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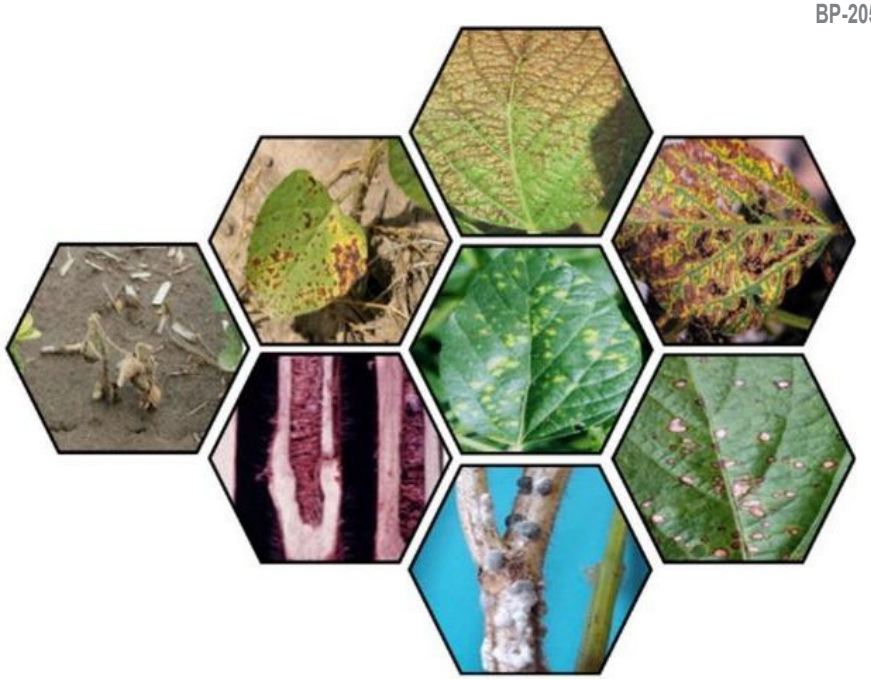

Applied Research in Field Crop Pathology for Indiana- 2019

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ACKNOWLEGEMENTS

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TABLE OF CONTENTS

SUMMARY OF 2019 FIELD CROP DISEASE SEASON

CORN

In 2018, most diseases on corn in Indiana remained relatively low across the state, with a few exceptions, as listed below. Gray leaf spot, northern corn leaf blight, northern corn leaf spot and diplodia leaf streak could be found in pockets. There were also numerous reports of Physoderma brown spot and node rot, and an increase of many different ear rots caused by insect feeding. Tar spot and southern rust were two diseases that were closely tracked this season.

Tar spot:

Tar spot of corn was a concern in 2019 following the localized epidemics experienced in 2018. In 2019, Indiana continued to have localized epidemics, but they were not as widespread as in 2019. The weather is going to be key in determining field risk year to year as **leaf wetness** plays an important role in tar spot disease development. The first year of tar spot-directed research has been completed here in Indiana. As a cautionary note, it is important to have multiple years of data for verification, but the initial results do serve as a good starting point for making future management decisions.

The field crop pathology team made a large effort at the end of the seaon to scout for tar spot across the state. Twenty-five new counties were confirmed with tar spot in 2019, making **65 counties total in Indiana**. Out of the 148 fields scouted, 132 were positive for tar spot (89.2%). In addition, incidence and severity were rated (examples of severity in fig. 1) and used to generate a tar spot index shown in the map in Figure 1 below – the darker orange the county, the greater tar spot index observed in 2019. The map demonstrates how corn produced in northern Indiana is at a higher risk for tar spot versus central and southern Indiana. The map also parallels the ideal weather conditions for tar spot, and reports during 2018 and 2019. It is important to document tar spot movement in the state, should favorable conditions arise increasing the tar spot disase risk across the remainder of the state.

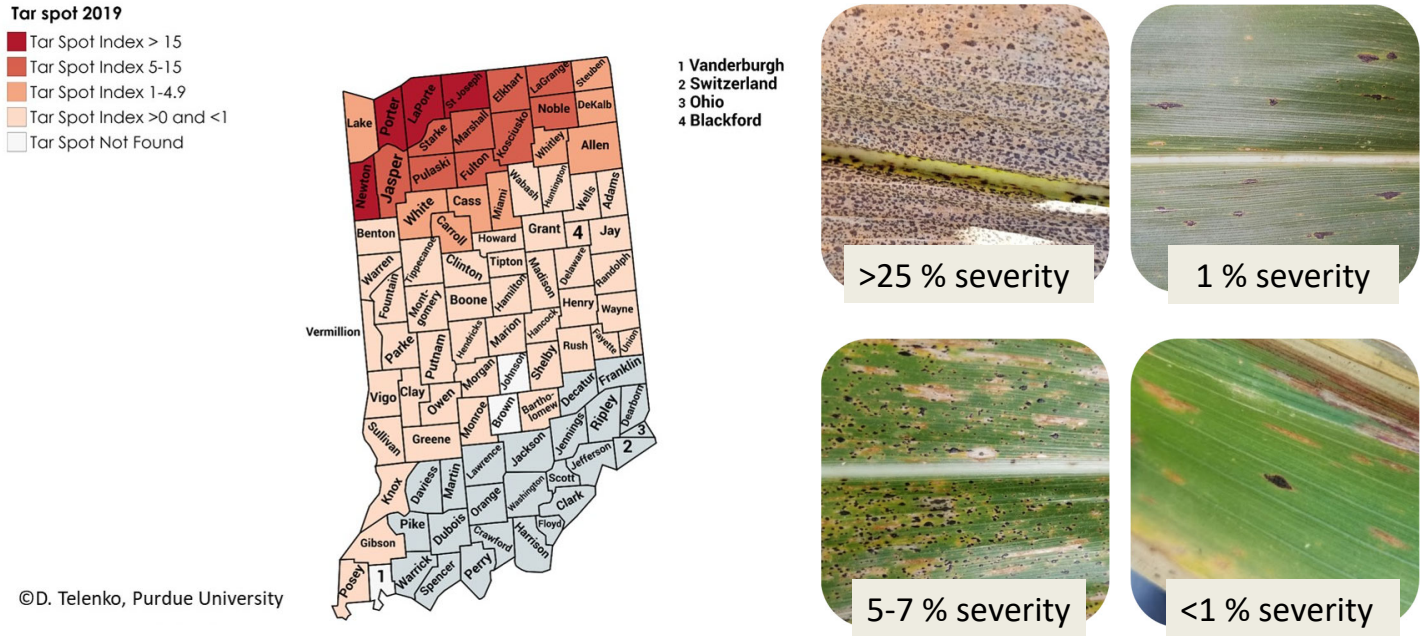

Figure 1. 2019 tar spot Index for Indiana. The darker orange the county, the greater the field incidence and severity of tar spot in the fields in which it was found. The range of tar spot severity on leaves ->25%, 5-7%, 1% and <1%. Photo credit: D. Telenko.

Southern corn rust: Southern corn rust was first confirmed in Indiana on July 25, 2019, and by the end of the season, the disease was found in 32 counties (Fig 2). Southern rust pustules usually occur on the upper leaf surface and produce chlorotic symptoms on the underside of the leaf (Fig. 2). These circular to oval pustules rupture the leaf surface and are orange to tan. Common rust was also widespread and both diseases could be present on a leaf and easily mistaken for each other. It is important to send a sample to the Purdue Plant Pest Diagnostic Lab for confirmation if southern rust is suscpected. There is an increased risk for yield impact if southern rust is identified early in the season.

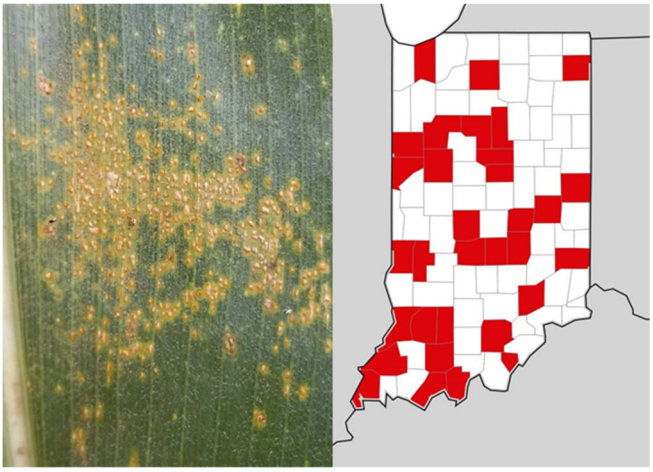

Figure 2. Southern corn rust pustules and map of confirmed (red) counties that had southern corn rust in Indiana in 2019. Photos credit: D. Telenko, Map source: https://corn.ipmpipe.org/southerncornrust/

Due to the need to monitor both southern rust and tar spot in Indiana, there will be **no charge for southern rust and tar spot samples submitted to the PPDL for diagnostic confirmation again in 2020**. This service is made possible through research supported by the Indiana Corn Marketing Council.

SOYBEAN

Fortunately, diseases in soybeans remained relatively low throughout the season for much of the state. Our research sites and sentinel plots across Indiana had low levels of frogeye leaf spot, Cercospora blight, downy mildew, and Septoria brown spot. There were a few patches of sudden death syndrome and white mold as well. It was a quiet year for soybean diseases.

WHEAT

Fusarium head blight (FHB) or scab is one of the most impactful diseases of wheat and most challenging to manage. In addition, FHB infection can cause the production of a mycotoxin called deoxynivalenol (DON or vomitoxin). The conditions in 2019 were extremely conducive to FHB development and we received numerous reports about issues with FHB and DON contamination in Indiana. Our research sites in both West Lafayette and Vincennes had high levels of FHB develop in our non-treated susceptible variety checks and initial DON testing was at 7 ppm. Fusarium head blight management requires an integrated approach. This includes selection of varieties with moderate resistance and timely fungicide application at flowering. Other diseases observed in our wheat trials in 2019 included barley yellow dwarf virus (BYDV), leaf rust, Septoria leaf and glume blotch, and stripe rust.

CORN (*Zea mays* 'P9998AM')
Gray leaf spot*; Cercospora zeae-maydis*
Northern corn leaf blight*; Exserohilum turcicum*
Common rust*; Puccinia sorghi*
Tar spot; *Phyllachora maydis*

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Comparison of fungicides applied at VT/R1 or R3 for foliar disease in corn in central Indiana, 2019 (COR19-01.ACRE).

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was bulk planted in the field at 30-inch row spacing at a rate of 34,000 seeds/A on 4 Jun using a GPS guided John Deere 1700 six row planter. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 4 Aug at VT/R1 (tassel/silk) and on 23 Aug at R3 (milk) growth stages. Disease ratings were assessed on 28 Aug and 23 Sep at the R4 (dough) and R5 (dent) growth stages respectively. Disease rated by visually assessing as percentage (0-100%) severity of disease on ear leaf, five plants per plot were rated and averaged. The two center rows of each plot were harvested on 16 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, gray leaf spot (GLS) and common rust (CR) were the most prominent diseases in the trial. All fungicide treatments significantly reduced gray leaf spot severity on the ear leaf compared to the nontreated control on 23 Sep at both the VT/R1 and R3 application timings (Table 1). Northern corn leaf blight and tar spot were also found in the trial but at low levels, there was no significant fungicide or timing effect on either disease (Table 1). All fungicide treatments and timings also significantly reduced severity of common rust over the nontreated control at ear leaf on 23 Sep (Table 2). There was no significant differences between treatments for percentage of stay green, lodging, ear rot, harvest moisture, test weight and yield (Table 2).

Table 1. Effect of fungicide on foliar diseases severity.

Treatment[z]	Rate/A	Timing	GLS % severity[y] EL 28-Aug	GLS % severity[y] EL 23-Sep	NCLB % severity[y] EL 23-Sep	CR % severity[y] EL 23-Sep	Tar spot % severity[x] EL 23-Sep
Nontreated control			0.60	3.8 a	0.10	0.61 a	0.01
Lucento 4.17 SC	5.0 fl oz	VT/R1	0.00	1.0 b-f	0.20	0.10 bc	0.00
Trivapro 2.21 SE	13.7 fl oz	VT/R1	0.00	0.9 f	0.00	0.16 bc	0.00
Miravis Neo 2.5 SE	13.7 fl oz	VT/R1	0.00	0.6 ef	0.00	0.06 bc	0.00
Veltyma 3.34 S	7.0 fl oz	VT/R1	0.00	0.3 f	0.00	0.10 bc	0.00
Delaro 325 SC	8.0 fl oz	VT/R1	0.00	1.5 b-e	0.00	0.10 bc	0.00
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	0.00	0.7 def	0.00	0.30 b	0.00
Headline AMP 1.68 SC	10.0 fl oz	VT/R1	0.00	1.5 b-e	0.10	0.21 bc	0.00
Revytek 3.33 LC	8.0 fl oz	VT/R1	0.00	0.2 f	0.00	0.12 bc	0.00
Lucento 4.17 SC	5.0 fl oz	R3	0.00	1.8 bc	0.10	0.00 c	0.00
Trivapro 2.21 SE	13.7 fl oz	R3	0.00	1.7 bcd	0.10	0.15 bc	0.00
Miravis Neo 2.5 SE	13.7 fl oz	R3	0.00	2.0 b	0.00	0.10 bc	0.00
Veltyma 3.34 S	7.0 fl oz	R3	0.00	0.9 c-f	0.00	0.20 bc	0.00
Delaro 325 SC	8.0 fl oz	R3	0.00	2.0 b	0.00	0.10 bc	0.00
Quilt Xcel 2.2 SE	10.5 fl oz	R3	0.00	1.6 b-e	0.10	0.11 bc	0.00
Headline AMP 1.68 SC	10.0 fl oz	R3	0.00	1.9 bc	0.10	0.31 b	0.00
Revytek 3.33 LC	8.0 fl oz	R3	0.00	1.1 b-f	0.00	0.10 bc	0.00
p-value			0.4727	0.0001	0.7916	0.0090	0.4727
LSD (0.05)[w]			NS[v]	1.02	NS	0.25	NS

[z] Fungicide treatments applied on 4 Aug at the VT/R1 (tassel/silk) and 23 Aug at the R3 (milk) growth stages, and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf (EL) on 28 Aug and 23 Sep. Five plants assessed per plot and averaged before analysis. GLS = gray leaf spot; NCLB = northern corn leaf blight; CR = common rust.

[x] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL).

[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[v] NS = not significant (α=0.05).

Table 2. Effect of fungicide on stay green, lodging, ear rot, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	Stay green[y] % 23-Sep	Lodging[x] % 23-Sep	Ear rot[w] % 8-Nov	Harvest moisture % 8-Nov	Test weight lb/bu % 8-Nov	Yield[v] bu/A 8-Nov
Nontreated control			58.8	0.25	2.23	19.15	54.95	165.67
Lucento 4.17 SC	5.0 fl oz	VT/R1	58.8	0.25	1.85	19.20	54.95	161.89
Trivapro 2.21 SE	13.7 fl oz	VT/R1	58.8	0.00	3.00	19.18	54.83	163.62
Miravis Neo 2.5 SE	13.7 fl oz	VT/R1	53.8	0.00	2.68	18.88	54.48	149.97
Veltyma 3.34 S	7.0 fl oz	VT/R1	60.0	0.00	1.33	19.30	54.95	175.55
Delaro 325 SC	8.0 fl oz	VT/R1	57.5	0.25	2.33	19.48	54.15	156.61
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	61.3	0.00	1.40	19.20	54.83	177.73
Headline AMP 1.68 SC	10.0 fl oz	VT/R1	58.8	0.00	2.18	19.35	54.50	158.36
Revytek 3.33 LC	8.0 fl oz	VT/R1	60.0	0.25	1.75	19.20	54.63	172.24
Lucento 4.17 SC	5.0 fl oz	R3	56.3	0.00	1.88	19.48	54.03	157.52
Trivapro 2.21 SE	13.7 fl oz	R3	58.8	0.00	2.33	19.10	54.90	163.20
Miravis Neo 2.5 SE	13.7 fl oz	R3	58.8	0.00	4.00	19.05	54.48	160.83
Veltyma 3.34 S	7.0 fl oz	R3	57.5	0.25	2.73	19.43	54.35	156.84
Delaro 325 SC	8.0 fl oz	R3	56.3	0.00	3.85	18.60	54.55	158.03
Quilt Xcel 2.2 SE	10.5 fl oz	R3	56.3	0.00	4.35	19.05	54.80	163.07
Headline AMP 1.68 SC	10.0 fl oz	R3	55.0	0.25	6.40	19.33	54.80	153.63
Revytek 3.33 LC	8.0 fl oz	R3	56.3	0.75	1.58	19.10	54.50	163.79
p-value			0.3085	0.4118	0.5087	0.61610	0.3636	0.2056
LSD (0.05)[u]				NS[t]	NS	NS	NS	NS

[z] Fungicide treatments applied on 4 Aug at the VT/R1 (tassel/silk) and 23 Aug at the R3 (milk) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 23 Sep.

[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.

[w] Ear rot was visually assessed percentage (0-100%) from 10 ears per plot – a mix of ear rot pathogens were identified and included *Fusarium* spp*., Gibberella, Diplodia, and Trichoderma*, that were associated with significant insect feeding (data not presented).

[v] Yields were adjusted to 15.5% moisture and harvested on 8 Nov.

[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[t] NS = not significant (α=0.05).

CORN (*Zea mays* 'P9998AM')
Gray leaf spot*; Cercospora zeae-maydis*

T. Ross, D. E. P. Telenko, J. D. Ravellette, and S. Shim. Dept. Botany and Plant Pathology
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Fungicide evaluation for gray leaf spot and other foliar diseases in corn in central Indiana, 2019 (COR19-02.ACRE).

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was bulk planted in the field at 30-inch row spacing at a rate of 34,000 seeds/A on 4 Jun using a GPS guided John Deere 1700 six row planter. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 4 Aug at VT/R1 (tassel/silk) growth stage. Disease ratings were assessed on 28 Aug and 23 Sep at the early R4 (dough) and R5 (dent) growth stages respectively. Disease severity visually assessed percentage (0=100%) of symptomatic leaf area on ear leaf (EL), five leaves were assessed per plot and averaged before analysis. The two center rows of each plot were harvested on 16 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

Gray leaf spot (GLS) was the most prominent disease in the trial. All fungicide treatments reduced severity of gray leaf spot, and increased percentage of stay green over the nontreated control on 23 Sep, except Headline AMP (Table 3). The Veltyma treatment resulted in the greenest canopy, but was not different from Trivapro, Delaro, Quilt Xcel, Headline SC, or Proline (Table 3). There was no significant difference between treatments for lodging, harvest moisture, test weight, and yield (Table 3).

Table 3. Effect of fungicide on foliar disease severity, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	GLS % severity[y] EL 23-Sep	Stay green[x] % 23-Sep	Lodging[w] % 23-Sep	Harvest moisture % 16-Oct	Test weight lb/bu 16-Oct	Yield[v] bu/A 16-Oct
Nontreated control			4.75 a	53.75 d	0.00	20.03	54.73	171.17
Trivapro 2.21 SE	13.7 fl oz	VT/R1	0.00 b	62.50 ab	0.50	20.70	54.78	172.97
Miravis Neo 2.5 SE	13.7 fl oz	VT/R1	0.00 b	60.00 bc	0.25	20.35	54.55	159.45
Delaro 325 SC	12 fl oz	VT/R1	0.00 b	61.25 abc	0.00	20.45	54.05	164.92
Headline AMP 1.68 SE	14.4 fl oz	VT/R1	0.00 b	56.25 cd	0.00	19.48	55.05	182.20
Topguard EQ 4.29 SE	7 fl oz	VT/R1	0.00 b	60.00 bc	0.25	20.93	54.13	177.14
Quilt Xcel 2.2 SE	14 fl oz	VT/R1	0.00 b	61.25 abc	0.00	19.90	54.98	179.14
Veltyma 3.34 S	7 fl oz	VT/R1	0.00 b	66.25 a	0.00	20.48	54.53	181.10
Aproach Prima 2.34 SC	6.8 fl oz	VT/R1	0.00 b	60.00 bc	0.00	20.73	54.18	166.04
Headline 2.08 SC	12 fl oz	VT/R1	0.00 b	61.25 abc	0.00	20.73	54.00	171.71
Proline 480 SC	5.7 fl oz	VT/R1	0.00 b	61.25 abc	0.00	20.38	54.43	174.83
p-value			0.0001	0.0123	0.1162	0.5329	0.3175	0.6710
LSD (0.05)[u]			0.22	5.48	NS[t]	NS	NS	NS

[z] Fungicide treatments applied on 4 Aug VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf (EL) on 23 Sep. Five plants assessed per plot and averaged before analysis. GLS = gray leaf spot.

[x] Stay green visually assessed percentage (0-100%) of crop canopy green on 23 Sep.

[w] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.

[v] Yields were adjusted to 15.5% moisture and harvested on 16 Oct.

[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[t] NS = not significant (α=0.05).

CORN (*Zea mays* 'P9998AM')
Gray leaf spot*; Cercospora zeae-maydis*

T. Ross, D. E. P. Telenko, J. D. Ravellette, and S. Shim. Dept. Botany and Plant Pathology
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Uniform fungicide timing and tar spot model validation in corn in central Indiana, 2019 (COR19-04.ACRE).

Plots were established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The trial was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, with the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 4 Jun. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Application timings of the fungicide Trivapro included growth stage applications at V6, V8, V10, VT (tassel/silk), R2 (blister), V6 followed by VT, and a tar spot weather-based model application. Fungicide was applied on 5 Jul, 11 Jul, 17 Jul, 4 Aug, and 16 Aug at the V6, V8, V10, VT/R1, and R2 growth stages, respectively. The tar spot weather-based model application did not cross the action threshold in Indiana during the season; therefore, no fungicide applied in this treatment. Disease ratings were assessed on 29 Aug at the early R4 (dough) growth stage and 16 Oct at the R6 (maturity). Disease severity visually assessed percentage (0=100%) of upper or lower canopy on 29 Aug. The two center rows of each plot were harvested on 16 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, gray leaf spot (GLS) was the most prominent diseases in the trial. All fungicide treatments reduced severity of gray leaf spot in upper and lower canopy as compared to nontreated control on 29 Aug (Table 4). There was no significant difference between treatments for percentage of stay green, moisture, test weight, and yield (Table 4).

Table 4. Effect of fungicide on foliar disease severity, stay green, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	GLS % severity[y] Lower canopy 29-Aug	GLS % severity[y] Upper canopy 29-Aug	Stay green[x] % 23-Sep	Harvest moisture % 16-Oct	Test weight lb/bu 16-Oct	Yield[w] bu/A 16-Oct
Nontreated control			11.25 a	2.00 a	55.0	20.5	55.2	177.0
Trivapro 2.21 SE	13.7 fl oz	V6	5.00 b	1.00 bc	57.5	20.1	54.8	182.4
Trivapro 2.21 SE	13.7 fl oz	V8	5.00 b	0.50 c	60.0	19.9	54.9	178.6
Trivapro 2.21 SE	13.7 fl oz	V10	5.00 b	0.50 c	53.8	19.9	54.9	173.4
Trivapro 2.21 SE	13.7 fl oz	VT	5.00 b	0.75 bc	60.0	20.0	54.6	182.5
Trivapro 2.21 SE	13.7 fl oz	R2	6.25 b	0.75 bc	56.3	19.3	55.0	181.6
Trivapro 2.21 SE	13.7 fl oz	V6 + VT	5.00 b	0.50 c	60.0	20.2	54.4	186.3
Trivapro 2.21 SE	13.7 fl oz	Model[v]	6.25 b	1.25 b	51.3	19.8	55.2	178.0
p-value			0.0001	0.0005	0.2990	0.8034	0.1932	0.6381
LSD (0.05)[u]			2.22	0.61	NS[t]	NS	NS	NS

[z] Fungicide treatments Trivapro was applied on 5 Jul at V6 growth stage, 11 Jul at V8 growth stage, 17 Jul at V10 growth stage, 4 Aug at the VT/R1 (tassel/silk) growth stage, and 16 Aug at R2 (blister) growth stage. All treatments did not contained a non-ionic surfactant.

[y] Disease severity visually assessed percentage (0=100%) of upper or lower canopy on 29 Aug. GLS = gray leaf spot.

[x] Stay green visually assessed percentage (0-100%) of crop canopy green on 23 Sep.

[w] Yields were adjusted to 15.5% moisture and harvested on 16 Oct.

[v] Model = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide applied to this treatment.

[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[t] NS = not significant (α=0.05).

CORN (*Zea mays* 'P9998AM')
Gray leaf spot; *Cercospora zeae-maydis*
Northern corn leaf blight; *Exserohilum turcicum*
Southern rust; *Puccinia polysora*

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West Lafayette, IN 47907-2054

Evaluation of fungicides for foliar disease in corn in central Indiana, 2019 (COR19-19.ACRE)

Plots were established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The trial was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, with the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 4 Jun. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 1 Jul at V5 growth stage, and 4 Aug at the VT/R1 (tassel/silk) growth stage. Disease ratings were assessed on 28 Aug and 23 Sep at the R4 (dough) and R5 (dent) growth stages, respectively. Disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, five plants were assessed per plot and averaged before analysis. The two center rows of each plot were harvested on 16 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, gray leaf spot (GLS), northern corn leaf blight (NCLB), and southern rust (SR) were the most prominent diseases in the trial. All fungicides significantly reduced gray leaf spot severity over nontreated control on 23 Sep (Table 5). The Brixen application at V5 had significantly higher gray leaf spot than the other fungicides and timings (Table 5). No differences between treatments and nontreated control was detected for northern corn leaf blight. Southern rust was significantly reduced by all fungicide applications and timings over nontreated control, Veltyma, Trivapro, Fortix, and two applications of Brixen had the lowest southern rust, but were only significantly different from Brixen applied at V5 (Table 5). Brixen applied at VT/R1, Fortix, USF0411, Trivapro, and Quilt Xcel significantly increased the percentage of stay green of the corn over the nontreated control on 23 Sep (Table 6). There was no significant difference between treatments for lodging, moisture, test weight, and yield (Table 6).

Table 5. Effect of fungicide on foliar diseases severity.

Treatment[z]	Rate/A	Timing	GLS % severity[y] EL 23-Sep	NCLB % severity[y] EL 23-Sep	SR % severity[y] EL 23-Sep
Nontreated control			4.40 a	0.30	1.00 a
Brixen 2.5 G	15.0 fl oz	V5	2.90 b	0.00	0.33 b
Brixen 2.5 G	15.0 fl oz fb 13.0 fl oz	V5 fb VT/R1	0.33 c	0.00	0.01 c
Brixen 2.5 G	3.0 fl oz	VT/R1	0.45 c	0.15	0.06 bc
Fortix 3.22 SC	5.0 fl oz	VT/R1	0.62 c	0.00	0.02 c
USF0411	8.0 fl oz	VT/R1	0.67 c	0.80	0.11 bc
Miravis Neo 2.5 SE	13.7 fl oz	VT/R1	0.43 c	0.05	0.11 bc
Trivapro 2.21 SE	13.7 fl oz	VT/R1	0.61 c	0.00	0.00 c
Veltyma 3.34 S	7.0 fl oz	VT/R1	0.31 c	0.00	0.00 c
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	0.81 c	0.13	0.16 bc
Headline AMP 1.68 SC	10.0 fl oz	VT/R1	1.16 c	0.05	0.10 bc
p-value			0.0001	0.3508	0.0001
LSD (0.05)[x]			1.02	NS[w]	0.28

[z] Fungicide treatments applied on 1 Jul at V5 growth stage and 4 Aug at the VT/R1 (tassel/silk) growth stage. All treatments except treatment USF0411 contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. Treatment USF0411 contained Induce at a rate of 0.12% v/v. fb= followed by.

[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf (EL), five plants were assessed per plot and averaged before analysis. GLS = gray leaf spot; NCLB = northern corn leaf blight; SR=southern rust.

[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[w] NS = not significant (α=0.05).

Table 6. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	Stay green[y] % 23-Sep	Lodging[x] % 23-Sep	Harvest moisture % 16-Oct	Test weight lb/bu 16-Oct	Yield[w] bu/A 16-Oct
Nontreated control			52.5 c	2.5	19.28	55.25	170.13
Brixen 2.5 G	15.0 fl oz	V5	57.5 abc	0.0	19.70	54.68	172.34
Brixen 2.5 G	15.0 fl oz fb 13.0 fl oz	V5 fb VT/R1	57.5 abc	2.5	19.80	54.68	176.40
Brixen 2.5 G	13.0 fl oz	VT/R1	61.3 a	0.0	20.23	54.55	174.94
Fortix 3.22 SC	5.0 fl oz	VT/R1	58.8 ab	0.0	19.45	54.63	182.57
USF0411	8.0 fl oz	VT/R1	58.8 ab	0.0	19.43	55.05	185.68
Miravis Neo 2.5 SE	13.7 fl oz	VT/R1	57.5 abc	5.0	19.60	54.23	175.72
Trivapro 2.21 SE	13.7 fl oz	VT/R1	58.8 ab	0.0	19.60	55.05	171.82
Veltyma 3.34 S	7.0 fl oz	VT/R1	55.0 bc	0.0	20.00	54.95	178.84
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	58.8 ab	0.0	20.05	54.78	183.27
Headline AMP 1.68 SC	10.0 fl oz	VT/R1	57.5 abc	0.0	19.70	54.45	175.03
p-value			0.1372	0.1989	0.9412	0.1660	0.6702
LSD (0.05)[v]			5.08	NS[u]	NS	NS	NS

[z] Fungicide treatments applied on 1 Jul at V5 growth stage and 4 Aug at the VT/R1 (tassel/silk) growth stage. All treatments except treatment USF0411 contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. Treatment USF0411 contained Induce at a rate of 0.12% v/v, fb = followed by.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 23 Sep.

[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.

[w] Yields were adjusted to 15.5% moisture and harvested on 16 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot*; Septoria glycines*
Cercospora leaf blight*; Cercospora kikuchii*

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Evaluation of fungicide timing and efficacy for foliar diseases in soybean in central Indiana, 2019 (SOY19-01.ACRE).

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 4 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 5 Aug at the R3 (beginning pod) growth stage. Diseases were assessed on 20 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopy of each plot. The two center rows were harvested on 17 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS) and Cercospora light blight (CLB) were the most prominent diseases in the trial. The fungicide treatments of Quadris Top SBX, Lucento, Priaxor, Headline AMP, Veltyma, Revytek, Trivapro, and Preemptor significantly reduced the disease severity of Septoria brown spot over nontreated control on 20 Sep (Table 7). No significant treatment effects were detected for frogeye leaf spot and Cercospora leaf blight on 20 Sep, harvest moisture, test weight, and yield (Table 7).

Table 7. Effect of fungicide on foliar diseases severity, moisture, test weight, and yield in soybean yield.

Treatment[z]	Rate/A	FLS % severity[y] 20-Sep	SBS % severity[y] 20-Sep	CLB % severity[y] 20-Sep	Harvest moisture % 17-Oct	Test weight lb/bu 17-Oct	Yield bu/A[x] 17-Oct
Nontreated control		0.78	0.78 a	0.38	12.83	55.88	51.13
Preemptor 3.22 SC	5 fl oz	0.75	0.28 bc	0.08	12.68	55.83	49.68
Topguard EQ 4.29 SC	5 fl oz	0.53	0.40 abc	0.25	12.60	55.30	49.65
Quadris Top SBX 3.76 SC	7 fl oz	0.45	0.03 c	0.25	12.80	55.85	50.61
Lucento 4.17 SC	5 fl oz	0.05	0.03 c	0.33	12.78	55.70	50.03
Miravis Top 1.67 SC	13.7 fl oz	0.40	0.30 bc	0.63	12.80	55.98	51.16
Priaxor 4.17 SC	4 fl oz	0.55	0.03 c	0.05	12.93	55.73	53.13
Trivapro 2.21 SE	13 fl oz	0.55	0.30 bc	0.28	12.65	55.38	51.74
Delaro 325 SC	8 fl oz	0.30	0.53 ab	0.25	12.68	55.90	51.05
Headline AMP 1.68 SC	10 fl oz	0.78	0.05 c	0.28	12.85	55.68	52.00
Veltyma 3.34 S	7 fl oz	0.63	0.05 c	0.53	12.95	55.30	52.38
Revytek 3.33 LC	8 fl oz	0.30	0.05 c	0.05	12.73	55.90	52.01
p-value		0.6862	0.0090	0.8782	0.3977	0.4031	0.7448
LSD (0.05)[w]		NS[v]	0.41	NS	NS	NS	NS

[z] Fungicide treatments applied on 5 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on 20 Sep. FLS = frogeye leaf spot; SBS = Septoria brown spot; CLB = Cercospora leaf blight. [x] Yields were adjusted to 13% moisture and harvested on 17 Oct. [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
Cercospora leaf blight; *Cercospora kikuchii*

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Evaluation of fungicides for foliar diseases on soybean in central Indiana – Trial 1, 2019 (SOY19-16.ACRE).

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 4 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 5 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 20 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS) and Cercospora leaf blight (CLB) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The two center rows were harvested on 17 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS) and Cercospora leaf blight (CLB) were the most prominent diseases in the trial. There were no significant treatment effects for the disease severity of frogeye leaf spot in the upper or lower canopies, Cercospora leaf blight in the upper canopy, harvest moisture, test weight, and yield (Table 8).

Table 8. Effect of fungicide on foliar diseases severity, moisture, test weight, and yield of soybean.

Treatment[z]	Rate/A	FLS severity[y] % upper canopy 20-Sep	FLS severity[y] % lower canopy 20-Sep	CLB severity[y] % upper canopy 20-Sep	Harvest moisture % 17-Oct	Test weight lb/bu 17-Oct	Yield[x] bu/A 17-Oct
Nontreated control		0.78	0.78	0.53	11.40	55.03	51.10
Delaro 325 SC	8.0 fl oz	0.88	0.15	0.28	11.43	55.40	54.77
Miravis Neo 2.5 SE	13.7 fl oz	0.43	0.08	0.28	11.40	55.60	53.45
Lucento 4.17 SC	5.0 fl oz	0.33	0.08	0.50	11.38	55.48	53.62
Priaxor 4.17 SC	4.0 fl oz	0.65	0.78	0.28	11.48	55.48	52.90
Veltyma 3.34 S	7.0 fl oz	0.10	0.28	0.00	11.48	55.40	51.34
Revytek 3.33 LC	8.0 fl oz	0.93	0.28	0.25	11.38	55.38	55.51
Trivapro 2.21 SE	13.7 fl oz	0.65	0.30	0.25	11.25	55.78	52.77
p-value		0.6383	0.0677	0.7311	0.4732	0.1084	0.7378
LSD (0.05)[w]		NS[v]	NS	NS	NS	NS	NS

[z] Fungicide treatments applied on 5 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity rated on scale of 0-100% within the upper or lower canopy. FLS = frogeye leaf spot; CLB = Cercospora leaf blight.
[x] Yields were adjusted to 13% moisture and harvested on 17 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Evaluation of fungicides for foliar diseases on soybean in central Indiana – Trial 2, 2019 (SOY19-17.ACRE).

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 4 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 5 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 28 Aug at the R5 (beginning seed) and 20 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were rated by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. The two center rows were harvested on 17 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS) and Septoria brown spot (SBS) were the most prominent diseases in the trial. All fungicide treatments reduced the disease severity of frogeye leaf spot on 28 Aug and 20 Sep, and Septoria brown spot on 20 Sep (Table 9). No significant treatment effects detected for soybean harvest moisture, test weight, and yield (Table 9).

Table 9. Effect of fungicide on foliar diseases severity, moisture, test weight, and yield of soybean.

Treatment[z]	Rate/A	FLS severity[y] % upper canopy 28-Aug	FLS severity[y] % upper canopy 20-Sep	SBS severity[y] % lower canopy 20-Sep	Harvest moisture % 17-Oct	Test weight lb/bu 17-Oct	Yield[x] bu/A 17-Oct
Nontreated control		0.05 a	2.03 a	1.28 a	11.83	55.70	46.16
Miravis Top 1.67 SC	13.7 fl oz	0.00 b	0.28 b	0.03 b	12.03	55.70	46.04
Miravis Neo 2.5 SE	13.7 fl oz	0.00 b	0.08 b	0.03 b	11.85	55.68	44.43
Experimental 1	8 fl oz	0.00 b	0.33 b	0.10 b	11.75	55.70	47.91
Delaro 325 SC	8 fl oz	0.00 b	0.30 b	0.03 b	11.95	56.28	50.80
Lucento 4.17 SC	5 fl oz	0.00 b	0.08 b	0.05 b	11.93	55.88	45.44
Aproach Prima 2.34 SC	6.8 fl oz	0.00 b	0.55 b	0.30 b	11.78	55.78	51.38
Priaxor 4.17 SC	4 fl oz	0.00 b	0.40 b	0.08 b	11.98	55.78	46.40
Headline AMP 1.68 SC	10 fl oz	0.00 b	0.30 b	0.28 b	11.93	55.90	48.28
Veltyma 3.34 S	7 fl oz	0.00 b	0.08 b	0.30 b	11.85	55.73	46.04
p-value		0.0130	0.0380	0.0024	0.8707	0.6725	0.7687
LSD (0.05)[w]		0.03	1.08	0.55	NS[v]	NS	NS

[z] Fungicide treatments applied on 5 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity rated on scale of 0-100% on 28 Aug and 20 Sep in upper and lower canopies. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] Yields were adjusted to 13% moisture and harvested on 17 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
Cercospora leaf blight; *Cercospora kikuchii*

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Fungicide comparison for foliar diseases in soybean in central Indiana, 2019 (SOY19-19.ACRE).

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 4 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 5 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 29 Aug at the R4 (beginning seed) and 20 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The two center rows were harvested on 17 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were the most prominent diseases in the trial. All fungicide treatments reduced Septoria brown spot on 20 Sep (Table 10). No significant treatment differences were detected for frogeye leaf spot or Cercospora leaf blight severity on 29 Aug, harvest moisture, test weight, and soybean yield (Tables 10 and 11).

Table 10. Effect of fungicide on foliar diseases severity.

Treatment and rate/A[z]	FLS severity[y] % upper canopy 29-Aug	FLS severity[y] % lower canopy 29-Aug	FLS severity[y] % upper canopy 20-Sep	SBS severity[y] % lower canopy 20-Sep	CLB severity[y] % upper canopy 20-Sep
Nontreated control	0.00	0.03	1.3	2.50 a	0.25
Topguard EQ 4.29 SC 5 fl oz	0.00	0.00	0.4	0.18 b	0.00
Lucento 4.17 SC 5 fl oz	0.00	0.00	0.1	0.10 b	0.00
Lucento 4.17 SC 5 fl oz + Hero 5 fl oz	0.00	0.00	0.3	0.03 b	0.03
Experimental 1 7 fl oz	0.00	0.00	0.3	0.55 b	0.25
Experimental 1 9 fl oz	0.00	0.00	0.3	0.33 b	0.00
Miravis Top 1.67 SC 13.7 fl oz	0.00	0.00	0.5	0.53 b	0.13
Priaxor 4.17 SC 4 fl oz + Tilt 3.6 EC 4 fl oz	0.00	0.00	1.3	0.53 b	0.25
Delaro 325 SC 8 fl oz	0.02	0.03	0.3	0.18 b	0.00
Quadris Top SBX 7 fl oz	0.00	0.00	0.7	0.28 b	0.00
p-value	0.4635	0.5728	0.4588	0.0003	0.4635
LSD (0.05)[x]	NS[w]	NS	NS	0.90	NS

[z] Fungicide treatments applied on 5 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity rated on scale of 0-100% within the upper or lower canopy. FLS = frogeye leaf spot; SBS = Septoria brown spot; CLB = Cercospora leaf blight.
[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[w] NS = not significant (α=0.05).

Table 11. Effect of fungicide on moisture, test weight, and yield of soybean.

Treatment[z]	Harvest moisture % 17-Oct	Test weight lb/bu 17-Oct	Yield[y] bu/A 17-Oct
Nontreated control	11.68	55.90	49.99
Topguard EQ 4.29 SC 5 fl oz	11.68	55.58	55.47
Lucento 4.17 SC 5 fl oz	11.58	55.60	52.65
Lucento 4.17 SC 5 fl oz + Hero 5 fl oz	11.75	55.83	57.15
Experimental 1 7 fl oz	11.93	55.53	51.21
Experimental 1 9 fl oz	11.78	55.75	49.64
Miravis Top 1.67 SC 13.7 fl oz	11.85	55.78	46.43
Priaxor 4.17 SC 4 fl oz + Tilt 3.6 EC 4 fl oz	11.73	56.08	52.33
Delaro 325 SC 8 fl oz	11.70	55.83	50.02
Quadris Top SBX 7 fl oz	11.75	55.83	50.62
p-value	0.6524	0.1883	0.1973
LSD (0.05)[x]	NS[w]	NS	NS

[z] Fungicide treatments applied on 5 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Yields were adjusted to 13% moisture and harvested on 17 Oct.

[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[w] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
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Evaluation of fungicide timing and efficacy for soybean foliar diseases in central Indiana, 2019 (SOY19-20.ACRE)

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 4 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 5 Aug at the R3 (beginning pod) and 16 Aug at the R5 (beginning seed) growth stages. Disease ratings were assessed on 20 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The two center rows were harvested on 17 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were the most prominent diseases in the trial. All fungicide applications and timings reduced frogeye leaf spot in the upper canopy over the nontreated control, except Priaxor at R3 (Table 12). No significant treatment effects were found for disease severity of Septoria brown spot, Cercospora leaf blight, harvest moisture, test weight, and soybean yield (Table 12 and 13).

Table 12. Effect of fungicide on foliar diseases severity.

Treatment[z]	Rate/A	Timing	FLS severity[y] % upper canopy 20-Sep	SBS severity[y] % lower canopy 20-Sep	CLB severity[y] % 20-Sep
Nontreated control			1.50 a	1.50 a	0.00
Delaro 325 SC	8.0 fl oz	R3	0.30 c	0.43 b	0.00
Miravis Neo 2.5 SE	13.7 fl oz	R3	0.10 c	0.25 b	0.50
Lucento 4.17 SC	5.0 fl oz	R3	0.15 c	0.43 b	0.25
Priaxor 4.17 SC	4.0 fl oz	R3	1.25 ab	0.83 ab	0.00
Trivapro 2.21 SE	13.7 fl oz	R3	0.53 c	0.28 b	0.28
Delaro 325 SC	8.0 fl oz	R5	0.18 c	0.30 b	0.00
Miravis Neo 2.5 SE	13.7 fl oz	R5	0.55 bc	0.03 b	0.03
Lucento 4.17 SC	5.0 fl oz	R5	0.03 c	0.05 b	0.03
Priaxor 4.17 SC	4.0 fl oz	R5	0.43 c	0.43 b	0.28
Trivapro 2.21 SE	13.7 fl oz	R5	0.43 c	0.78 ab	0.25
p-value			0.0030	0.1066	0.6236
LSD (0.05)[x]			0.02	0.72	NS[w]

[z] Fungicide treatments applied on 5 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Foliar disease severity rated on scale of 0-100% of upper and lower canopies on 20 Sep. FLS = frogeye leaf spot; SBS = Septoria brown spot; CLB = Cercospora leaf blight. [x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [w] NS = not significant (α=0.05).

Table 13. Effect of fungicide on moisture, test weight, and yield of soybean.

Treatment[z]	Rate/A	Timing	Harvest moisture % 17-Oct	Test weight lb/bu 17-Oct	Yield[y] bu/A 17-Oct
Nontreated control			12.58 b	55.58	47.10
Delaro 325 SC	8.0 fl oz	R3	12.75 b	55.35	48.78
Miravis Neo 2.5 SE	13.7 fl oz	R3	12.63 b	55.65	48.10
Lucento 4.17 SC	5.0 fl oz	R3	12.65 b	55.75	47.01
Priaxor 4.17 SC	4.0 fl oz	R3	12.88 ab	55.98	50.18
Trivapro 2.21 SE	13.7 fl oz	R3	12.73 b	55.78	48.77
Delaro 325 SC	8.0 fl oz	R5	12.60 b	55.65	49.84
Miravis Neo 2.5 SE	13.7 fl oz	R5	12.50 b	55.75	50.63
Lucento 4.17 SC	5.0 fl oz	R5	12.60 b	55.55	49.49
Priaxor 4.17 SC	4.0 fl oz	R5	13.25 a	55.95	48.84
Trivapro 2.21 SE	13.7 fl oz	R5	12.70 b	55.88	46.45
p-value			0.0160	0.1618	0.5718
LSD (0.05)[x]			0.55	0.47	NS[w]

[z] Fungicide treatments applied on 5 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Yields were adjusted to 13% moisture and harvested on 17 Oct.

[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[w] NS = not significant (α=0.05).

WHEAT (*Triticum aestivum*); 'P25R40'
Fusarium head blight; *Fusarium graminearum*
Leaf blotch; *Stagnospora nodorum*
Leaf rust; *Puccinia triticina*

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Fusarium head blight (FHB) integrated fungicide trials on wheat in central Indiana, 2019 (WHT19-01.ACRE).

Plots were established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. The previous crop was corn. Prior to planting, the field was vertically tilled twice on 20 Sep 2018, and disked and cultivated on 1 Oct 2018. Nitrogen 28% was applied at 30/A on 27 Mar 2019. On 3 Oct 2019 wheat cultivar P25R40 was drilled at 7.5 in. spacing. Harmony Extra at 0.8 oz/A plus AMS at 1 lb/A plus NIS at 0.25% v/v was applied on 27 Apr 2019 for weed management. Fungicide applications were applied with a CO_2 pressurized backpack sprayer using a handheld boom fitted with pair TJ8001VS nozzels spaced 20 in. apart and directed forward and backward at 45 degree angle which delivered 10 gal/A at 40 psi. Fungicides were applied on 23 May at the Feekes 10.3, 29 May at the Feekes 10.5.1, and 3 Jun at the Feekes 10.5.4. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 31 May at a concentration of 50,000 spores/ml. Spore suspension was applied at 300 ml/plot with the CO_2 handheld sprayer described previously. Disease ratings were assessed on 25 June 2019. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 100 in each plot, and calculated as a percentage. Fusarium head blight (FHB) severity was rated by visually assessing the percentage severity in each the infected heads out of 100. Fusarium head blight (FHB) index was calculated as: (total FHB incidence/average FHB severity)/100 per plot. Disease severity of leaf blotch was rated by visually assessing the percentage of symptomatic tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 9 July and yields were adjusted to 13.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for Fusarium head blight (FHB), leaf blotch and leaf rust diseases. Fusarium head blight (FHB) was the most prominent disease in the trial. All fungicides reduced both incidence and severity of Fusarium head blight, and severity of leaf blotch and leaf rust over nontreated control on 25 Jun, except Caramba for percent incidence of Fusarium head blight (Table 14). Miravis Ace applied at Feekes 10.5.1 followed by Caramba at 10.5.4 resulted in lowest FHB Index on 25 Jun, but this treatment was not different from Miravis Ace applied alone at 10.3 or 10.5.1 and the Miravis Ace at 10.5.1 followed by Prosaro at 10.5.4 (Table 14). The concentration of the mycotoxin deoxynivalenol (DON) was significantly reduced over the nontreated control with Caramba at 10.5.1, Miravis Ace at 10.5.1, and Miravis Ace at 10.5.1 followed by Prosaro at 10.5.4 (Table 15). The percentage of Fusarium damaged kernels (FDK) was significantly reduced with all treatments over nontreated control, except Prosaro at 10.5.1 and Miravis Ace at 10.5.4 (Table 15). All fungicide treatments significantly increased yield over the nontreated control, except for Miravis Ace at 10.3. Miravis Ace at 10.5.1 followed by Caramba at 10.5.4 resulted in highest yield (Table 15).

Table 14. Effect of fungicide on Fusarium head blight and foliar diseases.

Treatment, rate/A, and application timing[z]	FHB % incidence[y] 25-Jun	FHB % severity[y] 25-Jun	FHB Index[x] 25-Jun	Leaf blotch[w] % 25-Jun	Leaf rust[w] % 25-Jun
Nontreated control	68.75 a	60.58 a	42.20 a	33.75 a	1.75 a
Prosaro 421 SC 6.5 fl oz at 10.5.1	50.50 bc	31.73 b	16.10 b	12.65 b	0.00 b
Caramba 90 EC 13.5 fl oz at 10.5.1	60.25 ab	28.92 bc	17.54 b	7.45 b	0.10 b
Miravis Ace 5.2 SC 13.7 fl oz at 10.3	46.25 bcd	28.17 bc	13.15 bc	7.25 b	0.30 b
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	45.25 cd	24.02 bc	10.90 bc	8.35 b	0.00 b
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.4	47.00 bcd	31.04 b	15.05 b	5.10 b	0.20 b
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.4	42.50 cd	20.23 cd	9.17 bc	5.90 b	0.15 b
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 EC 13.5 fl oz at 10.5.4	35.00 d	12.56 d	4.35 c	5.20 b	0.10 b
p-value	0.0026	0.0001	0.0001	0.0001	0.0001
LSD (0.05)[v]	14.29	8.99	9.53	7.58	0.51

[z] All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. Plots inoculated with *Fusarium graminearum* spore suspension (40,000-100,000 spores/ml) 24-26 hours after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 31 May, fb = followed by. [y] Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 100 in each plot and calculated as a percentage and FHB severity was rated by visually assessing the percentage of the infected head from infected heads out of 100. [x] FHB index was calculated as: (total FHB incidence/average FHB severity)/100 per plot. [w] Disease severity of leaf blotch and leaf rust was rated by visually assessing the percentage of symptomatic tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 15. Effect of fungicide on deoxynivalenol (DON), Fusarium damaged kernels (FDK), moisture, test weight, and yield of wheat.

Treatment, rate/A, and application timing[z]	DON[y] ppm 9-Jul	FDK[x] % 9-Jul	Harvest moisture % 9-Jul	Test weight lb/bu 9-Jul	Yield[w] bu/A 9-Jul
Nontreated control	5.20 ab	23.8 a	11.98 f	56.43 d	69.8 c
Prosaro 421 SC 6.5 fl oz at 10.5.1	4.48 abc	18.8 ab	12.25 e	57.73 cd	80.1 ab
Caramba 90 EC 13.5 fl oz at 10.5.1	3.30 bc	9.3 cd	12.38 de	58.50 abc	78.2 b
Miravis Ace 5.2 SC 13.7 fl oz at 10.3	5.75 a	14.5 bc	12.48 bcd	57.93 bc	77.2 bc
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	3.43 bc	8.5 cd	12.58 bc	59.65 a	83.7 ab
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.4	4.75 ab	17.5 ab	12.45 cd	58.10 bc	80.5 ab
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.4	2.58 c	6.5 d	12.78 a	59.25 ab	84.5 ab
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 EC 13.5 fl oz at 10.5.4	3.20 bc	7.8 cd	12.65 ab	59.45 a	87.2 a
p-value	0.0009	0.0392	0.0001	0.0009	0.009
LSD (0.05)[v]	7.73	2.01	0.19	1.33	8.21

[z] All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. Plots inoculated with *Fusarium graminearum* spore suspension (40,000-100,000 spores/ml) 24-26 hours after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 31 May, fb = followed by. [y] Analysis of the mycotoxin deoxynivalenol completed by the University of Minnesota DON Testing Lab. [x] FDK = percentage of Fusarium damaged kernels out of subsample take from each plot. [w] Yields were adjusted to 13.5% moisture and harvested on 9 July. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

WHEAT (*Triticum aestivum*); 'P25R40'
Fusarium head blight; *Fusarium graminearum*
Stagnospora leaf and glume blotch; *Stagnospora nodorum*

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Evaluation of foliar fungicides for wheat disease management in central Indiana, 2019 (WHT19-03.ACRE).

Plots were established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. The previous crop was corn. Prior to planting, the field was vertically tilled twice on 20 Sep 2018, and disked and cultivated on 1 Oct 2018. Nitrogen 28% was applied at 30/A on 27 Mar 2019. On 3 Oct 2019 wheat cultivar P25R40 was drilled at 7.5 in. spacing. Harmony Extra at 0.8 oz/A plus AMS at 1 lb/A plust NIS at 0.25% v/v was applied on 27 Apr 2019 for weed management. Fungicide applications were applied with a CO_2 pressurized backpack sprayer using a handheld boom fitted with pair TJ8001VS nozzels spaced 20 in. apart and directed forward and backward at 45 degree angle which delivered 10 gal/A at 40 psi. Fungicides were applied on 29 May 2019 at the Feekes growth stage 10.5.1. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 31 May. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot with the CO_2 handheld sprayer described previously. Disease ratings were assessed on 18 June 2019. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 100 plants in each plot and calculated as a percentage. FHB severity severity was rated by visually assessing the percentage severity in each the infected heads out of 100. FHB index was calculated as: (total FHB incidence/average FHB severity)/100 per plot. Disease severity of Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 9 July and yields were adjusted to 13.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for Fusarium head blight (FHB), leaf blotch, and glume blotch diseases. Fusarium head blight was the most prominent disease. FHB incidence was reduced by Prosaro, Caramba, Miravis Ace and USF0115 over nontreated control on 18 Jun (Table 16). FHB severity and FHB Index were reduced by all fungicide treatments over nontreated control, except Stratego YLD (Table 16). FHB Index was lowest with Miravis Ace, but this was not significantly different from Prosaro, Caramba, and USF0115 (Table 16). All fungicide treatments significantly reduced the percentage of leaf blotch and glume blotch over the nontreated control, except for Stratego YLD (Table 16). The concentration of deoxynivalenol (DON) was significantly reduced over the nontreated control for all treatments, except for Trivapro and Tilt (Table 17). All fungicide treatments significantly increased yield over the nontreated control except for Headline SC (Table 17). Miravis Ace resulted in the highest yield, but was not significantly different from USF0115 (Table 17).

Table 16. Effect of fungicide on Fusarium head blight and foliar diseases in wheat.

Treatment[z]	Rate/A	FHB % incidence[y] 18-Jun	FHB % severity[y] 18-Jun	FHB Index[x] 18-Jun	Leaf blotch[w] % 18-Jun	Glume blotch[w] % 18-Jun
Nontreated control		85.3 a	37.6 a	32.3 a	32.4 a	27.5 a
Prosaro 421 SC	8.2 fl oz	71.3 bc	22.2 bcd	16.2 cde	16.2 cde	7.8 bc
Caramba 90 EC	13.5 fl oz	72.0 bc	19.0 cd	13.9 de	14.0 de	4.5 c
Miravis Ace 5.2 SC	13.7 fl oz	67.8 c	15.5 d	10.3 e	10.3 e	5.0 c
USF0115	10.3 fl oz	71.0 bc	21.0 bcd	14.8 cde	14.9 cde	7.7 bc
Trivapro 2.21 SE	13.7 fl oz	80.0 ab	27.0 b	21.5 bc	21.5 bc	6.0 c
Stratego YLD 4.18 SC	4 fl oz	78.8 ab	35.7 a	27.5 ab	27.5 ab	9.5 bc
Delaro 325 SC	8 fl oz	76.3 abc	25.5 bc	19.4 cd	19.4 cd	8.2 bc
Tilt 3.6 ED	4 fl oz	85.3 a	24.5 bc	20.9 bc	20.9 bc	15.4 b
Headline 2.08 SC	9 fl oz	80.3 ab	25.1 bc	20.1 cd	20.2 cd	4.4 c
p-value		0.0001	0.0001	0.0001	0.0001	0.0001
LSD (0.05)[v]		9.71	7.68	2.05	2.05	8.07

[z] Fungicides treatments applied at Feekes 10.5.1 all treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. Plots inoculated with *Fusarium graminearum* spore suspension (40,000-100,000 spores/ml) 24-26 hours after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 31 May. [y] FHB incidence was measured as the number of infected heads out of 100 plants in each plot and calculated as a percentage. FHB severity was rated by visually assessing the percentage of the infected head. FHB = Fusarium head blight. [x] FHB index was calculated as: (total FHB incidence/average FHB severity)/100 per plot. [w] Disease severity of Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 17. Effect of fungicide on Fusarium damaged kernels (FDK), deoxynivalenol (DON), moisture, test weight, and yield of wheat.

Treatment[z]	Rate/A	FDK[y] % 9-Jul	DON[x] ppm 9-Jul	Harvest moisture % 9 Jul	Test weight lbs/bu 9-Jul	Yield[w] bu/A 9-Jul
Nontreated control		23.8	7.98 a	11.80 b	55.40 d	66.34 d
Prosaro 421 SC	8.2 fl oz	13.8	3.68 d	12.25 a	57.53 bc	77.62 bc
Caramba 90 EC	13.5 fl oz	11.5	3.50 d	12.30 a	57.28 bc	76.37 bc
Miravis Ace 5.2 SC	13.7 fl oz	11.0	3.05 d	12.30 a	59.00 a	85.22 a
USF0115	10.3 fl oz	12.8	3.48 d	12.08 ab	58.13 ab	82.10 ab
Trivapro 2.21 SE	13.7 fl oz	20.8	6.65 abc	12.05 ab	56.45 c	74.10 c
Stratego YLD 4.18 SC	4 fl oz	18.8	5.28 c	12.13 a	56.63 bc	77.40 bc
Delaro 325 SC	8 fl oz	17.5	3.47 d	12.20 a	57.05 c	74.29 c
Tilt 3.6 ED	4 fl oz	23.8	6.90 ab	12.08 ab	56.70 c	74.89 c
Headline 2.08 SC	9 fl oz	17.5	5.88 bc	12.30 a	56.35 de	72.10 ed
p-value		0.053	0.0001	0.0343	0.0001	0.0001
LSD (0.05)[v]		NS[u]	1.55	0.29	1.06	6.11

[z] Fungicides treatments applied at Feekes 10.5.1 all treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. Plots inoculated with *Fusarium graminearum* spore suspension (40,000-100,000 spores/ml) 24-26 hours after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 31 May. [y] FDK = percentage of Fusarium damaged kernels (FDK) out of a subsample take from each plot. [x] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab. [w] Yields were adjusted to 13.5% moisture and harvested on 9 July. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

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Uniform fungicide comparison for tar spot of corn in northwestern Indiana, 2019 (COR19-03.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 8 Aug at the VT/R1 (tassel/silk) growth stage. Disease ratings were assessed on 21 Sep, and 30 Sep at the R3 (milk), and R5 (dent) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two leaves, and ear leaf plus two leaves. The values of the five leaves for each plot were averaged before analysis. The two center rows of each plot were harvested on 28 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Tukey-Kramer (α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate to high severity. All fungicides significantly reduced the percentage of stroma on the ear leaf minus two leaves, ear leaf, and ear leaf plus two leaves, and percent chlorotic and necrotic symptoms of tar spot on the ear leaves minus two leaves and the ear leaf over the nontreated control on 21 Sep (Table 18). All fungicides significantly reduced the percentage of stroma and chlorotic and necrotic symptoms on the ear leaf minus two, ear leaf, and ear leaf plus two as compared to the nontreated control on 30 Sep (Table 19). Headline SC had the lowest percentage of stroma on the ear leaf minus two on 30 Sep, but was not significantly different from Veltyma and Delaro (Table 19). All fungicide treatments significantly increased the percentage of stay green canopy over the nontreated control on 30 Sep (Table 20). No significant treatment effects detected for lodging, test weight, and corn yield (Table 20).

Table 18. Effect of fungicide on tar spot.

Treatment[z]	Rate/A	Tar spot % stroma[y] EL-2 21-Sep	Tar spot % stroma[y] EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep	Tar spot % chlor/nec[x] EL-2 21-Sep	Tar spot % chlor/nec[x] EL 21-Sep	Tar spot % chlor/nec[x] EL+2 21-Sep
Nontreated control		7.21 a	2.81 a	1.72 a	7.61 a	0.81 a	0.06
Trivapro 2.21 SE	13.7 fl oz	2.95 b	1.25 b	1.00 cd	2.20 b	0.10 b	0.00
Miravis Neo 2.5 SE	13.7 fl oz	3.15 b	1.30 b	0.95 d	1.00 b	0.05 b	0.05
Delaro 325 SC	12 fl oz	1.45 b	1.25 b	1.15 bcd	0.30 b	0.00 b	0.00
Headline AMP 1.68 SC	14.4 fl oz	1.45 b	1.15 b	1.10 cd	0.25 b	0.00 b	0.05
Topguard EQ 4.29 SC	7 fl oz	2.65 b	1.30 b	1.35 b	1.25 b	0.00 b	0.05
Quilt Xcel 2.2 SE	14 fl oz	2.85 b	1.30 b	1.05 cd	2.45 b	0.00 b	0.00
Veltyma 3.34 S	7 fl oz	2.00 b	1.25 b	1.20 bc	0.20 b	0.00 b	0.05
Aproach Prima 2.34 SC	6.8 fl oz	2.55 b	1.10 b	1.00 cd	1.45 b	0.00 b	0.00
Headline 2.08 SC	12 fl oz	1.40 b	1.10 b	1.05 cd	0.05 b	0.00 b	0.30
Proline 480 SC	5.7 fl oz	3.15 b	1.35 b	1.05 cd	1.55 b	0.10 b	0.50
p-value		0.0001	0.0001	0.0001	0.0002	0.0001	0.4446
LSD (0.05)[w]		-	-	-	-	-	NS[v]

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot chlorotic and necrotic symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [w] Means followed by the same letter are not significantly different based on Tukey's-Kramer (α=0.05). [v] NS = not significant (α=0.05).

Table 19. Effect of fungicide on tar spot.

Treatment[z]	Rate/A	Tar spot % stroma[y] EL-2 30-Sep	Tar spot % stroma[y] EL 30-Sep	Tar spot % stroma[y] EL+2 30-Sep	Tar spot % chlor/nec[x] EL-2 30-Sep	Tar spot % chlor/nec[x] EL 30-Sep	Tar spot % chlor/nec[x] EL+2 30-Sep
Nontreated control		38.79 a	34.33 a	23.49 a	77.68 a	57.80 a	32.43 a
Trivapro 2.21 SE	13.7 fl oz	26.50 b	15.95 b	7.85 b	57.00 b	24.00 b	5.65 b
Miravis Neo 2.5 SE	13.7 fl oz	24.75 bc	16.75 b	7.60 bc	56.25 b	18.20 b	5.05 b
Delaro 325 SC	12 fl oz	14.75 def	9.80 bc	6.05 cd	40.50 b	9.50 b	3.90 b
Headline AMP 1.68 SC	14.4 fl oz	16.25 de	11.50 bc	6.00 cd	34.50 b	10.45 b	2.85 b
Topguard EQ 4.29 SC	7 fl oz	25.50 bc	15.50 bc	6.75 bcd	52.50 b	18.50 b	4.80 b
Quilt Xcel 2.2 SE	14 fl oz	22.25 bcd	16.30 b	9.25 bc	55.10 b	17.45 b	9.15 b
Veltyma 3.34 S	7 fl oz	13.40 ef	12.00 bc	6.05 cd	35.65 b	14.75 b	5.35 b
Aproach Prima 2.34 SC	6.8 fl oz	18.25 cde	11.75 bc	5.65 cd	52.50 b	11.20 b	3.15 b
Headline 2.08 SC	12 fl oz	8.05 f	7.00 c	4.25 d	21.25 b	9.20 b	1.95 b
Proline 480 SC	5.7 fl oz	25.50 bc	16.25 b	10.20 b	65.50 b	24.25 b	9.75 b
p-value		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LSD (0.05)[w]		-	-	-	-	-	-

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot chlorotic and necrotic symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [w] Means followed by the same letter are not significantly different based on Tukey's-Kramer (α=0.05).

Table 20. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Stay green[y] % 21-Sep	Stay green[y] % 30-Sep	Lodging[x] % 30-Sep	Harvest moisture % 28-Oct	Test weight lb/bu 28-Oct	Yield[w] bu/A 28-Oct
Nontreated control		86.5	33.4 d	6.6	22.75 d	51.20	202.65
Trivapro 2.21 SE	13.7 fl oz	95.0	50.0 c	0.0	23.63 bcd	50.18	212.22
Miravis Neo 2.5 SE	13.7 fl oz	92.5	53.8 bc	0.0	23.90 a-d	49.90	215.25
Delaro 325 SC	12 fl oz	95.0	62.5 ab	0.0	24.35 abc	50.40	223.60
Headline AMP 1.68 SC	14.4 fl oz	92.5	65.0 a	0.0	24.60 ab	50.28	218.13
Topguard EQ 4.29 SC	7 fl oz	92.5	58.8 abc	0.0	24.05 abc	50.00	211.80
Quilt Xcel 2.2 SE	14 fl oz	90.0	57.5 abc	0.0	24.13 abc	50.68	214.15
Veltyma 3.34 S	7 fl oz	93.8	61.3 ab	0.0	24.78 ab	50.15	215.38
Aproach Prima 2.34 SC	6.8 fl oz	93.8	62.5 ab	0.0	24.40 abc	49.85	209.23
Headline 2.08 SC	12 fl oz	93.8	66.3 a	0.0	25.03 a	50.40	214.03
Proline 480 SC	5.7 fl oz	90.0	50.0 c	2.5	23.23 cd	50.63	206.13
p-value		0.0134	0.0001	0.3399	0.0001	0.0558	0.1502
LSD (0.05)[v]		NS[u]	-	NS	-	NS	NS

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 and 30 Sep. [x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical. [w] Yields were adjusted to 15.5% moisture and harvested on 28 Oct.
[v] Means followed by the same letter are not significantly different based on Tukey's-Kramer (α=0.05).
[u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

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Uniform fungicide timing and tar spot model validation in corn in northwestern Indiana, 2019 (COR19-05.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Application timings of the fungicide Trivapro included growth stage applications at V6, V8, V10, VT (tassel/silk), R2 (blister), V6 followed by VT, and a tar spot weather-based model application. Fungicides were applied on 8 July, 15 July, 19 July, 7 Aug and 23 Aug at the V7 (seven-leaf), V9 (nine-leaf), V10 (10-leaf), VT/R1 (silk), and R2 (blister) growth stages, respectively. A prediction model based treatment was include in the trial, but the model never triggered a fungicide application during the season at PPAC, therefore this treatment provided an additional nontreated control for comparison. Disease ratings were assessed on 18 Sept at the early R5 (dent) growth stage and 30 Sep at late R5 growth stage. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two, ear leaf plus two. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 28 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was first detected in the trial on 2 Aug and was the most prominent disease in the trial-reaching moderate to high severity. Trivapro applied at the V9, V10, VT/R1, R2, and V7 followed by (fb) VT significantly reduced tar spot stroma over the nontreated control on the ear leaf minus two and the ear leaf on 18 Sep, but no differences were detected on ear leaf plus two (Table 21). Chlorotic and necrotic symptoms of tar spot on the ear leaf minus two and ear leaf on 18 Sep were reduced by Trivapro applied at the VT/R1, R2, and V7 fb VT application timings (Table 21). All application timings reduced chlorotic and necrotic symptoms over the nontreated control on the ear leaf plus two on 18 Sep, except the V10 timing (Table 21). By 30 Sep, tar spot stroma was only significantly less in treatments made at VT/R1 or R2 as compared to the nontreated control for all leaf ratings (Table 22). The VT/R1 and R2 applications also significantly reduced chlorotic and necrotic symptoms on all leaves on 30 Sep (Table 22). Trivapro applied at V10, VT, R2, and V7 fb VT significantly increased the percent stay green of the corn over the nontreated control on both 18 Sep and 30 Sep (Tables 23). No differences in lodging was detected between treatments (Table 23). Trivapro applied VT/R1, R2, and V7 fb VT increased yield over the nontreated control (Table 23).

Table 21. Effect of fungicide on tar spot.

Treatment[z]	Rate	Timing	Tar spot % stroma[y] EL-2 18-Sep	Tar spot % stroma[y] EL 18-Sep	Tar spot % stroma[y] EL+2 18-Sep	Tar spot % chlor/nec[x] EL-2 18-Sep	Tar spot % chlor/nec[x] EL 18-Sep	Tar spot % chlor/nec[x] EL+2 18-Sep
Nontreated control			28.00 a	6.80 a	2.55	17.43 a	1.56 ab	0.23 a
Trivapro 2.21 SE	13.7 fl oz	V7	25.75 ab	4.78 abc	1.98	19.75 a	1.11 abc	0.03 c
Trivapro 2.21 SE	13.7 fl oz	V9	22.60 b	4.30 bc	1.65	11.05 ab	0.89 bcd	0.00 c
Trivapro 2.21 SE	13.7 fl oz	V10	8.53 c	3.78 cd	1.66	2.53 bc	0.18 cd	0.23 ab
Trivapro 2.21 SE	13.7 fl oz	VT/R1	4.65 cd	2.90 cde	1.03	1.33 c	0.00 d	0.00 c
Trivapro 2.21 SE	13.7 fl oz	R2	4.15 d	0.72 e	0.56	2.20 bc	0.14 cd	0.05 bc
Trivapro 2.21 SE	13.7 fl oz	V7 fb VT	5.81 cd	1.70 de	1.96	1.60 c	0.30 cd	0.00 c
Trivapro 2.21 SE	13.7 fl oz	Model[w]	25.60 ab	6.15 ab	2.35	17.75 a	2.00 a	0.08 abc
p-value			0.0001	0.0002	0.0821	0.0002	0.0036	0.0389
LSD (0.05)[v]			3.91	2.25	NS[u]	9.01	1.03	0.18

[z] Fungicide treatments applied on 8 July, 15 July, 19 July, 7 Aug and 22 Aug at the V7 (seven-leaf), V9 (nine-leaf), V10 (10-leaf), VT/R1 (tassel/silk) and R2 (blister) growth stages respectively and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb=followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [w] Model = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide applied to this treatment. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

Table 22. Effect of fungicide on tar spot.

Treatment[z]	Rate	Timing	Tar spot % stroma[y] EL-2 30-Sep	Tar spot % stroma[y] EL 30-Sep	Tar spot % stroma[y] EL+2 30-Sep	Tar spot % chlor/nec[x] EL-2 30-Sep	Tar spot % chlor/nec[x] EL 30-Sep	Tar spot % chlor/nec[x] EL+2 30-Sep
Nontreated control			37.75 ab	38.75 a	30.25 ab	88.50 ab	75.00 ab	45.00 ab
Trivapro 2.21 SE	13.7 fl oz	V7	41.75 a	39.00 a	36.50 a	95.75 a	80.50 a	53.50 a
Trivapro 2.21 SE	13.7 fl oz	V9	36.25 ab	35.00 a	28.75 ab	78.50 bc	59.25 bc	28.40 bc
Trivapro 2.21 SE	13.7 fl oz	V10	31.75 bc	34.75 a	26.75 bc	70.00 cd	56.25 bc	28.50 bc
Trivapro 2.21 SE	13.7 fl oz	VT/R1	24.25 d	23.75 b	16.50 d	65.25 d	43.00 cd	16.80 cd
Trivapro 2.21 SE	13.7 fl oz	R2	23.25 d	23.50 b	12.10 d	75.75 cd	30.00 d	7.00 d
Trivapro 2.21 SE	13.7 fl oz	V7 fb VT	25.25 cd	24.50 b	19.75 cd	68.75 cd	42.25 cd	16.30 cd
Trivapro 2.21 SE	13.7 fl oz	Model[w]	39.25 a	38.00 a	31.00ab	94.00 a	72.50 a	53.75 a
p-value			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LSD (0.05)[v]			6.95	6.62	8.35	12.26	16.00	19.01

[z] Fungicide treatments applied on 8 July, 15 July, 19 July, 7 Aug and 22 Aug at the V7 (seven-leaf), V9 (nine-leaf), V10 (10-leaf), VT/R1 (tassel/silk) and R2 (blister) growth stages respectively and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot chlorotic and necrotic symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [w]Model = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide applied to this treatment. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 23. Effect of fungicide on stay green, lodging, and yield.

Treatment[z]	Rate	Timing	Stay green[y] % 18-Sep	Stay green[y] % 30-Sep	Lodging[x] % 30-Sep	Harvest moisture % 28-Oct	Test weight lb/bu 28-Oct	Yield[w] bu/A 28-Oct
Nontreated check			63.8 cd	38.8 d	1.0	22.58 cd	53.25	181.85 c
Trivapro 2.21 SE	13.7 fl oz	V7	71.3 bc	41.3 cd	1.3	22.40 d	52.78	182.33 c
Trivapro 2.21 SE	13.7 fl oz	V9	75.0 b	43.8 cd	1.3	22.73 cd	52.80	188.28 bc
Trivapro 2.21 SE	13.7 fl oz	V10	86.3 a	50.0 bc	0.3	23.20 bc	52.55	191.63 abc
Trivapro 2.21 SE	13.7 fl oz	VT/R1	90.8 a	55.0 ab	1.0	23.45 ab	51.95	202.58 ab
Trivapro 2.21 SE	13.7 fl oz	R2	92.5 a	63.8 a	0.3	23.68 ab	53.40	205.23 a
Trivapro 2.21 SE	13.7 fl oz	V7 fb VT	88.8 a	57.5 ab	0.3	23.90 a	51.90	202.48 ab
Trivapro 2.21 SE	13.7 fl oz	Model[v]	58.8 d	37.5 d	1.8	22.43 d	53.48	181.63 c
p-value			0.0001	0.0001	0.6175	0.0003	0.1056	0.0051
LSD (0.05)[u]			10.70	9.34	NS[t]	0.67	NS	14.56

[z] Fungicide treatments applied on 8 July, 15 July, 19 July, 7 Aug and 22 Aug at the V7 (seven-leaf), V9 (nine-leaf), V10 (10-leaf), VT/R1 (tassel/silk) and R2 (blister) growth stages respectively and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green.

[x] Lodging = % lodged stalks when pushed from shoulder height to the 45° from vertical.

[w] Yields were adjusted to 15.5% moisture and harvested on 28 Oct.

[v] Model = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide applied to this treatment.

[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[t] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

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Fungicide evaluation for foliar disease in corn in northwestern Indiana, 2019 (COR19-13.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 9 Aug at the R1 (silk) growth stage. Disease ratings were assessed on 21 Sep and 2 Oct at the R5 (dent) and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two, ear leaf plus two. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 25 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate to high severity. All fungicide treatments reduced severity of tar spot stroma over the nontreated control at all rating dates (Tables 24 and 25). The chlorotic and necrotic symptoms were also significantly reduced with all fungicide treatments on 2 Oct on the ear leaf, ear leaf minus two, and ear leaf plus two (Table 25). All fungicide treatments significantly increased the percentage of stay green of the corn over the nontreated control on both 29 Aug and 2 Oct (Table 26). All fungicides significantly reduced lodging and increased yield over the nontreated control (Table 26).

Table 24. Effect of fungicide treatment on tar spot.

Treatment[z]	Rate/A	Tar spot % stroma[y] EL-2 21-Sep	Tar spot % stroma[y] EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep
Nontreated control		9.0 a	4.2 a	2.0 a
Topguard EQ 4.29 SC	5 fl oz	1.8 b	1.4 b	1.0 c
Lucento 4.17 SC	5 fl oz	2.4 b	1.2 b	1.1 bc
VJR90-R002	7 fl oz	2.0 b	1.7 b	1.1 bc
VJR90-R002	8 fl oz	1.9 b	1.4 b	1.0 c
VJR90-R002	9 fl oz	2.5 b	1.4 b	1.3 bc
Miravis Neo 2.5 SC	13.7 fl oz	2.8 b	1.3 b	1.0 c
Trivapro 2.21 SE	13.7 fl oz	3.4 b	1.2 b	1.0 c
Delaro 325 SC	8 fl oz	1.2 b	1.1 b	1.1 bc
p-value		0.0005	0.0001	0.0001
LSD (0.05)[x]		2.92	1.02	0.30

[z] Fungicide treatments applied on 9 Aug at the R1 (silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 25. Effect of fungicide treatment on tar spot.

Treatment[z]	Rate/A	Tar spot % stroma[y] EL-2 2-Oct	Tar spot % stroma[y] EL 2-Oct	Tar spot % stroma[y] EL+2 2-Oct	Tar spot % chlo/necr[x] EL-2 2-Oct	Tar spot % chlo/necr[x] EL 2-Oct	Tar spot % chlo/necr[x] EL+2 2-Oct
Nontreated control		43.3 a	39.3 a	31.3 a	94.3 a	87.0 a	58.8 a
Topguard EQ 4.29 SC	5 fl oz	23.3 b	17.6 b	10.4 b	65.8 b	28.5 bc	10.9 b
Lucento 4.17 SC	5 fl oz	31.0 b	19.3 b	10.2 b	73.3 b	36.8 b	9.4 b
VJR90-R002	7 fl oz	26.0 b	17.5 b	10.4 b	69.8 b	29.8 bc	15.5 b
VJR90-R002	8 fl oz	25.0 b	15.5 b	7.7 b	58.5 b	21.5 c	6.4 b
VJR90-R002	9 fl oz	28.5 b	18.6 b	10.2 b	72.5 b	36.5 b	9.4 b
Miravis Neo 2.5 SC	13.7 fl oz	25.5 b	13.6 b	7.3 b	66.5 b	27.0 bc	6.2 b
Trivapro 2.21 SE	13.7 fl oz	28.8 b	18.5 b	9.4 b	71.3 b	32.3 bc	13.5 b
Delaro 325 SC	8 fl oz	20.5 b	16.1 b	7.4 b	59.3 b	21.0 c	7.1 b
p-value		0.0001	0.0001	0.0149	0.0320	0.0001	0.0001
LSD (0.05)[w]		10.8	7.86	4.69	18.94	13.42	14.78

[z] Fungicide treatments applied on 9 Aug at the R1 (silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Tar spot chlorotic and necrotic symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 26. Effect of fungicide treatment on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Stay green[x] % 21-Sep	Stay green[y] % 2-Oct	Lodging[x] % 2-Oct	Harvest moisture % 25-Oct	Test weight lb/bu 25-Oct	Yield[w] bu/A 25-Oct
Nontreated control		77.5 b	30.0 b	17.5 a	23.05 c	51.63	197.26 b
Topguard EQ 4.29 SC	5 fl oz	88.8 a	71.3 a	2.5 b	24.48 ab	50.75	214.62 a
Lucento 4.17 SC	5 fl oz	90.0 a	63.8 a	2.5 b	24.08 ab	50.55	217.59 a
VJR90-R002	7 fl oz	90.0 a	71.3 a	0.0 b	24.43 ab	51.40	215.87 a
VJR90-R002	8 fl oz	92.5 a	71.3 a	2.5 b	24.25 ab	51.05	216.12 a
VJR90-R002	9 fl oz	90.0 a	68.8 a	2.5 b	23.70 bc	50.90	217.89 a
Miravis Neo 2.5 SC	13.7 fl oz	90.0 a	67.5 a	7.5 b	24.55 a	50.68	217.37 a
Trivapro 2.21 SE	13.7 fl oz	90.0 a	68.8 a	2.5 b	24.18 ab	50.68	216.96 a
Delaro 325 SC	8 fl oz	90.0 a	75.0 a	5.0 b	24.55 a	51.28	217.45 a
p-value		0.0001	0.0001	0.0111	0.0096	0.2815	0.0081
LSD (0.05)[v]		3.91	12.95	8.40	0.78	NS[u]	10.25

[z] Fungicide treatments applied on 9 Aug at the R1 (silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 Sep and 2 Oct.
[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.
[w] Yields were adjusted to 15.5% moisture and harvested on 25 Oct.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

CORN (*Zea mays* 'P9998AM')
Tar spot; *Phyllachora maydis*
Gray leaf spot; *Cercospora zeae-maydis*
Common rust; *Puccinia sorghi*

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Fungicide comparison for foliar diseases in corn in northwestern Indiana, 2019 (COR19-14.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 15 Jul at V8, 19 Jul at V10, and 7 Aug at the VT/R1 (tassel/silk) growth stage. Disease ratings were assessed on 21 Sep and 2 Oct at the R5 (dent) and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two, ear leaf plus two. Gray leaf spot and common rust severity were rated by visually assessing the percentage of symptomatic leaf area on five plants in each plot at the ear leaf. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 28 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot, gray leaf spot (GLS), common rust (CR) were the most prominent diseases in the trial. No differences between treatments for ratings on 21 Sep (Table 27). All fungicides reduced gray leaf spot and common rust over the nontreated on 21 Sep, except Dexter Xcel applied at V10 (Table 27). Tar spot stroma on ear leaf on 2 Oct was significantly reduced over nontreated by Dexter Xcel at V8 followed by (fb) VT/R1, Brixen at VT/R1, and Veltyma at VT/R1 (Table 28). No difference between treatment on tar spot stroma severity at ear leaf plus or minus two on 2 Oct (Table 28). Chlorotic and necrotic severity on ear leaf minus two was reduced by Dexter applied at V8 fb VT/R1, Dexter at V10, and Veltyma over nontreated. All fungicides reduced chlorosis and necrosis on the ear leaf and ear lead plus two on 2 Oct (Table 28). All fungicide treatments significantly increased the percentage of stay green over the nontreated check on 2 Oct (Table 29). No significant differences between treatment for lodging, test weight, and yield (Table 29).

Table 27. Effect of fungicide on tar spot and foliar diseases.

Treatment[z]	Rate/A	Timing	Tar spot % stroma[y] EL-2 21-Sep	Tar spot % stroma[y] % EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep	GLS % severity[x] 2-Oct	CR % severity[x] 2-Oct
Nontreated control			0.93	1.18	0.95	5.75 a	5.10 a
Dexter Xcel	48 fl oz	V8 fb VT/R1	0.85	0.28	0.28	2.40 bc	1.15 b
Dexter Xcel	48 fl oz	V10	0.78	0.78	0.93	4.20 ab	1.80 b
Dexter Xcel	48 fl oz	VT/R1	0.78	0.55	0.70	2.60 bc	1.00 b
Brixen 3.5 G	13 fl oz	VT/R1	0.95	0.78	0.70	1.35 c	1.15 b
Fortix 3.22 SC	5 fl oz	VT/R1	0.65	0.55	0.78	2.30 c	1.90 b
USF0411	8 fl oz	VT/R1	1.03	0.78	1.00	1.75 c	1.65 b
Veltyma 3.34 S	7 fl oz	VT/R1	0.78	0.55	0.63	1.40 c	2.15 b
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	0.78	0.78	0.93	2.55 bc	1.40 b
Headline AMP 1.68 SC	10 fl oz	VT/R1	0.78	0.33	0.55	2.10 c	1.25 b
p-value			0.9951	0.1283	0.2237	0.0012	0.013
LSD (0.05)[w]			NS[v]	NS	NS	1.87	2.01

[z] Fungicide treatments applied on 15 Jul at V8, 19 Jul at V10, and 7 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf (EL) on 23 Sep. Five plants assessed per plot and averaged before analysis. GLS = gray leaf spot; CR = Common rust. [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [v] NS = not significant (α=0.05).

Table 28. Effect of fungicide on tar spot.

Treatment[z]	Rate/A	Timing	Tar spot % stroma[y] % EL-2 2-Oct	Tar spot % stroma[y] % EL 2-Oct	Tar spot % stroma[y] % EL+2 2-Oct	Tar spot % chlo/necr[x] % EL-2 2-Oct	Tar spot % chlo/nec[x] % EL 2-Oct	Tar spot % chlo/necr[x] % EL+2 2-Oct
Nontreated control			6.95	4.70 a	6.15	71.5 a	47.8 a	21.70 a
Dexter Xcel	48 fl oz	V8 fb VT/R1	3.35	2.45 cd	4.00	38.2 cd	6.8 cd	3.25 bc
Dexter Xcel	48 fl oz	V10	5.45	4.95 a	4.80	46.5 bcd	21.9 bcd	7.60 bc
Dexter Xcel	48 fl oz	VT/R1	3.15	3.20 a-d	4.10	50.5 a-d	14.3 bcd	1.50 c
Brixen 3.5 G	13 fl oz	VT/R1	2.70	2.60 bcd	3.75	48.8 a-d	12.4 bcd	2.80 bc
Fortix 3.22 SC	5 fl oz	VT/R1	3.65	3.95 a-d	5.40	63.3 ab	23.9 bcd	8.30 bc
USF0411	8 fl oz	VT/R1	3.70	4.25 abc	5.60	58.0 a-c	22.5 bc	10.30 b
Veltyma 3.34 S	7 fl oz	VT/R1	2.90	2.15 d	5.45	29.3 d	6.7 d	4.75 bc
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	4.40	4.35 ab	5.80	52.3 a-d	20.8 bcd	6.45 bc
Headline AMP 1.68 SC	10 fl oz	VT/R1	2.35	3.45 a-d	5.25	59.0 abc	16.8 bcd	7.80 bc
p-value			0.1647	0.0386	0.1543	0.062	0.0009	0.0018
LSD (0.05)[w]			3.22	1.85	NS[v]	24.27	15.79	8.13

[z] Fungicide treatments applied on 15 Jul at V8, 19 Jul at V10, and 7 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [v] NS = not significant (α=0.05).

Table 29. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	Stay green[y] % 21-Sep	Stay green[y] % 2-Oct	Lodging[x] % 2-Oct	Harvest moisture % 28-Oct	Test weight lb/bu 28-Oct	Yield[w] bu/A 28-Oct
Nontreated control			82.5	43.8 c	5.0	21.15 c	52.95	201.18
Dexter Xcel	48 fl oz	V8 fb VT/R1	92.5	78.8 a	0.0	22.20 ab	51.88	214.36
Dexter Xcel	48 fl oz	V10	91.3	70.0 ab	2.5	21.60 bc	52.20	200.59
Dexter Xcel	48 fl oz	VT/R1	88.8	73.8 a	0.0	21.98 ab	52.50	216.65
Brixen 3.5 G	13 fl oz	VT/R1	90.0	80.0 ab	0.0	22.48 a	52.13	213.18
Fortix 3.22 SC	5 fl oz	VT/R1	90.0	73.8 b	0.0	21.40 bc	51.88	207.10
USF0411	8 fl oz	VT/R1	85.0	63.8 a	0.0	21.58 bc	52.58	211.32
Veltyma 3.34 S	7 fl oz	VT/R1	88.8	78.8 ab	0.0	22.53 a	51.85	217.66
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	86.3	72.5 ab	0.0	21.48 bc	52.33	217.53
Headline AMP 1.68 SC	10 fl oz	VT/R1	87.5	76.3 a	0.0	21.58 bc	52.00	209.75
p-value			0.1022	0.0001	0.5507	0.0196	0.1263	0.5495
LSD (0.05)[v]			NS[u]	10.31	NS	0.82	NS	NS

[z] Fungicide treatments applied on 15 Jul at V8, 19 Jul at V10, and 7 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 Sep and 2 Oct.

[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.

[w] Yields were adjusted to 15.5% moisture and harvested on 28 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

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Evaluation of fungicides and timing for tar spot in corn in northwestern Indiana, 2019 (COR19-15.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 3 Jul at the V5 growth stage and 9 Aug at the R1 (silk) growth stages. Disease ratings were assessed on 21 Sep and 2 Oct at the R5 (dent), and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two, ear leaf plus two. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 25 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate to high severity. Delaro, Trivapro, and Miravis Neo applications at the R1 or V5 plus R1 significantly reduced tar spot severity on the ear leaf and ear leaf plus or minus two on 21 Sep (Table 30). Single fungicide applications at the V5 were not different from the nontreated control for tar spot on the ear leaf minus two, but significantly reduced tar spot on the ear leaf and ear leaf plus two on 21 Sep (Table 30). The V5 applications were not different from the nontreated control for tar spot stroma or chlorotic and necrotic symptoms on all leaves on 2 Oct (Table 31). All fungicide treatments that included an R1 application significantly reduced tar spot stroma, and chlorotic and necrotic symptoms on all leaves on 2 Oct (Table 31). There were no significant differences between these fungicide treatments, except for Delaro which had significantly less tar spot stroma on the ear leaf verses a single application of Trivapro or Miravis Neo at R1, and a double application of Delaro showed less chlorotic and necrotic symptoms on the ear leaf than a single application of Trivapro (Table 31). All fungicide treatments that included an R1 application significantly increased the percent of stay green, reduced lodging, and increased yield over the nontreated control (Table 32).

Table 30. Effect of fungicide treatment on tar spot.

Treatment[z]	Rate/A	Timing	Tar spot % stroma[y] E -2 21-Sep	Tar spot % stroma[y] EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep
Nontreated control			7.00 a	4.00 a	1.92 a
Delaro 325 SC	8 fl oz	V5	5.83 a	2.50 b	1.42 b
Delaro 325 SC	8 fl oz	R1	1.25 b	1.00 c	1.00 b
Delaro 325 SC	8 fl oz	V5 fb R1	1.25 b	1.00 c	1.00 b
Trivapro 2.21 SE	13.7 fl oz	V5	5.42 a	2.75 b	1.25 b
Trivapro 2.21 SE	13.7 fl oz	R1	1.83 b	1.33 c	1.00 b
Trivapro 2.21 SE	13.7 fl oz	V5 fb R1	1.58 b	1.25 c	1.00 b
Miravis Neo 2.5 SE	13.7 fl oz	V5	7.58 a	2.33 b	1.42 b
Miravis Neo 2.5 SE	13.7 fl oz	R1	2.67 b	1.17 c	1.00 b
Miravis Neo 2.5 SE	13.7 fl oz	V5 fb R1	1.83 b	1.17 c	1.00 b
p-value			0.0001	0.0001	0.003
LSD (0.05)[x]			2.41	0.98	0.45

[z] Fungicide treatments applied on 3 Jul at the V5 growth stage and 9 Aug at the R1 (silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 31. Effect of fungicide treatment on tar spot.

Treatment[z]	Rate/A	Timing	Tar spot % stroma[y] EL-2 2-Oct	Tar spot % stroma[y] EL 2-Oct	Tar spot % stroma[y] EL+2 2-Oct	Tar spot % chlo/necr[x] EL-2 2-Oct	Tar spot % chlo/necr[x] EL 2-Oct	Tar spot % chlo/necr[x] EL+2 2-Oct
Nontreated control			37.25 a	35.25 a	23.35 a	92.75 a	81.75 a	33.25 ab
Delaro 325 SC	8 fl oz	V5	35.00 a	30.00 b	20.70 a	88.00 a	72.25 a	30.00 b
Delaro 325 SC	8 fl oz	R1	20.10 cd	10.85 e	8.25 b	58.25 b	15.60 bc	6.55 c
Delaro 325 SC	8 fl oz	V5 fb R1	19.25 d	10.75 e	6.70 b	58.00 b	12.35 c	7.30 c
Trivapro 2.21 SE	13.7 fl oz	V5	37.25 a	32.75 ab	24.70 a	95.25 a	77.50 a	47.25 a
Trivapro 2.21 SE	13.7 fl oz	R1	26.75 b	18.50 c	9.40 b	66.75 b	24.75 b	7.85 c
Trivapro 2.21 SE	13.7 fl oz	V5 fb R1	27.75 b	14.70 cde	8.85 b	66.25 b	23.10 bc	9.10 c
Miravis Neo 2.5 SE	13.7 fl oz	V5	37.75 a	35.00 a	22.75 a	91.25 a	79.00 a	29.50 b
Miravis Neo 2.5 SE	13.7 fl oz	R1	22.85 bcd	15.00 cd	7.40 b	59.00 b	22.85 bc	6.70 c
Miravis Neo 2.5 SE	13.7 fl oz	V5 fb R1	25.00 bc	12.50 de	7.75 b	58.00 b	14.75 bc	7.75 c
p-value			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LSD (0.05)[w]			5.18	3.99	4.82	10.65	11.21	14.45

[z] Fungicide treatments applied on 3 Jul at the V5 growth stage and 9 Aug at the R1 (silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 32. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	Stay green[y] % 21-Sep	Stay green[y] % 2-Oct	Lodging[x] % 2-Oct	Harvest moisture % 25-Oct	Test weight lb/bu 25-Oct	Yield[w] bu/A 25-Oct
Nontreated control			80.0 c	35.0 c	2.0 a	23.18 b	51.15	201.55 d
Delaro 325 SC	8 fl oz	V5	83.8 bc	47.5 b	0.5 cd	23.13 b	50.50	206.91 bcd
Delaro 325 SC	8 fl oz	R1	87.5 ab	68.8 a	0.5 cd	24.65 a	50.78	221.65 a
Delaro 325 SC	8 fl oz	V5 fb R1	91.3 a	76.3 a	0.8 bcd	24.90 a	50.80	223.43 a
Trivapro 2.21 SE	13.7 fl oz	V5	83.8 bc	36.3 c	1.3 abc	23.20 b	50.78	204.43 cd
Trivapro 2.21 SE	13.7 fl oz	R1	91.3 a	66.3 a	0.0 d	24.63 a	51.55	215.46 abc
Trivapro 2.21 SE	13.7 fl oz	V5 fb R1	91.3 a	67.5 a	0.3 d	24.25 a	50.83	216.85 ab
Miravis Neo 2.5 SE	13.7 fl oz	V5	83.8 bc	42.5 bc	1.5 ab	23.40 b	50.95	205.30 bcd
Miravis Neo 2.5 SE	13.7 fl oz	R1	90.0 a	71.3 a	0.0 d	24.30 a	50.83	219.96 a
Miravis Neo 2.5 SE	13.7 fl oz	V5 fb R1	90.0 a	72.5 a	0.0 d	24.58 a	50.63	225.02 a
p-value			0.0031	0.0001	0.0012	0.0001	0.8632	0.0009
LSD (0.05)[v]			6.09	10.93	0.96	0.79	NS[u]	11.76

[z] Fungicide treatments applied on 3 Jul at the V5 growth stage and 9 Aug at the R1 (silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 Sep and 2 Oct.

[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.

[w] Yields were adjusted to 15.5% moisture and harvested on 25 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05)

[u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

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Fungicide evaluation for foliar disease in corn in northwestern Indiana, 2019 (COR19-16.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 19 July at the V10 growth stage and 8 Aug at the VT/R1 (tassel/silk) growth stages. Disease ratings were assessed on 21 Sep and 2 Oct at the R5 (dent), and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two, ear leaf plus two. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 28 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate to high severity. All fungicide treatments reduced severity of tar spot stroma over the nontreated control at all rating dates (Tables 33 and 34). The percent of chlorotic and necrotic symptoms were also significantly reduced with all fungicide treatments on 2 Oct (Tables 34). All fungicide treatments significantly increased the percentage of stay green canopy over the nontreated control on both 21 Aug and 2 Oct (Table 35). All fungicide treatments significantly reduced lodging and increased and yield over the nontreated control (Table 35). Corn yield was highest in plots treated with Veltyma 9 fl oz, but this was not significantly different from Delaro, Trivapro, Headline AMP at 10 fl oz, Veltyma at 7 fl oz, and Priaxor followed by Velytma (Table 35).

Table 33. Effect of fungicide on tar spot.

Treatment, rate/A and timing[z]	Tar spot % stroma[y] EL-2 21-Sep	Tar spot % stroma[y] EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep
Nontreated control	21.2 a	5.6 a	2.7 a
Lucento 4.17 SC 5 fl oz at VT	2.8 b	1.4 b	1.3 b
Delaro 325 SC 8 fl oz at VT	1.7 b	1.4 b	1.1 c
Trivapro 2.21 SE 13.7 fl oz at VT	3.3 b	1.6 b	1.3 b
Miravis Neo 2.5 SE 13.7 fl oz at VT	4.2 b	1.4 b	1.0 c
Headline AMP 1.68 SC 10 fl oz at VT	2.3 b	1.2 b	1.2 bc
Veltyma 3.34 S 7 fl oz at VT	1.8 b	1.1 b	1.0 c
Priaxor 4.17 SC 4 fl oz at V10 fb Veltyma 3.34 S 7 fl oz at VT	1.3 b	1.2 b	1.0 c
Veltyma 3.34 S 9 fl oz at VT	1.4 b	1.1 b	1.0 c
Headline AMP 1.68 SC 14.4 fl oz at VT	2.4 b	1.3 b	1.1 bc
p-value	0.0001	0.0001	0.0001
LSD (0.05)[x]	4.28	0.82	0.23

[z] Fungicide treatments applied on 19 July at the V10 growth stage and 8 Aug at the VT/R1 (tassel/silk) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 34. Effect of fungicide on tar spot.

Treatment, rate/A and timing[z]	Tar spot % stroma[y] EL-2 2-Oct	Tar spot % stroma[y] EL 2-Oct	Tar spot % stroma[y] EL+2 2-Oct	Tar spot % chlor/nec[x] EL-2 2-Oct	Tar spot % chlor/nec[x] EL 2-Oct	Tar spot % chlor/nec[x] EL+2 2-Oct
Nontreated control	40.8 a	40.8 a	37.1 a	98.8 a	94.8 a	89.2 a
Lucento 4.17 SC 5 fl oz at VT	27.8 bcd	23.8 b	15.2 bc	75.5 b-e	59.5 b	22.5 b
Delaro 325 SC 8 fl oz at VT	28.0 bcd	20.3 bc	12.4 bcd	79.0 bcd	34.5 cd	15.0 b-e
Trivapro 2.21 SE 13.7 fl oz at VT	33.3 ab	24.3 b	13.7 bc	86.3 ab	54.8 b	16.3 bcd
Miravis Neo 2.5 SE 13.7 fl oz at VT	32.8 bc	20.8 bc	10.6 cde	83.5 abc	46.0 b	15.2 b-e
Headline AMP 1.68 SC 10 fl oz at VT	25.3 cd	14.7 d	16.0 b	69.5 b-e	28.1 d	17.6 bc
Veltyma 3.34 S 7 fl oz at VT	24.3 d	12.0 d	10.4 cde	68.3 b-e	12.2 ef	7.4 cde
Priaxor 4.17 SC 4 fl oz at V10 fb Veltyma 3.34 S 7 fl oz at VT	13.0 f	6.4 e	7.0 e	60.0 de	9.7 f	5.0 de
Veltyma 3.34 S 9 fl oz at VT	16.3 ef	10.9 de	7.8 de	56.5 e	10.6 f	3.8 e
Headline AMP 1.68 SC 14.4 fl oz at VT	21.4 de	16.0 cd	10.2 cde	64.8 cde	26.7 de	21.0 b
p-value	0.0001	0.0001	0.0001	0.0029	0.0001	0.0001
LSD (0.05)[w]	7.69	5.51	5.15	19.15	14.60	12.45

[z] Fungicide treatments applied on 19 July at the V10 growth stage and 8 Aug at the VT/R1 (tassel/silk) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 35. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment, rate/A and timing[z]	Stay green[y] % 21-Sep	Stay green[y] % 2-Oct	Lodging[x] % 2-Oct	Harvest moisture % 28-Oct	Test weight lb/bu 28-Oct	Yield[w] bu/A 28-Oct
Nontreated control	61.3 b	21.3 d	40.0 a	23.20 d	50.70	179.79 e
Lucento 4.17 SC 5 fl oz at VT	92.5 a	45.0 c	25.0 b	23.58 bcd	49.78	197.06 d
Delaro 325 SC 8 fl oz at VT	93.8 a	58.8 bc	0.0 b	23.43 cd	50.38	209.59 a-d
Trivapro 2.21 SE 13.7 fl oz at VT	91.3 a	45.0 c	0.0 b	23.25 cd	53.60	209.27 a-d
Miravis Neo 2.5 SE 13.7 fl oz at VT	88.8 a	47.5 c	25.0 b	23.33 cd	50.45	202.80 bcd
Headline AMP 1.68 SC 10 fl oz at VT	92.5 a	65.0 ab	25.0 b	23.55 cd	50.43	211.24 abc
Veltyma 3.34 S 7 fl oz at VT	92.5 a	68.8 ab	25.0 b	24.40 ab	50.53	214.52 ab
Priaxor 4.17 SC 4 fl oz at V10 fb Veltyma 3.34 S 7 fl oz at VT	95.0 a	75.0 a	0.0 b	25.00 a	50.25	213.71 ab
Veltyma 3.34 S 9 fl oz at VT	95.0 a	73.8 a	25.0 b	25.13 a	50.20	223.54 a
Headline AMP 1.68 SC 14.4 fl oz at VT	91.3 a	58.8 bc	0.0 b	24.05 bc	50.50	193.36 d
p-value	0.0001	0.0001	0.0001	0.0001	0.3575	0.0002
LSD (0.05)[v]	6.76	13.85	60.37	0.83	NS[u]	14.88

[z] Fungicide treatments applied on 19 July at the V10 growth stage and 8 Aug at the VT/R1 (tassel/silk) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.
[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 Sep and 2 Oct.
[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.
[w] Yields were adjusted to 15.5% moisture and harvested on 28 Oct.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

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Assessment of fungicides applied at VT/R1 for tar spot in corn in northwestern Indiana, 2019 (COR19-17.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 8 Aug at the VT/R1 (tassel/silk) growth stages. Disease ratings were assessed on 21 Sep and 2 Oct at the R5 (dent), and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two, ear leaf plus two. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 25 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance and means were compared using Fisher's Least Significant Difference (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate to high severity. All fungicide treatments reduced severity of tar spot stroma over the nontreated control at all rating dates (Tables 36 and 37). The percentage of chlorotic and necrotic symptoms were also significantly reduced with all fungicide treatments on 2 Oct (Table 37). All fungicide treatments significantly increased the percentage of stay green of the corn over the nontreated control on both 21 Sep and 2 Oct (Table 38), treatments of Priaxor, Quilt Xcel, and Miravis Neo were less green than Veltyma, Revytek, Headline AMP. All fungicide treatments significantly reduced lodging, and increased yield over the nontreated control, and yield was highest with Veltyma, Revytek, Stratego YLD, and Miravis Neo (Table 38).

Table 36. Effect of fungicide on tar spot.

Treatment[z]	Rate/A	Tar spot % stroma[y] EL-2 21-Sep	Tar spot % stroma[y] EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep
Nontreated control		14.3 a	4.8 a	2.3 a
Veltyma 3.34 S	7 fl oz	1.2 b	1.1 b	1.0 b
Revytek 3.33 LC	8 fl oz	2.1 b	1.2 b	1.0 b
Trivapro 2.21 SE	13.7 fl oz	2.7 b	1.4 b	1.0 b
Headline AMP 1.68 SC	10 fl oz	1.5 b	1.1 b	1.2 b
Priaxor 4.17 SC	4 fl oz	2.1 b	1.2 b	1.1 b
Quilt Xcel 2.2 SE	14.5 fl oz	2.0 b	1.0 b	1.1 b
Stratego YLD 4.18 SC	4 fl oz	1.9 b	1.1 b	1.1 b
Miravis Neo 2.5 SE	13.7 fl oz	2.4 b	1.2 b	1.0 b
p-value		0.0005	0.0001	0.0001
LSD (0.05)[x]		5.13	0.98	0.21

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 37. Effect of fungicide on tar spot.

Treatment[z]	Rate/A	Tar spot % stroma[y] EL-2 2-Oct	Tar spot % stroma[y] EL 2-Oct	Tar spot % stroma[y] EL+2 2-Oct	Tar spot % chlor/necr[x] EL-2 2-Oct	Tar spot % chlor/necr[x] EL 2-Oct	Tar spot % chlor/necr[x] EL+2 2-Oct
Nontreated control		38.3 a	37.3 a	26.3 a	98.0 a	83.5 a	82.0 a
Veltyma 3.34 S	7 fl oz	12.0 f	6.9 g	5.7 c	44.5 e	5.4 f	2.9 b
Revytek 3.33 LC	8 fl oz	15.2 ef	9.0 fg	6.1 c	45.8 de	10.3 ef	9.6 b
Trivapro 2.21 SE	13.7 fl oz	28.3 b	18.6 b	9.4 bc	67.8 b	34.8 b	11.0 b
Headline AMP 1.68 SC	10 fl oz	15.7 def	10.7 ef	8.3 bc	49.5 cde	15.4 b	8.4 b
Priaxor 4.17 SC	4 fl oz	24.0 bc	16.1 bc	9.5 bc	57.5 b-e	25.0 de	8.5 b
Quilt Xcel 2.2 SE	14.5 fl oz	21.8 cd	14.6 cd	6.8 bc	60.0 bcd	19.6 c	9.0 b
Stratego YLD 4.18 SC	4 fl oz	21.0 cde	10.9 ef	10.7 b	52.0 cde	17.7 cd	9.9 b
Miravis Neo 2.5 SE	13.7 fl oz	21.3 cde	12.9 de	6.5 bc	63.3 bc	22.4 cde	3.9 b
p-value		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LSD (0.05)[w]		6.32	2.99	4.54	14.71	7.42	24.87

[z] Fungicide treatments applied on 8 Aug at the VT/R1 growth (tassel/silk) stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 38. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Stay green[y] % 21-Sep	Stay green[y] % 2-Oct	Lodging[x] % 2-Oct	Harvest moisture % 28-Oct	Test weight lb/bu 28-Oct	Yield[w] bu/A 28-Oct
Nontreated control		75.0 b	28.8 c	28.0 a	23.1 d	50.1	198.3 e
Veltyma 3.34 S	7 fl oz	95.0 a	78.8 a	0.0 b	25.7 a	50.8	229.1 a
Revytek 3.33 LC	8 fl oz	91.3 a	78.8 a	0.0 b	25.0 ab	50.7	225.7 abc
Trivapro 2.21 SE	13.7 fl oz	93.8 a	70.0 ab	3.0 b	24.5 bc	50.2	216.0 d
Headline AMP 1.68 SC	10 fl oz	95.0 a	78.8 a	0.0 b	24.6 bc	49.5	217.0 cd
Priaxor 4.17 SC	4 fl oz	95.0 a	66.3 b	3.0 b	24.2 c	50.3	215.9 d
Quilt Xcel 2.2 SE	14.5 fl oz	93.8 a	65.0 b	0.0 b	24.2 c	50.4	219.6 bcd
Stratego YLD 4.18 SC	4 fl oz	93.8 a	71.3 ab	0.0 b	24.1 c	50.5	220.0 a-d
Miravis Neo 2.5 SE	13.7 fl oz	95.0 a	62.5 b	0.0 b	24.3 c	50.6	228.3 ab
p-value		0.0001	0.0001	0.0001	0.0001	0.1925	0.0001
LSD (0.05)[v]		4.97	11.47	5.60	0.63	NS[u]	9.45

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 Sep and 2 Oct.

[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.

[w] Yields were adjusted to 15.5% moisture and harvested on 28 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

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Fungicide evaluation for foliar disease in corn in northwestern Indiana, 2019 (COR19-22.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 3 Jul at V5 growth stage and 9 Aug at R1 (silk) growth stage. Disease ratings were assessed on 29 Aug, 21 Sep and 30 Sep at the R3 (milk), R5 (dent), and R6 (maturity) growth stages, respectively. Disease severity was rated by visually assessing the percentage of symptomatic leaf area on three to five plants in each plot at the ear leaf, ear leaf minus two, and ear leaf plus two. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 28 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate to high severity. Fungicide applications of Affiance and Domark applied at R1 reduced tar spot stroma and chlorotic and necrotic symptoms at all rating dates (Tables 39 and 40). Fungicides applied at V5 generally were not significantly different from the nontreated control (Table 39 and 40). Affiance and Domark applied at R1 significantly increased the percentage of stay green of the corn over the nontreated control on both 21 Aug and 30 Sep, and increased yield over the nontreated control (Table 41).

Table 39. Effect of fungicide on tar spot.

Treatment[z]	Rate/A	Timing	Tar spot % stroma[y] EL-2 21-Sep	Tar spot % stroma[y] EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep	Tar spot % chlor/necr[x] EL-2 21-Sep	Tar spot % chlor/necr[x] EL 21-Sep	Tar spot % chlor/necr[x] EL+2 21-Sep
Nontreated control			27.35 ab	7.40 a	3.40 a	46.50 a	7.00	0.70
Affiance 1.5 SC	10 fl oz	V5	27.25 ab	7.10 a	2.20 bc	50.25 a	7.30	0.75
Domark 230 ME	6 fl oz	V5	21.75 b	6.55 a	2.05 bc	44.75 a	4.85	0.35
Delaro 325 SC	8 fl oz	V5	27.50 ab	10.40 a	2.75 ab	52.25 a	10.85	2.75
Trivapro 2.21 SE	13.7 fl oz	V5	32.50 a	8.85 a	3.45 a	50.25 a	7.00	0.90
Affiance 1.5 SC	10 fl oz	R1	11.95 c	2.10 b	1.45 cd	18.75 b	0.50	1.65
Domark 230 ME	6 fl oz	R1	6.15 c	1.85 b	1.05 d	11.35 b	1.40	0.10
p-value			0.0001	0.0034	0.0003	0.0001	0.0575	0.1965
LSD (0.05)[w]			7.39	4.28	0.97	15.67	NS[v]	NS

[z] Fungicide treatments applied on 3 Jul at V5 growth stage and 9 Aug at R1 (silk) growth stage.
[y] Tar spot stroma visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

Table 40. Effect of fungicide on tar spot.

Treatment[z]	Rate/A	Timing	Tar spot % stroma[y] % EL -2 30-Sep	Tar spot % stroma[y] % EL 30-Sep	Tar spot % stroma[y] % EL +2 30-Sep	Tar spot % chlor/necr[x] % EL -2 30-Sep	Tar spot % chlor/necr[x] % EL 30-Sep	Tar spot % chlor/necr[x] % EL +2 30-Sep
Nontreated control			45.00 a	39.75 a	39.00 a	93.50	81.75 a	65.75 a
Affiance 1.5 SC	10 fl oz	V5	40.75 ab	39.00 a	34.75 a	98.00	89.25 a	62.00 a
Domark 230 ME	6 fl oz	V5	38.75 abc	39.00 a	34.75 a	98.50	83.25 a	54.00 a
Delaro 325 SC	8 fl oz	V5	36.25 bc	33.25 ab	30.25 a	80.75	65.60 a	47.55 a
Trivapro 2.21 SE	13.7 fl oz	V5	39.00 abc	38.50 a	32.25 a	96.50	86.50 a	52.75 a
Affiance 1.5 SC	10 fl oz	R1	32.75 bc	27.75 b	17.00 b	73.25	32.80 b	10.65 b
Domark 230 ME	6 fl oz	R1	31.50 c	25.25 b	19.25 b	69.50	32.00 b	14.25 b
p-value			0.0372	0.0197	0.0008	0.0882	0.0019	0.0001
LSD (0.05)[w]			8.14	9.65	9.61	NS[v]	31.30	20.05

[z] Fungicide treatments applied on 3 Jul at V5 growth stage and 9 Aug at R1 (silk) growth stage.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

Table 41. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	Stay green[y] % 21-Sep	Stay green[y] % 30-Sep	Lodging[x] % 30-Sep	Harvest moisture % 28-Oct	Test weight lb/bu 28-Oct	Yield[w] bu/A 28-Oct
Nontreated control			51.3 b	28.8 c	1.5	22.78	53.20	182.68 b
Affiance 1.5 SC	10 fl oz	V5	61.3 b	33.8 bc	1.0	22.58	53.68	183.33 b
Domark 230 ME	6 fl oz	V5	58.8 b	35.0 bc	1.3	21.95	53.23	176.70 b
Delaro 325 SC	8 fl oz	V5	63.8 b	32.5 bc	0.5	22.60	53.25	178.35 b
Trivapro 2.21 SE	13.7 fl oz	V5	63.8 b	36.3 b	0.8	21.98	53.38	181.45 b
Affiance 1.5 SC	10 fl oz	R1	83.8 a	57.5 a	0.0	23.33	52.13	203.28 a
Domark 230 ME	6 fl oz	R1	82.5 a	56.3 a	0.8	23.23	52.90	198.33 a
p-value			0.0001	0.0001	0.2399	0.1792	0.3662	0.0003
LSD (0.05)[v]			7.38	7.03	NS[u]	NS	NS	10.77

[z] Fungicide treatments applied on 3 Jul at V5 growth stage and 9 Aug at R1 (silk) growth stage.
[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 and 30 Sep.
[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.
[w] Yields were adjusted to 15.5% moisture and harvested on 28 Oct.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Tar spot; *Phyllachora maydis*

C. R. Da Silva, D. E. P. Telenko, J. D. Ravellette, and S. Shim. Dept. Botany and Plant Pathology
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Evaluation of a fungicide programs for tar spot in corn in northwestern Indiana, 2019 (COR19-23.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 8 Aug at the VT/R1 (tassel/silk) and 22 Aug at the R2 (blister) growth stages. Disease ratings were assessed on 21 Sep and 30 Sep at the R5 (dent) and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf, ear leaf minus two, ear leaf plus two. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 25 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Tar spot was the most prominent disease and reached moderate to high severity. All fungicide treatments reduced severity of tar spot stroma over the nontreated control at all rating dates (Tables 42 and 43). The Aproach Prima, Aproach followed by (fb) Aproach Prima, and Aproach Prima fb Aproach has significantly reduced tar spot stroma severity on 30 Sep as compared to nontreated control and Aproach at VT (Tables 43). The percent of chlorotic and necrotic symptoms were also significantly reduced with all fungicide treatments on 21 Sep on the ear leaf minus two and ear leaf on 21 Sep, and all leaves on 30 Sep (Tables 42 and 43). All fungicide treatments significantly increased the percent of stay green of the corn over the nontreated control on both 21 Aug and 30 Sep (Table 44). No difference between treatments was detected for lodging (Table 44). All fungicides treatments significantly increased yield over the nontreated control (Table 44) Aproach Prima fb Aproach had the highest yield, but was not different from the Aproach fb Aproach Prima program (Table 44).

Table 42. Effect of fungicide on tar spot.

Treatments, rate/A and timing[z]	Tar spot % stroma[y] EL-2 21-Sep	Tar spot % stroma[y] EL 21-Sep	Tar spot % stroma[y] EL+2 21-Sep	Tar spot %chlor/necr[x] EL-2 21-Sep	Tar spot %chlor/necr[x] EL 21-Sep	Tar spot %chlor/necr[x] EL+2 21-Sep
Nontreated control	25.0 a	7.8 a	2.6 a	39.5 a	7.5 a	0.5
Aproach 2.08 SC 6 fl oz at VT	10.8 b	2.7 b	1.7 b	18.8 b	2.2 b	1.0
Aproach Prima 2.34 SC 6.8 fl oz at VT	2.8 c	1.5 b	1.0 c	4.0 c	0.3 b	0.1
Aproach 2.08 SC 6 fl oz at VT/R1 fb Aproach Prima 2.34 SC 6.8 fl oz at R2	1.6 c	1.0 b	1.0 c	6.7 c	0.3 b	0.0
Aproach Prima 2.34 SC 6.8 fl oz at VT/R1 fb Aproach 2.08 SC 6 fl oz at R2	1.9 c	1.1 b	1.0 c	7.6 c	0.5 b	0.0
p-value	0.0001	0.0017	0.0003	0.0001	0.0093	0.2821
LSD (0.05)[w]	3.77	3.02	0.62	9.14	4.08	NS[v]

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) and 22 Aug at the R2 (blister) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). EL = ear leaf. [x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [v] NS = not significant (α=0.05).

Table 43. Effect of fungicide on tar spot.

Treatments, rate/A and timing[z]	Tar spot % stroma[y] EL-2 30-Sep	Tar spot % stroma[y] EL 30-Sep	Tar spot % stroma[y] EL+2 30-Sep	Tar spot % chlor/necr[x] EL-2 30-Sep	Tar spot % chlor/necr[x] EL 30-Sep	Tar spot % chlor/necr[x] EL+2 30-Sep
Nontreated control	39.3 a	37.0 a	30.5 a	89.3 a	76.8 a	45.5 a
Aproach 2.08 SC 6 fl oz at VT	31.3 b	25.8 b	19.0 b	70.3 b	53.3 b	21.3 b
Aproach Prima 2.34 SC 6.8 fl oz at VT	21.3 c	19.5 c	14.0 c	55.8 c	28.8 c	8.1 c
Aproach 2.08 SC 6 fl oz at VT/R1 fb Aproach Prima 2.34 SC 6.8 fl oz at R2	16.3 d	14.8 c	5.8 e	57.5 bc	19.6 c	4.6 c
Aproach Prima 2.34 SC 6.8 fl oz at VT/R1 fb Aproach 2.08 SC 6 fl oz at R2	16.1 d	17.3 c	9.9 d	65.0 bc	27.0 c	6.8 c
p-value	0.0001	0.0001	0.0001	0.0016	0.0001	0.0001
LSD (0.05)[w]	4.45	4.85	4.07	14.16	10.72	9.55

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) and 22 Aug at the R2 (blister) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[x] Tar spot chlorotic and necrotic symptoms visually assessed as percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2).
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 44. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatments, rate/A and timing[z]	Stay green[y] % 21-Sep	Stay green[y] % 30-Sep	Lodging[x] % 30-Sep	Harvest moisture % 25-Oct	Test weight lb/bu 25-Oct	Yield[w] bu/A 25-Oct
Nontreated control	53.8 b	32.5 c	7.5	22.65 d	52.38	186.74 c
Aproach 2.08 SC 6 fl oz at VT	80.0 a	47.5 b	7.5	23.00 cd	52.35	199.30 bc
Aproach Prima 2.34 SC 6.8 fl oz at VT	86.3 a	56.3 a	0.0	23.38 bc	51.53	200.65 b
Aproach 2.08 SC 6 fl oz at VT/R1 fb Aproach Prima 2.34 SC 6.8 fl oz at R2	87.5 a	60.0 a	2.5	24.45 a	51.78	207.75 ab
Aproach Prima 2.34 SC 6.8 fl oz at VT/R1 fb Aproach 2.08 SC 6 fl oz at R2	86.3 a	62.5 a	5.0	23.83 b	52.00	213.87 a
p-value	0.0001	0.0001	0.2754	0.0001	0.4778	0.0071
LSD (0.05)[v]	8.53	8.08	NS[u]	0.53	NS	12.87

[z] Fungicide treatments applied on 8 Aug at the VT/R1 (tassel/silk) and 22 Aug at the R2 (blister) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, fb = followed by.
[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 21 and 30 Sep.
[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.
[w] Yields were adjusted to 15.5% moisture and harvested on 25 Oct.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05)
[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max*); 'P35T75X'
White mold; *Sclerotinia sclerotiorum*
Frogeye leaf spot; *Cercospora sojina*
Cercospora leaf blight; *Cercospora kukuchii*
Septoria brown spot; *Septoria glycines*
Sudden death syndrome*; Fusarium virguliforme*

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Fungicide comparison for white mold in soybean, 2019 (SOY19-02.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 6.7-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T75X'' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 6 Jun. Inoculum of *Sclerotinia sclerotiorum* was applied on the seedbed at 1.25 g/ft at planting. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 23 Jul at the R1 (beginning bloom) and 30 Jul at the R2 (full bloom) growth stages. Disease ratings were assessed on 29 Aug and 18 Sep at the R4 (full pod) and R6 (full pod) growth stages, respectively. Disease severity was rated by visually assessing the number of symptomatic plants in each plot for white mold and sudden death syndrome (SDS). Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were rated for severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, white mold, frogeye leaf spot (FLS), Cercospora leaf blight (CLB) and Septoria brown spot (SBS) were the most prominent diseases in the trial. There was no significant difference between fungicide treatments for white mold or any other diseases on 18 Sep (Tables 45). There was no significant treatment effect on percentage of stay green, defoliation, and soybean yield (Table 46).

Table 45. Effect of fungicide on soybean diseases.

Treatment[z]	Rate/A	White mold # plants/plot[y] 18-Sep	FLS % severity[x] 18-Sep	CLS % severity[x] 18-Sep	SBS % severity[x] 18-Sep	SDS # plants/plot[w] 18-Sep
Nontreated, non-inoculated		1.0	1.0	7.3	1.5	2.1
Nontreated, inoculated		0.3	1.0	5.5	1.0	1.0
Acropolis 2.37 LC	23 fl oz	2.5	1.0	5.5	0.8	6.8
Aproach 2.08 SC	8 fl oz	1.0	1.5	5.0	0.8	2.8
Endura 70 WDG	12.5 oz	1.0	1.3	7.5	0.8	1.3
Priaxor 4.17 SC	6 fl oz	2.3	1.0	6.3	0.8	2.8
Stratego YLD 4.18 SC	4 fl oz	2.0	1.0	4.3	0.6	1.6
Proline 480 SC	4 fl oz	0.3	1.0	5.8	0.6	3.3
Omega 500 F	0.75 pt	0.5	1.5	6.8	0.8	5.3
Topsin 4.5 F	15 fl oz	3.8	1.3	8.8	0.8	3.5
Miravis Neo 2.5 SE	20.8 fl oz	3.5	1.0	8.0	0.6	1.8
Double Nickel 55 WG	1 qt	2.8	1.0	5.0	1.9	2.8
Doubel Nickel 55 WG	2 qt	2.8	2.0	8.8	0.9	5.5
p-value		0.1826	0.5847	0.4090	0.2681	0.5652
LSD (0.05)[v]		NS[u]	NS	NS	NS	NS

[z] All plots inoculated with *S. sclerotiorum* in-furrow at planting, except noninoculated check. Fungicide treatments applied on 23 Jul at the R1 (beginning bloom) and 30 Jul at the R2 (full bloom) growth stages. All treatments contained a non-ionic surfactant at a rate of 0.25% v/v. [y] White mold disease assessed by counting the number of plants/plots with symptoms. [x] Severity visually assessed the percentage (0-100%) of symptomatic leaf area in the plot. FLS = frogeye leaf spot; CLB = Cercospora leaf blight; SBS = Septoria brown spot. [w] Sudden death syndrome (SDS) disease assessed by counting the number of plants/plots with symptoms. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

Table 46. Effect of fungicide on stay green, defoliation, moisture, test weight, and yield of soybean.

Treatment[z]	Rate/A	Stay green[y] % 18-Sep	Defoliation[x] % 18-Sep	Harvest % moisture 23-Oct	Test weight lbs/bu 23-Oct	Yield[w] bu/A 23-Oct
Nontreated, non-inoculated		92.9	2.1	12.46	55.32	80.36
Nontreated, inoculated		92.5	2.3	12.44	55.20	81.31
Acropolis 2.37 LC	23 fl oz	90.0	2.5	12.49	55.08	79.49
Aproach 2.08 SC	8 fl oz	92.5	2.5	12.66	55.33	82.92
Endura 70 WDG	12.5 oz	92.5	1.8	12.61	55.36	80.55
Priaxor 4.17 SC	6 fl oz	92.5	2.5	12.65	55.51	81.14
Stratego YLD 4.18 SC	4 fl oz	96.3	1.5	12.63	55.15	82.22
Proline 480 SC	4 fl oz	92.5	2.0	12.58	55.20	77.96
Omega 500 F	0.75 pt	92.5	2.8	12.66	55.41	80.62
Topsin 4.5 F	15 fl oz	87.5	2.5	12.55	55.35	81.89
Miravis Neo 2.5 SE	20.8 fl oz	91.3	2.8	12.95	55.33	79.35
Double Nickel 55 WG	1 qt	87.5	3.8	12.75	55.11	79.77
Doubel Nickel 55 WG	2 qt	87.5	2.5	12.56	55.23	77.72
p-value		0.5527	0.8474	0.5915	0.3664	0.8352
LSD (0.05)[v]		NS[u]	NS	NS	NS	NS

[z] All plots inoculated with *S. sclerotiorum* in-furrow at planting, except noninoculated check. Fungicide treatments applied on 23 Jul at the R1 (beginning bloom) and 30 Jul at the R2 (full bloom) growth stages. All treatments contained a non-ionic surfactant at a rate of 0.25% v/v. [y] Stay green visually assessed the percentage (0-100%) in the plot on 18 Sep. [x] Defoliation = percentage of leaf loss in plot. [w] Yields were adjusted to 13% moisture and harvested on 23 Oct. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05). [u] NS = not significant α=0.05.

SOYBEAN (*Glycine max* 'P34A13X')
White mold; *Sclerotinia sclerotiorum*
Frogeye leaf spot; *Cercospora sojina*
Cercospora leaf blight; *Cercospora kikuchii*
Septoria brown spot; *Septoria glycines*
Sudden death syndrome; *Fusarium virguliforme*

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Evaluation of fungicides for foliar diseases in soybean in northwestern Indiana, 2019 (SOY19-14.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'P34A13X'' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 8 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 10 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 15 Aug and 18 Sep at the R3/R4 (beginning pod/full pod) and R6 (full pod) growth stages, respectively. Disease severity was rated by visually assessing the number of symptomatic plants in each plot for white mold. Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). Disease incidence refers to the percentage of plants with disease symptoms, and disease severity (DS) was rated using a 1-9 scale where 1 refers to low disease pressure and 9 refers to premature death of the plant. SDS Index was then calculated using the equation: DX= (DI x DS)/9. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB) and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the plots. The two center rows of each plot were harvested on 24 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, white mold, frogeye leaf spot (FLS), sudden death syndrome (SDS), Septoria brown spot (SBS), and Cercospora leaf blight (CLB) were the most prominent diseases in the trial. There was no significant difference between fungicide treatments and nontreated control for all disease ratings on 18 Sep (Tables 47 and 48). There was no significant effect of treatment on percentage of stay green, defoliation, and yield of soybean (Tables 49).

Table 47. Effect of fungicide on soybean diseases.

Treatment[z]	Rate/A	White mold #plant/plot[y] 18-Sep	FLS % severity[x] 18-Sep	CLB % severity[x] 18-Sep	SBS % severity[x] 18-Sep
Nontreated control		5.00	1.25	0.75	1.88
Miravis Top 1.67 SC	13.7 fl oz	4.00	1.00	3.00	0.30
Miravis Neo 2.5 SE	13.7 fl oz	2.50	1.00	1.25	0.43
USF0411	8.0 fl oz	2.75	1.25	1.25	0.30
Delaro 325 SC	8.0 fl oz	4.75	1.00	0.00	0.20
Lucento 4.17 SC	5.0 fl oz	10.00	1.00	0.50	0.40
Aproach Prima 2.34 SC	6.8 fl oz	5.00	1.00	1.50	0.50
Priaxor 4.17 SC	4.0 fl oz	18.50	1.25	1.75	0.30
Headline AMP 1.68 SC	10.0 fl oz	21.25	2.00	1.50	0.53
Veltyma 3.34 S	7.0 fl oz	3.25	1.00	3.00	0.38
p-value		0.3409	0.5403	0.2991	0.1155
LSD (0.05)[w]		NS[v]	NS	NS	NS

[z] Fungicide treatments applied on 10 Aug at the R3 (beginning pod) growth stage. All treatments contained a Preference at a rate of 0.25% v/v. Except treatment USF0411, which contained Induce at 0.12% v/v. [y] White mold disease assessed by counting the number of plants/plots with symptoms. [x] Severity visually assessed the percentage (0-100%) of symptomatic leaf area in the plot. FLS = frogeye leaf spot; CLB = Cercospora leaf blight; SBS = Septoria brown spot leaf. [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [v] NS = not significant (α=0.05).

Table 48. Effect of fungicide on foliar disease.

Treatment[z]	Rate/A	SDS % incidence[y] 18-Sep	SDS % severity[x] (1-9) 18-Sep	SDS Index[w] 18-Sep
Nontreated control		3.25	1.50	0.73
Miravis Top 1.67 SC	13.7 fl oz	0.75	0.50	0.18
Miravis Neo 2.5 SE	13.7 fl oz	4.25	2.00	1.03
USF0411	8.0 fl oz	2.25	1.50	0.45
Delaro 325 SC	8.0 fl oz	1.75	1.00	0.38
Lucento 4.17 SC	5.0 fl oz	3.75	1.00	0.83
Aproach Prima 2.34 SC	6.8 fl oz	2.00	1.75	0.53
Priaxor 4.17 SC	4.0 fl oz	7.25	1.50	1.58
Headline AMP 1.68 SC	10.0 fl oz	2.50	0.75	0.43
Veltyma 3.34 S	7.0 fl oz	2.75	2.00	0.60
p-value		0.1219	0.4120	0.1733
LSD (0.05)[v]		NS[u]	NS	NS

[z] Fungicide treatments applied on 10 Aug at the R3 (beginning pod) growth stage. All treatments contained a Preference at a rate of 0.25% v/v. Except treatment USF0411, which contained Induce at 0.12% v/v. [y] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). Disease incidence refers to the percentage of plants with disease symptoms. [x] Disease severity (DS) was rated using a 1-9 scale where 1 refers to low disease pressure and 9 refers to premature death of the plant. [w] SDS Index was then calculated using the equation: DX= (DI x DS)/9. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

Table 49. Effect of fungicide on stay green, defoliation, moisture, test weight, and yield of soybean.

Treatment[z]	Rate/A	Stay green[y] % 18-Sep	Defoliation[x] % 18-Sep	Harvest moisture % 24-Oct	Test weight lbs/bu 24-Oct	Yield[w] bu/A 24-Oct
Nontreated control		92.50	1.50	13.85	55.55	63.12
Miravis Top 1.67 SC	13.7 fl oz	95.00	1.00	13.80	55.45	67.43
Miravis Neo 2.5 SE	13.7 fl oz	95.00	1.00	13.90	55.28	64.75
USF0411	8.0 fl oz	93.75	1.25	13.78	55.55	63.67
Delaro 325 SC	8.0 fl oz	95.00	1.00	13.88	55.45	63.19
Lucento 4.17 SC	5.0 fl oz	95.00	1.25	13.73	55.63	63.52
Aproach Prima 2.34 SC	6.8 fl oz	95.00	1.25	13.73	55.38	64.59
Priaxor 4.17 SC	4.0 fl oz	88.75	2.00	13.90	55.58	62.57
Headline AMP 1.68 SC	10.0 fl oz	90.00	2.50	14.05	55.40	63.61
Veltyma 3.34 S	7.0 fl oz	93.75	1.00	14.73	56.18	64.20
p-value		0.4699	0.2256	0.5023	0.5956	0.5187
LSD (0.05)[v]		NS[u]	NS	NS	NS	NS

[z] Fungicide treatments applied on 10 Aug at the R3 (beginning pod) growth stage. All treatments contained a Preference at a rate of 0.25% v/v. Except treatment USF0411, which contained Induce at 0.12% v/v.

[y] Stay green visually assessed the percentage (0-100%) in the plot on 18 Sep.

[x] Defoliation = percentage of leaf loss in plot.

[w] Yields were adjusted to 13% moisture and harvested on 24 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
White mold; *Sclerotinia sclerotiorum*
Frogeye leaf spot; *Cercospora sojina*
Cercospora leaf blight; *Cercospora kikuchii*
Septoria brown spot; *Septoria glycines*
Sudden death syndrome; *Fusarium virguliforme*

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Comparison of fungicides for white mold in soybean in northwestern Indiana, 2019 (SOY19-15.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 6.7-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T75X'' was planted in 15-inch row spacing at a rate of 8 seeds/ft on 6 Jun. Inoculum of *S. sclerotiorum* was applied on the seedbed at 1.25 g/ft at planting. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 23 Jul at the R1 (begining bloom) and 10 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 29 Aug and 18 Sep at the R4 (full pod) and R6 (full seed) growth stages, respectively. Disease severity was rated by visually assessing the number of symptomatic plants in each plot for white mold. Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). Disease incidence refers to the percentage of plants with disease symptoms, and disease severity (DS) was rated using a 1-9 scale where 1 refers to low disease pressure and 9 refers to premature death of the plant. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB) and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, very little disease developed in plots. White mold, frogeye leaf spot (FLS), sudden death syndrome (SDS) and Septoria brown spot (SBS), Cercospora leaf blight (CLB) were the most prominent diseases. There was no significant difference between fungicide treatments and nontreated control for all disease ratings on 18 Sep (Tables 50 and 51). There was no significant effect of treatment on percentage of stay green, defoliation, and soybean yield (Table 52).

Table 50. Effect of fungicide on soybean diseases.

Treatment[z]	Rate/A	Timing	White mold #/plot[y] 18-Sep	FLS % severity[x] 18-Sep	CLB % severity[x] 18-Sep	SBS % severity[y] 18-Sep
Nontreated control			2.00	1.0	8.75	0.75
Proline 480 SC	3 fl oz	R1	1.75	1.0	8.75	0.50
Delaro 325 SC	8 fl oz	R1	0.50	1.0	6.25	0.50
USF0411	8 fl oz	R1	0.75	1.0	10.00	0.63
Delaro 325 SC fb Delaro 325 SC	8 fl oz	R1 fb R3	0.75	1.0	7.00	0.50
USF0411 fb USF0411	8 fl oz	R1 fb R3	2.25	1.0	7.50	0.50
p-value			0.8087	-	0.7771	0.2161
LSD (0.05)[w]			NS[v]	NS	NS	0.25

[z] Fungicide treatments applied on 23 Jul at the R1 (beginning bloom) and 10 Aug at the R3 (beginning pod) growth stages, respectively. All treatments contained a non-ionic surfactant (Induce) at a rate of 0.12% v/v. All plots inoculated with *S. sclerotiorum*, fb=followed by.

[y] White mold disease assessed by counting the number of plants/plots with symptoms.

[x] Severity visually assessed the percentage (0-100%) of symptomatic leaf area in the plot. FLS = frogeye leaf spot; CLB = Cercospora leaf blight; SBS = Septoria brown spot leaf.

[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[v] NS = not significant (α=0.05).

Table 51. Effect of fungicide on foliar diseases severity.

Treatment[z]	Rate/A	Timing	SDS % incidence[y] 18-Sep	SDS % severity[y] (1-9) 18-Sep	SDS Index[x] 18-Sep
Nontreated control			7.5	1.50	2.78
Proline 480 SC	3 fl oz	R1	8.75	3.00	3.88
Delaro 325 SC	8 fl oz	R1	3.25	1.75	1.35
USF0411	8 fl oz	R1	1.25	1.00	0.55
Delaro 325 SC fb Delaro 325 SC	8 fl oz	R1 fb R3	2.50	2.00	1.10
USF0411 fb USF0411	8 fl oz	R1 fb R3	2.50	2.00	1.10
p-value			0.3399	0.8272	0.4370
LSD (0.05)[w]			NS[v]	NS	NS

[z] Fungicide treatments applied on 23 Jul at R1 (beginning bloom) and 10 Aug at R3 (beginning pod) growth stages, respectively. All treatments contained a non-ionic surfactant (Induce) at a rate of 0.12% v/v. All plots inoculated with *S. sclerotiorum,* fb = followed by.

[y] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). Disease incidence refers to the percentage of plants with disease symptoms, and disease severity (DS) was rated using a 1-9 scale where 1 refers to low disease pressure and 9 refers to premature death of the plant.

[x] SDS Index was then calculated using the equation: DX = (DI x DS)/9.

[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[v] NS = not significant (α=0.05).

Table 52. Effect of fungicide on stay green, defolidation, moisture, test weight, and yield of soybean.

Treatment[z]	Rate/A	Timing	Stay green[y] % 18-Sep	Defoliation[x] % 18-Sep	Harvest moisture % 24-Oct	Test weight lb/bu 24-Oct	Yield[w] bu/A 24-Oct
Nontreated control			87.5	3.0	13.36	55.67	109.55
Proline 480 SC	3 fl oz	R1	90.0	2.0	13.43	55.55	106.89
Delaro 325 SC	8 fl oz	R1	90.0	2.3	14.25	56.20	112.02
USF0411	8 fl oz	R1	91.3	3.0	14.43	54.93	110.24
Delaro 325 SC fb Delaro 325 SC	8 fl oz	R1 fb R3	88.8	2.8	13.45	55.53	113.77
USF0411 fb USF0411	8 fl oz	R1 fb R3	90.0	2.8	13.35	56.28	113.43
p-value			0.8319	0.9072	0.3439	0.2392	0.3670
LSD (0.05)[v]			NS[u]	NS	NS	NS	NS

[z] Fungicide treatments applied on 23 Jul at R1 (beginning bloom) and 10 Aug at R3 (beginning pod) growth stages, respectively. All treatments contained a non-ionic surfactant (Induce) at a rate of 0.12% v/v. All plots inoculated with *Sclerotinia sclerotiorum*, fb = followed by.

[y] Stay green visually assessed the percentage (0-100%) in the plot on 18 Sep.

[x] Defoliation = percentage of leaf loss in plot.

[w] Yields were adjusted to 13% moisture and harvest on 24 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P35T75X')
White mold; *Scerotinia sclerotiorum*
Frogeye leaf spot*; Cercospora sojina*
Septoria brown spot*; Septoria glycines*

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Fungicide evaluation for white mold in soybean in northwestern Indiana, 2019 (SOY19-22.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 6.7-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T75X'' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 6 Jun. Inoculum of *S. sclerotiorum* was applied on the seedbed at 1.25 g/ft at planting. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 30 Jul at the R1 (beginning bloom) growth stage. Disease ratings were assessed on 29 Aug and 18 Sep at the early R4 (full pod) and R6 (full seed) growth stages, respectively. Disease severity was rated by visually assessing the number of symptomatic plants in each plot for white mold. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were rated for severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2014) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, white mold, frogeye leaf spot (FLS) and Septoria brown spot (SBS) were the most prominent diseases in the trial. There was no significant difference between fungicide treatments for white mold on 29 Aug, and frogeye leaf spot, Septoria brown spot and defoliation on 18 Sep (Tables 53). All fungicide programs reduced the number of plants with white mold over nontreated control on 18 Sep, except Domark plus Badge (Table 53). There was no significant treatment effect on harvest moisture, test weight, and yield of soybean (Table 54).

Table 53. Effect of fungicide on soybean diseases.

Treatment and Rate/A[z]	White mold #/plot[y] 29-Aug	White mold #/plot[y] 18-Sep	FLS % severity[x] Upper canopy 18-Sep	FLS % severity[x] Lower canopy 18-Sep	SBS % severity[x] Lower canopy 18-Sep
Nontreated control	0.25	2.75 a	1.50	6.50	1.50
Domark 230 ME 5 fl oz	0.00	0.50 cd	1.00	5.00	1.00
Domark 230 ME 5 fl oz + Badge SC 1 qt	0.00	2.25 ab	1.00	5.00	1.00
Aproach 2.08 SC 10 fl oz	0.00	0.25 cd	1.25	5.50	1.00
Aproach 2.08 SC 10 fl oz + Badge SC 1 qt	0.00	0.00 d	1.25	5.00	2.25
Endura 70 WDG 8 oz	0.00	0.50 cd	1.00	5.00	1.00
Endura 70 WDG 8 oz + Badge SC 1 qt	0.00	0.25 cd	1.00	5.50	1.00
Topsin M 15 fl oz	0.00	0.00 d	1.00	4.25	1.00
Topsin M 15 fl oz + Badge SC 1 qt	0.00	0.50 cd	1.25	4.50	2.00
Badge SC 1 qt	0.00	1.75 abc	1.00	4.00	1.25
GWN 10473 6 fl oz	0.00	0.00 d	1.00	7.00	0.88
GWN 10473 6 fl oz + Badge SC 1 qt	0.00	0.75 bcd	1.00	3.50	1.00
p-value	0.4671	0.0068	0.3526	0.7807	0.3664
LSD (0.05)[w]	NS[v]	1.55	NS	NS	NS

[z] All plots inoculated with *S. sclerotiorum* in-furrow at planting. Fungicide treatments applied on 30 Jul at the R1 (beginning bloom) growth stage. [y] White mold disease assessed by counting the number of plants/plots with symptoms. [x] Severity visually assessed the percentage (0-100%) of symptomatic leaf area in the upper and lower canopies. FLS = frogeye leaf spot; SBS = Septoria brown spot leaf. [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant difference test (LSD; α=0.05). [v] NS = not significant (α=0.05).

Table 54. Effect of fungicide on defoliation, moisture, test weight, and yield of soybean.

Treatment and Rate/A[z]	Defoliation[y] % 18-Sep	Harvest moisture % 23-Oct	Test weight lb/bu 23-Oct	Yield[x] bu/A 23-Oct
Nontreated control	4.0	12.33	55.51	79.98
Domark 230 ME 5 fl oz	2.0	12.46	55.14	76.18
Domark 230 ME 5 fl oz + Badge SC 1 qt	1.0	12.31	55.15	78.03
Aproach 2.08 SC 10 fl oz	1.0	12.36	55.34	78.25
Aproach 2.08 SC 10 fl oz + Badge SC 1 qt	3.3	12.53	55.30	75.29
Endura 70 WDG 8 oz	3.3	12.53	55.46	76.40
Endura 70 WDG 8 oz + Badge SC 1 qt	2.5	12.30	55.33	83.21
Topsin M 15 fl oz	2.5	12.53	55.28	75.37
Topsin M 15 fl oz + Badge SC 1 qt	1.3	12.33	55.21	78.90
Badge SC 1 qt	2.0	12.40	55.29	78.32
GWN 10473 6 fl oz	2.8	12.60	55.11	77.44
GWN 10473 6 fl oz + Badge SC 1 qt	2.0	12.55	55.20	74.98
p-value	0.1443	0.7999	0.6037	0.8026
LSD (0.05)[w]	NS[v]	NS	NS	NS

[z] All plots inoculated with *S. sclerotiorum* in-furrow at planting. Fungicide treatments applied on 30 Jul at the R1 (beginning bloom) growth stage. [y] Defoliation = percentage of leaf loss in plot. [x] Yields were adjusted to 13% moisture and harvested on 23 Oct. [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant difference test (LSD; α=0.05). [v] NS = not significant α=0.05.

CORN (*Zea mays* 'P9998AM')
Southern rust; *Puccinia polysora*
Northern corn leaf blight; *Exserohilum turcicum*
Gray leaf spot; *Cercospora zeae-maydis*

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Evaluation of fungicide for foliar diseases on corn in southwestern Indiana, 2019 (COR19-18.SWPAC).

A trial was established at the Southwest Purdue Agricultural Center (SWPAC) in Knox County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was planted in 30-inch row spacing at a rate of 27,000 seeds/A on 28 May. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 24 Jul at the early R1 (silk) growth stage and 14 Aug at the R3 (milk). Disease ratings were assessed on 27 Aug at the R4 (dough) growth stage, and on 12 Sep at the R5 (dent) growth stage. Disease severity was rated by visually assessing the percentage of symptomatic leaf area of the ear leaf on five plants in each plot. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 9 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Southern rust (SR), gray leaf spot (GLS), and northern corn leaf blight (NCLB) were the most prominent diseases in the trial and reached moderate severity. Physoderma brown spot were also noted in some plots, but not rated. Lucento, Trivapro, Miravis Neo, Veltyma, Delaro, Quilt Excel and Revytek applied at the early R1 significantly reduced southern rust on 27 Aug as compared to the nontreated control (Table 55). There was no significant difference between fungicide treatments and nontreated control for northern corn leaf blight and gray leaf spot on 27 Aug. All fungicides at both the early R1 and R3 application timings significantly reduced southern rust on 12 Sep as compared to the nontreated control (Table 55). All fungicide treatments and timings reduced gray leaf spot on 12 Sep. By 12 Sep, only Lucento and Revytek applied at the early R1 had significantly less northern corn leaf blight than the nontreated control. All fungicides applied at R3 reduced northern corn leaf blight over nontreated control, except Miravis Neo on 12 Sep. There was no difference between treatments for percentage of stay green, lodging, and ear rot (Table 56). Test weight was significantly lower than nontreated control for Veltyma, Quilt Xcel, Headline AMP, and Revytek at the early R1, and Veltyma, Quilt Xcel, and Revytek at R3, but no differences were detected between fungicide treatments and nontreated control for yield (Table 56).

Table 55. Effect of fungicide on foliar diseases severity.

Treatment[z]	Rate/A	Timing	SR % severity[y] 27-Aug	NCLB % severity[y] 27-Aug	GLS % severity[y] 27-Aug	SR % severity[y] 12-Sep	NCLB % severity[y] 12-Sep	GLS % severity[y] 12-Sep
Nontreated control			0.70 a	0.00	2.50	11.95 a	7.30 a	4.00 a
Lucento 4.17 SC	5 fl oz	VT/R1	0.20 bc	0.10	1.25	0.68 b	1.28 de	0.95 cd
Trivapro 2.21 SE	13.7 fl oz	VT/R1	0.05 c	0.15	1.05	0.25 b	5.60 abc	1.28 cd
Miravis Neo 2.5 SE	13.7 fl oz	VT/R1	0.05 c	0.00	1.15	1.20 b	5.00 a-d	0.69 d
Veltyma 3.34 S	7 fl oz	VT/R1	0.05 c	0.20	1.15	0.83 b	0.75 e	0.80 d
Delaro 325 SC	8 fl oz	VT/R1	0.05 c	0.10	1.45	2.53 b	6.65 ab	1.18 cd
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	0.00 c	0.45	1.20	1.43 b	5.45 a-d	1.23 cd
Headline AMP 1.68 SC	10 fl oz	VT/R1	0.40 abc	0.05	1.25	0.88 b	5.85 abc	1.26 cd
Revytek 3.33 LC	8 fl oz	VT/R1	0.10 c	0.15	1.25	3.71 b	0.35 e	0.76 d
Lucento 4.17 SC	5 fl oz	R3	0.55 ab	0.65	1.70	0.74 b	0.55 e	1.83 bcd
Trivapro 2.21 SE	13.7 fl oz	R3	0.30 abc	0.00	2.60	0.37 b	2.30 cde	1.84 bcd
Miravis Neo 2.5 SE	13.7 fl oz	R3	0.35 abc	0.30	1.65	0.89 b	3.60 a-e	2.20 bc
Veltyma 3.34 S	7 fl oz	R3	0.65 a	0.45	1.70	0.50 b	0.45 e	0.91 cd
Delaro 325 SC	8 fl oz	R3	0.30 abc	0.25	1.95	1.29 b	3.00 b-e	1.73 bcd
Quilt Xcel 2.2 SE	10.5 fl oz	R3	0.30 abc	0.20	1.65	0.47 b	2.25 cde	2.63 b
Headline AMP 1.68 SC	10 fl oz	R3	0.30 abc	0.60	1.70	1.67 b	0.00 e	1.69 bcd
Revytek 3.33 LC	8 fl oz	R3	0.35 abc	0.85	2.30	2.87 b	2.95 b-e	1.44 bcd
p-value			0.0130	0.3483	0.2247	0.0001	0.0041	0.0008
LSD (0.05)[x]			0.40	NS[w]	NS	3.78	4.21	1.31

[z] Fungicide treatments applied on 24 Jul at the early R1 (silk) growth stage and 14 Aug at the R3 (milk) growth stage, and all treatments contained a non-ionic surfactant at a rate of 0.25% v/v.

[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf. Five leaves assessed per plot and averaged. GLS = gray leaf spot; SR = southern rust; NCLB = northern corn leaf blight; SR = southern rust.

[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[w] NS = not significant (α=0.05).

Table 56. Effect of fungicide on stay green, lodging, ear rot, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Timing	Stay green[y] % 12-Sep	Lodging[x] % 12-Sep	Ear rot[w] % 1-Nov	Harvest moisture % 9-Oct	Test weight lb/bu 9-Oct	Yield[v] bu/A 9-Oct
Nontreated control			60.00	2.50	4.45	13.98	58.18 a	154.12
Lucento 4.17 SC	5 fl oz	VT/R1	56.25	0.00	4.85	14.53	58.13 a	149.01
Trivapro 2.21 SE	13.7 fl oz	VT/R1	48.75	0.00	3.73	14.03	57.73 a-c	154.56
Miravis Neo 2.5 SE	13.7 fl oz	VT/R1	57.50	0.00	3.15	14.53	57.63 abc	157.53
Veltyma 3.34 S	7 fl oz	VT/R1	51.25	0.00	4.98	13.98	57.38 b-d	163.85
Delaro 325 SC	8 fl oz	VT/R1	63.75	5.00	4.38	14.23	57.73 abc	167.65
Quilt Xcel 2.2 SE	10.5 fl oz	VT/R1	51.25	0.00	3.58	14.40	56.90 e	155.58
Headline AMP 1.68 SC	10 fl oz	VT/R1	60.00	0.00	3.95	14.48	57.43 b-e	151.93
Revytek 3.33 LC	8 fl oz	VT/R1	57.50	0.00	3.73	14.65	57.25 b-e	152.02
Lucento 4.17 SC	5 fl oz	R3	53.75	0.00	4.03	14.18	57.60 a-d	168.10
Trivapro 2.21 SE	13.7 fl oz	R3	48.75	0.00	3.15	14.43	57.45 a-e	165.70
Miravis Neo 2.5 SE	13.7 fl oz	R3	55.00	2.50	3.53	14.50	57.80 abc	161.10
Veltyma 3.34 S	7 fl oz	R3	55.00	2.50	4.05	14.38	56.95 de	155.13
Delaro 325 SC	8 fl oz	R3	50.00	0.00	5.43	14.48	57.83 ab	155.65
Quilt Xcel 2.2 SE	10.5 fl oz	R3	58.75	0.00	4.69	14.45	57.15 cde	163.35
Headline AMP 1.68 SC	10 fl oz	R3	62.50	2.50	4.45	14.30	57.58 a-d	162.79
Revytek 3.33 LC	8 fl oz	R3	52.50	0.00	4.43	14.60	57.38 b-e	160.97
p-value			0.5601	0.6716	0.6780	0.8951	0.0110	0.6268
LSD (0.05)[u]			NS[t]	NS	NS	NS	0.66	NS

[z] Fungicide treatments applied on 24 Jul at the early R1 (silk) growth stage and 14 Aug at the R3 (milk) growth stage, and all treatments contained a non-ionic surfactant at a rate of 0.25% v/v.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green on 12 Sep.

[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical on 12 Sep.

[w] Ear rot was visually assessed percentage (0-100%) from 10 ears per plot – a mix of ear rot pathogens were identified and included *Fusarium* spp*., Gibberella, Diplodia, and Trichoderma* associated with significant insect feeding (data not presented).

[v] Yields were adjusted to 15.5% moisture and harvested on 9 Oct.

[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[t] NS = not significant (α=0.05).

CORN (*Zea mays* 'P9998AM')
Gray leaf spot; *Cercospora zeae-maydis*
Southern rust; *Puccinia polysora*
Northern corn leaf blight; *Exserohilum turcicum*

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Evaluation of fungicides for foliar diseases on corn in southwestern Indiana, 2019 (COR19-20.SWPAC).

A trial was established at the Southwest Purdue Agricultural Center (SWPAC) in Knox County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was planted in 30-inch row spacing at a rate of 27,000 seeds/A on 28 May. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 24 Jul at the early R1 (silk) growth stage. Disease ratings were assessed on 27 Aug at the R4 (dough) growth stage, and on 12 Sep at the R5 (dent) growth stage. Disease severity was rated by visually assessing the percentage of symptomatic leaf area of the ear leaf on five plants in each plot. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 9 Oct and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for disease. Southern rust (SR), gray leaf spot (GLS), and northern corn leaf blight (NCLB) were the most prominent diseases in the trial and reached moderate severity. Physoderma brown spot were also noted in some plots, but not rated. All fungicide treatments reduced gray leaf spot as compared to the nontreated control on 27 Aug and 12 Sep (Table 57). Brixen, USF0411, and Headline AMP treatments were not different from nontreated control for southern rust on 27 Aug, but on 12 Sep all fungicides treatments had significantly less southern rust as compared to the nontreated control (Table 57). There was no difference between treatments for northern corn leaf blight on 27 Aug, but on 12 Sep all fungicides significantly reduced northern corn leaf blight over nontreated control, except USF0411 (Table 57). No significant differences between fungicide treatments and the nontreated control for percentage of stay green, percentage of lodging, and yield of corn (Table 58).

Table 57. Effect of fungicide on foliar diseases severity.

Treatment[z]	Rate/A	GLS % severity[y] 27-Aug	SR % severity[y] 27-Aug	NCLB % severity[y] 27-Aug	GLS % severity[y] 12-Sep	SR % severity[y] 12-Sep	NCLB % severity[y] 12-Sep
Nontreated control		4.25 a	1.1 a	1.4	4.0 a	6.3 a	9.3 a
Miravis Neo 2.5 SE	13.7 fl oz	0.65 b	0.4 bc	0.1	0.7 b	1.6 b	3.4 bc
Trivapro 2.21 SE	13.7 fl oz	0.95 b	0.1 c	0.8	0.5 b	0.5 b	1.9 c
Brixen 3.5 G	13.7 fl oz	1.05 b	0.7 ab	0.0	0.3 b	0.9 b	1.0 c
Fortix 3.22 SC	5.0 fl oz	0.80 b	0.5 bc	0.0	0.6 b	0.7 b	1.2 c
USF0411	8.0 fl oz	0.80 b	0.8 ab	0.4	0.6 b	1.0 b	6.8 ab
Veltyma 3.34 S	7.0 fl oz	0.95 b	0.3 bc	0.8	0.5 b	0.6 b	0.1 c
Quilt Xcel 2.2 SE	10.5 fl oz	0.95 b	0.4 bc	0.0	0.3 b	0.7 b	2.3 c
Headline AMP 1.68 SC	10.5 fl oz	0.80 b	0.7 ab	0.6	0.7 b	0.9 b	3.2 bc
p-value		0.0001	0.0162	0.1045	0.0001	0.0051	0.0007
LSD (0.05)[x]		0.95	0.50	NS[w]	0.70	2.73	3.78

[z] Fungicide treatments applied on 24 Jul at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf. GLS = gray leaf spot; SR = southern rust; NCLB = northern corn leaf blight. [x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [w] NS = not significant (α=0.05).

Table 58. Effect of fungicide on stay green, lodging, moisture, test weight, and yield of corn.

Treatment[z]	Rate/A	Stay green[y] % 12-Sep	Lodging[x] % 12-Sep	Harvest moisture % 9-Oct	Test weight lb/bu 9-Oct	Yield[w] bu/A 9-Oct
Nontreated control		33.8	0.3	14.30	57.23	145.05
Miravis Neo 2.5 SE	13.7 fl oz	52.5	0.3	14.65	57.38	148.11
Trivapro 2.21 SE	13.7 fl oz	40.0	0.0	14.20	57.55	146.35
Brixen 3.5 G	13.7 fl oz	43.8	0.3	14.25	57.50	158.21
Fortix 3.22 SC	5.0 fl oz	40.0	0.5	14.43	57.33	137.72
USF0411	8.0 fl oz	51.3	0.5	14.50	57.20	156.42
Veltyma 3.34 S	7.0 fl oz	45.0	0.0	15.18	57.00	159.31
Quilt Xcel 2.2 SE	10.5 fl oz	37.5	0.0	14.58	57.03	150.57
Headline AMP 1.68 SC	10.5 fl oz	48.8	0.5	14.20	57.43	149.91
p-value		0.0615	0.4613	0.0537	0.0438	0.6725
LSD (0.05)[v]		NS[u]	NS	NS	NS	NS

[z] Fungicide treatments applied on 24 Jul at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Stay green visually assessed percentage (0-100%) of crop canopy green.

[x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical.

[w] Yields were adjusted to 15.5% moisture and harvested on 9 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P35T75X')
Frogeye leaf spot; *Cercospora sojina*
Septoria Brown spot; *Septoria glycines*
Cercospora leaf blight; *Cercospora kikuchii*

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Evaluation of fungicides for foliar diseases on soybean in southwestern Indiana, 2019 (SOY19-18.SWPAC).

A trial was established at the Southwest Purdue Agricultural Center (SWPAC) in Knox County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was soybean. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P35T75x' was planted in 30-inch row spacing at a rate of 150,000 seeds/A on 3 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 1 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 27 Aug at the R5 (beginning seed) growth stage, and on 12 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The two center rows were harvested on 8 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS), Septoria brown spot (SBS) and Cercospora leaf blight (CLB) were the most prominent diseases in the trial. All fungicide treatments reduced frogeye leaf spot and Septoria brown spot in both upper and lower canopy as compared to the nontreated control on 27 Aug and 12 Sep (Tables 59 and 60). Veltyma, Headline AMP, Miravis Neo, Miravis Top, and Delaro reduced Cercospora leaf blight severity as compared to the nontreated control on 12 Sep (Table 59). All fungicides reduced defoliation as compared to the nontreated control on 12 Sep (Table 60). All fungicide treatments increased yield over nontreated control, except Aproach Prima and Priaxor. Both were not significant different from Headline AMP, and Priaxor was not significantly different from Lucento in yield (Table 60).

Table 59. Effect of fungicide on foliar diseases severity.

Treatment[z]	Rate/A	FLS severity[y] % upper canopy 27-Aug	FLS severity[y] % lower canopy 27-Aug	SBS severity[y] % lower canopy 27-Aug	FLS severity[y] % upper canopy 12-Sep	FLS severity[y] % lower canopy 12-Sep	CLB % severity[y] 12-Sep
Nontreated control		1.05 a	0.6 a	1.1 a	10.0 a	1.8 a	22.5 a
Miravis Neo 2.5 SE	13.7 fl oz	0.05 b	0.0 b	0.1 b	1.1 b	0.6 b	11.3 bc
Miravis Top 1.67 SC	13.7 fl oz	0.03 b	0.0 b	0.1 b	1.3 b	0.3 b	11.3 bc
Delaro 325 SC	8.0 fl oz	0.23 b	0.0 b	0.3 b	2.3 b	0.3 b	12.5 bc
Lucento 4.17 SC	5.0 fl oz	0.08 b	0.1 b	0.1 b	0.5 b	0.3 b	16.3 ab
Aproach Prima 2.34 SC	6.8 fl oz	0.10 b	0.0 b	0.4 b	2.5 b	0.3 b	16.3 ab
Priaxor 4.17 SC	4.0 fl oz	0.23 b	0.0 b	0.3 b	2.3 b	0.8 b	16.3 ab
Headline AMP 1.68 SC	10.0 fl oz	0.18 b	0.0 b	0.1 b	2.3 b	0.8 b	12.5 bc
Veltyma 3.34 S	7.0 fl oz	0.08 b	0.0 b	0.1 b	1.0 b	0.3 b	7.5 c
p-value		0.0002	0.0035	0.0505	0.0001	0.0034	0.0051
LSD (0.05)[x]		0.37	0.26	0.63	2.42	0.72	6.45

[z] Fungicide treatments applied on 1 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Severity visually assessed the percentage (0-100%) of symptomatic leaf area in the upper and lower canopies. FLS = frogeye leaf spot; SBS = Septoria brown spot leaf; CLB = Cercospora leaf blight. [x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 60. Effect of fungicide treatment on foliar disease severity, defolidation, moisture, test weight, and yield of soybean.

Treatment[z]	Rate/A	SBS severity[y] % upper canopy 12-Sep	SBS severity[y] % lower canopy 12-Sep	Defoliation[x] % 12-Sep	Harvest moisture % 8-Oct	Test weight lb/bu 8-Oct	Yield[w] bu/A 8-Oct
Nontreated control		3.5 a	28.8 a	5.0 a	13.38	55.08	66.65 d
Miravis Neo 2.5 SE	13.7 fl oz	0.0 b	1.0 b	1.0 b	13.40	54.83	76.04 a
Miravis Top 1.67 SC	13.7 fl oz	0.3 b	0.5 b	1.9 b	13.40	54.78	76.82 a
Delaro 325 SC	8.0 fl oz	1.0 b	2.8 b	1.0 b	13.23	54.90	73.34 ab
Lucento 4.17 SC	5.0 fl oz	0.3 b	1.0 b	0.9 b	13.30	54.75	76.01 a
Aproach Prima 2.34 SC	6.8 fl oz	0.0 b	3.8 b	1.0 b	13.25	54.88	68.10 cd
Priaxor 4.17 SC	4.0 fl oz	0.0 b	2.8 b	0.8 b	13.43	55.05	69.82 bcd
Headline AMP 1.68 SC	10.0 fl oz	0.5 b	3.3 b	1.1 b	13.30	54.73	72.04 abc
Veltyma 3.34 S	7.0 fl oz	0.0 b	0.8 b	0.9 b	13.83	54.75	76.58 a
p-value		0.0001	0.0001	0.0001	0.1685	0.7909	0.0007
LSD (0.05)[v]		1.23	3.42	1.22	NS[u]	NS	0.50

[z] Fungicide treatments applied on 1 Aug at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.

[y] Severity visually assessed the percentage (0-100%) of symptomatic leaf area in the upper and lower canopies. SBS = Septoria brown spot leaf.

[x] Defoliation = percentage of leaf loss in plot.

[w] Yields were adjusted to 13% moisture and harvested on 8 Oct.

[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

[u] NS = not significant (α=0.05).

WHEAT (*Triticum aestivum*); 'P25R40'
Fusarium head blight; *Fusarium graminearum*
Leaf rust; *Puccinia triticina*

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Fusarium head blight (FHB) integrated fungicide trials in wheat in southwestern Indiana, 2019 (WHT19-02.SWPAC).

Plots were established at the Southwest Purdue Agricultural Center (SWPAC) in Knox Count, IN. The experiment was a randomized complete block design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. Standard practices for non-irrigated wheat production in Indiana were followed. On 8 Oct 2019 wheat cultivar P25R40 was drilled at 7.5 in. spacing. Fungicide applications were applied with a CO_2 pressurized backpack sprayer using a handheld boom fitted with pair TJ8001VS nozzels spaced 20 in. apart and directed forward and backward at 45 degree angle which delivered 10 gal/A at 40 psi. Fungicides were applied on 11 May 2019 at the Feekes growth stage 10.5.1 and 16 May 2019 at the Feekes growth stage 10.5.3 (10.5.3 + 4 days). Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 100 plants in each plot and calculated as a percentage. FHB severity was rated by visually assessing the percentage of the infected head, FHB index was calculated as: (total FHB incidence/Average FHB severity)/100 per plot. Disease severity of leaf blotch was rated by visually assessing the percentage of symptomatic tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 28 June and yields were adjusted to 13.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, weather conditions were favorable for Fusarium head blight (FHB) and leaf rust. Fusarium head blight (FHB) was the most prominent disease in the trial. All fungicide programs significantly reduced FHB incidence on 3 Jul (Table 61). Miravis Ace applied at 10.5.4, Miravis Ace followed by Prosaro, and Miravis Ace followed by Caramba significantly reduced FHB severity (Table 61). All fungicide programs reduced FHB Index over nontreated control, except Caramba (Table 61). No differences were detected between treatments for leaf rust (Table 61). Deoxynivalenol (DON) was reduced by all fungicide programs over nontreated control (2.34 ppm), except Prosaro and Miravis Ace followed by Caramba (Table 62). All fungicide treatments significantly increased moisture and test weight over the nontreated control (Table 62). All fungicide programs increased yield over nontreated, except Caramba (Table 62). The percentage of Fusarium damaged kernels (FDK) was significantly reduced with Miravis Ace followed by Prosaro, Miravis Ace followed by Caramba, and Miravis Ace applied at 10.5.4 and 10.5.1 as compared to the nontreated control (Table 62).

Table 61. Effect of fungicide on Fusarium head blight (FHB) and foliar diseases severity.

Treatment, rate/A, and application timing[z]	FHB % incidence[y] 3-Jul	FHB % severity[y] 3-Jul	FHB Index[x] 3-Jul	Leaf rust[y] % severity[y] 3-Jul
Nontreated control	62.5 a	42.3 a	27.5 a	1.3
Prosaro 421 SC 6.5 fl oz at 10.5.1	35.3 b	33.6 abc	12.1 b	0.1
Caramba 90 EC 13.5 fl oz at 10.5.1	46.3 b	35.1 ab	18.6 ab	0.3
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	36.0 b	35.3 ab	12.6 b	0.4
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.4	42.3 b	27.4 bc	11.8 b	0.5
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.4	33.3 b	23.5 c	9.2 b	0.2
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 ED 13.5 fl oz at 10.5.4	37.5 b	25.6 bc	9.5 b	0.0
p-value	0.0181	0.034	0.0286	0.2988
LSD (0.05)[v]	16.11	11.44	11.03	NS[u]

[z] All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v, fb = followed by. [y] Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 100 in each plot and calculated as a percentage and FHB severity was rated by visually assessing the percentage of the infected head from infected heads out of 100. [x] FHB index was calculated as: (total FHB incidence/average FHB severity)/100 per plot. [w] Disease severity of leaf rust was rated by visually assessing the percentage of symptomatic tissue on five flag leaves per plot. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

Table 62. Effect of fungicide on deoxynivalenol (DON), moisture, test weight, yield, and Fusarium damaged kernels (FDK) of wheat.

Treatment, rate/A, and application timing[z]	DON[y] ppm 28-Jun	Harvest moisture % 28-Jun	Test weight lbs/bu 28-Jun	Yield[x] bu/A 28-Jun	FDK[w] % 28-Jun
Nontreated control	2.35 a	12.83 d	53.55 d	87.26 d	20.0 a
Prosaro 421 SC 6.5 fl oz at 10.5.1	1.80 ab	13.20 bc	54.83 c	93.87 c	20.0 a
Caramba 90 EC 13.5 fl oz at 10.5.1	1.34 cd	13.00 cd	54.78 c	92.90 cd	15.3 ab
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	1.15 bc	13.50 a	56.10 a	104.21 a	8.8 bc
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.4	1.44 bc	13.45 ab	55.85 ab	98.68 abc	7.3 bc
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.4	0.82 bc	13.43 ab	55.88 ab	101.97 ab	5.3 c
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 ED 13.5 fl oz at 10.5.4	1.55 abc	13.48 a	55.30 bc	97.65 bc	10.3 bc
p-value	0.0481	0.0001	0.0001	0.0003	0.0091
LSD (0.05)[v]	0.89	0.26	0.66	6.17	8.87

[z] All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v, fb = followed by.
[y] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab.
[x] Yields were adjusted to 13.5% moisture and harvested on 28 Jun.
[w] FDK = Percentage of Fusarium damaged kernels.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

CORN (*Zea mays* 'P0157AM')
Gray leaf spot*; Cercospora zeae-maydis*
Northern corn leaf spot; *Bipolaris zeicola*
Southern rust; *Puccinia polysora*
Tar spot; *Phyllachora maydis*

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Field-scale fungicide timing comparison for foliar diseases on corn in northeastern Indiana, 2019 (COR19-10.NEPAC).

A trial was established at the Northeast Purdue Agricultural Center (NEPAC) in Whitley County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 400 feet long, consisted of four rows. The previous crop was soybean. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P0157AM' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 5 June. Fungicide treatments applied on 9 Jul at the V6, 24 July at the V10, and 9 Aug at the VT (tassel) growth stages. Disease ratings were assessed on 13 Sep at the R5 (beginning seed) growth stage. Southern rust (SR), northern corn leaf spot (NCLS), and gray leaf spot (GLS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area on the ear leaf. Tar spot was rated by visually assessing the percentage of stroma per leaf on five plants in each plot at the ear leaf. Corn was harvested on 5 Nov and yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, tar spot, southern rust (SR), northern corn leaf spot (NCLS), and gray leaf spot (GLS) were the most prominent diseases. There were no significant fungicide timing effects over nontreated control for all disease ratings on 13 Sep (Table 63). There was no significant effect of fungicide timing on moisture and yield (Table 63).

Table 63. Effect of fungicide on foliar disease, moisture, and yield of corn.

Treatment[z]	Rate/A	Timing	GLS % severity[y] 13-Sep	NCLS % severity[y] 13-Sep	SR % severity[y] 13-Sep	Tar spot % stroma[x] 13-Sep	Harvest moisture % 5-Nov	Yield[w] bu/A 5-Nov
Nontreated control			2.27	1.55	0.79	20.53	20.53	220.90
Headline AMP 1.68 SC	10 fl oz	V6	2.22	1.11	0.60	20.80	20.80	225.80
Headline AMP 1.68 SC	10 fl oz	V10	1.92	0.86	0.60	20.85	20.85	222.98
Headline AMP 1.68 SC	10 fl oz	VT/R1	2.62	0.92	1.03	20.63	20.63	218.98
p-value			0.98	0.71	0.88	0.82	0.82	0.72
LSD (0.05)[v]			NS[u]	NS	NS	NS	NS	NS

[z] Fungicide treatments applied on 9 Jul at the V6, 24 July the V10, and 9 Aug at the VT (tassel) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on leaf. GLS = gray leaf spot; SR = southern rust; NCLS = northern corn leaf spot.
[x] Tar spot stroma visually assessed percentage (0-100%) of leaf area.
[w] Yields were adjusted to 15.5% moisture and harvested on 5 Nov.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
White mold; *Sclerotinia sclerotiorum*

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Field-scale fungicide timing comparison for foliar diseases on soybean in northeastern Indiana, 2019 (SOY19-12.NEPAC).

A trial was established at the Northeast Purdue Agricultural Center (NEPAC) in Whitley County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 365 feet long, consisted of four rows. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 15-inch row spacing at a rate of 140,000 seeds/A on 5 June. Fungicides were applied on 10 Jul at the V4, 6 Aug at the R3 (beginning pod), and 29 Aug at the R5 (beginning seed) growth stage. Disease ratings were assessed on 13 Aug at the R5 growth stage. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. Soybean plots were harvested on 17 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS), Septoria brown spot (SBS), and white mold were the most prominent diseases. There was no significant difference between fungicide treatments and nontreated control for all disease ratings on 28 Aug (Table 64). There was no significant effect of treatment on soybean yield (Table 64).

Table 64. Effect of fungicide on diseases and yield of soybean.

Treatment[z]	Rate /A	Timing	FLS severity[y] % upper canopy 28-Aug	FLS severity[y] % lower canopy 20-Sep	SBS severity[y] % lower canopy 20-Sep	White mold[x] #/plot 17-Oct	Yield[w] bu/A 17-Oct
Nontreated control			3.00	1.84	3.94	2.38	68.90
Priaxor 4.17 SC	4 fl oz	V4	1.38	0.96	3.75	2.00	69.78
Priaxor 4.17 SC	4 fl oz	R3	2.43	1.55	3.63	0.75	71.68
Priaxor 4.17 SC	4 fl oz	R5	1.34	0.39	3.00	1.13	70.23
p-value			0.2952	0.3612	0.9202	0.2879	0.8538
LSD (0.05)[v]			NS[u]	NS	NS	NS	NS

[z] Fungicide treatments applied 10 Jul at the V4 (forth-leaf), 6 Aug at the R3 (beginning pod), and 29 Aug at the R5 (beginning seed) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity rated on scale of 0-100% of upper and lower canopy with disease symptoms. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] White mold disease assessed by counting the number of plants/plots with symptoms.
[w] Yields were adjusted to 13% moisture and harvested on 17 Oct.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
Cercospora leaf blight; *Cercospora kikuchii*
Septoria brown spot; *Septoria glycines*

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Field-scale fungicides timing comparison for foliar diseases on soybean in southeastern Indiana, 2019 (SOY19-11.SEPAC).

A trial was established at the Southeast Purdue Agricultural Center (SEPAC) in Jennings County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 365-ft long, consisted of four rows. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 15-inch row spacing at a rate of 150,000 seeds/A on 1 Jul. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. Fungicides were applied on 1 Aug at the V4, 28 Aug at the R3 (beginning pod), and 16 Sep at the R5 (beginning seed) growth stage. Disease ratings were assessed on 25 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. Soybean plots were harvested on 23 Oct and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were the most prominent diseases in the trial. Lucento in all timings reduced frogeye leaf spot in upper canopy (Table 65). There was no difference for frogeye leaf spot in the lower canopy, Cercospora blight, and Septoria brown spot (Table 65). All application timings (V4, R3, and R5) of Lucento increase yield of soybean over nontreated control (Table 65).

Table 65. Effect of fungicide on foliar diseases severity and soybean yield.

Treatment[z]	Rate/A	Timing	FLS severity[y] % upper canopy 25-Sep	FLS severity[y] % lower canopy 25-Sep	CLB severity[y] % upper canopy 25-Sep	SBS severity[y] % lower canopy 25-Sep	Yield[x] bu/A 23-Oct
Nontreated control			5.25 a	1.75	6.50	3.00	52.70 b
Lucento 4.17 SC	5 fl oz	V4	2.25 b	1.00	8.75	1.38	58.50 a
Lucento 4.17 SC	5 fl oz	R3	1.00 b	1.13	6.25	1.25	60.83 a
Lucento 4.17 SC	5 fl oz	R5	1.75 b	0.75	8.75	1.50	57.13 a
p-value			0.0021	0.1174	0.8444	0.1191	0.0053
LSD (0.05)[w]			1.77	NS[v]	NS	NS	3.74

[z] Fungicide treatments applied 1 Aug at the V4 and 28 Aug at the R3 (beginning pod), and 16 Sep at the R5 (beginning seed) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity rated on scale of 0-100% of upper and lower canopy with disease symptoms. FLS = frogeye leaf spot; SBS = Septoria brown spot; CLB = Cercospora leaf blight.
[x] Yields were adjusted to 13% moisture and harvested on 23 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

CORN (*Zea mays* 'P0157AM')

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Field-scale fungicide timing comparison for foliar diseases on corn in central Indiana, 2019 (COR19-09.DPAC)

A trial was established at the Davis Purdue Agricultural Center (DPAC) in Randolph County, IN. The experiment was a randomized complete block design with four replications. Plots were 30-ft wide and 450 feet long, consisted of twelve rows. The previous crop was soybean. Standard practices for non-irrigated soybean production in Indiana were followed. Corn hybrid 'P1057AM' was planted in 30-inch row spacing at a rate of 30,000 seeds/A on 6 Jun. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. Fungicides were applied on 31 Jul at the V9 and 12 Aug at the VT (tassel) growth stages. Yields were adjusted to 15.5% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, there was no significant treatment effect on harvest moisture and yield of corn (Table 66).

Table 66. Effect of fungicide on moisture and yield of corn.

Treatment[z]	Rate/A	Timing	Harvest moisture % 9-Nov	Yield[y] bu/A 9-Nov
Nontreated control			17.98	135.53
Delaro 325 SC	8 fl oz	V9	18.12	143.79
Delaro 325 SC	8 fl oz	V9	18.04	140.19
Delaro 325 SC	8 fl oz	VT	18.12	135.78
p-value			0.5914	0.3626
LSD (0.05)[x]			NS[w]	NS

[z] Fungicide treatments applied on 31 Jul at the V9 and 12 Aug at the VT (tassel) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Yields were adjusted to 15.5% moisture and harvested on 9 Nov.
[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[w] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A13X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
Sudden death syndrome; *Fusarium virguliforme*

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Field-scale fungicide timing comparison for foliar diseases on soybean in central Indiana, 2019 (SOY19-10.DPAC)

A trial was established at the Davis Purdue Agricultural Center (DPAC) in Randolph County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 500 feet long, consisted of twelve rows. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P34A13X' was planted in 7.5-inch row spacing at a rate of 200,000 seeds/A on 14 Jun and replanted on 27 Jun. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. Fungicides were applied on 30 Jul at the V4, 28 Aug at the R3 (beginning pod), and 9 Sep at the R5 (beginning seed) growth stage. Disease ratings were assessed on 25 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS) and Cercospora leaf blight (CLB) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. Soybean plots were harvested on 4 Nov and yields were adjusted to 13% moisture. Data were subjected to analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2019, frogeye leaf spot (FLS) and Septoria brown spot (SBS) were the most prominent diseases. There was no significant difference between fungicide treatments and nontreated control for all disease ratings on 25 and 28 Sep (Table 67). There was no significant treatment effect on moisture and yield of soybean (Table 67).

Table 67. Effect of fungicide on foliar disease, moisture, and yield of soybean.

Treatment[z]	Rate/A	Timing	FLS severity[y] % upper canopy 25-Sep	FLS severity[y] % lower canopy 25-Sep	SBS severity[y] % lower canopy 25-Sep	Harvest moisture % 4-Nov	Yield[x] bu/A 4-Nov
Nontreated control			0.88	1.13	1.63	14.38	56.71
Delaro 325 SC	12 fl oz	V4	1.50	0.88	0.75	14.61	52.77
Delaro 325 SC	12 fl oz	R3	0.75	0.88	1.13	14.39	56.79
Delaro 325 SC	12 fl oz	R5	0.63	0.38	1.38	14.34	55.32
p-value			0.2216	0.6831	0.2148	0.002	0.6816
LSD (0.05)[w]			NS[v]	NS	NS	NS	NS

[z] Fungicide treatments applied 30 Jul at the V4, 28 Aug at the R3 (beginning pod), and 9 Sep at the R5 (beginning seed) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity rated on scale of 0-100% of upper and lower canopy with disease symptoms. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] Yields were adjusted to 13% moisture and harvested on 4 Nov.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

APPENDIX – WEATHER DATA

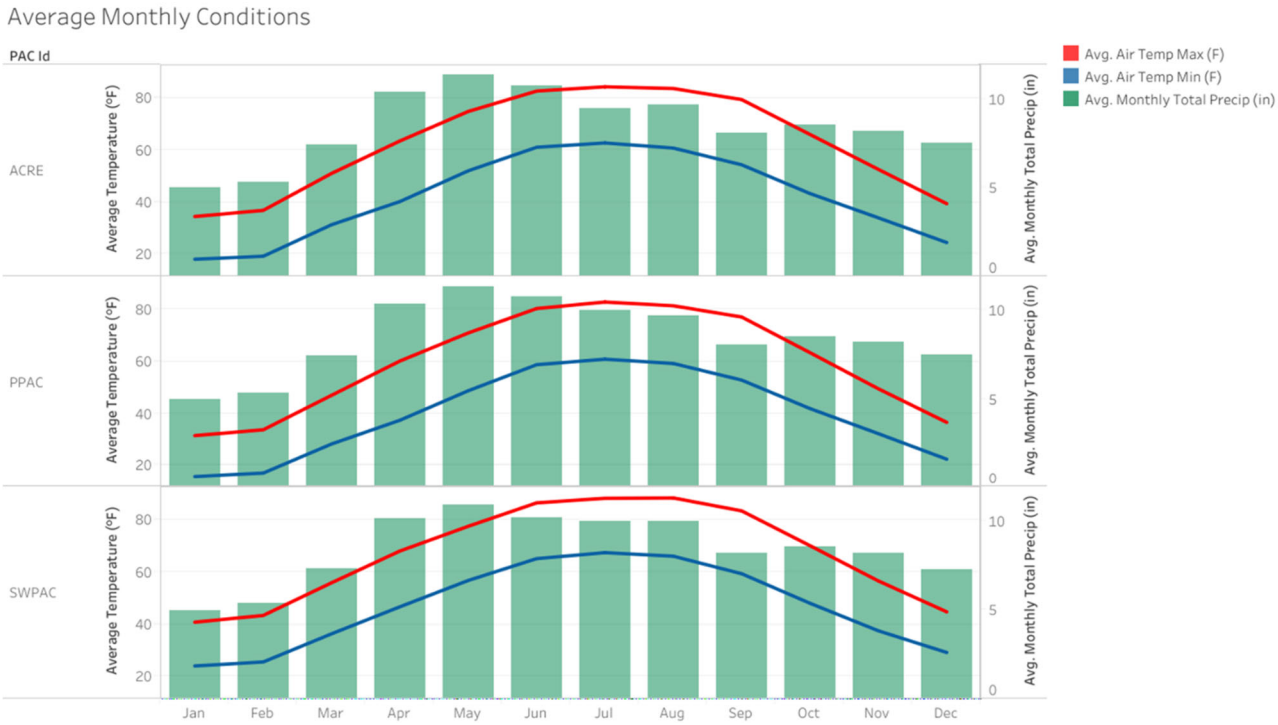

Figure 3. Average air temperatures and total precipitation at research sites in Indiana. Image courtesy of Dr. Beth Hall and Jonathan Weaver. Indiana State Climate Office.

Table 68. Average monthly minimum and maximum air temperature and total prescipitation at research sites in Indiana.

	ACRE			PPAC			SWPAC		
Months	Min temp (°F)[y]	Max temp (°F)[y]	Total precip (in.)[x]	Min temp (°F)[y]	Max temp (°F)[y]	Total precip (in.)[x]	Min temp (°F)[y]	Max temp (°F)[y]	Total precip (in.)[x]
January	18.05	34.43	5.03	15.76	31.46	5.03	23.99	40.74	4.96
February	19.18	36.80	5.35	17.09	33.71	5.35	25.52	43.33	5.42
March	31.29	50.97	7.47	28.26	46.94	7.47	36.30	55.83	7.29
April	40.18	63.42	10.41	37.37	60.09	10.41	46.64	67.99	10.15
May	51.98	74.75	11.38	48.69	70.86	11.38	56.72	77.45	10.90
June	61.00	82.55	10.82	58.67	80.22	10.82	65.07	86.40	10.19
July	62.66	84.21	9.52	60.79	82.72	10.00	67.35	88.16	10.00
August	60.70	83.55	9.71	59.15	81.29	9.71	66.00	88.29	10.05
September	54.28	79.30	8.12	52.77	76.99	8.12	59.30	83.34	8.23
October	43.25	65.92	8.55	41.85	63.30	8.55	47.99	70.03	8.55
November	33.94	52.52	8.24	32.23	49.45	8.24	37.46	56.54	8.24
December	24.45	39.36	7.49	22.42	36.56	7.49	29.16	44.71	7.25

[z] Data courtesy of Dr. Beth Hall and Jonathan Weaver. Indiana State Climate Office - Purdue Mesonet stations at the Purdue Agronomy Center for Research and Education (ACRE), Pinney Purdue Agricultural Center (PPAC) and Southwest Purdue Agricultural Center (SWPAC). (https://ag.purdue.edu/indiana-state-climate/). [y] Average minimum and maximum temperatures recorded for each month. [x] Total precipitation recorded for each month.