 b	12.9 bc	2.8 bc	137.4	7210.7 b	10.4	13.4 ab	2.8 b	157.2	7935.9 bcd
Fontelis (1.5 pt)	14.8 b	14.2 b	2.9 ab	138.6	7357.9 ab	12.4	12.7 ab	2.8 b	157.4	7759.3 cd
Aproach (6 fl oz)	13.6 b	12.5 bc	2.7 bc	138.7	6866.0 b	13.8	17.5 a	2.8 b	152.7	7744.1 cd
Non-treated	20.1 a	21.5 a	2.7 bc	137.7	6873.5 b	13.4	14.8 ab	2.8 b	150.8	7457.6 d
Pr>F	<0.01	<0.01	<0.01	ns	<0.01	ns	<0.01	<0.01	ns	<0.01

[a]Average disease severity of crops 1-3.
[b]Average defoliation of crops 1-3.
[c]Total dry-matter yield for crops 1-3.
[d]Average RFQ of crops 1-3.
[e]Total milk production of crops 1-3 as estimated by the Milk 2006 model.
[f]Means with the same letter are not significantly different based on the test of least significant difference (LSD) at P=0.05

Table 5. Hay return on investment when applying 3 applications of Headline, Priaxor, or Quadris Fungicide to conventional (DKA44-16RR) and reduced-lignin (HarvXtra) alfalfa in Wisconsin, 2016[a].

	DKA44-16RR				HarvXtra		
	Headline (6 fl oz)	Priaxor (4 fl oz)	Quadris (6 fl oz)		Headline (6 fl oz)	Priaxor (4 fl oz)	Quadris (6 fl oz)
30-day cutting Interval	($29.28)	($5.01)	($8.22)		($68.92)	($49.15)	($56.86)
40-day Cutting Interval	($37.65)	$4.62	($12.09)		($46.65)	($8.88)	$14.91

[a]ROI based on dry matter yield of prime grade hay and a June - August 2016 average price of $180 per ton. Headline, Priaxor, and Quadris season programs were calculated to be $60, $54, and $35, respectively. These estimates DO NOT incorporate a custom application fee.

Table 6. Milk return on investment when applying 3 applications of Headline, Priaxor, or Quadris Fungicide to conventional (DKA44-16RR) and reduced-lignin (HarvXtra) alfalfa in Wisconsin, 2016[a].

	DKA44-16RR				HarvXtra		
	Headline (6 fl oz)	Priaxor (4 fl oz)	Quadris (6 fl oz)		Headline (6 fl oz)	Priaxor (4 fl oz)	Quadris (6 fl oz)
30-day cutting Interval	($33.51)	$66.46	$18.06		($78.87)	($30.39)	($121.75)
40-day Cutting Interval	($4.62)	$104.72	$3.23		$18.60	$106.43	$154.50

[a]ROI based on milk per acre produced for each treatment and June – August 2016 average milk price of $16.47 cwt. Headline, Priaxor, and Quadris season programs were calculated to be $60, $54, and $35, respectively. These estimates DO NOT incorporate a custom application fee.

Evaluation of foliar fungicides for control of diseases of dent corn in Wisconsin, 2016

DENT CORN (*Zea mays* '197-31T2PRIB')
Northern corn leaf blight; *Setosphaeria turcica*
Anthracnose stalk rot; *Colletotrichum graminicola*

The trial was established at the Arlington Agricultural Research Station located in Arlington, WI. The corn hybrid '197-31T2PRIB' was chosen for this study. Corn was planted on 4 May 16 in a field consisting of a Plano silt loam soil (0 to 2% slopes) with a Joy silt loam intrusion (0 to 4% slopes). The experimental design was a randomized complete block with four replicates. Plots consisted of four 30-in spaced rows, 20 ft long and 10 ft wide with 7-ft alleys between plots. Standard corn production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of one non-treated control and 24 fungicide treatments. Pesticides were applied using a CO_2-pressurized backpack sprayer equipped with 8002XR TurboJet flat fan nozzles calibrated to deliver 20 GPA at 30 psi. Pesticides were applied at growth stages V6, V12, VT, and V6 or V12 followed by VT. Natural sources of pathogen inoculum were relied upon for disease. Plots were irrigated every other day with 0.5 in. of water, over-head, during the V12-R2 growth stage to encourage foliar disease. Northern corn leaf blight (NCLB) was rated on 18 Aug. Greening, lodging, ear rot severity, and stalk rot on 20 Sep. NCLB was visually assessed by inspecting ear leaves on 5 plants in each plot with the aid of standardized area diagrams. Stalk rot was assessed on five plants in each plot at R6 by cutting stalks with a knife and rating using the Illinois 0-5 scale where 0=no stalk rot and 5=severe stalk rot with lodging. Greening was rated by assessing percent green foliage at R6 growth stage. Ear rot severity was assessed by visually rating 5 ears per plot at the R6 growth stage. Lodging was assessed by visually estimating the percent plants per plot leaning greater than 45 degrees from vertical. Yield was determined by harvesting the center 2 rows of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic grain gauge. NCLB, greening, lodging, ear rot severity, and yield data were analyzed using a mixed model analysis of variance (α=0.05). Stalk rot data were analyzed using non-parametric analysis due to the ordinal nature of the ratings and reported as rank estimates.

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Wet conditions were observed late in the summer at this location. Dry weather during the middle of the summer kept NCLB levels low. There were no significant differences in NCLB severity, ear rot severity, stalk rot, greening, lodging and yield among all treatments. Phytotoxicity was not observed for any treatment.

Table 7. Northern corn leaf blight severity, ear rot severity, stalk rot damage, greening effect, lodging, and yield of dent corn treated with fungicide in Wisconsin, 2016.

Treatment and rate/A (crop growth stage at application)[z]	NCLB severity (%)[y]	Ear Rot Severity (%)[x]	Stalk rot Rank Estimate[w]	Greening effect (%)[v]	Lodging (% 45-degree angle)	Yield (bu/a)
Headline AMP 1.68SC 10 fl oz (VT)	1.3	0.6	43.0	15.0	0.3	237.9
Experimental 1 (VT)	1.4	0.8	52.4	15.0	0	232.3
Preemptor 3.22SC 5 fl oz (V6 + VT)	.03	1.2	34.9	13.1	0	232.1
Fortix 3.22SC 5 fl oz (VT)	2.3	0.2	41.0	10.6	0	229.6
Quilt Xcel 2.2SE 10.5 fl oz (V6)	0.1	1.2	61.0	10.6	0	228.8
TrivaPro A 0.83SC 4.1 fl oz (VT) TrivaPro B 2.2SE 10.5 fl oz (VT)	1.5	1.8	41.1	11.3	0	228.2
Non-Treated Control	1.2	1.8	74.4	4.4	0	228.1
Headline AMP 1.68SC 10.0 fl oz (V12)	1.1	0.7	63.6	3.1	0.3	225.7
Affiance 1.5SC 6.8 fl oz (VT)	3.0	4.0	59.0	6.9	0	225.0
TrivaPro A 0.83SC 4.1 fl oz (V6) TrivaPro B 2.2SE 10.5 fl oz (V6)	0.2	0.5	47.9	8.8	0	225.0
Preemptor 3.22SC 5 fl oz (VT)	1.2	0.2	56.6	6.3	0	223.0
Quilt Xcel 2.2SE 10.5 fl oz (V12)	1.0	1.1	39.4	9.0	0	221.0
Stratego YLD 500SC 2.0 fl oz (VT)[u]	1.1	3.1	52.6	6.3	0	220.0
Experimental 2 (VT)	1.3	5.5	34.3	6.9	0	218.1
Priaxor 4.17SC 5 fl oz (V6)	1.3	0.1	33.0	10.0	0	217.1
TrivaPro A 0.83SC 4.1 fl oz (V12) TrivaPro B 2.2SE 10.5 fl oz (V12)	0.3	0.9	64.9	8.1	0	215.1
Aproach Prima 2.34SC 6.8 fl oz (V12 + VT)	0.4	0.5	47.1	10.6	0	213.9
Helmstar Plus 3.0SC 10.8 fl oz (VT)	1.6	0.4	52.6	11.5	0	211.6
Preemptor 3.22SC 5 fl oz (V12)	0.4	0.1	40.3	11.9	0	211.5
Priaxor 4.17SC 5 fl oz (V12)	0.3	0.5	43.8	8.0	0	211.4
Headline AMP 1.68SC 10.0 fl oz (V6)	0.4	0.7	38.4	8.8	0	211.3
Quilt Xcel 2.2SE 10.5 fl oz (VT)	0.9	0.9	47.1	11.3	0.3	209.9
Priaxor 4.17SC 5 fl oz (VT)	1.2	0.3	41.5	9.4	0	208.8
Zolera FX 3.34 SC 5 fl oz (VT)	1.8	0.4	90.5	5.3	0	208.4
Custodia 2.67SC 12.9 fl oz (VT)	1.0	1.3	62.3	8.1	0	188.9
LSD (α=0.05)[t]	ns[u]	ns[u]	ns[u]	ns[u]	ns[u]	ns[u]

[z]Glyphosate herbicide applied to all plots at V6 growth stage

[y]Foliar disease ratings were assessed on 5 ear leaves in each plot with the aid of a standard area diagram; means for each plot were used in the analysis.

[x]Ear rot severity assessed visually on 5 ears per plot.

[w]Stalk rot was assessed on five plants in each plot using the Illinois 1-5 scale where 0=no stalk rot and 5=severe stalk rot with lodging; means for each plot were used in the analysis.

[v]Greening effect determined by rating the percentage green foliage still present in each plot at early black layer.

[u]Treatments including the non-ionic surfactant Induce 90SL at 0.25% v/v.

[t]LSD = Fisher's Least Significant Difference (LSD; α=0.05); ns = no least significant difference (α=0.05)

Evaluation of foliar fungicides for control of foliar diseases on soybean in Wisconsin, 2016

SOYBEAN (*Glycine max* 'AG2031')
Brown spot; *Septoria glycines*

The trial was established at the Arlington Agricultural Research Station located in Arlington, WI. The soybean cultivar 'AG2031' was chosen for this study. Soybeans were planted on 19 May 16 in a field with a Joy silt loam soil (0 to 2 % slopes). The experimental design was a randomized complete block with four replicates. Plots consisted of four 30-in. spaced rows, 20 ft long and 10 ft wide with 5-ft alleys between plots. Standard soybean production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control and 15 fungicide and/or insecticide treatments. Pesticides were applied using a CO_2-pressurized backpack sprayer equipped with 8002XR TurboJet flat fan nozzles calibrated to deliver 20 GPA at 30 psi. Pesticides were applied at growth stages R1 (6 Jul), R3 (19 Jul), or both R1 and R3. Natural sources of pathogen inoculum were relied upon for disease. Brown spot was evaluated at growth stage R6 by visually assessing average leaf disease severity using a standardized area diagram. Yield (corrected to 13% moisture) was determined by harvesting the center 2 rows of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic grain gauge. All disease and yield data were analyzed using a mixed model analysis of variance and means were separated using Fisher's least significant difference (α=0.05).

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Wet conditions were observed late in the summer at this location. Application of fungicide resulted in a significant decrease in brown spot severity in all treatments compared to not treating except Preemptor + Hero at R3, Aproach at R1, Quadris Top at R3, Aproach Prima at R3, and TrivaPro A+B at R1. Headline applied at R3 resulted in the lowest Septoria brown spot severity. Only the application of Priaxor at R3 resulted in similar Septoria brown spot severity. All other treatments resulted in significantly higher Septoria brown spot severity. No significant difference in yield was observed among treatments. No phytotoxicity was observed in this trial.

Table 8. Septoria brown spot severity and yield of soybeans treated with fungicide in Wisconsin, 2016.

Treatment rate/A (crop growth stage at application)	Septoria Brown Spot Severity (%)[y, x]	Yield (bu/a)
Non-treated Check	18.2 a	68.6
TrivaPro A 0.83SC 4.1 fl oz (R1)[z] TrivaPro B 2.2SE 10.5 fl oz (R1)	17.3 ab	66.6
Aproach 2.08SC 9.0 fl oz (R1)[z]	14.9 abc	69.5
Aproach Prima 2.34SC 6.8 fl oz (R3)[z]	12.5 a-d	67.4
Preemptor 3.22SC 5 fl oz (R3) Hero 1.24EC 5.0 fl oz (R3)	11.6 a-e	70.3
Quadris Top 2.72SC 8.0 fl oz (R3)[z]	11.6 a-e	69.0
Preemptor 3.22SC 5 fl oz (R3)	10.9 b-e	64.7
Topguard EQ 4.29SC 5.0 fl oz (R3)	10.1 cde	69.8
Zolera FX 3.34SC 5.0 fl oz (R3)	9.8 cde	62.2
Quadris 2.08F 6.0 fl oz (R3)[z]	8.6 de	68.5
Quilt Xcel 2.2SE 10.5 fl oz (R3)[z]	8.2 de	66.2
TrivaPro A 0.83SC 4.1 fl oz (R3)[z] TrivaPro B 2.2SE 10.5 fl oz (R3)	7.4 def	69.3
Stratego YLD 500SC 4.0 fl oz (R3)[z]	6.7 ef	71.9
Topguard EQ 4.29SC 5.0 fl oz (R3) Hero 1.24EC 5.0 fl oz (R3)	6.6 ef	66.6
Priaxor 4.17SC 4.0 fl oz (R3)[z]	3.8 fg	72.7
Headline 2.08SC 12 fl oz (R3)[z]	2.0 g	70.5
LSD (α=0.05)	1.35	ns[w]

[z]Induce 90% SL (Non-ionic surfactant) at 0.25% v/v was added to the pesticide treatment.
[y]Brown spot severity was visually assessed using a standard area diagram. Scale is from 0% to 100% coverage of leaves by brown spot lesions.
[x]Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD α=0.05).
[w]ns = no least significant difference (α=0.05).

Evaluation of foliar fungicide treatments for control of Sclerotinia stem rot of soybean in Hancock Wisconsin, 2016

SOYBEAN (*Glycine max* 'AG2031')
Sclerotinia stem rot; *Sclerotinia sclerotiorum*

The trial was established at the Hancock Agricultural Research Station located in Hancock, WI. The soybean cultivar 'AG2031' was chosen for this study. Soybeans were planted on 17 May 16 in a field with a Sparta loamy sand soil (0 to 2 % slopes). The field was overhead irrigated as needed to prevent wilt. The experimental design was a randomized complete block with four replicates. Plots consisted of four 30-in spaced rows, 20 ft long and 10 ft wide with 5-ft alleys between plots. Standard soybean production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control and 14 fungicide treatments. Pesticides were applied using a CO_2-pressurized backpack sprayer equipped with 8002XR TurboJet flat fan nozzles calibrated to deliver 20 GPA at 30 psi. Pesticides were applied at growth stages R1 (6 Jul), R3 (21 Jul), or both R1 and R3. Sclerotinia stem rot incidence and severity was rated at on16 Aug and 8 Sep. Sclerotinia stem rot severity index (DSI) was determined by rating 30 arbitrarily selected plants in each plot and scoring plants on a 0-3 scale: 0 = no infection; 1 = infection on branches; 2 = infection on main stem with little effect on pod fill; 3 = infection on main stem resulting in death or poor pod fill. The scores of the 30 plants were totaled for each class and divided by 0.9. Disease incidence was scored as percentage of symptomatic plants relative to the total stand. Natural sources of pathogen inoculum were relied upon for disease. Yield (corrected to 13% moisture) was determined by harvesting the center two rows of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic grain gauge. All disease and yield data were analyzed using a mixed model analysis of variance and means were separated using Fisher's least significant difference (α=0.05).

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Wet conditions were observed late in the summer at this location. Application of Vida + Domark at R3 resulted in a significant reduction in DSI compared to the non-treated check. All other treatments resulted in DSI levels comparable to the non-treated check. No significant differences in disease incidence and yield were identified among all treatments. Phytotoxicity was observed in plots where Cobra was applied and lasted for approximately two weeks after application. Phytotoxicity was milder in plots where Vida was applied and lasted for approximately two weeks after application.

Table 9. Sclerotinia stem rot DSI, incidence, and yield of soybeans treated with fungicide in Wisconsin, 2016.

Treatment and rate/A (crop growth stage at application)	Sclerotinia Stem Rot DSI (0-100) [z]	Disease Incidence (%) [y]	Yield (bu/a)
Domark 230ME 4.0 fl oz (R1) [x] Priaxor 4.17SC 4.0 fl oz (R1)[x]	44.7 a	7.4	77.8
Domark 230ME 4.0 fl oz (R1) Topsin-M 1.0WSB 0.75 lb (R1)	35.3 abc	7.1	74.9
Domark 230ME 5.0 fl oz (R1)	33.6 abc	6.2	78.4
Non-treated check	32.2 abc	6.9	74.9
Domark 230ME 5.0 fl oz (R3)	30.3 abc	6.9	77.1
Topsin-M 1.0WSB 0.75 lb (R3)	26.4 a-d	3.8	69.3
Domark 230ME 4.0 fl oz (R3) Topsin-M 1.0WSB 0.75 lb (R3)	21.4 cd	3.0	78.0
Aproach 2.08SC 9.0 fl oz (R1+R3)[x]	20.8 cd	3.7	82.5
Endura 70WDG 8.0 oz (R1)[x]	20.3 cd	3.9	79.2
Endura 70WDG 6.0 oz (R1)[x]	18.9 cd	3.6	77.2
Endura 70WDG 6.0 oz (R1)[x] Priaxor 4.17SC 4.0 fl oz (R1)[x]	17.2 cd	3.0	78.5
Endura 70WDG 6.0 oz (R1)[x] Priaxor 4.17SC 4.0 fl oz (R3)[x]	17.0 cd	3.5	81.9
Topsin-M 1.0WSB 0.75 lb (R1)	16.1 cd	2.6	76.2
Cobra 2EC 6.0 fl oz (R1)[x] Endura 70WDG 8.0 oz (R1)[x]	13.6 bcd	2.7	72.9
Vida 0.208EC 0.5 fl oz (R3) Domark 230ME 5.0 fl oz (R3)	7.8 d	1.4	72.1
LSD (α=0.05)	2.05	ns[v]	ns[v]

[z]Sclerotinia stem rot DSI was generated by rating 30 arbitrarily selected plants in each plot and scoring plants with on a 0-3 scale: 0 = no infection; 1 = infection on branches; 2 = infection on main stem with little effect on pod fill; 3 = infection on main stem resulting in death or poor pod fill. The scores of the 30 plants were totaled for each class and divided by 0.9

[y]Percentage of symptomatic plants relative to the total stand.

[x]Induce 90SL (Non-ionic surfactant) at 0.25% v/v was added to the fungicide treatment.

[v]ns = not significant (α=0.05)

Evaluation of herbicides for control of Sclerotinia stem rot of soybean in Hancock Wisconsin, 2016

SOYBEAN (*Glycine max* 'AG2031')
Sclerotinia stem rot; *Sclerotinia sclerotiorum*

The trial was established at the Hancock Agricultural Research Station located in Hancock, WI. The soybean cultivar 'AG2031' was chosen for this study. Soybeans were planted on 17 May 16 in a field with a Sparta loamy sand soil (0 to 2 % slopes). The field was overhead irrigated as needed to prevent wilt. The experimental design was a randomized complete block with four replicates. Plots consisted of four 30-in spaced rows, 20 ft long and 10 ft wide with 5-ft alleys between plots. Standard soybean production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control and 14 fungicide treatments. Pesticides were applied using a CO_2-pressurized backpack sprayer equipped with 8002XR TurboJet flat fan nozzles calibrated to deliver 20 GPA at 30 psi. Treatments were applied at growth stage R1 (6 Jul) and 10 days after R1 (15 Jul). Sclerotinia stem rot severity was rated at growth stage R6 (16 Aug). Sclerotinia stem rot severity index (DSI) was determined by rating 30 arbitrarily selected plants in each plot and scoring plants on a 0-3 scale: 0 = no infection; 1 = infection on branches; 2 = infection on main stem with little effect on pod fill; 3 = infection on main stem resulting in death or poor pod fill. The scores of the 30 plants were totaled for each class and divided by 0.9. Disease incidence was scored as percentage of symptomatic plants relative to the total stand. Natural sources of pathogen inoculum were relied upon for disease. Yield (corrected to 13% moisture) was determined by harvesting the center two rows of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic Grain gauge. All disease and yield data were analyzed using a mixed model analysis of variance and means were separated using Fisher's least significant difference (α=0.05).

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Wet conditions were observed late in the summer at this location. Application of Cobra at the R1 growth stage + Aproach 10 days after R1 resulted in significantly lower disease incidence compared to not treating. No other treatments resulted in differences in disease incidence compared to not-treating. No significant differences in disease severity index and yield were identified among treatments. Phytotoxicity was observed in plots where Cobra and Cadet were applied and lasted for approximately two weeks after application.

Table 10. Sclerotinia stem rot incidence, DSI, and yield of soybeans treated with fungicide or herbicide in Wisconsin, 2016.

Treatment and rate/A (crop growth stage at application)	Disease incidence (%)[z,y]	Sclerotinia Stem Rot DSI (0-100)[x,y]	Yield (bu/a)
Cadet 0.91EC 0.45 fl oz (R1)	17.9 a	52.9	71.5
Cobra 2.0EC 6.0 fl oz (R1)	15.0 a	42.0	68.7
Aproach 2.08SC 9.0 fl oz (R1)[w]	12.2 a	35.0	71.9
Non-treated Control	11.1 a	28.2	69.2
Cobra 2.0EC 3.0 fl oz (R1)	10.7 a	39.0	72.4
Cadet 0.91EC 0.9 fl oz (R1)	10.0 a	39.3	73.5
Aproach 2.08SC 9.0 fl oz (R1)[w] Cobra 2.0EC 3.0 fl oz (R1)[w]	9.8 a	26.9	70.2
Cobra 2EC 3.0 fl oz (R1) Aproach 2.08SC 9.0 fl oz (10 days post R1)	4.8 b	17.0	76.4
P-value	0.05	0.1	0.1

[z]Percentage of symptomatic plants relative to the total stand.
[y]Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05).
[x]Sclerotinia stem rot DSI was generated by rating 30 arbitrarily selected plants in each plot and scoring plants with on a 0-3 scale: 0 = no infection; 1 = infection on branches; 2 = infection on main stem with little effect on pod fill; 3 = infection on main stem resulting in death or poor pod fill. The scores of the 30 plants were totaled for each class and divided by 0.9.
[w]Induce 90SL (Non-ionic surfactant) at 0.25% v/v was added to the fungicide treatment.

Evaluation of fungicide application timing for control of Sclerotinia stem rot of soybean in Hancock Wisconsin, 2016

SOYBEAN (*Glycine max* 'AG2031')
Sclerotinia stem rot; *Sclerotinia sclerotiorum*

The trial was established at the Hancock Agricultural Research Station located in Hancock, WI. The soybean cultivar 'AG2031' was chosen for this study. Soybeans were planted on 17 May 16 in a field with a Sparta loamy sand soil (0 to 2 % slopes). The field was overhead irrigated as needed to prevent wilt. The experimental design was a randomized complete block with four replicates. Plots consisted of four 30-in spaced rows, 20 ft long and 10 ft wide with 5-ft alleys between plots. Standard soybean production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control and 15 fungicide treatments. Pesticides were applied using a CO_2-pressurized backpack sprayer equipped with 8002XR TurboJet flat fan nozzles calibrated to deliver 20 GPA at 30 psi. Treatments were applied at growth stage V5 (28 Jun), R1 (7 Jul), R3 (21 Jul), R4 (4 Aug), and R5 (9 Aug). Sclerotinia stem rot severity was rated at growth stage R6 (16 Aug). Sclerotinia stem rot severity index (DSI) was determined by rating 30 arbitrarily selected plants in each plot and scoring plants on a 0-3 scale: 0 = no infection; 1 = infection on branches; 2 = infection on main stem with little effect on pod fill; 3 = infection on main stem resulting in death or poor pod fill. The scores of the 30 plants were totaled for each class and divided by 0.9. Disease incidence was scored as percentage of symptomatic plants relative to the total stand. Natural sources of pathogen inoculum were relied upon for disease. Yield (corrected to 13% moisture) was determined by harvesting the center two rows of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic Grain gauge. All disease and yield data were analyzed using a mixed model analysis of variance and means were separated using Fisher's least significant difference (α=0.05).

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Wet conditions were observed late in the summer at this location. Heavy disease was present in this trial. Application of Aproach at R1 + R3 and single applications of Endura at either R1 or R3 resulted in the lowest disease incidence and DSI in the trial and were significantly lower than the non-treated control. Aproach applied at R1 + R3 had the highest yield among all treatments. Endura applied at either R1 or R3, Aproach at R3, and Proline at R4 resulted in similar yield to Aproach applied at R1 + R3. Application of fungicide at V5, R4, or R5 resulted in yields similar to the non-treated control and significantly lower than the best treatments in the trial. No phytotoxicity was observed in this trial.

Table 11. Sclerotinia stem rot incidence, DSI, and yield of soybeans treated with fungicide at various growth stages in Wisconsin, 2016.

Treatment and rate/A (crop growth stage at application)[z]	Disease incidence (%)[y,w]	Sclerotinia Stem Rot DSI (0-100)[x,w]	Yield (bu/a)[w]
Aproach 2.08SC 9.0 fl oz (R1+R3) [Standard Check]	10.2 de	30.8 f	77.0 a
Endura 70WDG 8.0 oz (R3)	6.8 e	20.2 g	75.3 ab
Aproach 2.08SC 9.0 fl oz (R3)	15.0 b-d	45.2 de	72.5 abc
Endura 70WDG 8.0 oz (R1) [Standard Check]	14.3 cd	37.1 ef	68.6 bcd
Proline 480SC 5.0 fl oz (R4)	21.0 abc	66.1 abc	68.5 bcd
Proline 480SC 5.0 fl oz (R3)	15.9 bcd	47.5 cde	66.4 cde
Aproach 2.08SC 9.0 fl oz (R5)	20.0 ac	49.1 be	66.0 c-f
Aproach 2.08SC 9.0 fl oz (R4)	25.3 ab	67.1 ab	62.9 d-g
Endura 70WDG 6.0 oz (V5)	22.5 abc	51.9 be	61.7 e-g
Aproach 2.08SC 9.0 fl oz (V5)	24.2 abc	54.5 bcd	61.6 e-g
Non-Treated Control	25.6 ab	62.5 a-d	61.0 e-g
Endura 70WDG 8.0 oz (R4)	32.1 a	77.0 a	60.8 e-g
Endura 70WDG 8.0 oz (R5)	30.1 a	64.5 abc	60.3 e-g
Proline 480SC 5.0 fl oz (R1)	25.2 ab	66.3 abc	59.7 fg
Proline 480SC 5.0 fl oz (R5)	25.3 ab	56.9 a-d	59.0 g
Aproach 2.08SC 9.0 fl oz (R1)	33.0 a	68.2 ab	57.2 g
P-value	<0.01	<0.01	<0.01

[z] Induce 90SL (Non-ionic surfactant) at 0.25% v/v was added to all fungicide treatments except the non-treated control
[y]Percentage of symptomatic plants relative to the total stand.
[x]Sclerotinia stem rot DSI was generated by rating 30 arbitrarily selected plants in each plot and scoring plants with on a 0-3 scale: 0 = no infection; 1 = infection on branches; 2 = infection on main stem with little effect on pod fill; 3 = infection on main stem resulting in death or poor pod fill. The scores of the 30 plants were totaled for each class and divided by 0.9.
[w]Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05).

Evaluation of foliar fungicides for control of foliar diseases of sweet corn in Wisconsin, 2016

SWEET CORN (*Zea mays* 'Serendipity')
Northern corn leaf blight; *Setosphaeria turcica*
Common rust; *Puccinia sorghi*

The trial was established at the Arlington Agricultural Research Station located in Arlington, WI. The sweet corn variety 'Serendipity' was chosen for this study. Sweet corn was planted on 21 Jun 16 in a field with a Plano silt loam soil (0 to 2 percent slopes). The experimental design was a randomized complete block with four replicates. Plots consisted of six 30-in. spaced rows, 50 ft long and 15 ft wide with 6-ft alleys between plots. Standard sweet corn production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control and 14 fungicide treatments. Pesticides were applied using a CO_2-pressurized backpack sprayer equipped with 8002XR TurboJet flat fan nozzles calibrated to deliver 20 GPA at 30 psi. Fungicides were applied at the V9-10 (29 Jul) and VT-R1 (11 Aug) growth stages. Common rust severity (0-100%) was rated on five ear leaves in each plot on 10 Aug, 22 Aug, and 2 Sep using a standard area diagram. Data were converted to area under the disease progress curve (AUDPC). Northern corn leaf blight severity (0-100%) was rated on five ear leaves in each plot and averaged at harvest (2 Sep) using a standard area diagram. Marketable ears were harvested by hand from one center row of each plot. AUDPC data were log-normal transformed for normality. All disease and yield data were analyzed using a mixed model analysis of variance and means were separated using Fisher's least significant difference (α=0.05).

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Wet conditions were observed late in the summer at this location. Rust persisted throughout the season while NCLB developed late in the season. Applications of Aproach at VT-R1, Aproach at V9-V10 + VT-R1, Headline AMP at VT-R1, Aproach at V9-V10, Priaxor at VT-R1, and Headline AMP at V9-10 were not significantly different in rust severity than the non-treated check. All other treatments had significantly less rust severity than the non-treated control. Quilt Xcel applied at V9-10 + VT-R1 had the lowest rust severity. All fungicide treatments resulted in significantly lower NCLB severity compared to not treating, except the application of Quilt Xcel at V9-10. All treatments lead to significantly higher yields than the non-treated control except the application of Aproach at VT-R1. Phytotoxicity was not observed in any plot.

Table 12. Common rust severity, northern corn leaf blight severity, and yield of sweet corn treated with fungicide in Wisconsin, 2016.

Treatment and rate/A (crop growth stage at application)	Common rust severity (AUDPC)$^{z, y}$	NCLB severity (%)$^{z, y}$	Yield (tons/A)^{y}
Non-treated Check	5.3 a	11.4 a	5.7 c
Aproach 2.08SC 12.0 fl oz (VT-R1)	5.0 abc	4.7 cd	5.7 c
Aproach 2.08SC 12.0 fl oz (V9-V10) Aproach 2.08SC 12.0 fl oz (VT-R1)	5.0 abc	6.6 bc	6.7 bc
Headline AMP 1.68SC 10.0 fl oz (VT-R1)	5.1 ab	4.0 d	6.9 bc
Quilt Xcel 2.2SE 11.0 fl oz (VT-R1)	4.9 bc	5.5 bcd	7.5 ab
Aproach 2.08SC 12.0 fl oz (V9-V10)	5.0 abc	5.2 bcd	7.6 ab
Priaxor 4.17SC 4.0 fl oz (VT-R1)	5.0 abc	6.9 bc	7.7 ab
Priaxor 4.17SC 4.0 fl oz (V9-10)	4.9 bc	5.3 bcd	8.0 ab
Stratego YLD 500SC 4.0 fl oz (V9-10) Prosaro 421SC 6.5 fl oz (VT-R1)	4.8 cde	5.5 bcd	8.5 a
Headline AMP 1.68SC 10.0 fl oz (V9-10)	5.0 abc	6.0 bcd	8.6 a
Quilt Xcel 2.2SE 14.0 fl oz (V9-10) Tilt 3.6EC 4.0 fl oz (VT-R1)	4.6 de	4.7 cd	8.7 a
Headline AMP 1.68SC 10.0 fl oz (V9-10) Headline AMP 1.68SC 10.0 fl oz (VT-R1)	4.8 bcd	6.9 bc	8.7 a
Quilt Xcel 2.2SE 11.0 fl oz (V9-10) Quilt Xcel 2.2SE 11.0 fl oz (VT-R1)	4.5 e	6.7 bc	8.9 a
Quilt Xcel 2.2SE 11.0 fl oz (V9-10)	4.8 cde	8.0 ab	8.9 a
Priaxor 4.17SC 4.0 fl oz (V9-V10) Priaxor 4.17SC 4.0 fl oz (VT-R1)	4.9 bc	5.9 bcd	8.9 a
LSD (*P*=0.05)	2.3	2.4	4.4

^{z}Common rust (0-100%) was rated on five ear leaves in each plot on 10 Aug, 22 Aug, and 2 Sep using a standard area diagram; Data were converted to area under the disease progress curve (AUDPC) and log-normal transformed for analysis.
^{y}Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05)

Evaluation of foliar fungicides for control of leaf rust of wheat in Wisconsin, 2016

WHEAT, SOFT WINTER (*Triticum aestivum* 'Hopewell')
Leaf rust; *Puccinia triticina*

The trial was established at the Arlington Agricultural Research Station located in Arlington, WI. The soft red winter wheat cultivar 'Hopewell' was chosen for this study. Wheat was planted on 24 Sep 15 in a field with a Joy silt loam soil (0 to 4% slopes). The experimental design was a randomized complete block with four replicates. Plots were 21 ft long and 7.5 ft wide with 4-ft alleys between plots. Standard wheat production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control and 18 fungicide treatments. All fungicide treatments contained the non-ionic surfactant Induce 90SL at 0.125% v/v. Fungicides were applied using a CO_2 pressurized backpack sprayer equipped with TTJ60-11002 Turbo TwinJet flat fan nozzles calibrated to deliver 20 GPA at 21 psi. Fungicides were applied either just before jointing (Feekes 5), at emerging flag leaf (Feekes 8), at anthesis (Feekes 10.5.1), applied 5-days post anthesis (7 Jun), or using a two-spray program with the first occurring just prior to jointing (6 May) or at emerging flag leaf (23 May) and the second spray being applied at anthesis (3 Jun). Natural sources of pathogen inoculum were relied upon for disease and plots were also inoculated at a 100 lbs/A rate of *Fusarium graminearum*-colonized corn grain. Leaf rust was evaluated by visually estimating average incidence (% plants with symptoms) and severity (% leaf with symptoms) per plot. Yield (corrected to 13.5% moisture) was determined by harvesting the center 5 feet of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic Grain gauge. All disease and yield data were analyzed using a mixed model analysis of variance and means were separated using Fisher's least significant difference (α=0.05).

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Weather was very dry preceding and during anthesis. Fungicide applications were applied to target Fusarium head blight but low levels of disease developed due to the dry conditions around flowering. Leaf rust developed late in the season. Caramba applied 5 days after Feekes 10.5.1 resulted in the lowest leaf rust incidence and severity. Other comparable treatments included Caramba applied at Feekes 10.5.1, Prosaro applied 5 days after anthesis, and Avaris applied at Feekes 5 + Viathon at Feekes 10.5.1. Due to late onset of disease there were no significant differences in yield among all treatments. DON Content of finished grain ranged from 0 – 1ppm. No significant difference in DON content were identified among all treatments. Phytotoxicity was not observed with any treatment.

Table 13. Leaf rust incidence, severity, yield, and test weight of winter wheat treated with fungicide in Wisconsin, 2016.

Treatment and rate/A (crop growth stage at application)[z]	Leaf Rust Incidence (%)[y,w]	Leaf Rust Severity (%)[x,w]	Yield (bu/a)	Test Weight (lbs/bu) [w]
Stratego YLD 500SC 5.0 fl oz (Feekes 8)	100.0 a	29.9 b	107.3	59.0 bc
Non-treated control	98.8 ab	73.9 a	99.8	58.3 c
Prosaro 421SC 6.5 fl oz (Feekes 8)	97.5 ab	24.1 bcd	108.9	59.3 b
Experimental 1	90.0 abc	19.9 b-e	106.4	60.3 a
Quilt Xcel 2.2SE 10.5 fl oz (Feekes 8)	90.0 abc	27.5 bc	105.3	59.2 b
Quilt Xcel 2.2SE 8 fl oz (Feekes 8) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	83.8 a-d	21.7 b-e	113.2	59.4 b
Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	83.8 a-d	12.2 c-g	109.9	59.1 b
Experimental 2	77.5 a-d	15.6 b-f	101.3	60.3 a
Absolute 500SC 5.0 fl oz (Feekes 8)	73.8 a-e	24.2 b-d	112.4	59.2 b
Stratego YLD 500SC 2.0 fl oz (Feekes 5) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	73.8 a-e	13.7 b-g	108.0	59.3 b
Viathon 4.08SC 2.0 pt (Feekes 10.5.1)	62.5 b-e	12.3 c-g	107.4	59.1 b
Stratego YLD 500SC 5.0 fl oz (Feekes 8) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	53.8 c-f	9.1 e-h	113.7	59.6 b
TrivaPro A 0.83SC 4.1 fl oz (Feekes 8) TrivaPro B 2.2SE 10.5 (Feekes 8)	52.5 def	10.7 d-h	109.1	58.9 bc
Priaxor 4.17SC 2.0 fl oz (Feekes 5) Caramba 90EC 13.5 fl oz (Feekes 10.5.1)	51.3 def	18.2 b-e	100.2	58.bc
Avaris 2XS 2.2SE 10.5 fl oz (Feekes 5) Viathon 4.08SC 2.0 pt (Feekes 10.5.1)	47.5 d-g	10.5 d-h	108.6	58.9 bc
Prosaro 421SC 6.5 fl oz (5-d post Feekes 10.5.1)	40.3 e-g	7.1 f-h	105.3	59.3 b
Caramba 90EC 13.5 fl oz (Feekes 10.5.1)	17.5 f-g	6.0 gh	108.2	58.9 bc
Caramba 90EC 13.5 fl oz (5-d post Feekes 10.5.1)	13.6 g	4.2 h	108.3	59.3 b
Viathon 4.08SC 2.0 pt (Feekes 10.5.1) Tilt 3.6EC 4.0 fl oz (Feekes 10.5.1)	-	-	106.9	59.6 b
LSD (α=0.01)	4.24	4.52	ns[v]	3.5

[z]Induce 90 SL (Non-ionic surfactant) at 0.125% v/v was added to all fungicide treatments.
[y]Leaf rust incidence was visually assessed as the % plants symptomatic per plot.
[x]Leaf rust severity was visually assessed as the average % flag leaf symptomatic per plot
[w]Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05).
[v]ns = no least significant difference (α=0.05)

Evaluation of a biocontrol agent for management of winter wheat diseases in Wisconsin, 2016

WHEAT, SOFT WINTER
(*Triticum aestivum* 'Hopewell, Kaskaskia, Turkey Red, Pro Seed 380)
Fusarium head blight; *Fusarium graminearum*
Septoria tritici blotch; *Septoria tritici*

The trial was established at the Arlington Agricultural Research Station located in Arlington, WI. Soft red winter wheat cultivars 'Hopewell (susceptible)' 'Kaskaskia (moderately resistant)' 'Pro Seed 380 (resistant)' and 'Turkey Red (unknown)' were chosen for this study based on reported resistance to *Fusarium* head scab. Wheat was planted on 24 Sep 15 in a field with a Joy silt loam soil (0 to 4% slopes). The experimental design was a randomized complete block with four replicates. Plots were 21 ft long and 7.5 ft wide with 4-ft alleys between plots. Standard wheat production practices as described by the University of Wisconsin Cooperative Extension Service were followed. Treatments consisted of a non-treated control, DonGuard (organic compound), and Prosaro (commercial fungicide) applied to each of the four cultivars. Fungicides were applied using a CO_2 pressurized backpack sprayer equipped with TTJ60-11002 Turbo TwinJet flat fan nozzles calibrated to deliver 20 GPA at 21 psi. Fungicides were applied at anthesis (Feekes 10.5.1) for control of head scab. Natural sources of pathogen inoculum were relied upon for disease and plots were also inoculated at a 100 lbs/A rate of *Fusarium graminearum*-colonized corn grain. Fusarium head blight disease index was calculated by visually estimating average incidence (% plants with symptoms) and severity (% leaf with symptoms) per plot multiplying values together and dividing by 100. Level of deoxynivalenol (DON) was also evaluated in grain harvested from each treatment. Septoria tritici blotch was evaluated by visually estimating average severity (% leaf with symptoms) per plot. Yield (corrected to 13.5% moisture) was determined by harvesting the center 5 feet of each plot using an Almaco SPC40 small-plot combine equipped with a HarvestMaster HM800 Classic Grain gauge. All disease and yield data were analyzed using a mixed model analysis of variance and means were separated using Fisher's least significant difference.

Spring and early summer 2016 was average with seasonal temperatures and adequate precipitation. Low levels of head scab were observed in this trial due to very dry weather preceding and during anthesis, while Septoria persisted throughout the season. The cultivar Kaskaskia had significantly higher Septoria severity levels compared to the other cultivars, which were not different from each other. The cultivar Pro Seed 380 had lowest FDI followed by Hopewell. Turkey Red and Pro Seed 380 had the highest test weights, followed by Kaskaskia then Hopewell. Hopewell had the highest yield, but was not different from Kaskaskia. Pro Seed 380 yielded comparable to Kaskaskia, while Turkey Red yielded significantly less than all other cultivars. DON content of finished grain was not different for any fungicide treatment for the cultivars Pro Seed 380 and Turkey Red. Don Content of finished grain for Hopewell and Kaskaskia was below 1ppm. However, DON content was significantly higher in plots treated with DonGuard than not treated for Hopewell, while the DonGuard application resulted in DON content similar to the non-treated control. Phytotoxicity was not observed with any treatment.

Table 14. Septoria leaf spot severity, Fusarium head blight index, test weight, and yield of four wheat cultivars planted to a field infested with *Fusarium graminearum* and treated with Prosaro fungicide, DonGuard biocontrol agent, or not treated.[z]

Variety	Septoria Severity (%)[y,w]	FDI[x,w]	Test Weight[w]	Yield (bu/a)[w]
Hopewell	11.2 b	1.0 ab	58.2 c	95.0 a
Kaskaskia	20.0 a	1.7 a	60.6 b	90.3 ab
Pro Seed 380	10.8 b	0.2 b	61.2 a	86.6 b
Turkey Red	8.3 b	1.9 a	61.5 a	55.0 c
LSD	3.5	1.12	0.57	7.29

[z]Fungicide treatment was not significant for any dependent variable measured in the table. Thus, means are analyzed for each variety [y]Septoria tritici blotch severity was visually assessed as the average % flag leaf symptomatic per plot
[x]Fusarium head blight disease index was calculated by visually estimating average incidence (% plants with symptoms) and severity (% leaf with symptoms) per plot multiplying values together and dividing by 100
[w]Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05).

Table 15. Deoxynivalenol (DON) concentration (ppm) in grain harvested from plots planted to four wheat cultivars in a field infested with *Fusarium graminearum* and treated with Prosaro fungicide, DonGuard biocontrol agent, or not treated.

	Variety			
Treatment rate/A (crop growth stage at application)	Hopewell[z]	Kaskaskia[z]	Pro Seed 380[z]	Turkey Red[z]
DonGuard 125 g (Feekes 10.5.1)	0.3 a	0.2 a	0.1	0.1
None (Feekes 10.5.1)	0.1 b	0.1 ab	0.0	0.1
Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	0.1 b	0.1 b	0.0	0.1
LSD	0.10	0.10	ns[y]	ns[y]

[z]Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.10).
[y]ns=Not significant at α=0.10.