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Purdue Field Crop Pathology
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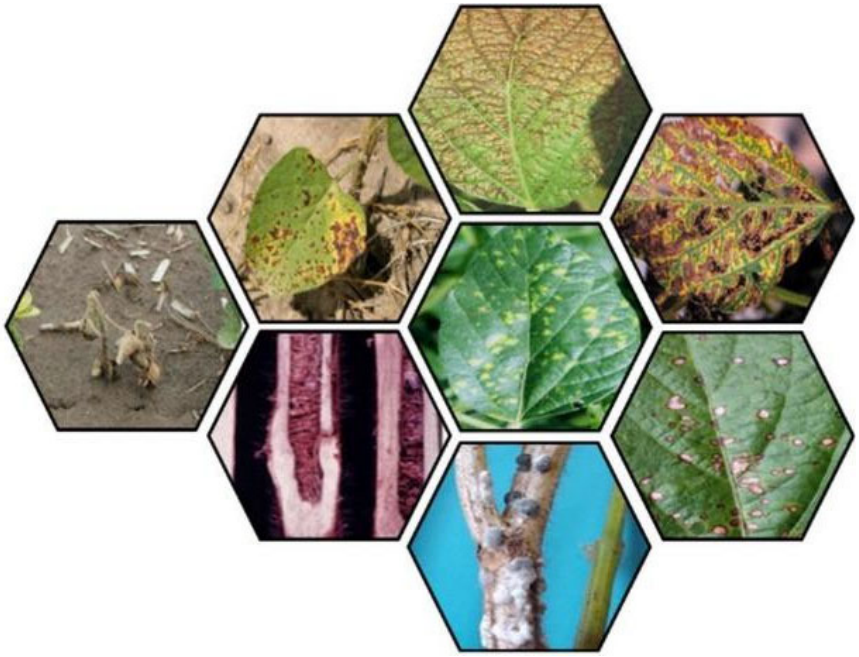

Applied Research in Field Crop Pathology for Indiana - 2021

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ACKNOWLEGEMENTS

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SUMMARY OF 2021 FIELD CROP DISEASE SEASON

CORN

In 2021, there was moderate disease on corn in Indiana across the state, details of major issues listed below. Gray leaf spot, northern corn leaf blight, northern corn leaf spot and Diplodia streak were found in pockets. There were also numerous reports of Physoderma brown spot and stalk rot. Tar spot and southern rust were two diseases that were closely monitored this season.

Tar spot:

Tar spot of corn was a concern in 2021 due to favorable weather conditions. In 2021, a widespread epidemic occurred in northern Indiana and in pockets in other areas of the state. The environmental conditions are key in determining field risk year to year as leaf wetness plays an important role in tar spot disease development. The third year of tar spot-directed research has been completed here in Indiana. As a cautionary note, it is still 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 season to scout for tar spot across the state. Four new counties were confirmed with tar spot in 2021, making 82 counties total in Indiana to date. Out of the 188 fields scouted, 143 were positive for tar spot (76.1%). 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 – with increasing severity indicated by the darkness of the orange color of the county. The map demonstrates how corn produced in northern Indiana is at a higher risk for tar spot versus central and southern Indiana, but there are new pockets of disease emerging in Indiana. The map also parallels the weather conditions and reports during 2021. It is important to document tar spot movement in the state, so that when favorable conditions arise, increased tar spot disease risk can be more accurately assessed across the remainder of the state.

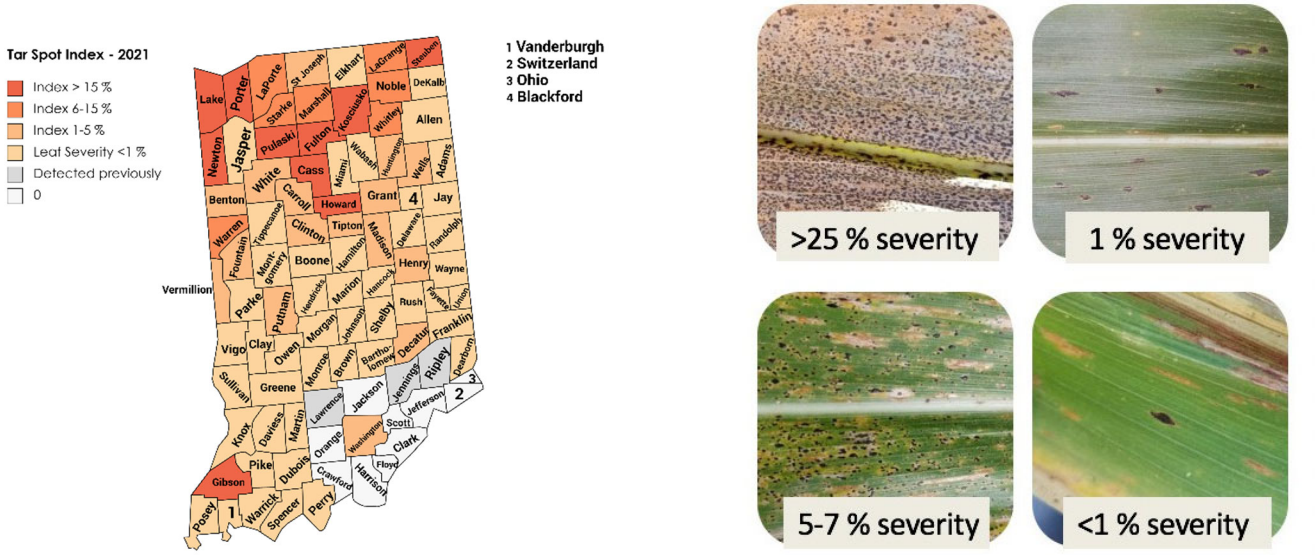

Figure 1. 2021 tar spot index for Indiana. The darker orange the county, the greater the field incidence and severity of tar spot in the fields in which it was found. The range of tar spot severity on leaves >25%, 5-7%, 1% and <1%. Photo credit: D. Telenko.

SUMMARY OF 2021 FIELD CROP DISEASE SEASON

Southern corn rust:

Southern corn rust was first found in Indiana in the 2021 season on July 16, and by the end of the season, a total of 73 counties were confirmed to have the disease present (Fig 2.). Southern rust pustules generally tend to occur on the upper surface of the leaf and produce chlorotic symptoms on the underside of the leaf (Fig. 2). These pustules rupture the leaf surface and are orange to tan in color. They are circular to oval in shape. 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 (PPDL) for confirmation if southern rust is suspected. There is an increased risk for yield impact if southern rust is identified early in the season.

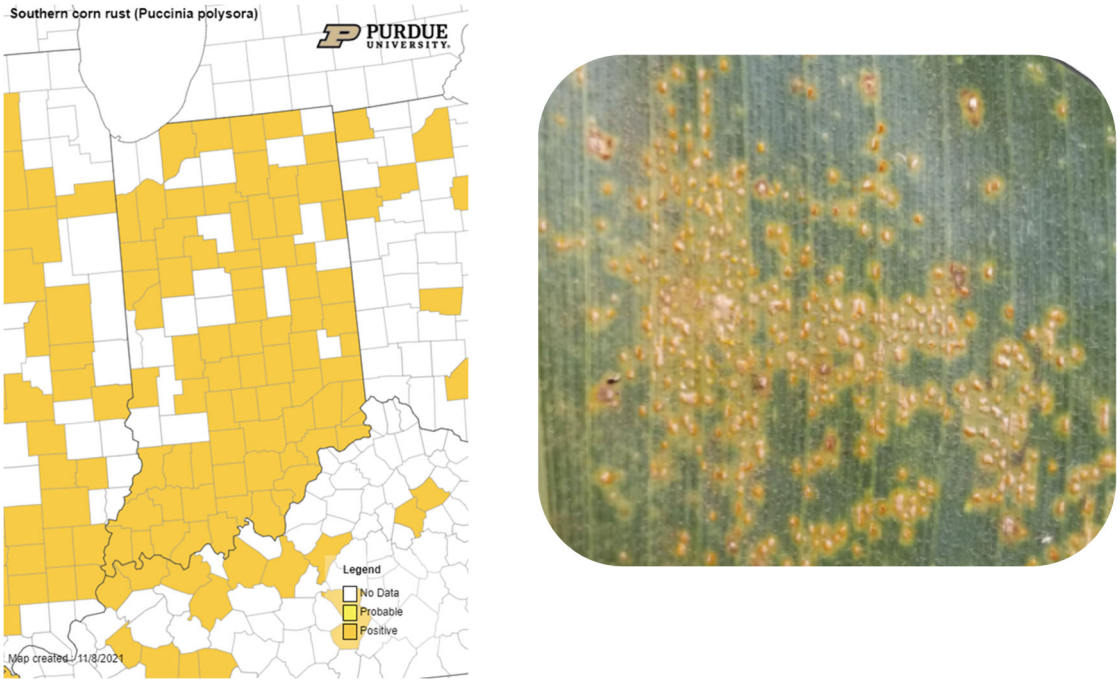

Figure 2. Southern corn rust map of confirmed (yellow) counties that had southern corn rust in Indiana in 2021 and a corn leaf with southern rust infection. Photos credit: D. Telenko, Map source: https://corn.ipmpipe.org/southerncornrust/

Due to the need to monitor both southern rust and tar spot in Indiana, there will be **no charge for Indiana growers to submit southern rust and tar spot samples to the PPDL for diagnostic confirmation again in 2022.** This service is made possible through research supported by the Indiana Corn Marketing Council.

SOYBEAN

Diseases in soybeans remained relatively low throughout the season for much of the state. Our research sites and sentinel plots across the state saw low levels of frogeye leaf spot, Cercospora leaf blight, downy mildew, and Septoria brown spot. There were pockets where sudden death syndrome and white mold caused issues in fields. In general, it was a quiet year for foliar diseases in soybean.

WHEAT

Fusarium head blight (FHB) or scab is one of the most impactful diseases of wheat and among most challenging to prevent. In addition, FHB infection can cause the production of a mycotoxin called deoxynivalenol (DON or vomitoxin). The conditions in 2021 were less conducive to FHB development. Our research sites in both West Lafayette and Vincennes had low levels of FHB develop in our non-treated susceptible variety checks and initial DON testing was less than 1 ppm. Fusarium head blight management requires an integrated approach, including selection of varieties with moderate resistance and timely fungicide application at flowering. Other diseases observed in our wheat trials in 2021 included leaf rust, and Septoria leaf and glume blotch.

CORN (*Zea mays* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*

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Evaluation of fungicides for foliar disease in corn in central Indiana, 2021 (COR 21-01.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 'P0574AMXT' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 22 May. All foliar 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 July at V12 and 26 July at the R1 (silk) growth stages. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were moderately favorable for disease. Gray leaf spot (GLS) was the most prominent disease in the trial and reached low severity. All fungicide programs significantly reduced GLS severity on the ear leaf compared to the non-treated controls on 2 Sep (Table 1). There was no significant difference between treatments for tar spot stroma severity, harvest moisture, test weight, and corn yield.

Table 1. Effect of fungicide on foliar diseases severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 2 Sep	Tar spot % stroma[y] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control 1	2.7 a	0.00	16.6	55.4	155.0
Headline AMP 1.68 SC 10.0 fl oz at V12	1.1 b-e	0.00	16.4	56.0	168.3
Veltyma 3.34 S 7.0 fl oz at V12	0.5 de	0.01	16.5	56.1	157.0
Trivapro 2.21 SE 13.7 fl oz at V12	0.6 de	0.00	16.4	55.9	170.8
Delaro Complete 458 SC 8.0 fl oz at V12	1.7 bc	0.02	16.6	55.4	175.9
Lucento 4.17 SC 5.0 fl oz at V12	0.8 cde	0.00	16.1	55.5	186.1
Non-treated control 2	1.9 ab	0.00	16.1	56.0	160.8
Headline AMP 1.68 SC 10.0 fl oz at R1	1.1 b-e	0.00	17.1	55.2	156.9
Veltyma 3.34 S 7.0 fl oz at R1	0.4 e	0.00	16.3	57.3	172.6
Trivapro 2.21 SE 13.7.0 fl oz at R1	1.4 bcd	0.00	16.4	55.6	163.2
Delaro Complete 458 SC 8.0 fl oz at R1	1.0 b-e	0.00	16.3	55.8	161.3
Lucento 4.17 SC 5.0 fl oz at R1	0.8 cde	0.00	16.9	55.6	163.7
p-value[w]	*0.0014*	*0.4671*	*0.6977*	*0.1306*	*0.8274*

[z] Fungicide treatments applied on 15 July at V12 and 26 July at the R1 (silk) growth stage. All foliar treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Gray leaf spot and tar spot disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis 2 Sep. GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

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Evaluation of fungicides for foliar diseases in corn in central Indiana, 2021 (COR21-12.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 'P0574AMXT' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 22 May. Foliar applications were made at R1 (silk) growth stage on 26 Jul. All foliar 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. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severity visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) and tar spot were present in the trial, but only remained at low levels. All treatments reduced GLS over the non-treated control on 2 Sep (Table 2). There was no significant effect of treatment on tar spot over the non-treated control. There was no significant effect of treatment on harvest moisture, test weight and yield of corn.

Table 2. Effect of treatment on foliar disease severity and corn yield.

Treatment and rate/A[z]	GLS % severity[y] 2 Sep	Tar spot % stroma[y] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	1.8 a	0.00	16.9	55.7	160.5
Delaro Complete 485 SC 8.0 fl oz	0.4 bc	0.01	16.6	55.8	177.8
Veltyma 3.34 S 7.0 fl oz	0.1 c	0.01	17.2	55.2	167.3
Trivapro 2.21 SE 13.7 fl oz	0.4 bc	0.01	17.0	55.7	168.6
Miravis Neo 2.5 SE 13.7 fl oz	0.3 bc	0.00	16.7	55.6	176.1
Brixen 15.0 fl oz	0.3 bc	0.00	16.5	55.8	167.4
Brixen 13.0 fl oz	0.5 bc	0.01	16.4	55.7	167.6
Brixen 10.0 fl oz	0.2 c	0.00	16.4	55.8	167.9
Zolera ODX 5 fl oz	0.2 c	0.01	16.8	55.4	167.7
Aproach Prima 2.34 SC 6.8 fl oz	0.6 b	0.01	16.3	55.9	168.9
Brixen 10.0 fl oz + Proline 480 SC 1 fl oz	0.1 c	0.00	16.3	55.5	167.4
p-value[w]	*0.0001*	*0.8725*	*0.3601*	*0.9341*	*0.9839*

[z] Foliar applications were made at R1 (silk) growth stage on 26 Jul. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Gray leaf spot and tar spot disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

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Evaluation of in-furrow fungicides in corn in central Indiana, 2021 (COR21-20.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. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P0574AMXT' was planted in 30-inch row spacing at a rate of 2 seeds/ft on 14 May. In-furrow applications were applied at planting at 10 gal/A. Foliar applications were made at R1 (silk) on 26 Jul. All foliar 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. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severity visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) and tar spot were present in the trial, but only remained at low levels. All treatments reduced GLS severity over the non-treated control, except Tepera in-furrow (Table 3). Treatments that included a fungicide application at R1 resulted in the lowest amount of GLS verses Xyway in-furrow only application. There was no significant effect of treatment on tar spot stroma severity, harvest moisture, test weight and yield of corn.

Table 3. Effect of treatment on stand, foliar disease severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 2 Sep	Tar spot % stroma[y] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	4.0 a	0.0	16.0	54.4	146.9
Xyway LFR 15.2 fl oz in-furrow	2.6 bc	0.1	15.5	54.7	164.9
Xyway LFR 10.5 fl oz in-furrow fb Topguard EQ 4.29 SC 5 fl oz at R1	1.6 cd	0.0	15.6	55.3	165.1
Topguard EQ 4.29 SC 5.0 fl oz at R1	1.4 d	0.0	15.6	54.5	153.0
Veltym 3.34 SC 7.0 fl oz at R1	0.7 d	0.0	15.6	54.5	150.2
Tepera Plus HD 5.4 fl oz in-furrow	3.5 ab	0.0	15.9	55.1	153.3
p-value[w]	*0.0001*	*0.2431*	*0.6271*	*0.0790*	*0.7120*

[z] In-furrow applications were applied at planting on 14 May. Foliar applications were made at R1 (silk) on 26 Jul.
[y] Gray leaf spot and tar spot disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

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Xyway efficacy for foliar diseases in corn in central Indiana, 2021 (COR21-24.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 'P0574AMXT' was planted in 30-inch row spacing at a rate of 2 seeds/ft on 14 May. Xyway applications were applied at planting. Foliar applications were made at R1 (silk) on 26 Jul. All foliar 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. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severity visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) and tar spot were present in the trial, but only remained at low levels. All treatments reduced GLS over the non-treated control on 2 Sep (Table 4). There was no significant effect of treatment on tar spot stroma severity on 2 Sep. Treatments that included Xyway in-furrow, dribbled at 3 and 7 gal/A, and Delaro had reduced test weight over the non-treated control. There was no significant effect of treatment on canopy greeness, moisture, and yield of corn.

Table 4. Effect of treatment on foliar disease severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 2 Sep	Tar spot % stroma[y] 2 Sep	Canopy % green[x] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	3.5 a	0.00	51.3	16.0	55.5 a	141.3
Xyway LFR 15.2 fl oz in-furrow 10 GPA	1.9 b	0.00	61.3	16.3	54.6 c	133.9
Xyway LFR 15.2 fl oz–2x2 10 GPA	2.1 b	0.00	57.5	16.0	54.9 abc	128.6
Xyway LFR 15.2 fl oz–Y-drop 2 stream on tee jet	2.2 b	0.00	60.0	16.3	55.4 ab	133.8
Xyway LFR 15.2 fl oz–dribble 3 GPA single stream nozzle	2.0 b	0.00	53.8	15.9	54.4 c	130.4
Xyway LFR 15.2 fl oz–dribble 5 GPA single stream nozzle	1.6 b	0.00	57.5	15.8	55.6 a	129.7
Xyway LFR 15.2 fl oz–dribble 7 GPA single stream nozzle	1.9 b	0.00	58.8	16.0	54.7 bc	143.4
Xyway LFR 15.2 fl oz–dribble 5 GPA 2-in. off-row single stream nozzle	2.1 b	0.01	55.0	15.8	55.4 ab	129.8
Delaro complete 458 SC 8.0 fl oz at R1	1.3 b	0.00	58.8	16.2	54.8 bc	127.3
p-value[w]	*0.0264*	*0.4613*	*0.2159*	*0.7071*	*0.0124*	*0.9410*

[z] Xyway applications were applied at planting on 14 May and foliar applications were made at R1 (silk) on 26 Jul. GPA=gallons per acre.
[y] Gray leaf spot and tar spot disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 2 Sep.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'W2585SSRIB')
Gray leaf spot; *Cercospora zeae-maydis*
Stalk rot; *Stenocarpella maydis, Colletotrichum graminicola; Fusarium graminearum; Nigrospora oryzae; Fusarium sp.*

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Xyway efficacy for stalk rot diseases in Indiana, 2021 (COR21-25.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 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 2 seeds/ft on 14 May. Xyway applications were applied in-furrow at 10 gal/A at planting. Foliar applications were made at R1 (silk) on 26 Jul. All foliar 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. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot disease severity visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) was present in the trial, but only remained at low levels. Stalk disease was evaluated, and stalk rot pathogens identified included *Stenocarpella maydis, Colletotrichum graminicola, Fusarium graminearum, Nigrospora oryzae,* and *Fusarium spp.* All treatments reduced GLS over the non-treated control on 2 Sep, except Xyway at 7.6 oz in-furrow (Table 5). Xyway 15.2 fl oz in-furrow and Xyway 10.5 fl oz in-furrow followed by Topguard 5 fl oz at R1 increased % canopy green over the non-treated control on 2 Sep. Treatments that included Xyway in-furrow reduced stalk disease over the non-treated control. There was no significant effect of treatment on harvest moisture, test weight, and yield of corn.

Table 5. Effect of treatment on foliar disease severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 2 Sep	Canopy % green[x] 2 Sep	Stalk disease scale 0-5[w] 11 Oct	Harvest moisture %	Test weight lb/bu	Yield[v] bu/A
Non-treated control	2.7 a	50.0 b	3.7 a	16.1	55.4	167.1
Xyway LFR 15.2 fl oz in-furrow	1.4 b	61.3 a	2.6 bc	16.6	54.9	157.5
Xyway LFR 10.5 fl oz in-furrow fb Topguard EQ 5 fl oz at R1	1.7 b	61.7 a	2.4 c	16.8	55.1	166.3
Topguard EQ 5 fl oz at R1	1.4 b	56.7 ab	3.1 ab	16.1	55.3	167.7
Xyway LFR 7.6 fl oz in-furrow	1.9 ab	56.7 ab	2.4 bc	16.2	55.0	160.3
p-value[u]	*0.0201*	*0.0459*	*0.0039*	*0.3098*	*0.8220*	*0.8762*

[z] Xyway applications were applied in-furrow, 2x2, and dribble by hand at 10 gal/A at planting on 15 May and foliar applications were made at R1 (silk) on 26 Jul and contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. fb= followed by.
[y] Gray leaf spot disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 2 Sep.
[w] Stalk disease scale 0-5 (Hines, University of Illinois) where 0 = no visible discoloration of the internal below ear stalk nodes or pith; 1 = internal discoloration at the stalk nodes below the ear; 2 = internal discoloration at the stalk nodes and in the pith below the ear; 3 = pith separation occurring below the ear; 4 = complete discoloration and decay of the pith between at least two nodes below the ear, but stalk still standing; and 5 = stalk lodged below the ear due to stalk rot.
[v] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[u] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

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Fungicide comparison for foliar diseases in corn in central Indiana, 2021 (COR21-26.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 'P0574AMT' was planted in 30-inch row spacing at a rate of 2 seeds/ft on 14 May. Xyway applications were applied in-furrow at 10 gal/A at planting. Foliar applications were made at R1 (silk) on 26 Jul. All foliar 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. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severity visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) and tar spot were present in the trial, but only remained at low levels. All treatments reduced GLS over the non-treated control on 2 Sep (Table 6). There was no significant effect of tar spot stroma severity, % canopy green, harvest moisture, test weight, and yield of corn.

Table 6. Effect of treatment on foliar disease severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 2 Sep	Tar spot % stroma[y] 2 Sep	Canopy % green[x] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	4.2 a	0.01	53.8	15.6	54.7	156.1
Topguard EQ 4.29 5.0 fl oz at R1	2.2 bc	0.01	61.9	15.7	66.2	159.4
Lucento 4.17 SC 5.0 fl oz at R1	2.5 b	0.00	60.0	15.7	55.3	157.4
Veltyma 3.34 S 7.0 fl oz at R1	1.4 c	0.01	65.0	16.2	55.6	158.3
Delaro Complete 458 SC 8.0 fl oz at R1	2.3 bc	0.00	60.0	15.5	55.6	154.4
Miravis Neo 2.4 SE 13.7 fl oz at R1	1.4 c	0.00	58.8	15.6	55.3	168.7
Xyway LFR 15.2 fl oz in-furrow	2.9 b	0.06	58.8	15.4	55.3	164.3
p-value[v]	*0.0009*	*0.5063*	*0.3119*	*0.1533*	*0.2382*	*0.5542*

[z] Xyway applications were applied in-furrow 10 gal/A at planting on 15 May and foliar applications were made at R1 (silk) on 26 Jul. All foliar treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Gray leaf spot and tar spot disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 2 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

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Fungicide comparison for foliar diseases in corn in central Indiana, 2021 (COR21-28.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 'P0574AMXT' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 22 May. Foliar applications were made at V5, V12 or R1 (silk) growth stages on 24 Jun, 15 Jul, and 26 Jul, respectively. All foliar fungicide applications were applied at 15 gal/A and 40 psi using either a CO_2 backpack sprayer or Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severities visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) and tar spot were present in the trial, but only remained at low levels. All treatments reduced GLS over the non-treated control on 2 Sep, except Delaro Complete 4.0 fl oz at V5 (Table 7). There was no significant effect of treatment on tar spot stroma severity on 2 Sep. There was no significant effect of treatment on harvest moisture, test weight and yield of corn.

Table 7. Effect of treatment on foliar disease severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 2 Sep	Tar spot % stroma [y] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	0.7 a	0.02	17.0	55.0	167.9
Delaro Complete 458 SC 4.0 fl oz at V5	0.7 a	0.00	16.6	55.4	170.4
Delaro Complete 458 SC 8.0 fl oz at V12	0.1 b	0.03	16.1	55.7	177.8
Delaro Complete 458 SC 12.0 fl oz at V12	0.1 b	0.02	16.7	55.6	172.5
Veltyma 3.34 S 7.0 fl oz at V12	0.2 b	0.01	16.7	56.0	174.1
Miravis Neo 2.4 SE 13.0 fl oz at V12	0.2 b	0.01	17.2	55.4	181.5
Delaro Complete 458 SC 12.0 fl oz at R1	0.2 b	0.01	17.1	54.8	177.9
Veltyma 3.34 S 7.0 fl oz at R1	0.0 b	0.01	16.9	55.2	171.7
Miravis Neo 2.4 SE 13.0 fl oz at R1	0.1 b	0.00	16.5	55.2	173.2
p-value[w]	*0.0037*	*0.1197*	*0.6691*	*0.4470*	*0.9099*

[z] Foliar applications were made at V5, V12 or R1 (silk) growth stages on 24 Jun, 15 Jul, and 26 Jul, respectively. All treatments applied at R1 contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Gray leaf spot and tar spot disease severities visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

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Fungicide comparison at V5 for foliar diseases in corn in central Indiana, 2021 (COR21-32.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 'P0574AMXT' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 22 May. Foliar applications were made at V5 growth stage on 24 Jun. All foliar fungicide applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severities visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) and tar spot were present in the trial, but only remained at low levels. There was no significant effect of treatment on GLS and tar spot stroma severity over the non-treated control 2 Sep (Table 8). There was no significant effect of treatment on harvest moisture, test weight and yield of corn.

Table 8. Effect of treatment on foliar disease severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 2 Sep	Tar spot % stroma[y] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	1.8	0.00	16.6	55.3	145.5
Affiance 1.5 SC 10.0 fl oz at V5	1.1	0.00	16.6	55.5	144.1
Domark 230 ME 5.0 fl oz at V5	1.0	0.01	16.5	55.6	141.5
Revytek 3.33 LC SC 8.0 fl oz at V5	1.1	0.01	16.1	55.7	143.8
Miravis Neo 2.4 SE 13.7 fl oz at V5	1.3	0.00	15.9	55.9	140.1
Trivapro 2.21 SE 13.7 fl oz at V5	1.7	0.00	16.1	55.9	144.7
Veltyma 3.34 S 7.0 fl oz at V5	1.4	0.00	16.3	56.0	136.5
Delaro Complete 458 SC 8.0 fl oz at V5	1.0	0.00	16.2	56.2	139.6
p-value[w]	*0.1539*	*0.5828*	*0.5482*	*0.5021*	*0.9158*

[z] Foliar applications were made at V5 growth stage on 24 Jun.
[y] Gray leaf spot and tar spot disease severities visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*

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Evaluation of OroAgri products in corn in central Indiana, 2021 (COR21-34.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 'P0574AMXT' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 22 May. Foliar applications were made at R1 (silk) growth stage on 26 Jul. All foliar 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. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot was visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) was present in the trial, but only remained at low levels. All treatments reduced GLS as compared to the non-treated control (Table 9). There was no significant effect of treatment on harvest moisture, test weight and yield of corn.

Table 9. Effect of treatment on foliar disease severity and corn yield.

Treatment and rate/A[z]	GLS % severity[y] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	1.18 a	16.4	55.4	166.7
Veltyma 3.34 S 7.0 fl oz	0.08 b	17.0	55.2	170.3
Veltyma 3.34 S 7.0 fl oz + OR-099-E 0.25% v/v	0.03 b	17.0	55.0	160.7
Veltyma 3.34 S 7.0 fl oz + OR-295-A 0.25% v/v	0.05 b	17.1	54.7	165.8
Veltyma 3.34 S 7.0 fl oz + OR-025-F 1.0 pt	0.01 b	17.1	55.1	162.8
Veltyma 3.34 S 7.0 fl oz + OR-009-A 0.4 % v/v	0.01 b	16.8	54.9	173.5
p-value[w]	*0.0001*	*0.5737*	*0.6161*	*0.8333*

[z] Foliar applications were made at V5 growth stage on 24 Jun.
[y] Gray leaf spot severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea maydis* 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

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In-furrow fungicide evaluation in corn in central Indiana, 2021 (COR21-36.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 'P0574AMXT' was planted in 30-inch row spacing at a rate of 2 seeds/ft on 14 May. In-furrow and 2x2 applications were applied at planting at 10 gal/A. Disease ratings were assessed on 2 Sep at R5 (dent) growth stage. Gray leaf spot and tar spot disease severity visually assessed as a percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis. The two center rows of each plot were harvested on 23 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Gray leaf spot (GLS) and tar spot were present in the trial, but only remained at low levels. There was no significant effect of treatment on GLS and tar spot severity on 2 Sep (Table 10). There was no significant effect of treatment on % canopy green, harvest moisture, test weight, and yield of corn.

Table 10. Effect of treatment on stand, foliar disease severity and corn yield.

Treatment and rate/A[z]	GLS % severity[y] 2 Sep	Tar spot % stroma[y] 2 Sep	Canopy % green[x] 2 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	3.8	0.01	48.8	15.6	54.7	152.8
Double Nickel LC 8.0 oz in-furrow	2.2	0.00	41.7	15.0	54.0	151.6
Double Nickel LC 8.0 oz 2x2	2.7	0.00	47.5	15.2	54.8	150.8
Double Nickel LC 16.0 oz in-furrow	2.9	0.00	53.8	15.2	55.0	159.7
Double Nickel LC 16.0 oz 2x2	2.5	0.00	57.5	15.3	55.0	151.3
p-value[v]	*0.4893*	*0.4860*	*0.2825*	*0.4781*	*0.8045*	*0.8408*

[z] In-furrow and 2x2 applications were applied at planting on 14 May.
[y] Gray leaf spot and tar spot disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, with five plants were assessed per plot and ratings averaged before analysis on 2 Sep. GLS = gray leaf spot.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 2 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 23 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P34A79X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Fungicide comparison for foliar soybean diseases in central Indiana, 2021 (SOY21-01.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 soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 22 May. Fungicide applications were applied on 31 July at R3 (beginning pod) and were applied at 15 gal/A at 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3 mph. Disease ratings were assessed on 3 Sep at R6 (full seed) 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. The two center rows of each plot were harvested on 10 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. All fungicides reduced SBS over the non-treated control on 8 Sep (Table 11). There was no significant effect of treatment on FLS severity, harvest moisture, test weight, and yield of soybean.

Table 11. Effect of treatment on foliar disease severity and soybean yield.

Treatment and rate/A[z]	FLS % severity[y] 8 Sep	SBS % severity[y] 8 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	1.2	1.5 a	15.08	55.50	54.89
Preemptor 3.22 SC 5.0 fl oz	0.0	0.2 b	15.10	54.15	51.06
Topguard EQ 4.29 SC 5.0 fl oz	0.0	0.3 b	14.88	54.95	50.52
Quadris Top SBX 3.76 SC 7.0 fl oz	0.0	0.2 b	15.15	55.58	51.78
Lucento 4.17 SC 5.0 fl oz	0.0	0.4 b	15.35	54.55	55.54
Miravis Top 1.67 SC 13.7 fl oz	0.0	0.1 b	15.58	54.88	59.44
Priaxor Xemium SC 4.0 fl oz	0.0	0.2 b	15.43	54.25	52.69
Trivapro 2.21 SE 13.0 fl oz	0.0	0.1 b	15.18	54.40	57.79
Delaro 325 SC 8.0 fl oz	0.0	0.4 b	15.53	54.23	61.22
Headline 2.09 SC 10.0 fl oz	0.2	0.4 b	15.75	55.18	54.94
Veltyma 3.24 S 7.0 fl oz	0.0	0.2 b	15.28	54.35	57.41
Revytek 3.33 LC 8.0 fl oz	0.0	0.1 b	15.45	54.83	56.38
p-value[w]	*0.2303*	*0.0001*	*0.6985*	*0.8217*	*0.2976*

[z] Fungicide applications were made on 13 Jul at R3 (full seed) growth stage and contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 8 Sep. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] Yields were adjusted to 13% moisture and harvest on 10 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P25T09E')
Sudden death syndrome; *Fusarium virguliforme*
Soybean cyst nematode; *Heterodera glycines*

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Evaluation of seed treatments against SDS and soybean cyst nematode on soybean in Indiana, 2021 (SOY21-15.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 soybean. Standard practices for soybean production in Indiana were followed. Soybean variety P25T09E was planted in 30-inch row spacing at a rate of 8 seeds/ft on 22 May. Seed treatments were applied on seeds before planting; all treatments contained a base treatment except nontreated control. Soybean cyst nematode (SCN) females were counted on 21 Jun at V3/V4 (third/ fourth trifoliate) growth stages. White or tan females were extracted from the roots by washing over a #20 sieve nested over a #60 sieve and then counted using a dissecting microscope. SCN egg count was assessed on 22 May at planting and on 27 Sep at harvest. Five soybean roots were dug from each outside row, washed and root rot was rated by visually assessing dark discoloration on roots on 5 Aug at R4 (full pod) growth stage. The two center rows were harvested on 27 Sep and yields were adjusted to 13% moisture. All rating and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were not favorable for soybean disease. No foliar symptoms were observed for soybean sudden death syndrome (SDS). No significant differences were observed between seed treatments and the non-treated control for SCN egg counts on 22 May and 27 Sep (Table 12). No significant differences between seed treatments and the non-treated control were found for SCN females on 21 Jun and for root rot on 5 Aug. No significant differences between seed treatments and the non-treated control were found for yield of soybean.

Table 12. Effect of nematicide seed treatments against soybean cyst nematode (SCN), root rot, and soybean yield.

Treatment[z]	SCN Females[y] 21 Jun	SCN Eggs[x] 22 May	SCN Eggs[x] 27 Sep	Root rot %[w] 5 Aug	Harvest moisture %	Test weight lb/bu	Yield[v] bu/A
Non-treated control	3.8	5750	7188	26.6	10.5	53.2	52.0
Base	1.8	4625	5063	28.8	10.8	54.4	55.1
Base + BioST nematicide 100 at 195.0 ml/100kg	5.5	4500	4250	29.9	10.0	54.0	53.5
Base + Aveo at 2.0 ml/100000 seed	5.0	3625	5688	28.3	10.5	54.4	58.5
Base + Clariva PN at 130.0 ml/100 kg	6.8	3000	6406	33.9	10.3	54.5	55.6
Base + ILeVO at 0.15 mg/seed	3.8	4563	4031	24.8	10.5	55.0	52.6
Base + Trunemco at 20.2 ml/100 kg	5.5	4875	5375	26.5	10.8	54.1	61.8
Base + Saltro at 0.075 mg/seed	6.0	2813	6500	34.0	10.3	54.9	55.5
p-value[u]	*0.3369*	*0.6265*	*0.8209*	*0.2469*	*0.3374*	*0.1121*	*0.0869*

[z] Seed treatments applied before planting on 22 May, all treatments contained a base treatment of Allegiance Fl at 4.0 g a/100 kg, Stamina at 7.5 g a/100 kg, Systiva XS Xemium Brand at 5.0 g a/100 kg, Poncho 600 at 0.11 mg a/seed, Flo Rite 1706 at 66.0 ml/100 kg, and Color Coat Red at 33.0 ml/100 kg, except non-treated control.
[y] SCN female visually assessed (#) of white or tan females on 21 Jun.
[x] SCN egg count was assessed on 22 May at planting and on 27 Sep at harvest for each treatment plot from soil samples.
[w] Root rot visually assessed percentage (0-100%) of dark discoloration on roots on 5 Aug.
[v] Yields were adjusted to 13% and harvested on 27 Sep.
[u] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P28T14E' & 'P25A04X')
Sudden death syndrome; *Fusarium virguliforme*

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Evaluation of the efficacy of seed treatments in soybean in central Indiana, 2021 (SOY21-17.ACRE).

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County. 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 'P25A04X' (resistant) and 'P28T14E' (susceptible) were planted in 30-inch row spacing at a rate of 8 seeds/ft on 15 May. Seed treatments were applied on seeds before planting. Ten roots per plot were sampled from border rows at R4/R5 on 9 Aug, gently washed and rated for root rot severity on scale of 0-100%. Disease ratings were assessed on 25 Aug at the R6 (maturity). 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. The two center rows of each plot were harvested on 11 Oct and 18 Oct and part of harvest was delayed due to rain and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Sudden death syndrome (SDS) was the most prominent diseases in the trial, but only reached low severity. There was no significant difference between varieities and seed treatments for root rot on 9 Aug. P25A04X non-treated and treated with Ilevo and Saltro had significantly lower levels of SDS incidence, severity, and index over non-treated P28T14E, but was not significantly different from P28T14E treated with either Illevo or Saltro (Table 13). P25A04X has lower harvest moisture than P28T14E. There were no significant differences between variety and seed treatments for test weight and yield.

Table 13. Effect of seed treatment on SDS, root rot, and soybean yield.

Treatment and variety[z]	Root rot %[x] 9 Aug	SDS DI[y] 25 Aug	SDS DS[y] 25 Aug	SDS Index[y] 25 Aug	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control, P25A04X	13.5	0.3 b	0.3 b	0.0 b	13.0 c	53.8	63.9
ILeVO	18.9	0.3 b	0.3 b	0.0 b	13.1 bc	54.5	59.0
Saltro	10.8	0.5 b	0.5 ab	0.1 b	13.1 bc	55.0	59.1
Non-treated control, P28T14E	16.0	4.8 a	1.0 a	0.5 a	14.1 a	54.2	59.8
ILeVO	16.3	2.5 ab	1.0 a	0.3 ab	13.9 ab	53.9	56.4
Saltro	15.5	2.5 ab	1.0 a	0.3 ab	13.8 ab	53.5	65.5
p-value[v]	*0.1423*	*0.0037*	*0.0179*	*0.0039*	*0.0342*	*0.3762*	*0.7465*

[z] Seed treatments were pre-applied to the seed of varieties 'P25A04X' (resistant) and 'P28T14E' (susceptible).
[y] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS) on 25 Aug. 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] Ten roots per plot were sampled from border rows at R6, gently washed and rated for root rot severity on scale of 0-100% on 9 Aug.
[w] Yields were adjusted to 13% moisture and harvested on 11 Oct and 18 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'AG36XF1 ')

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Evaluation of seed treatments in soybean in central Indiana, 2021 (SOY21-20.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. Standard practices for soybean production in Indiana were followed. Soybean variety 'AG36XF1' was planted in 30-inch row spacing at a rate of 8 seeds/ft on 15 May. Seed treatments were applied by cooperator. Stand counts were assessed on 10 Jun and 22 Jun at V1-V2 and V4 growth stages, respectively. Green stem was visually rated on a scale of 0-100% on 18 Oct. The two center rows of each plot were harvested on 18 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated usingFisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. There was no significant effect of treatment on stand count, % green stem, harvest moisture, test weight, and yield of soybean (Table 14).

Table 14. Effect of treatment on foliar and stem diseases and soybean yield.

Treatment and rate/A[z]	Stand count #/A[y] 10 Jun	Stand count #/A[y] 22 Jun	Green % stem[x] 18 Oct	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
V-10503 FS 3.78 fl oz/cwt (Zeltera Suite S)	120879	122839	33.8	15.0	54.0	74.0
Cruizer Maxx Vibrance 3.22 fl oz/cwt	125017	122186	30.0	15.2	54.4	72.7
V-10503 FS 3.78 fl oz/cwt + AVEO EX 0.2 fl oz/cwt	117176	125017	47.5	14.6	54.8	64.4
Acceleron 0.8 fl oz/cwt	123493	120443	27.5	14.9	54.7	74.8
p-value[v]	*0.2528*	*0.3877*	*0.4943*	*0.9075*	*0.4872*	*0.3299*

[z] Seed treatments were applied by cooperator.
[y] Stand counts were assessed on 10 Jun and 22 Jun at V1-V2 and V4 growth stages, respectively.
[x] % Green stem visually rated on a scale of 0-100% on 18 Oct.
[w] Yields were adjusted to 13% moisture and harvest on 18 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Evaluation of fungicide products for foliar diseases in soybean in central Indiana, 2021 (SOY21-21.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 sunflower. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 22 May. Fungicide applications were applied at R3 (beginning pod) on 27 Jul and were applied at 15 gal/A at 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3 mph. Disease ratings were assessed on 3 Sep at R6 (full seed) 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. The two center rows of each plot were harvested on 10 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. All fungicide treatments reduced FLS and SBS severity over the non-treated control on 8 Sep (Table 15). There was no significant effect of treatment on % green stem, harvest moisture, test weight, and yield of soybean.

Table 15. Effect of treatment on foliar, stem diseases and soybean yield.

Treatment and rate/A[z]	FLS % severity[y] 3 Sep	SBS % severity[y] 3 Sep	Green % stem [x] 10 Oct	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	0.08 a	2.0 a	2.5	14.9	55.2	48.6
Miravis Neo 2.4 SE 13.7 fl oz	0.00 b	0.1 b	15.0	15.1	55.5	55.4
Miravis Top 1.67 SC 13.7 fl oz	0.00 b	0.2 b	20.0	15.4	55.5	49.2
Miravis Neo 2.4 SE 13.7 fl oz + Endigo ZC 4.0 fl oz	0.03 b	0.2 b	25.0	15.3	53.8	56.1
Miravis Top 1.67 SC 13.7 fl oz + Endigo ZC 4.0 fl oz	0.00 b	0.1 b	23.8	15.2	54.3	55.9
Delaro Complete 458 SC 8.0 fl oz	0.00 b	0.3 b	51.3	14.9	55.3	51.7
Priaxor Xemium SC 4.0 fl oz	0.03 b	0.2 b	2.5	15.6	55.4	49.5
Revytek 3.33 LC 8.0 fl oz	0.00 b	0.3 b	22.5	15.0	55.1	56.3
Trivapro 2.21 SE 13.7 fl oz	0.03 b	0.4 b	7.5	15.4	53.8	54.1
p-value[v]	*0.0424*	*0.0001*	*0.0643*	*0.8395*	*0.2828*	*0.2377*

[z] Fungicides were applied on 27 Jul at R3 (beginning pod) growth stage and contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 3 Sep. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] % Green stem visually rated on a scale of 0-100% on 10 Oct.
[y] Yields were adjusted to 13% moisture and harvest on 10 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance as performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Xyway efficacy for foliar disease in soybean in Indiana, 2021 (SOY21-23.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 soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 30-inch row spacing at a rate of 8 seeds/ft on 15 May. Xyway applications were applied in 2x2 application at 10 gal/A at planting on 15 May and foliar applications were made at V5 and R3 (beginning pod) on 9 Jul and 25 Jul, respectively. Fungicides were applied at 15 gal/A at 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3 mph. Disease ratings were assessed on 30 Aug at R6 (full seed) 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. The two center rows of each plot were harvested on 11 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. All treatments reduced FLS and SBS over the non-treated control on 30 Aug (Table 16). There was no significant effect of treatment on % green stem, moisture, test weight, and yield of soybean.

Table 16. Effect of treatment on foliar and stem diseases and soybean yield.

Treatment, rate/A, and timing[z]	FLS % severity[y] 30 Aug	SBS % severity[y] 30 Aug	Green % stem[x] 11 Oct	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	0.4 a	0.4 a	5.0	15.3	54.5	65.0
Topguard EQ 4.29 5.0 fl oz at R3	0.1 b	0.1 b	3.8	15.3	54.7	63.2
Lucento 4.17 SC 5.0 fl oz at R3	0.0 b	0.0 b	2.8	15.3	55.3	56.2
Miravis Top 1.67 SC 13.7 fl oz at R3	0.0 b	0.1 b	5.0	15.5	55.0	58.2
Revytek 3.33 LC 8.0 fl oz at R3	0.0 b	0.1 b	15.0	15.6	54.8	56.6
Delaro Complete 458 SC 8.0 fl oz at R3	0.1 b	0.1 b	8.8	15.7	54.9	56.8
Xyway LFR 15.2 fl oz 2x2 application	0.1 b	0.1 b	0.0	15.3	55.3	58.8
Topguard EQ 4.29 7.0 fl oz at V5 fb Lucento 4.17 SC 5.0 fl oz at R3	0.0 b	0.1 b	6.3	15.5	55.4	56.5
p-value[v]	*0.0005*	*0.0002*	*0.0736*	*0.6366*	*0.4636*	*0.4387*

[z] Xyway 2x2 application were made at plating on 15 May and fungicide applications on 9 Jul and 25 Jul at V5 and R3 growth stages, respectively. All foliar treatments at R3 contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms 30 Aug. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] % Green stem visually rated on a scale of 0-100% on 11 Oct.
[w] Yields were adjusted to 13% moisture and harvested on 11 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Xyway efficacy for foliar disease in soybean in Indiana, 2021 (SOY21-24.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 soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 30-inch row spacing at a rate of 8 seeds/ft on 15 May. Xyway applications were applied in-furrow and 2x2 at 10 gal/A, and dribble by hand at 5 gal/A on 15 May and foliar applications were made at R3 (beginning pod) on 27 Jul. Foliar fungicides were applied at 15 gal/A at 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3 mph. Disease ratings were assessed on 30 Aug at R6 (full seed) 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. The two center rows of each plot were harvested on 11 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. All treatments reduced FLS and SBS over the non-treated control on 30 Aug, except Xyway at 15.2 fl oz dribbled on FLS and SBS, and Xyway 7.6 fl oz 2x2 application on SBS (Table 17). There was no significant effect of treatment on % green stem, harvest moisture, test weight, and yield of soybean.

Table 17. Effect of treatment on foliar and stem diseases and soybean yield.

Treatment, rate/A, and timing[z]	FLS % severity[y] 30 Aug	SBS % severity[y] 11 Oct	Green % stem[x] 11 Oct	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	0.5 a	0.9 a	0.0	15.1	55.7	56.4
Xyway LFR 15.2 fl oz in-furrow	0.1 b	0.4 b	0.0	15.4	55.5	51.4
Xyway LFR 7.6 fl oz 2x2 application	0.1 b	0.8 a	0.0	15.0	55.2	52.0
Xyway LFR 15.2 fl oz 2x2 application	0.1 b	0.3 b	0.0	15.2	55.1	56.7
Xyway LFR 15.2 fl oz dribble by hand 10 gal/A	0.5 a	0.8 a	0.0	15.1	55.1	55.0
Lucento 4.17 SC 5.0 fl oz at R3	0.0 b	0.1 b	0.0	15.5	55.2	55.2
Delaro Complete 458 SC 8 fl oz at R3	0.1 b	0.1 b	6.3	15.1	55.1	56.9
p-value[v]	*0.0053*	*0.0001*	*0.4531*	*0.1391*	*0.8609*	*0.5708*

[z] Xyway applications were applied in-furrow, 2x2, and dribble by hand at 10 gal/A at planting on 15 May and foliar applications were made at R3 (beginning pod) on 27 Jul.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 3 Aug and 11 Oct. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] % Green stem visually rated on a scale of 0-100% on 11 Oct.
[w] Yields were adjusted to 13% moisture and harvested on 11 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Compare the efficacy of Nano Technology for foliar disease in soybean in central Indiana, 2021 (SOY21-26.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 soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 22 May. Fungicide applications were applied on 327 July at R3 (beginning pod) and were applied at 15 gal/A at 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3 mph. Disease ratings were assessed on 3 Sep at R6 (full seed) 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. The two center rows of each plot were harvested on 10 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. All treatments that included Miravis Neo reduced Septoria brown spot over the non-treated control on 3 Sep (Table 18). There was no significant effect of treatments on FLS severity, harvest moisture, test weight and yield of soybean.

Table 18. Effect of treatment on foliar disease severity and soybean yield.

Treatment and rate/A[z]	FLS % severity[y] 3 Sep	SBS % severity[y] 3 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	0.0	2.4 b	3.8	14.3	55.6
NanoStress 4.0 fl oz	0.0	1.3 bc	0.0	14.2	55.3
NanoPack 4.0 fl oz	0.1	4.0 a	0.0	14.6	55.5
NanoN 4.0 fl oz	0.2	1.1 bc	0.0	14.4	55.2
Miravis Neo 2.5 SE 13.7 fl oz	0.0	0.3 c	2.5	14.5	55.2
Miravis Neo 2.5 SE 13.7 fl oz + NanoStress 4.0 fl oz	0.0	0.3 c	6.3	14.3	54.9
Miravis Neo 2.5 SE 13.7 fl oz + NanoPack 4.0 fl oz	0.0	0.1 c	7.5	14.5	55.8
Miravis Neo 2.5 SE 13.7 fl oz + NanoN 4.0 fl oz	0.0	0.3 c	1.3	14.4	54.8
Miravis Neo 2.5 SE 13.7 fl oz + NanoPro 4.0 fl oz	0.0	0.1 c	6.3	14.2	54.9
p-value[w]	*0.3494*	*0.0002*	*0.7685*	*0.6656*	*0.4926*

[z] Fungicide applications were made on 27 Jul at R3 growth stage.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 3 Sep. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] Yields were adjusted to 13% moisture and harvest on 10 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Tempera efficacy for disease in soybean in Indiana, 2021 (SOY21-28.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 soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 30-inch row spacing at a rate of 8 seeds/ft on 15 May. Tempera applications were applied in-furrow at 10 gal/A at planting on 15 May. Disease ratings were assessed on 3 Sep at R6 (full seed) 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. The two center rows of each plot were harvested on 11 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. There was no significant effect of treatment on FLS and SBS severity, harvest moisture, test weight, and yield of soybean (Table 19).

Table 19. Effect of treatment on foliar disease severity and soybean yield.

Treatment and rate/A[z]	FLS % severity[y] 3 Sep	SBS % severity[y] 3 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	0.5	0.7	14.9	54.2	72.6
Tepera Plus 5.4 fl oz in-furrow	0.5	0.6	14.9	54.8	73.2
p-value[w]	-	*0.9037*	*0.8425*	*0.1216*	*0.4292*

[z] Tempera in-furrow application were made at plating on 15 May.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 3 Sep. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] Yields were adjusted to 13% moisture and harvested on 11 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05). NS=not significant.

SOYBEAN (*Glycine max* 'P35T15E')
White mold; *Sclerotinia sclerotiorum*
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Evaluation of OroAgri products for white mold in soybean in Indiana, 2021 (SOY21-29.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 6.7-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was sunflower. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 15 May. Inoculum of *S. sclerotiorum* was applied on the seedbed at 1.25 g/ft at planting. Preemergence pesticide applications were applied at 20 gal/A and R1 (beginning bloom) were applied at 15 gal/A at 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3 mph. Preemergence (PRE-E) application were applied on 15 Jun and fungicide applications on 13 Jul at R1 growth stage. Disease ratings were assessed on 30 Aug at R6 (full seed) 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. White mold disease assessed by counting the number of plants in each plot with symptoms. The two center rows of each plot were harvested on 10 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were unfavorable for soybean disease. White mold, frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. SBS was reduced mostly by Contans plus Valor XLT on 30 Aug over the non-treated control (Table 20). There were no significant differences between treatments and the non-treated control for FLS and white mold on 30 Aug. There was no significant effect of treatment on harvest moisture, test weight, and yield of soybean.

Table 20. Effect of fungicide on foliar diseases severity and soybean yield.

Treatment, rate/A, and timing[z]	FLS % severity[y] 30 Aug	SBS % severity[y] 30 Aug	White mold #/plot[x] 30 Aug	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control – Valor XLT 4.0 oz PRE-E	0.5	0.5 a	0.0	13.6	55.4	67.4
OR-079-B 2.0 pts + Valor XLT 4.0 oz PRE-E	0.5	0.5 a	0.3	13.7	55.6	67.4
OR-369-A 2.0 pts + Valor XLT 4.0 oz PRE-E	0.4	0.5 a	0.3	13.5	55.3	67.1
OR 009-A 2.0 pts + Valor XLT 4.0 oz PRE-E	0.4	0.5 a	0.0	13.6	55.5	68.3
Contans WG 2.0 lbs + Valor XLT 4.0 oz PRE-E	0.4	0.3 b	0.5	13.7	55.1	70.4
Valor XLT 4.0 oz PRE-E fb OR 009-A 1.0 pt at R1	0.5	0.5 a	0.0	13.6	55.2	69.7
OR-079-B 2.0 pts + Valor XLT 4.0 oz PRE-E fb OR 009-A 1.0 pt at R1	0.4	0.5 a	0.0	13.6	55.5	67.4
Endura 70 WDG 8.0 oz at R1	0.2	0.5 a	0.0	13.5	55.2	67.0
p-value[v]	*0.5521*	*0.0239*	*0.5962*	*0.9474*	*0.3301*	*0.6279*

[z] Preemergence (PRE-E) application were applied on 15 Jun and fungicide applications on 13 Jul at R1 growth stage. All plots inoculated with *S. sclerotiorum*.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 30 Aug. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] White mold disease assessed by counting the number of plants/plots with symptoms on 30 Aug.
[w] Yields were adjusted to 13% moisture and harvested on 10 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*

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Fungicide comparison of OroAgri productions in soybean in central Indiana, 2021 (SOY21-30.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 soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 22 May. Fungicide applications were applied on 31 July at R3 (beginning pod) and were applied at 15 gal/A at 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3 mph. Disease ratings were assessed on 3 Sep at R6 (full seed) 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. The two center rows of each plot were harvested on 10 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS) and Septoria brown spot (SBS) were present in the trial, but only remained at low levels. All fungicides reduced SBS over the non-treated control on 3 Sep (Table 21). There was no significant effect of treatment on FLS severity, harvest moisture, test weight, and yield of soybean.

Table 21. Effect of treatment on foliar diseases and soybean yield.

Treatment and rate/A[z]	FLS % severity[y] 3 Sep	SBS % severity[y] 3 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	0.1	3.0 a	14.8	54.8	47.1
Topguard EQ 4.29 5.0 fl oz	0.0	0.5 b	14.8	55.6	49.3
Topguard EQ 4.29 5.0 fl oz + OR-099-E 0.25% (v/v)	0.0	0.9 b	14.6	55.9	48.2
Topguard EQ 4.29 5.0 fl oz + OR-295-A 0.25% (v/v)	0.0	0.7 b	15.3	55.4	50.0
Topguard EQ 4.29 5.0 fl oz + OR-025-F 1.0 pt/A	0.0	0.9 b	15.5	55.9	46.7
Topguard EQ 4.29 5.0 fl oz + OR-009-A 0.4 5 (v/v)	0.0	0.6 b	15.4	55.1	44.8
p-value[w]	*0.2978*	*0.0360*	*0.4136*	*0.2832*	*0.7229*

[z] Fungicide applications were made on 31 Jul at R3 growth stage.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 3 Sep. FLS = frogeye leaf spot; SBS = Septoria brown spot.
[x] Yields were adjusted to 13% moisture and harvest on 10 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

WHEAT (*Triticum aestivum* 'Kaskaskia and Harpoon')
Fusarium head blight; *Fusarium graminearum*

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Evaluation of foliar fungicides and organic varieties for scab management in central Indiana, 2021 (WHT21-01.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 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. Organic wheat varieties 'Kaskaskia and Harpoon' were planted in 7.5-inch row spacing using a drill on 14 Oct, 2020. All fungicide applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45-degree angle, at 3.0 mph. Fungicides were applied on 22 May and 23 May, 2021 at the Feekes growth stage 10.5.1. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 23 May and 24 May, 2021 with a spore suspension (50,000 spores/ml) applied at 300 ml/plot. Disease ratings were assessed on 11 Jun. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 60 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: (% FHB incidence multiplied by average FHB severity)/100 per plot. The eight center rows of each plot were harvested with a Kincaid plot combine on 7 Jul and yields were adjusted to 13.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were not favorable for Fusarium head blight (FHB). No differences between treatments for FHB incidence, severity and Index and non-treated control on 11 Jun (Table 22). The % of Fusarium damaged kernals (FDK) was lowest in the Kaskaskia variety and when treated with Prosaro and Actinovate. The concentration of deoxynivalenol (DON) was lowest in the variety Kaskaskia. An application of Pacesetter increased DON over non-treated. There was no difference in treatment for wheat yield.

Table 22. Effect of variety and fungicide on Fusarium head blight and foliar diseases in organic wheat.

Variety, treatment and rate/A[z]	FHB % incidence[y] 11 Jun	FHB % severity[x] 11 Jun	FHB Index[w] 11 Jun	FDK %[v] 21 Sep	DON ppm[u] 21 Oct	Yield[t] bu/A 7 Jul
Variety						
Kaskaskia	17.6[s]	3.8	0.6	14.5 b	0.067 b[v]	41.4
Harpoon	20.3	4.5	0.9	20.8 a	0.341 a	46.4
Fungicide programs						
Non-treated control	21.5	6.3	1.4	20.7 a	0.150 b	41.7
Prosaro 421 SC 8.2 fl oz	23.3	2.5	0.6	14.7 c	0.243 ab	45.2
ChampION 50 WP 1.5 lb	17.1	1.9	0.4	18.6 ab	0.200 ab	46.6
Pacesetter WS 13.0 fl oz	17.7	3.3	0.6	18.2 ab	0.367 a	43.2
Sonata 1.0 qt	14.9	7.3	0.8	18.3 ab	0.120 b	44.0
Actinovate AG 12.0 fl oz	20.2	3.5	0.8	16.1 bc	0.150 b	42.9
p-value *variety*[u]	*0.2606*	*0.6373*	*0.1798*	*0.0001*	*0.0001*	*0.1880*
p-value *fungicide*	*0.2389*	*0.3333*	*0.1916*	*0.0223*	*0.0957*	*0.9796*
p-value *variety*fungicide*	*0.1083*	*0.8776*	*0.4629*	*0.7277*	*0.1323*	*0.8851*

[z] Fungicides were applied on 22 May and 23 May 2021 at the Feekes growth stage 10.5.1. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 23 May and 24 May with a spore suspension (50,000 spores/ml) applied at 300 ml/plot on 23 May and 24 May.
[y] FHB incidence was measured as the number of infected heads out of 60 plants in each plot and calculated as a percentage.
[x] FHB severity was rated by visually assessing the percentage of the infected head. FHB = Fusarium head blight.
[w] FHB index was calculated as: (% FHB incidence multiplied by average FHB severity)/100 per plot.
[v] FDK = percentage of Fusarium damaged kernels.
[u] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab.
[t] Yields were adjusted to 13.5% moisture and harvested on 7 Jul.
[s] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on least squares means test (α=0.05).

WHEAT (*Triticum aestivum* 'P25R40')
Fusarium head blight; *Fusarium graminearum*

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Evaluation of foliar fungicides for scab management in central Indiana, 2021 (WHT21-02.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 disked and chisel plowed on 10 Oct 2020. Nitrogen (28%) at 30 gal/A was applied on 10 Mar 2020. On 16 Oct 2020 wheat cultivar P25R40 was drilled at 7.5 in. spacing. All fungicide applications were applied at 15 gal/A and 40 psi using a CO2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45 degree angle, at 3.0 mph. Fungicides were applied on 20 May, 22 May and 29 May 2021 at the Feekes growth stage 10.3, 10.5.1 and 10.5.1 + 6 d, respectively. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 22 May. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot with the CO_2 handheld sprayer. Disease ratings were assessed on 11 June 2021. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 60 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: (% FHB incidence multiplied by average FHB severity)/100 per plot. The eight center rows of each plot were harvested with a Kincaid plot combine on 7 July and yields were adjusted to 13.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were not favorable for Fusarium head blight (FHB). FHB incidence was reduced by all fungicides over the non-treated control on 11 Jun, except for Caramba applied at 10.5.1 (Table 23). No differences were detected for FHB Index and severity as compared to the non-treated control. The concentration of deoxynivalenol (DON) was reduced over the non-treated control in all treatments, except Prosaro applied at 10.5.1 and Miravis Ace applied at 10.3. Fusarium damaged kernals (FDK) were reduced in all treatments over non-treated control, except for Caramba and Sphaerex applied at 10.5.1. There were no significant differences in yield.

Table 23. Effect of fungicide on Fusarium head blight and foliar diseases in wheat.

Treatment and rate/A[z]	FHB % incidence[y] 11 Jun	FHB % severity[x] 11 Jun	FHB Index[w] 11 Jun	DON (ppm)[v] 7 Jul	FDK %[u] 7 Jul	Yield[t] bu/A
Non-treated control	25.8 a[s]	6.5	2.2	0.925 a	12.0 a	98.2
Prosaro 421 SC 6.5 fl oz at 10.5.1	15.0 bc	2.1	0.4	0.758 ab	8.5 bcd	86.8
Caramba 90 EC 13.5 fl oz at 10.5.1	19.6 ab	1.2	0.2	0.573 bc	11.3 ab	97.2
Sphaerex (BAS 84000F) 7.3 fl oz at 10.5.1	14.2 bc	2.1	0.3	0.410 cd	9.5 abc	90.1
Miravis Ace 5.2 SC 13.7 fl oz at 10.3	9.6 c	5.2	0.5	0.713 ab	7.3 cde	101.8
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	10.4 c	2.9	0.4	0.385 ab	6.5 cde	95.3
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1+ 4d	14.2 bc	3.3	0.5	0.370 cd	5.8 de	86.3
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.1 + 4d	7.1 c	2.1	0.2	0.213 cd	6.3 de	88.6
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 EC 13.5 fl oz 10.5.1 + 4d	7.5 c	1.5	0.1	0.173 d	5.8 de	89.0
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.51 + 4d	10.8 bc	3.2	0.3	0.248 d	4.3 e	88.7
p-value[v]	*0.0066*	*0.1838*[u]	*0.1826*	*0.0001*	*0.0001*	*0.4829*

[z] Fungicides treatments applied on 20 May, 22 May and 29 May 2021 at the Feekes growth stage 10.3, 10.5.1 and 10.5.1 + 6d, respectively. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 23 May.
[y] FHB incidence was measured as the number of infected heads out of 60 plants in each plot and calculated as a percentage.
[x] FHB severity was rated by visually assessing the percentage of the infected head. FHB = Fusarium head blight.
[w] FHB index was calculated as: (% FHB incidence multiplied by average FHB severity)/100 per plot.
[v] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab.
[u] FDK = percentage of Fusarium damaged kernels.
[t] Yields were adjusted to 13.5% moisture and harvested on 7 Jul.
[s] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

WHEAT (*Triticum aestivum* 'P25R40 and P25R61')
Fusarium head blight; *Fusarium graminearum*

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Evaluation of foliar fungicides and varieties for scab management in central Indiana, 2021 (WHT21-03.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 disked and chisel plowed on 10 Oct 2020. Nitrogen (28%) at 30 gal/A was applied on 10 Mar 2020. On 16 Oct 2020 wheat cultivar P25R40 was drilled at 7.5 in. spacing. All fungicide applications were applied at 15 gal/A and 40 psi using a CO2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45-degree angle, at 3.0 mph. Fungicides were applied on 20 May, 22 May and 29 May 2021 at the Feekes growth stage 10.3, 10.5.1 and 10.5.1 + 6d, respectively. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 22 May. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot with the CO_2 handheld sprayer. Disease ratings were assessed on 11 June 2021. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 60 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: (% FHB incidence multiplied by average FHB severity)/100 per plot. The eight center rows of each plot were harvested with a Kincaid plot combine on 7 July and yields were adjusted to 13.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were not favorable for Fusarium head blight (FHB). There was a significant interaction between variety and treatment (>0.05), therefore treatment affect evaluated across each variety. In the susceptible variety, P25R40, FHB incidence was reduced by Miravis Ace applied at 10.5.1, 10.3, and applied at 10.5.1 followed by (fb) Folicur at 10.5.1+6d. All fungicides redueced FHB severity when compared to non-treated, inculated control, but not the non-treated non-inoculated control in P25R40. FHB Index was lowest with the Miravis Ace fb Folicur, but not different from the single Miravis Ace applications for P25R40. In P25R40, DON was reduced by Prosaro and Miravis Ace fb Folicur, while Fusarium damaged kernals (FDK) were lowest with Miravis Ace applied at 10.5.1 and Miravis Ace fb Folicur treatments over non-treated controls. There was no difference in fungicide treatments for FHB incidence, severity and Index, DON and FDK in the resistant variety, P25R61. No differences in yield were detected in either variety.

Table 24. Effect of variety and fungicide on Fusarium head blight, DON, Fusarium damaged kernels (FDK) and yield in wheat.

	FHB % incidence[y]		FHB % severity[x]		FHB Index[w]		DON (ppm)[v]		% FDK[u]		Yield[t]	
Treatment and rate/A[z]	**P25R40**	**P25R61**	**P25R40**	**P25R61**	**P25R40**	**P25R61**	**P25R40**	**P25R61**	**P25R40**	**P25R61**	**P25R40**	**P25R61**
Non-treated control, inoculated control	38.7 a	17.1	5.4 a	1.8	2.0 a	0.3	0.89 ab	0.05	10.5 ab	9.5	98.9	92.9
Prosaro 421 SC 6.5 fl oz at 10.5.1	26.3 ab	12.9	2.4 bc	1.9	0.7 b	0.3	0.44 c	0.00	7.0 bc	7.0	91.6	94.7
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	13.8 b	9.2	1.8 bc	1.8	0.2 bc	0.1	0.48 bc	0.00	4.4 c	5.8	87.2	95.0
Miravis Ace 5.2 SC 13.7 fl oz at 10.3	15.4 b	8.8	3.0 bc	1.5	0.4 bc	0.1	0.67 abc	0.03	6.8 bc	5.0	97.6	95.7
Miravis Ace 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.5.1 + 6d	12.1 b	8.8	1.3 c	1.7	0.2 c	0.2	0.34 c	0.00	4.4 c	5.5	106.8	91.7
Non-treated, non-inoculated control	27.1 ab	18.7	2.2 bc	1.8	0.6 bc	0.4	0.99 a	0.07	11.8 a	9.3	92.9	93.0
p-value[s]	*0.0126*	*0.1274*	*0.0004*	*0.9874*	*0.0001*	*0.4380*	*0.0325*	*0.0519*	*0.0114*	*0.0654*	*0.0652*	*0.9019*

[z] Fungicides treatments applied on 20 May, 22 May and 29 May 2021 at the Feekes growth stage 10.3, 10.5.1 and 10.5.1 + 6d, respectively. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 23 May.
[y] FHB incidence was measured as the number of infected heads out of 60 plants in each plot and calculated as a percentage.
[x] FHB severity was rated by visually assessing the percentage of the infected head. FHB = Fusarium head blight.
[w] FHB index was calculated as: (% FHB incidence multiplied by average FHB severity)/100 per plot.
[v] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab.
[u] FDK = percentage of Fusarium damaged kernels.
[t] Yields were adjusted to 13.5% moisture and harvested on 7 Jul.
[s] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

WHEAT (*Triticum aestivum*); 'P25R40'
Fusarium head blight; *Fusarium graminearum*

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Evaluation of foliar fungicides for wheat disease management in central Indiana, 2021 (WHT21-06.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 disked and chisel plowed on 10 Oct 2020. Nitrogen (28%) at 30 gal/A was applied on 10 Mar 2020. On 16 Oct 2020 wheat cultivar P25R40 was drilled at 7.5 in. spacing. All fungicide applications were applied at 15 gal/A and 40 psi using a CO2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45 degree angle, at 3.0 mph. Fungicides were applied on 22 May 2021 at the Feekes growth stage 10.5.1. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 22 May. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot with the CO_2 handheld sprayer. Disease ratings were assessed on 11 June 2021. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 60 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: (% FHB incidence multiplied by average FHB severity)/100 per plot. The eight center rows of each plot were harvested with a Kincaid plot combine on 7 July and yields were adjusted to 13.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD; α=0.05).

In 2021, weather conditions were not favorable for Fusarium head blight (FHB). FHB incidence and Index was reduced by all fungicides over the non-treated control on 11 Jun (Table 25). FHB severity and the concentration of deoxynivalenol (DON) was not significantly reduced over the non-treated control for all treatments. There was no difference in wheat yield.

Table 25. Effect of fungicide on Fusarium head blight (FHB), DON, Fusarium damaged kernels (FDK) and yield in wheat.

Treatment and rate/A[z]	FHB % incidence[y] 11 Jun	FHB % severity[x] 11 Jun	FHB Index[w] 11 Jun	DON (ppm)[v] 7 Jul	% FDK[u] 7 Jul	Yield[t] bu/A
Non-treated control	37.1 a	7.1	2.6 a	0.86	10.8 a	90.5
Prosaro 421 SC 8.2 fl oz	16.7 b	3.1	0.5 b	0.68	9.0 a	94.6
Prosaro Pro SC 10.3 fl oz	12.5 b	3.1	0.5 b	0.64	8.3 ab	102.5
Miravis Ace 5.2 SC 13.7 fl oz	11.7 b	1.6	0.2 b	0.35	5.5 b	86.2
p-value[s]	*0.0060*	*0.1154*	*0.0413*	*0.0571*	*0.0300*	*0.2736*

[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. All plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 23 May.
[y] FHB incidence was measured as the number of infected heads out of 60 plants in each plot and calculated as a percentage.
[x] FHB severity was rated by visually assessing the percentage of the infected head. FHB = Fusarium head blight.
[w] FHB index was calculated as: (% FHB incidence multiplied by average FHB severity)/100 per plot.
[v] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab.
[u] FDK = percentage of Fusarium damaged kernels.
[t] Yields were adjusted to 13.5% moisture and harvested on 7 Jul.
[s] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means followed by standard errors. Values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Uniform fungicide comparison for tar spot in corn in northwestern Indiana, 2021 (COR21-02.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 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 27 May. The field was overhead irrigated at 1 in. on 5 Aug and 20 Aug. All fungicide applications were applied at the R1 (silk) corn growth stage on 6 Aug 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. Disease ratings were assessed on 14 Sep, and 29 Sep at 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 (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 3 Nov and yields were adjusted to 15.5% moisture All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD; α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached high severity. At R5 on 14 Sep, tar spot stroma severity was significantly reduced on all leaves over the non-treated control by Delaro Complete, Delaro SC, Tilt and Veltyma, and Revytek on EL (Table 26). The percent symptomatic tissue was significantly reduced on all leaves by Delaro Compete, Delaro SC, Headline Amp, and Veltyma. No significant differences were observed among fungicide treatments and the non-treated control for all disease ratings at R6 on 29 Sep (Table 27). All fungicides significantly increased percent canopy green over non-treated control except for Miravis Neo on 14 Sep, but no significant differences among fungicide treatments and the non-treated control were observed on 29 Sep for percent canopy green, lodging, moisture, test weight and corn yield (Table 28).

Table 26. Effect of fungicide on tar spot at R5 (dent) growth stage.

Treatment and rate/A[z]	Tar spot % stroma[y] EL-2 14 Sep	Tar spot % stroma[y] EL 14 Sep	Tar spot % stroma[y] EL+2 14 Sep	Tar spot % chlor/nec[x] EL-2 14 Sep	Tar spot % chlor/nec[x] EL 14 Sep	Tar spot % chlor/nec[x] EL+2 14 Sep
Non-treated control	30.0 a	22.5 a	20.8 a	65.8 ab	34.8 a	15.0 a
Revytek 3.33 LC at 8.0 fl oz	22.3 abc	14.5 cde	15.6 a-d	42.5 a-e	20.5 abc	6.0 bcd
Veltyma 3.24 S 7.0 fl oz	19.3 bc	14.0 cde	14.3 cde	31.5 cde	15.3 bcd	6.5 bcd
Headline 2.09 SC at 6 fl oz	25.5 ab	20.0 abc	17.0 abc	57.0 abc	28.3 abc	8.0 a-d
Headline AMP 1.68 SC at 10.0 fl oz	20.5 bc	14.3 cde	13.3 cde	40.3 b-e	15.8 bcd	4.8 bcd
Aproach Prima 2.34 SC at 6.8 fl oz	25.8 ab	17.8 abc	16.5 a-d	50.3 abc	23.5 abc	7.0 bcd
Miravis Neo 2.5 SE at13.7 fl oz	30.3 a	20.8 ab	18.0 abc	68.3 a	29.3 ab	12.3 ab
Delaro Complete 3.83 SC at 8.0 fl oz	16.8 cd	10.5 de	11.6 de	21.8 de	8.8 cd	3.5 cd
Delaro 325 SC at 8.0 fl oz	10.5 d	8.9 e	9.5 e	18.0 e	3.3 d	0.5 d
Lucento 4.17 SC at 5.0 fl oz	23.8 abc	19.8 abc	19.5 ab	46.0 a-d	25.5 ab	8.8 abc
Tilt 3.6 EC at 4.0 fl oz	19.0 bc	15.5 bcd	15.3 bcd	47.5 a-d	22.5 abc	6.0 bcd
p-value[w]	*0.0016*	*0.0010*	*0.0046*	*0.0107*	*0.0078*	*0.0388*

[z] Fungicides were applied at R1 (silk) growth stage on 6 Aug. All treatments applied 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 chlorosis and necrosis 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] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

Table 27. Effect of fungicide on tar spot at R6 (maturity) growth stage.

Treatment and rate/A[z]	Tar spot % stroma[y] EL-2 29 Sep	Tar spot % stroma[y] EL 29 Sep	Tar spot % stroma[y] EL+2 29 Sep	Tar spot % chlor/nec[x] EL-2 29 Sep	Tar spot % chlor/nec[x] EL 29 Sep	Tar spot % chlor/nec[x] EL+2 29 Sep
Non-treated control	38.5	32.0	28.5	100.0	100.0	100.0
Revytek 3.33LC at 8 fl oz	32.8	28.0	24.5	100.0	100.0	98.8
Veltyma 3.24S 7 fl oz	32.8	28.3	26.3	100.0	96.0	93.3
Headline 2.09SC at 6 fl oz	35.3	27.8	26.5	100.0	100.0	99.0
Headline AMP 1.68SC at 10 fl oz	30.0	25.8	23.3	100.0	100.0	96.5
Aproach Prima 2.34SC at 6.8 fl oz	31.0	25.8	25.8	100.0	100.0	99.3
Miravis Neo 2.5SE at 13.7 fl oz	35.8	31.0	26.3	100.0	100.0	100.0
Delaro Complete 3.83SC at 8 fl oz	33.3	27.5	24.8	100.0	100.0	97.0
Delaro 325SC at 8 fl oz	35.8	29.5	26.8	100.0	100.0	97.4
Lucento 4.17SC at 5 fl oz	34.0	28.3	22.3	100.0	100.0	100.0
Tilt 3.6EC at 4 fl oz	34.5	31.3	27.5	100.0	100.0	98.0
p-value[w]	*0.1497*	*0.2591*	*0.5059*	-	*0.4654*	*0.2378*

[z] Fungicides were applied at R1 (silk) growth stage on 6 Aug. All treatments applied 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 chlorosis and necrosis 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] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

Table 28. Effect of fungicide on % green, lodging, and yield of corn.

Treatment and rate/A[z]	Canopy % green[y] 14 Sep	Canopy % green[y] 29 Sep	Lodging %[x] 29 Sep	Moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	63.8 d	0.0	32.5	19.6	52.9	135.6
Revytek 3.33LC at 8 fl oz	83.8 ab	0.5	15.0	20.9	52.3	139.2
Veltyma 3.24S 7 fl oz	82.5 ab	5.0	12.5	19.9	67.7	155.8
Headline 2.09SC at 6 fl oz	77.5 bc	1.3	12.5	20.8	53.4	149.0
Headline AMP 1.68SC at 10 fl oz	81.3 ab	2.5	5.0	20.9	52.2	145.6
Aproach Prima 2.34SC at 6.8 fl oz	78.8 bc	1.0	7.5	21.2	51.9	145.8
Miravis Neo 2.5SE at 13.7 fl oz	68.8 cd	0.0	15.0	19.8	53.6	146.3
Delaro Complete 3.83SC at 8 fl oz	87.5 ab	3.0	2.5	22.0	51.8	154.3
Delaro 325SC at 8 fl oz	91.3 a	2.3	10.0	21.7	52.1	141.9
Lucento 4.17SC at 5 fl oz	77.5 bc	0.0	7.5	20.4	51.8	138.5
Tilt 3.6EC at 4 fl oz	81.3 ab	1.8	5.0	20.9	52.2	147.8
p-value[v]	*0.0039*	*0.1470*	*0.4175*	*0.1729*	*0.4386*	*0.0973*

[z] Fungicides were applied at R1 (silk) growth stage on 6 Aug. All treatments applied contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Canopy greenness 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 harvest on Nov 3.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Evaluation of fungicide timing for tar spot management in corn in northwestern Indiana, 2021 (COR21-03.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 27 May. The field was overhead irrigated at 1 in. on 5 Aug and 20 Aug. 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, 2 Aug, 6 Aug, 20 Aug, 30 Aug, 10 Sep, and 16 Sep at the V8 (eight-leaf), V12 (12-leaf), VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent), V8 followed by VT (V8 fb VT) growth stages, respectively. A weather-based prediction model, Tarspotter, was used to predict fungicide timing which trigger at V12 (12-leaf) application. Disease ratings were assessed on 14 Sep, and 29 Sep at 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 (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 3 Nov and yields were adjusted to 15.5% moisture All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached high severity. Trivapro applied at R2 and R3 and with Tarspotter at V12 significnatly reduced tar spot stroma on all leaves over the non-treated control, except for Tarspotter V12 on EL at R5 (Table 29). Trivapro applied at R2, R3 and at Tarspotter (V2) orAll treatments significantly reduced symptomatic tissue severity on the EL-2, EL, and EL+2 over the non-treated control on 14 Sep. In addition, application at V8 followed by R1 reduced tar spot symtoms on EL and EL+ 2 on 14 Sep. No significant differences were observed among fungicide treatments and the non-treated control for stroma severity on the EL-2, but all application timings significantly reduced stroma severity over the non-treated control on the EL and EL-2 at R6 on 29 Sep (Table 30). On 29 Sep, R3, R4 and Tarspotter timed applications significantly reduced symptomatic tissue severity on the EL-2, whereas, V12, R2, R3, R4, and Tarspotter significantly reduced symptomatic tissue severity on the EL and V12, R2, R3, R4, and R5 applications significantly reduced symptomatic tissue severity on the EL+2. All application timings significantly increased percent canopy green over the non-treated control, except for applications made at the V12, VT/R1, and R5 growth stages on 24 Sep whereas. On 29 Sep all timings except V8, VT/R1, and V8 fb R1 significantly increased percent canopy green over the non-treated control (Table 31). No significant differences were detected for moisture and test weight. Trivapro applied at the VT/R1, R2, R3 and R4 growth stages significantly increase yield of corn over the non-treated control.

Table 29. Effect of fungicide on tar spot at R5 (dent) growth stage.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] EL-2 14 Sep	Tar spot % stroma[y] EL 14 Sep	Tar spot % stroma[y] EL+2 14 Sep	Tar spot % chlor/nec[x] EL-2 14 Sep	Tar spot % chlor/nec[x] EL 14 Sep	Tar spot % chlor/nec[x] EL+2 14 Sep
Non-treated control	14.5 bc	12.2 abc	9.9 ab	15.3 bc	4.8 bcd	0.5 bc
Trivapro 2.21 SE 13.7 fl oz at V8	10.9 cd	10.2 cd	7.9 bc	5.5 cd	2.3 cde	0.5 bc
Trivapro 2.21 SE 13.7 fl oz at V12	9.4 cd	9.0 cde	7.6 bc	6.0 cd	1.5 de	0.0 c
Trivapro 2.21 SE 13.7 fl oz at VT/R1	17.8 ab	14.5 ab	11.8 a	14.3 bc	6.0 abc	3.3 a
Trivapro 2.21 SE 13.7 fl oz at R2	8.3 d	5.7 e	4.2 d	3.5 d	0.3 e	0.0 c
Trivapro 2.21 SE 13.7 fl oz at R3	7.7 d	6.6 de	4.3 d	1.0 d	0.0 e	0.0 c
Trivapro 2.21 SE 13.7 fl oz at R4	18.0 ab	14.6 ab	9.9 ab	19.0 b	7.3 ab	2.0 ab
Trivapro 2.21 SE 13.7 fl oz at R5	20.8 a	15.5 a	11.0 a	29.8 a	9.8 a	2.5 a
Trivapro 2.21 SE 13.7 fl oz at V8 fb R1	11.0 cd	11.0 bc	7.9 bc	4.3 d	2.0 cde	0.0 c
Trivapro 2.21 SE 13.7 fl oz at Tarspotter (V12)	7.1 d	9.0 cde	6.4 cd	2.8 d	0.3 e	0.0 c
p-value[w]	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0002*	*0.0016*

[z] Fungicide treatments applied on 23 Jul, 2 Aug, 6 Aug, 20 Aug, 30 Aug, 10 Sep, and 16 Sep at the V8 (eight-leaf), V12 (12-leaf), VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent), V8 followed by VT (V8 fb VT) growth stages, respectively. Tarspotter = tar spot weather-based model application. The tar spot model triggered application at V12. 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 chlorosis and necrosis 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] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

Table 30. Effect of fungicide on tar spot at R6 (maturity) growth stage.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] EL-2 29 Sep	Tar spot % stroma[y] EL 29 Sep	Tar spot % stroma[y] EL+2 29 Sep	Tar spot % chlor/nec[x] EL-2 29 Sep	Tar spot % chlor/nec[x] EL 29 Sep	Tar spot % chlor/nec[x] EL+2 29 Sep
Non-treated control	28.3	29.0 a	24.0 a	100.0 a	98.0 a	78.8 a
Trivapro 2.21 SE 13.7 fl oz at V8	26.0	22.8 b	17.8 b	94.8 ab	86.8 ab	66.8 ab
Trivapro 2.21 SE 13.7 fl oz at V12	30.3	20.3 bc	15.8 bc	90.0 ab	70.8 bc	51.8 bc
Trivapro 2.21 SE 13.7 fl oz at VT/R1	24.0	22.0 b	19.3 b	100.0 a	91.0 ab	66.5 ab
Trivapro 2.21 SE 13.7 fl oz at R2	21.3	15.5 cd	12.3 cd	79.0 ab	39.3 de	3.0 e
Trivapro 2.21 SE 13.7 fl oz at R3	15.9	8.7 e	7.4 e	24.3 d	1.0 f	0.3 e
Trivapro 2.21 SE 13.7 fl oz at R4	24.5	14.8 d	10.5 de	76.3 b	52.5 cd	13.8 de
Trivapro 2.21 SE 13.7 fl oz at R5	21.3	22.0 b	16.8 b	96.3 ab	70.0 bc	34.3 cd
Trivapro 2.21 SE 13.7 fl oz at V8 fb R1	23.5	21.3 b	19.0 b	100.0 a	88.3 ab	64.8 ab
Trivapro 2.21 SE 13.7 fl oz at Tarspotter (V12)	21.3	13.0 de	8.9 de	53.3 c	18.3 ef	2.8 e
p-value[w]	*0.3507*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*

[z] Fungicide treatments applied on 23 Jul, 2 Aug, 6 Aug, 20 Aug, 30 Aug, 10 Sep, and 16 Sep at the V8 (eight-leaf), V12 (12-leaf), VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent), V8 followed by VT (V8 fb VT) growth stages, respectively. Tarspotter = tar spot weather-based model application. The tar spot model triggered application at V12. 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 chlorosis and necrosis 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] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

Table 31. Effect of fungicide on % canopy green and yield of corn.

Treatment, rate/A, and timing[z]	Canopy % green[y] 24 Sep	Canopy % green[y] 29 Sep	Moisture % 3 Nov	Test weight lb/bu	Yield[x] bu/A
Non-treated control	55.0 d	36.3 d	22.1	53.5	97.2 b
Trivapro 2.21 SE 13.7 fl oz at V8	61.3 cd	40.0 d	21.7	53.0	112.1 ab
Trivapro 2.21 SE 13.7 fl oz at V12	67.5 bc	62.5 c	22.6	52.9	120.0 ab
Trivapro 2.21 SE 13.7 fl oz at VT/R1	63.8 cd	40.0 d	21.8	53.2	125.2 a
Trivapro 2.21 SE 13.7 fl oz at R2	93.8 a	86.3 ab	22.8	62.7	128.3 a
Trivapro 2.21 SE 13.7 fl oz at R3	96.5 a	95.0 a	24.4	53.1	130.1 a
Trivapro 2.21 SE 13.7 fl oz at R4	76.3 b	75.0 abc	21.8	53.6	135.9 a
Trivapro 2.21 SE 13.7 fl oz at R5	65.0 cd	67.5 bc	22.2	53.3	115.5 ab
Trivapro 2.21 SE 13.7 fl oz at V8 fb R1	66.3 bc	33.8 d	22.6	52.9	116.2 ab
Trivapro 2.21 SE 13.7 fl oz at Tarspotter (V12)	92.5 a	88.8 a	22.6	53.3	122.6 ab
p-value[w]	*0.0001*	*0.0001*	*0.0886*	*0.4448*	*0.1877*

[z] Fungicide treatments applied on 23 Jul, 2 Aug, 6 Aug, 20 Aug, 30 Aug, 10 Sep, and 16 Sep at the V8 (eight-leaf), V12 (12-leaf), VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent), V8 followed by VT (V8 fb VT) growth stages, respectively. Tarspotter = tar spot weather-based model application. The tar spot model triggered application at V12. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by.

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

[x] Yields were adjusted to 15.5% moisture and harvest on Nov 3.

[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea mays* 'ALSEED O.84-95UP')
Tar spot; *Phyllachora maydis*
Northern corn leaf blight; *Setosphaeria turica*

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Fungicide evaluation for tar spot in organic corn in northwestern Indiana, 2021 (COR21-05.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 organic grain corn production in Indiana were followed. Corn organic hybrid ALSEED O.84-95UP was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 25 May. 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. Fungicide treatments were applied on 2 Aug at R1 (silk) growth stage. Disease ratings were assessed on 16 Sep at R5 (dent) growth stage. Tar spot was rated by visually assessing the percentage of stroma (0-100%) and percentage of symptomatic tissues (chlorosis and necrosis) (0-100%) per leaf on five plants in each plot at the ear leaf. Northern corn leaf blight (NCLB) was rated for disease severity by visually assessing the percentage of symptomatic leaf area in the mid canopy. Values for the five leaves were averaged before analysis. Percent canopy green was rated by visually assessing the percentage (0-100%) of whole plot for crop canopy that remained green at R5 (dent) growth stage. The two center rows of each plot were harvested on 3 Nov and yields were adjusted to 15.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. All fungicide treatments reduced tar spot stroma severity on ear leaf over the non-treated control (Table 32). Headline Amp significantly reduced the percentage of symptomatic tissues on ear leaf. There was no significant difference between treatments for severity of NCLB on ear leaf. Headline Amp had a highest percent of green plots and corn yield. There were no significant differences between treatments for harvest moisture and test weight.

Table 32. Effect of fungicide on foliar disease severity at R5 (dent) growth stage, stay green and corn yield.

Treatment and rate/A[z]	Tar spot % severity[y] 16 Sep	Tar spot % chlor/nec[x] 16 Sep	NCLB % severity[w] 16 Sep	Canopy % green[v] 16 Sep	Harvest moisture %	Test weight lb/bu	Yield[u] bu/A
Non-treated control	25.8 a	86.0 a	0.5 a	23.8 b	16.8	55.9	148.2 b
Headline AMP 1.68 SE 10.0 fl oz	10.0 d	56.3 b	1.2 a	40.0 a	17.0	56.4	162.6 a
Serifel WP 16.0 fl oz	18.3 bc	86.8 a	0.5 a	22.5 b	16.8	56.2	148.3 b
Actinovate AG 12.0 ox	20.3 b	76.3 ab	0.0 a	25.0 b	16.7	55.6	160.7 ab
Badge X2 SC 1.8 lb	14.8 cd	74.3 ab	1.9 a	33.8 b	17.1	56.2	149.9 b
OxiDate 5.0 128.0 fl oz	20.3 b	78.3 ab	0.5 a	23.8 b	16.9	56.3	159.4 ab
p-value[t]	*0.0001*	*0.0001*	*0.6753*	*0.0001*	*0.4366*	*0.2614*	*0.0001*

[z] Fungicide treatments were applied at on 2 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 on 16 Sep.
[x] Tar spot chlorosis and necrosis symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf on 16 Sep.
[w] NCLB was rated for disease severity by visually assessing the percentage of symptomatic leaf area in the mid canopy on 16 Sep. NCLB = northern corn leaf blight.
[v] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 16 Sep.
[u] Yields were adjusted to 15.5% moisture and harvested on 3 Nov.
[t] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Fungicide timing and application for tar spot in corn in northwestern Indiana, 2021 (COR21-06.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 27 May. 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. Fungicides were applied at first detection of tar spot, and at V8, VT/R1 (tassel/silk), and R3 (milk) growth stages on 14 Jul, 23 Jul, 5 Aug, and 30 Aug, respectively. To compare a single verses double fungicide application programs, a three weeks after treatment (WAT) was applied, these occurred on 2 Aug, 12 Aug, 27 Aug, and 16 Sep. Disease ratings were assessed on 24 Sep at the R5 (dent) growth stage. Tar spot was rated by visually assessing the percentage of stroma (0-100%) and percentage of symptomatic tissues (chlorosis and necrosis) (0-100%) per leaf on five plants in each plot at the ear leaf. Values for the five leaves were averaged before analysis. Percent stay green was rated by visually assessing the percentage (0-100%) of whole plot for crop canopy that remained green at R5 (dent) growth stage. The two center rows of each plot were harvested on 3 Nov and yields were adjusted to 15.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for tar spot which reached high severity. Veltyma applied at V8, first detection fb 3 WAT, V8 fb 3 WAT, VT fb 3 WAT and R3 fb 3 WAT significantly reduced tar spot stroma severity over the non-treated controls on the ear leaf (Table 33). In addition, Lucento applied V8 fb 3 WAT and VT fb 3 WAT reduced tar spot. A single application of Veltyma at V8 and R3 reduced chlorotic and necrotic symptoms over non-treated control, in addition tar spot symptoms were reduced by Veltyma at the first detection of tar spot fb 3 WAT, V8 fb 3 WAT, VT fb 3 WAT, and R3 fb 3 WAT, and Lucento at R3, V8 fb 3 WAT, VT fb 3 WAT and R3 fb 3 WAT. All fungicide programs of Veltyma and Lucento significantly increased the percentage of green canopy over the non-treated control. Veltyma when applied at R3, V8 fb 3 WAT, VT fb 3 WAT, R3 fb 3 WAT and Lucento when applied at V8 fb 3 WAT, VT fb 3 WAT and R3 fb 3 WAT increased yield over the non-treated control.

Table 33. Effect of fungicide on tar spot of corn at R5 (dent) growth stage, stay green and corn yield.

Treatment, rate/A, and timing[z]	Tar spot % severity[y] 24 Sep	Tar spot %chlor/nec[x] 24 Sep	Canopy % green [w] 24 Sep	Harvest moisture %	Test weight lb/bu	Yield[v] bu/A 3-Nov
Non-treated control	31.3 a	90.5 a	30.0 i	21.15	52.85	143.2 d
Veltyma 3.34 S 7.0 fl oz at first detection	28.5 ab	75.0 a	40.0 h	20.40	53.38	149.3 cd
Veltyma 3.34 S 7.0 fl oz at V8	17.4 efg	45.2 b	60.0 def	23.15	52.98	157.6 bcd
Veltyma 3.34 S 7.0 fl oz at VT	26.3 a-d	75.5 a	42.5 h	21.99	52.15	157.1 bcd
Veltyma 3.34 S 7.0 fl oz at R3	22.3 b-e	32.5 b-e	62.5 bcd	21.98	53.03	169.8 ab
Veltyma 3.34 S 7.0 fl oz at first detection fb 3 WAT	18.3 efg	41.7 bc	61.3 cde	21.75	53.23	149.4 cd
Veltyma 3.34 S 7.0 fl oz at V8 fb 3 WAT	0.5 h	0.0 f	91.3 a	23.95	52.63	184.2 a
Veltyma 3.34 S 7.0 fl oz at VT fb 3 WAT	11.9 g	12.8 ef	68.3 bc	22.03	53.40	188.2 a
Veltyma 3.34 S 7.0 fl oz at R3 fb 3 WAT	20.6 def	30.2 b-e	52.5 fg	21.85	53.30	176.8 ab
Non-treated control	27.8 abc	86.5 a	31.3 i	22.00	53.60	144.5 d
Lucento 7.17 SC 5.0 fl oz at first detection	27.5 abc	78.5 a	42.5 h	21.70	53.50	149.1 cd
Lucento 7.17 SC 5.0 fl oz at V8	25.5 a-d	77.2 a	40.0 h	16.26	52.68	160.9 bcd
Lucento 7.17 SC 5.0 fl oz at VT	26.2 a-d	73.2 a	41.3 h	21.23	52.05	150.9 cd
Lucento 7.17 SC 5.0 fl oz at R3	21.0 cde	14.6 def	65.0 bcd	21.35	52.68	159.5 bcd
Lucento 7.17 SC 5.0 fl oz at first detection fb 3 WAT	26.5 a-d	70.5 a	46.3 gh	21.58	53.58	158.0 bcd
Lucento 7.17 SC 5.0 fl oz at V8 fb 3 WAT	14.1 fg	25.1 cde	70.0 b	21.75	52.98	175.0 ab
Lucento 7.17 SC 5.0 fl oz at VT fb 3 WAT	16.1 efg	33.0.bcd	57.5 def	21.85	53.70	163.4 bc
Lucento 7.17 SC 5.0 fl oz at R3 fb 3 WAT	25.5 a-d	34.0 bcd	53.8 efg	21.45	53.48	164.2 bc
p-value[u]	*0.0001*	*0.0001*	*0.0001*	*0.3341*	*0.3289*	*0.0001*

[z] Fungicides were applied at first detection of tar spot, V8, VT/R1 (tassel/silk), and R3 (milk) growth staged on 14 Jul, 23 Jul, 5 Aug, and 30 Aug, respectively. The second application occurred 3 weeks after treatment (WAT) on 2 Aug, 12 Aug, 27 Aug, and 16 Sep. All treatments contained a non-ionic surfactant (Preference) at VT or later applications at a rate of 0.25% v/v. fb = followed by, WAT = weeks after treatment. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf on 24 Sep.[x] Tar spot chlorosis and necrosis symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf on 24 Sep.[w] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 24 Sep. [v] Yields were adjusted to 15.5% moisture and harvested on 3 Nov. [u] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea mays* 'W2585SSRIB, P0589AMXT ')
Tar spot; *Phyllachora maydis*

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Evaluation of effect of tillage and variety for foliar disease risk in corn, 2021 (COR21-08.PPAC).

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a split-plot with four replications. Plots were 7.5-ft wide and 30-ft long, consisted of six 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 hybrids W2585SSRIB and P0589AMXT were planted in 30-inch row spacing at a rate of 32,000 seeds/A on 27 May. Standard practices for non-irrigated grain corn production in Indiana were followed. No foliar fungicides were applied. Disease ratings were assessed on 14 Sep and 28 Sep at 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 twenty plants in each plot at the ear leaf minus two (EL-2), ear leaf minus one (EL-1), ear leaf (EL), ear leaf plus one (EL+1). Values for each plot were averaged before analysis. The four center rows of each plot were harvested on 4 Nov and yields were adjusted to 15.5% moisture All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's least significant difference (α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. Tar spot stroma severity and chlorotic and necrotic symptoms significantly reduced with tar spot moderate resistant variety (P0589AMXT) compared to tar spot susceptible variety (W2585SSRIB) on all leaves on 14 Sep (Table 34). Tar spot stroma severity was significantly reduced with tillage treatment (low residue) compared to no-tillage (high residue) on the EL-1 on 14 Sep. Tar spot chlorotic and necrotic symptoms were walso reduced with tillage treatment compared to no-tillage treatment on the EL-2 and EL-1 on 14 Sep. On 28 Sep, tar spot stroma severity was significantly reduced with tar spot moderate resistant variety (P0589AMXT) compared to tar spot susceptible variety (W2585SSRIB) on all leaves on 28 Sep (Table 35). Tar spot stroma severity was significantly reduced with tillage treatment (low residue) compared to no-tillage (high residue) on the EL-1 on 28 Sep. % canopy greenness was increased with tar spot resistant variety (P0589AMXT) compared to tar spot susceptible variety (W2585SSRIB) on 28 Sep. Test weight was higher with tillage treatment (low residue) and there were sno significant differences on effect of tillage and variety for harvest moisture, and corn yield.

Table 34. Effect of tillage and hybrid for foliar disease risk in corn.

	Tar spot % stroma[y]				Tar spot % chlor/nec[x]			
Treatment[z]	**EL-2 14 Sep**	**EL-1 14 Sep**	**EL 14 Sep**	**EL+1 14 Sep**	**EL-2 14 Sep**	**EL-1 14 Sep**	**EL 14 Sep**	**EL+1 14 Sep**
No-tillage (high residue)	16.2	13.2 a	10.1	5.0	25.6 a	17.3 a	10.0	3.8
Yes-tillage (low residue)	11.2	8.9 b	7.3	6.4	14.0 b	9.1 b	6.3	3.9
P0589AMXT	6.0 b	5.2 b	4.6 b	3.9 b	4.9 b	3.3 b	2.4 b	1.4 b
W2585SSRIB	21.4 a	17.0 a	12.8 a	7.4 a	34.7 a	23.0 a	13.9 a	6.3 a
p-value *(tillage)*[w]	*0.0502*	*0.0445*	*0.0984*	*0.1698*	*0.0244*	*0.0223*	*0.1008*	*0.8559*
p-value *(variety)*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*
p-value *(tillage*variety)*	*0.0548*	*0.0703*	*0.1031*	*0.0093*	*0.0145*	*0.0341*	*0.1396*	*0.4102*

[z] No foliar fungicides were applied.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on twenty plants in each plot at the ear leaf minus two (EL-2), ear leaf minus one (EL-1), ear leaf (EL), ear leaf plus one (EL+1).
[x] Tar spot chlorosis and necrosis symptoms visually assessed percentage (0-100%) of leaf area on twenty plants in each plot at the ear leaf minus two (EL-2), ear leaf minus one (EL-1), ear leaf (EL), ear leaf plus one (EL+1).
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

Table 35. Effect of tillage and hybrid for foliar disease risk, canopy greenness and corn yield.

	Tar spot % stroma[y]				Canopy	Harvest		
Treatment[z]	EL-2 28 Sep	EL-1 28 Sep	EL 28 Sep	EL+1 28 Sep	% green[x] 28 Sep	moisture %	Test weight lb/bu	Yield[w] bu/A
No-tillage (high residue)	19.6	19.8 a	18.8	17.4	23.3	19.3	54.1	265.6
Yes-tillage (low residue)	15.8	16.2 b	17.1	16.9	14.9	18.6	56.5	308.2
P0589AMXT	12.4 b	12.9 b	13.0 b	11.5 b	30.0 a	18.8	56.2	286.9
W2585SSRIB	23.0 a	23.1 a	22.9 a	22.8 a	8.3 b	19.1	54.4	287.0
p-value *(tillage)*[v]	*0.0573*	*0.0239*	*0.0537*	*0.6249*	*0.1032*	*0.2349*	*0.0441*	*0.0763*
p-value *(variety)*[v]	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.2919*	*0.0798*	*0.9972*
p-value *(tillage*variety)*[v]	*0.4366*	*0.3155*	*0.4702*	*0.1209*	*0.0717*	*0.7990*	*0.3307*	*0.9044*

[z] No foliar fungicides were applied.

[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on twenty plants in each plot at the ear leaf minus two (EL-2), ear leaf minus one (EL-1), ear leaf (EL), ear leaf plus one (EL+1) on 28 Sep.

[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green 28 Sep.

[w] Yields were adjusted to 15.5% moisture and harvested on 4 Nov.

[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Fungicide comparison for foliar diseases in corn in northwestern Indiana, 2021 (COR21-15.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 27 May. The field was overhead irrigated at 1 in. on 5 Aug and 20 Aug. 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 at V12, R1 (silk), R2 (blister), and R3 (milk) growth stages on 2 Aug, 6 Aug, 20 Aug, and 30 Aug, respectively. Disease ratings were assessed on 22 Sep, and 29 Sep at 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. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 3 Nov and yields were adjusted to 15.5% moisture All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. On 22 Sep, all fungicides reduced tar spot stroma severity over the non-treated control, except Miravis Neo at R1, Trivapro at R1, Veltyma at R1, Zolera at R1, and Vacciplant at R1 and R2 (Table 36). Miravis Neo at V12 and V12 fb R3, Zolera + Vacciplant at R2, Veltyma at R2, and Delaro Complete at R2 reduced chlorosis and necrosis over the non-treated controls at R5. On 29 Sep, Miravis Neo applied at V12 and V12 fb R3, Zolera + Vacciplant at R1 and R2, Zolera at R2, Veltyma at R2, Delaro Complete at R2 reduced tar spot stroma and increased leaf greenness over the non-treated controls. In addition, Brixen at all rates and Zolera at R1 reduced stroma. Miravis Neo at V12 and V12 fb R3, Delaro Complete at R1 and R2, Brixen all rates at R1, Zolera at R1 and R2, Zolera + Vacciplant at R1 and R2, and Veltyma at R2 increased greenness of corn on 22 Sep (R5). By 29 Sep (R6) only treatments of Miravis Neo at V12 fb R3, Zolera at R1 and R2, Zolera + Vacciplant at R2, Veltyma at R2, and Delaro Complete at R2 were significantly greener than non-treated controls. Corn yield was highest in plots treated with Veltyma at R2, Delaro Complete at R2, Miravis Neo at V12 fb R3, Miravis Neo at V12, Veltyma at R1, Zolera at R1 and R2, and Zolera + Vacciplant over the non-treated controls (Table 37).

Table 36. Effect of fungicide on tar spot.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] 22 Sep	Tar spot %chlor/nec[x] 22 Sep	Tar spot % stroma[y] 29 Sep	Leaf % green[x] 29 Sep	Canopy % green[w] 22 Sep	Canopy % green[w] 29 Sep
Non-treated control	30.8 a	92.2 a	25.0 a	3.5 g	45.0 fg	2.0 f
Miravis Neo 2.5 SE 13.7 fl oz at V12	10.0 i	23.7 h	21.0 de	14.5 d	57.5 bc	6.8 ef
Miravis Neo 2.5 SE 13.7 fl oz at R1	28.0 a-d	80.0 abc	23.8 abc	7.0 d-g	50.0 def	4.8 ef
Miravis Neo 2.5 SE 13.7 fl oz at V12 fb R3	3.8 j	36.7 gh	5.5 g	80.3 a	66.3 a	50.0 a
Trivapro 2.21 SE 13.7 fl oz at R1	28.3 abc	85.0 ab	24.5 ab	4.4 g	48.8 ef	3.3 f
Delaro Complete 458 SC 8.0 fl oz at R1	21.2 fg	60.0 b-f	24.8 a	5.7 fg	55.0 bcd	5.5 ef
Veltyma 3.34 S 7.0 fl oz at R1	27.3 a-e	79.8 abc	23.8 abc	6.9 d-g	50.0 def	5.5 ef
Aproach Prima 2.34 SC 6.8 fl oz at R1	22.6 d-g	77.0 abc	23.3 abc	8.9 d-g	50.0 def	3.8 f
Brixen 15.0 fl oz at R1	22.3 efg	66.8 b-f	22.5 bcd	9.2 d-g	53.8 cde	5.8 ef
Brixen 13.0 fl oz at R1	21.3 fg	64.8 b-f	22.5 bcd	9.8 d-g	53.8 cde	7.0 ef
Brixen 10.0 fl oz at R1	17.8 gh	73.3 a-d	22.3 cd	9.4 d-g	52.5 cde	4.5 ef
Zolera ODX 5.0 fl oz at R1	24.0 a-f	69.3 a-d	19.9 e	14.0 de	53.8 cde	10.5 e
Vacciplant SL 14.0 fl oz at R1	29.3 ab	85.0 ab	25.0 a	5.0 g	45.0 fg	2.8 f
Zolera ODX 5.0 fl oz + Vacciplant SL 14.0 fl oz at R1	23.0 c-g	78.5 abc	20.0 e	13.4 def	52.5 cde	5.7 ef
Zolera ODX 5.0 fl oz at R2	14.1 hi	63.5 b-f	10.8 f	50.0 c	57.5 bc	27.5 d
Vacciplant SL 14 fl oz at R2	28.0 a-d	79.8 abc	23.3 abc	5.8 efg	48.8 ef	4.0 f
Zolera ODX 5.0 fl oz + Vacciplant SL 14.0 fl oz at R2	10.9 i	47.8 efg	11.1 f	50.3 c	57.5 bc	33.8 c
Veltyma 3.34 S 7.0 fl oz at R2	14.6 hi	44.5 fgh	6.9 g	71.8 b	60.0 b	47.5 a
Delaro Complete 458 SC 8.0 fl oz at R2	13.7 hi	51.5 d-g	10.0 f	54.8 c	60.0 b	40.0 b
Non-treated control	31.8 a	85.0 ab	25.3 a	3.7 g	45.0 fg	2.0 f
p-value[v]	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*

[z] Fungicides were applied at V12, R1 (silk), R2(blister), and R3 (milk) growth stages on 2 Aug, 6 Aug, 20 Aug, and 30 Aug, respectively. All treatments applied at R1, R2 or R3 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. [x] Tar spot chlorosis and necrosis symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf. [w] Canopy and leaf greenness visually assessed percentage (0-100%) of leaf or crop canopy green on 22 and 28 Sep, respectively. [v] A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

Table 37. Effect of fungicide on stay green, lodging, and corn yield.

Treatment, rate/A, and timing[z]	Lodging %[y] 29 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	0.5 a	20.5 hi	52.8	149.0 fg
Miravis Neo 2.5 SE 13.7 fl oz at V12	0.0 b	21.5 e-h	53.8	161.7c-f
Miravis Neo 2.5 SE 13.7 fl oz at R1	0.0 b	20.8 ghi	53.7	155.1 d-g
Miravis Neo 2.5 SE 13.7 fl oz at V12 fb R3	0.0 b	23.9 a	52.5	181.5 ab
Trivapro 2.21 SE 13.7 fl oz at R1	0.5 a	21.2 f-i	55.4	160.6 c-g
Delaro Complete 458 SC 8.0 fl oz at R1	0.0 b	22.6 b-e	52.6	153.0 efg
Veltyma 3.34 S 7.0 fl oz at R1	0.0 b	22.3 b-f	52.3	161.9 c-f
Aproach Prima 2.34 SC 6.8 fl oz at R1	0.0 b	21.7 e-h	53.0	149.7 fg
Brixen 15.0 fl oz at R1	0.0 b	22.2 b-f	52.5	158.0 c-g
Brixen 13.0 fl oz at R1	0.0 b	21.7 d-h	53.1	151.6 efg
Brixen 10.0 fl oz at R1	0.0 b	21.0 f-i	53.6	156.5 c-g
Zolera ODX 5.0 fl oz at R1	0.0 b	21.8 d-g	53.1	164.4 cde
Vacciplant SL 14.0 fl oz at R1	0.0 b	21.2 f-i	52.4	151.9 efg
Zolera ODX 5.0 fl oz + Vacciplant SL 14.0 fl oz at R1	0.0 b	21.2 f-i	53.2	158.6 c-g
Zolera ODX 5.0 fl oz at R2	0.0 b	23.2 abc	53.2	170.8 bc
Vacciplant SL 14 fl oz at R2	0.0 b	22.1 c-f	52.7	151.5 efg
Zolera ODX 5.0 fl oz + Vacciplant SL 14.0 fl oz at R2	0.0 b	23.3 abc	52.5	169.1 bcd
Veltyma 3.34 S 7.0 fl oz at R2	0.0 b	23.0 a-d	53.4	188.7 a
Delaro Complete 458 SC 8.0 fl oz at R2	0.0 b	23.5 ab	52.9	181.8 ab
Non-treated control	0.5 a	20.5 hi	52.8	149.0 fg
p-value[w]	0.0055	0.0001	0.1689	0.0001

[z] Fungicides were applied at V12, R1 (silk), R2(blister), and R3 (milk) growth stages on 2 Aug, 6 Aug, 20 Aug, and 30 Aug, respectively. All treatments applied at R1, R2 or R3 contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. fb = followed by. [y] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical. [x] Yields were adjusted to 15.5% moisture and harvest on Nov 3. [w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Evaluation of Xyway and foliar fungicide programs for tar spot in corn in northwestern Indiana, 2021 (COR21-16.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 2 seeds/ft on 27 May. In-furrow treatments applied at planting at 10 gal/A. All foliar 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, 6 Aug, and 30 Aug at V10, R1 (silk) and R3 (milk) growth stages, respectively. Disease ratings were assessed on 28 Sep at R6 (maturity) growth stages. Tar spot was rated by visually assessing the percentage of stroma per leaf 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 4 Nov and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. There was no significant effect on treatment for tar spot stroma severity on 28 Sep (Table 38). On 28 Sep at R6, treatments that included Topguard at V10 or R3 were the only plots greener than the non-treated control. There was no significant effect of treatment on harvest moisture, test weight, and corn yield.

Table 38. Effect of fungicide on tar spot, canopy green, and corn yield.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] 28 Sep	Canopy % green[x] 28 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	25.8	17.5 c	52.2	31.8	167.5
Xyway LFR 15.2 fl oz in-furrow	25.3	21.3 c	51.8	33.2	172.9
Xyway LFR 10.5 fl oz in-furrow fb Topguard EQ 4.29 5.0 fl oz at V10	20.0	31.3 b	52.9	33.4	172.4
Xyway LFR 10.5 fl oz in-furrow fb Topguard EQ 4.29 5.0 fl oz at R1	24.8	17.5 c	51.7	31.6	165.5
Xyway LFR 10.5 fl oz in-furrow fb Topguard EQ 4.29 5.0 fl oz at R3	17.2	42.5 a	52.4	32.5	172.3
Topguard EQ 4.29 5.0 fl oz at R1	23.3	18.8 c	52.3	31.8	167.9
Xyway LFR 15.2 fl oz 2x2 at plant	26.0	18.8 c	52.4	33.8	173.8
Xyway LFR 10.5 fl oz in-furrow	25.0	21.3 c	52.5	32.3	167.6
Trivapro 2.21 SE 13.7 fl oz at R1	23.0	22.5 c	53.2	32.5	171.6
Xyway LFR 15.2 fl oz in-furrow fb Trivapro 2.21 SE 13.7 fl oz at R1	22.8	20.0 c	52.3	35.0	180.7
p-value[v]	*0.1087*	*0.0001*	*0.3831*	*0.3709*	*0.6565*

[z] In-furrow treatments applied at planting at 10 gal/A. Fungicides were applied on 23 Jul, 6 Aug, and 30 Aug at V10, R1 (silk) and R3 (milk) growth stages, respectively.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf on 28 Sep.
[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 28 Sep.
[w] Yields were adjusted to 15.5% moisture and harvest on Nov 4.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Evaluation of Xyway programs in corn for tar spot in northwestern Indiana, 2021 (COR21-21.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 six 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 2 seeds/ft on 27 May. Standard practices for non-irrigated grain corn production in Indiana were followed. In-furrow treatments applied at planting at 10 gal/A. All foliar 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. Foliar fungicides were applied on 8 Aug at the R1 (silk) growth stage. Disease ratings were assessed on 14 and 28 Sep at R5 (dent) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma per leaf 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 4 Nov and yields were adjusted to 15.5% moisture All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's least significant difference (α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. Xyway in-furrow fb Topguard at R1 and Veltyma at R1 significantly reduced the percent of tar spot stroma severity over the non-treated control on 14 Sep and 28 Sep (Table 39). There were no significant differences between treatments and the non-treated control for % canopy green, harvest moisture, test weight, and corn yield.

Table 39. Effect of fungicide on tar spot, canopy green, and corn yield.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] 14 Sep	Tar spot % stroma[y] 28 Sep	Canopy % green[x] 28 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	9.8 a	0.3	18.3	21.5	51.6	163.8
Xyway LFR 15.2 fl oz in-furrow	7.5 b	0.0	17.5	21.3	51.9	168.0
Xyway LFR 10.5 fl oz in-furrow fb Topguard EQ, 4.29 5.0 fl oz at R1	5.8 bc	0.0	21.7	21.5	52.6	168.9
Topguard EQ, 4.29 5.0 fl oz at R1	7.3 bc	0.0	18.3	21.7	52.0	166.0
Veltyma 3.34 S 7.0 fl oz at R1	5.4 c	0.0	20.0	22.2	51.4	160.1
p-value[v]	*0.0022*	*0.0751*	0.3843	0.6212	0.4205	0.5578

[z] Xyway was applied in-furrow at planting on 27 May. Topguard and Veltyma were applied on 8 Aug at the R1 (silk) growth stages and 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 on 14 and 28 Sep.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 28 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 4 Nov.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Fungicide comparison for tar spot in corn in northwestern Indiana, 2021 (COR21-23.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 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 25 May. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. In-furrow fungicides applied at planting in 10 gal/A. All foliar fungicide applications were applied at 15 gal/A and 40 psi using either a CO_2 backpack sprayer or 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 25 May in-furrow, 9 Jul, 2 Aug, 6 Aug, and 30 Aug at V5, V12, R1 (silk), R3 (milk) growth stages, respectively. Disease ratings were assessed on 22 and 29 Sep. Tar spot was rated by visually assessing the percentage of stroma per leaf 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 3 Nov and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. There were significant differences between fungicide treatments and the non-treated control for all disease ratings. Both on 22 Sep and 29 Sep at R6, Veltyma at V12 and Veltyma applied at V12 followed by (fb) R3 were the only treatments with reduced tar spot stromata (Table 40). Vetlyma applied at V12 fb R3 increased % canopy green as compared to the non-treated control. The programs that included Veltyma at V12 followed by R3 has significantly higher grain moisture and yield than the non-treated control and other treatments, except for grain moisture with Priaxor fb Veltyma. There was no significant effect of treatment on test weight.

Table 40. Effect of fungicide treatment on tar spot, canopy green, and corn yield.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] 22 Sep	Tar spot % stroma[y] 29 Sep	Canopy % green[x] 29 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	30.8 a	24.8 a	7.8 b	20.5 b	52.9	168.1 b
Headline 2.08 SC 6.0 fl oz in-furrow	31.3 a	25.0 a	6.5 b	20.0 b	54.2	167.0 b
Priaxor 4.17 SC 4.0 fl oz at V5	31.5 a	24.8 a	4.3 b	20.3 b	53.9	172.5 b
Veltyma 3.34 S 7.0 fl oz at V12	14.4 b	17.8 b	14.5 b	20.5 b	54.4	182.4 b
Veltyma 3.34 S 7.0 fl oz at R1	30.5 a	24.8 a	18.8 ab	20.1 b	54.1	172.7 b
Veltyma 3.3.4 S 7.0 fl oz at V12 fb Veltyma 3.3.4 S 7.0 fl oz at R3	4.0 c	4.1 c	39.5 a	23.2 a	53.6	199.4 a
Priaxor 4.17 SC 4.0 fl oz at V5 fb Veltyma 3.3.4 S 7.0 fl oz at R1	25.5 a	22.1 a	6.8 b	21.7 ab	53.1	171.3 b
p-value[v]	*0.0001*	*0.0001*	*0.0768*	*0.0408*	*0.5059*	*0.0066*

[z] In-furrow treatments applied at planting on 25 May. Foliar fungicide treatments applied on 9 Jul, 2 Aug, 6 Aug, and 30 Aug at V12, R1 (silk), R3 (milk) growth stages, respectively. Foliar fungicide treatments at R1 and R3 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 on 22 and 29 Sep.
[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 29 Sep.
[w] Yields were adjusted to 15.5% moisture and harvest on 3 Nov.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Fungicide comparison for tar spot in corn in northwestern Indiana, 2021 (COR21-27.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 25 May. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. In-furrow fungicides applied at planting in 10 gal/A. All foliar 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 6 Aug at R1 growth stage. Disease ratings were assessed on 22 Sep and 29 Sep at R5 (dent) and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma per leaf 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 3 Nov and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. On 22 Sep at R5, all fungicide treatments reduced tar spot stroma severity compared to the non-treated control, except Xyway and Lucento (Table 41). Delaro Complete significantly reduced tar spot stroma severity than the non-treated control and other fungicide treatments on 22 Sep. There was no significant difference between treatments for tar spot stroma severity on 29 Sep at R6. There was no significant effect of treatment on % canopy greenness, moisture, test weight, and yield of corn.

Table 41. Effect of fungicide treatment on tar spot, canopy green and corn yield.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] 22 Sep	Tar spot % stroma[y] 29 Sep	Canopy % green[x] 29 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	24.3 a	25.5	7.0	19.6	55.0	177.7
Veltyma 3.34 S 7.0 fl oz at R1	17.5 b	24.5	4.0	19.8	54.3	177.6
Xyway LFR 15.2 fl oz in-furrow	23.0 a	25.3	4.5	19.4	54.5	171.6
Delaro Complete 458 SC 8.0 fl oz at R1	12.3 c	23.3	10.0	20.1	54.9	183.0
Lucento 4.1 SC 5.0 fl oz at R1	20.5 ab	24.8	8.5	19.8	54.1	181.5
Miravis Neo 2.5 SE 13.6 fl oz at R1	18.9 b	24.0	12.5	19.8	54.6	180.4
Trivapro 2.21 SE 13.7 fl oz at R1	18.0 b	24.8	6.3	20.1	54.5	180.3
p-value[v]	*0.0001*	*0.2952*	*0.1042*	*0.7936*	*0.3406*	*0.9237*

[z] In-furrow treatments applied at planting on 25 May. Foliar fungicide treatments applied on 6 Aug at R1 (silk) growth stage. All foliar fungicide 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 on 29 Sep.
[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 29 Sep.
[w] Yields were adjusted to 15.5% moisture and harvest on 3 Nov.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Fungicide comparison for tar spot in corn in northwestern Indiana, 2021 (COR21-29.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 27 May. All foliar 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 6 Aug at R1 (silk) growth stage. Disease ratings were assessed 28 Sep at R6 (maturity) growth stage. Tar spot was rated by visually assessing the percentage of stroma per leaf 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 3 Nov and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. There were no significant differences between fungicide treatments and the non-treated control for disease ratings (Tables 42). All fungicide treatments increased % canopy greenness over the non-treated control on 28 Sep. There was no significant effect of treatment on moisture, test weight, and yield of corn.

Table 42. Effect of fungicide on canopy green, and corn yield.

Treatment and rate/A[z]	Tar spot % stroma[y] 14 Sep	Tar spot % stroma[y] 28 Sep	Canopy % green[x] 28 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	8.4	23.5	18.8 b	22.1	52.2	143.3
Delaro Complete 458 SC 8.0 fl oz	3.9	20.3	33.8 a	22.0	52.6	177.5
Delaro Complete 458 SC 12.0 fl oz	4.0	22.5	32.5 a	21.8	53.0	168.5
Delaro 325 SE 11.8 fl oz	5.4	21.8	32.5 a	22.2	52.6	171.7
Veltyma 3.34S 7.0 fl oz	4.2	22.0	37.5 a	22.5	52.7	151.2
Miravis Neo 2.5 SE 13.7 fl oz	4.6	21.0	30.0 a	21.7	52.7	166.8
Trivapro 2.21 SE 13.7 fl oz	5.2	22.0	35.0 a	23.1	51.9	153.8
p-value[v]	*0.1277*	*0.3662*	*0.0124*	*0.2167*	*0.4903*	*0.4870*

[z] Foliar fungicide treatments applied on 6 Aug at R1 (silk) growth stages. Fungicide 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 on 14 and 28 Sep.
[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 28 Sep.
[w] Yields were adjusted to 15.5% moisture and harvest on 3 Nov.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Fungicide comparison for tar spot in corn in northwestern Indiana, 2021 (COR21-30.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 27 May. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All foliar 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 2 Aug and 6 Aug at V14 and R1 (silk) growth stages, respectively. Disease ratings were assessed on 22 Sep, and 29 Sep at R5 (dent) and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma per leaf 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 3 Nov and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. There were no significant differences between fungicide treatments and the non-treated control for tar spot stroma severity on 22 and 29 Sep (Table 43). There was no significant effect of treatment on % canopy greenness, moisture, test weight, and yield of corn.

Table 43. Effect of fungicide on canopy green and corn yield.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] 22 Sep	Tar spot % stroma[y] 29 Sep	Canopy % green[x] 29 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	30.3	25.3	2.5	19.9	53.9	158.6
Headline AMP 1.68 SE 10.0 fl oz at V14	26.5	24.8	5.0	20.9	53.0	160.8
Quilt XCEL 2.2 SE 10.5 fl oz at v14	30.5	24.8	4.3	20.9	53.6	141.9
Veltyma 3.24 S 7.0 fl oz at V14	16.6	21.8	10.5	21.3	53.0	167.4
Miravis Neo 2.5 SE 13.7 fl oz at V14	22.9	24.5	5.5	21.5	54.2	170.5
Headline AMP 1.68 SE 6.0 fl oz at R1	30.3	24.3	4.5	19.7	53.6	152.4
Quadris 2.1 F 9.0 fl oz at R1	29.4	23.3	4.0	20.6	53.6	156.1
Headline AMP 1.68 SE 10.0 fl oz at R1	24.3	23.8	3.5	20.8	71.3	152.9
Quilt XCEL 2.2 SE 10.5 fl oz at R1	30.8	24.8	3.8	20.4	53.7	157.8
Veltyma 3.24 S 7.0 fl oz at R1	23.5	24.3	19.8	21.0	53.2	154.9
Miravis Neo 2.5 SE 13.7 fl oz at R1	27.5	24.3	3.8	20.1	54.1	150.0
p-value[v]	*0.0919*	*0.5970*	*0.4663*	*0.4283*	*0.4197*	*0.4119*

[z] Foliar fungicide treatments applied on 2 Aug and 6 Aug at V14 and R1 (silk) growth stages, respectively. Foliar fungicide treatments at R1 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 on 22 and 29 Sep at R5 and R6 growth stages, respectively.
[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green 29 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 3 Nov.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

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

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Evaluation of Veltyma timing programs for tar spot in corn in northwestern Indiana, 2021 (COR21-35.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 2 seeds/ft on 27 May. In-furrow treatments applied at planting at 10 gal/A. All foliar 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, 2 Aug, 6 Aug, 20 Aug, 30 Aug, 10 Sep and 16 Sept at V8, V12, R1 (silk), R2 (blister), R3 (milk), R4 (dough) and R5 (dent) growth stages, respectively. Disease ratings were assessed on 28 Sep at R6 (maturity) growth stages. Tar spot was rated by visually assessing the percentage of stroma per leaf 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 4 Nov and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached high severity. Tar spot stroma severity on all leaves on 28 Sep was significantly reduced over the non-treated by all fungicide programs, except Veltyma applied at R4 and R5 (Table 44). Veltyma applied at R2 resulted in the lowest amount tar spot stroma on 28 Sep. Canopy greenness was increased by treatments applied at R2, R3, and R1 fb R4. Veltyma applied at R3 significantly increased yield over the non-treated controls.

Table 44. Effect of fungicide on tar spot stroma severity, canopy green and corn yield.

Treatment, rate/A, and timing[z]	Tar spot % stroma[y] 28 Sep	Canopy % green[x] 28 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	25.5 a	26.3 e	20.6 c	52.9	163.4 c
Non-treated control	24.0 ab	32.5 de	20.7 c	54.0	178.7 bc
Veltyma 3.34 S 7.0 fl oz at V8	15.5 e	41.3 bcd	22.2 abc	53.0	180.9 bc
Veltyma 3.34 S 7.0 fl oz at V12	16.0 de	31.3 de	21.5 bc	53.4	163.5 c
Veltyma 3.34 S 7.0 fl oz at R1	19.5 cd	40.0 cd	21.2 bc	53.4	167.1 c
Veltyma 3.34 S 7.0 fl oz at R2	10.2 f	53.8 ab	23.3 a	53.5	203.4 ab
Veltyma 3.34 S 7.0 fl oz at R3	14.6 e	55.0 a	22.5 ab	53.4	209.3 a
Veltyma 3.34 S 7.0 fl oz at R4	21.5 bc	42.5 a-d	22.8 ab	52.6	159.1 c
Veltyma 3.34 S 7.0 fl oz at R5	22.5 abc	35.0 cde	21.4 bc	52.9	177.0 c
Veltyma 3.34 S 7.0 fl oz at R1 fb R4	16.0 de	46.3 abc	22.2 abc	53.4	173.7 c
p-value[v]	*0.0001*	*0.0018*	*0.0446*	*0.5876*	*0.0036*

[z] Fungicides were applied on 23 Jul, 2 Aug, 6 Aug, 20 Aug, 30 Aug, 10 Sep and 16 Sept at V8, V12, R1 (silk), R2 (blister), R3 (milk), R4 (dough) and R5 (dent) growth stages, respectively.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf on 28 Sep.
[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 28 Sep.
[w] Yields were adjusted to 15.5% moisture and harvest on 4 Nov.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
White mold; *Sclerotinia sclerotiorum*

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Fungicide evaluation for white mold in soybean in northwestern Indiana, 2021 (SOY21-02).

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 sunflower. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 24 May. 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 pesticide applications were applied at 15 gal/A and 40 psi using a CO2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20 in. apart at 3 mph. Treatments were applied on 14 Jul, 21 Jul and 30 Jul at R1 (beginning bloom), 21 Jul at R2 (full bloom), and R3 (beginning pod) growth stages, respectively. Disease ratings were assessed on 8 Sep at R6 (full seed) growth stage. White mold disease assessed by counting the number of plants in each plot with symptoms. The two center rows of each plot were harvested on 1 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were unfavorable for disease and very little disease developed in the trial. White mold was present in the trial, but only remained at low levels. There were differences between fungicide treatments and nontreated control for disease ratings on 8 Sep. White mold was not detected in the non-treated control plots, but was found in Endura at R3, Delaro at R2 and Exp 1 at R2 plots at a low incidence (Table 45). There was no significant effect of treatment on moisture, test weight, and yield of soybean.

Table 45. Effect of fungicide on white mold incidence and soybean yield.

Treatment, rate/A, and timing[z]	White mold #/plot[y] 8 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	0.0 d	10.6	57.2	59.7
Endura 70 WDG 8.0 fl oz at R1 fb Endura 70 WDG 8.0 fl oz at R3	0.0 d	10.4	56.9	57.1
Endura 70 WDG 8.0 fl oz at R3	1.0 abc	10.6	57.2	59.3
Omega 16.0 fl oz at R3	0.5 bcd	10.4	57.5	54.5
Cobra 6.0 fl oz at R1	0.3 cd	10.7	57.4	56.2
Cobra 6.0 fl oz at R1 fb Domark 5.0 fl oz at R3	0.8 a-d	10.7	58.0	56.2
Omega 12.0 fl oz at R1 fb Miravis Neo 13.7 fl oz at R3	0.0 d	10.4	57.1	56.6
Delaro Complete 458 SC 8.0 fl oz at R2	1.5 a	11.0	60.5	58.8
Propulse 6.0 fl oz at R1 fb Delaro Complete 8.0 fl oz at R3	0.5 bcd	10.6	57.7	54.0
Miravis Neo 2.5 SE 16.0 fl oz at R2	0.3 cd	10.8	57.2	58.9
Exp A 13.7 fl oz at R2	1.3 ab	10.5	57.5	55.6
p-value[w]	*0.0375*	*0.8200*	*0.1118*	*0.0790*

[z] Fungicide treatments applied on 14 Jul at R1 growth stage, 21 Jul at the R2 (beginning bloom) growth stage, and 30 Jul at the R3 (beginning pod) growth stage. All fungicide treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, no NIS with Cobra. All plots inoculated with *S. sclerotiorum*.
[y] White mold disease assessed by counting the number of plants/plots with symptoms on 8 Sep.
[x] Yields were adjusted to 13% moisture and harvest on 1 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'Dane and MN1410')
Frogeye leaf spot; *Cercospora sojina*
White mold; *Sclerotinia sclerotiorum*

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Fungicide comparison for white mold in organic soybean in northwestern Indiana, 2021 (SOY21-09).

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 sunflower. Cereal rye was planted on 18 Sep 2020 at a rate of 150 lbs/A. On 24 May and 25 May the cover crop was terminated using either tillage or roller-crimping. Standard practices for soybean organic production in Indiana were followed. Organic soybean varieties 'Dane and MN1410' were planted in 20-inch row spacing at a rate of 8 seeds/ft on 25 May. Inoculum of *S. sclerotiorum* was applied within the seedbed at 1.25 g/ft at planting and 60 sclerotia per plot were spread between the middle two rows after tillage and before roller-crimping. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicides applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with four or six TJ-VS 8002 nozzles spaced 20 or 30-in. apart at 3 mph. Fungicides were applied on 19 Jul at R2 (full bloom) growth stage. Disease ratings were assessed on 26 Aug at R6 (full seed). Frogeye leaf spot (FLS) severity was rated by visually assessing the percentage (0-100%) of symptomatic leaf area in the upper canopy. The two center rows of each plot were harvested on 28 Sep and yields were adjusted to 13% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. White mold was not observed in the plots. Frogeye leaf spot was the most prominent disease in the trial, but only reached low severity. Main effects of variety, cover crop termination, and fungicide treatments are presented since no significant interactions between tillage, variety, fungicide, except for tillage by variety in yield (Table 46). Frogeye leaf spot severity was significantly reduced in the variety Dane when compared to MN1410. Roller-crimped rye increased yield of Dane as compared to full tillage, but there were no differences in yield of MN1410 with cover crop termination treatment.

Table 46. Effect of fungicide on foliar disease severity at R6 (full seed) growth stage, and corn yield.

Treatment[z]	Frogeye leaf spot % severity[y] 26 Aug	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A 28 Sep	
Cover crop termination				**Dane**	**MN1410**
Full tillage	0.3	12.8	50.7	29.1 b	53.2
Roller-crimped rye	0.4	12.6	54.9	52.0 a	65.9
Variety				*p=0.0158*	*p=0.0566*
Dane	0.1 b	12.4 b	50.7 b	-	
MN1410	0.6 a	13.1 a	54.9 a	-	
Fungicide programs and rate/A					
Non-treated control	0.5	12.5	52.1	52.0	
Endura 70 WDG 8.0 fl oz	0.4	12.5	52.3	49.2	
Double Nickel 55 DWG 2 qt	0.2	12.9	54.3	51.3	
Serifel WP 16 fl oz	0.7	13.0	52.9	50.3	
Actinovate AG 12 oz	0.3	12.4	52.1	49.0	
BotryStop 2 lb	0.2	13.1	53.3	48.8	
p-value *till*[w]	*0.6481*	*0.3946*	*0.0860*	*0.0252*	
p-value *variety*	*0.0003*	*0.0001*	*0.0001*	*0.0001*	
p-value *fungicide*	*0.1618*	*0.0162*	*0.4855*	*0.9379*	
p-value *till*variety*	*0.3741*	*0.5705*	*0.0001*	*0.0188*	
p-value *till*fungicide*	*0.6915*	*0.0485*	*0.4606*	*0.3631*	
p-value *variety*fungicide*	*0.0612*	*0.2259*	*0.2945*	*0.8294*	
p-value *till*variety*fungicide*	*0.7392*	*0.1507*	*0.2673*	*0.5359*	

[z] Fungicide treatments applied on 19 Jul at R2 (full bloom) growth stage. All plots were inoculated with *S. sclerotiorum* at 1.25 g/ft within the seedbed at planting and 60 sclerotia per plot were spread between the middle two rows before roller-crimped and after tillage.
[y] Frogeye leaf spot severity was rated by visually assessing the percentage (0-100%) of symptomatic tissue (lesions) per leaf in the upper canopy on ten plants per plot on 26 Aug. Values for the 10 plants were averaged before analysis.
[x] Yields were adjusted to 13% moisture and harvested on 28 Sep.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different. based on least.

SOYBEAN (*Glycine max* 'P28T14E' and 'P25A04X')
Sudden death syndrome; *Fusarium virguliforme*

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Evaluation of seed treatment for management of sudden death syndrome on soybean in northwestern Indiana, 2021 (SOY21-14).

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 varieties 'P28T14E' (susceptible) and 'P25A04X' (resistant) were planted in 30-inch row spacing at a rate of 8 seeds/ft on 24 May. *F. virguliforme* inoculum was applied at planting at 1.25 g/ft within the seedbed. Seed treatments were applied on seeds before planting. A foliar application of NanoStress was applied at R1 (beginning bloom) growth stage to one of the seed treatment programs. All treatments contained a base treatment except nontreated control. Sudden death syndrome (SDS) foliar disease ratings were assessed on 16 Sep at the R7 (beginning maturity) growth stage. 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. Root rot rating was assessed on 12 Aug at the R4 (full pod) growth stage by visually assessing dark discoloration on roots. The two center rows of each plot were harvested on 29 Sep and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, sudden death syndrome (SDS) was the most prominent disease in the trial but only reached low incidence and severity. There were no significant interactions between variety and seed treatments, therefore main effects are presented. No significant differences were observed in root rot for variety or seed treatments on 12 Aug (Table 47). The resistant variety, P25A04X, had significantly lower levels of SDS Index over the susceptible variety, P28T14E. No significant differences were observed in % canopy green for variety or seed treatments on 16 Sep. The resistant variety yielded more than the susceptible variety and all the seed treatments resulted in higher yields over the non-treated.

Table 47. Effect of variety and seed treatments on root rot, SDS index, canopy green and yield in soybean.

Variety, treatment and rate[z]	Root Rot %[y] 12 Aug	SDS Index DS[x] 16 Sep	Canopy % green[w] 16 Sep	Yield [v] bu/A
Variety				
P25A04X (R)	30.4	0.0 b	32.3	72.5 a
P28T14E (S)	29.1	21.7 a	34.8	66.6 b
Seed treatment programs				
Non-treated control	27.5	14.0	29.4	65.0 b
BASF Base	27.5	8.2	31.3	70.4 a
BASF Base + ILeVO	27.1	12.6	38.8	71.3 a
BASF Base + Saltro	28.6	9.5	26.9	69.1 a
BASF Base + CeraMax	33.7	10.7	38.1	70.1 a
BASF Base + ILeVO fb NanoStress 4 fl oz at R1	31.6	9.5	38.1	71.6 a
Albaugh Base + Mertect 340F + HeadsUp + BioST VPH	31.7	10.9	36.9	70.2 a
Albaugh Base + Mertect 340F + HeadsUp + BioST VPH + ILeVO + TWO.O	30.5	11.3	29.4	68.9 a
p-value *variety*[u]	*0.3627*	*0.0001*	*0.3611*	*0.0001*
p-value *seed treatment*	*0.2221*	*0.7233*	*0.1595*	*0.0119*
p-value *variety by seed treatment*	*0.3727*	*0.7233*	*0.2453*	*0.5881*

[z] Soybean varieties included SDS susceptible (S) and resistant (R). Seed treatments applied before planting on 24 May. BASF Base contained Allegiance Fl at 4.0 g a/100 kg, Stamina at 7.5 g a/100 kg, Systiva XS Xemium Brand at 5.0 g a/100 kg, Poncho 600 at 0.11 mg a/seed, Flo Rite 1706 at 66.0 ml/100 kg, and Color Coat Red at 33.0 ml/100 kg. Albaugh Base contained Allegiance Fl at 16.0 g a/100 kg, Flo Rite 1706 at 66.0 ml/100 kg, Color Coat Red at 33.0 ml/100 kg, Dynasty at 2.0 g a/100 kg, and Gaucho 600 FS at 0.12 mg a/seed. fb=followed by. [y] Root rot visually assessed percentage (0-100%) of dark discoloration on roots on 12 Aug. [x] Disease Index calculated SDS disease incidence x disease severity (DI x DS)/9. [w] Canopy green visually assessed percentage (0-100%) of crop canopy green on 16 Sep.

[v] Yields were adjusted to 13% moisture and harvested on 29 Sep. [u] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P28T14E' & 'P25A04X')
Sudden death syndrome; *Fusarium virguliforme*

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Compare the efficacy of seed treatments in soybean in northwestern Indiana, 2021 (SOY21-18.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 'P25A04X' (resistant) and 'P28T14E' (susceptible) were planted in 30-inch row spacing at a rate of 8 seeds/ft on 24 May. Seed treatments were applied on seeds before planting. Disease ratings were assessed on 8 Sep at the R6 (full seed) growth stages. 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. The two center rows of each plot were harvested on 1 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Sudden death syndrome (SDS) was the most prominent disease in the trial. There were no significant differences between seed treatments and root rot rating (Table 49). Resistant variety, P25A04X had significantly lower levels of SDS incidence, severity, and index over the susceptible variety, P28T14E. There were no significant differences between seed treatments and variety selection for harvest moisture, test weight and yield.

Table 49. Effect of seed treatment on SDS, root rot, and soybean yield.

Variety and treatment[z]	Root rot %[y] 24 Aug	SDS DI[x] 8 Sep	SDS DS[x] 8 Sep	SDS Index[x] 8 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control, P25A04X	9.2	0.3 c	0.3 b	0.0 c	10.0	55.6	78.8
ILeVO	11.6	0.0 c	0.0 b	0.0 c	10.2	56.0	79.9
Saltro	9.7	0.3 c	0.8 b	0.1 c	10.3	56.2	79.7
Non-treated control, P28T14E	14.1	86.3 a	6.0 a	57.5 a	12.4	56.4	73.1
ILeVO	7.0	60.0 b	5.5 a	36.3 b	9.9	54.8	68.7
Saltro	5.1	75.0 ab	5.5 a	45.3 b	9.9	55.4	73.4
p-value[v]	*0.1640*	*0.0001*	*0.0001*	*0.0001*	*0.5329*	*0.5397*	*0.0616*

[z] Seed treatments were pre-applied to the seed of varieties 'P25A04X' (resistant) and 'P28T14E' (susceptible).
[y] Ten roots per plot were sampled from border rows at R4, gently washed and rated for root rot severity on scale of 0-100% on 24 Aug.
[x] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS) on 8 Sep. 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.
[w] Yields were adjusted to 13% moisture and harvested on 1 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P34A79X')
White mold; *Sclerotinia sclerotiorum*

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Evaluation of planting population, fertilizer, and fungicide timing for white mold in soybean, 2021 (SOY21-22.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 sunflower. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 24 May. 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 pesticide applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with four or six TJ-VS 8002 nozzles spaced 20 or 30-in. apart at 3 mph. Fungicides were applied on 24 Jun at V3 growth stage, 17 Jul at the R1 (beginning bloom) growth stage (based on Sporecaster), and 30 Jul at the R3 (beginning pod) growth stage. Disease ratings were assessed on 8 Sep at R6 (full seed) growth stage. White mold disease assessed by counting the number of plants in each plot with symptoms. The two center rows of each plot were harvested on 1 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. White mold was present in the trial but only remained at low levels. There were no significant differences between fungicide treatments and the non-treated control for disease ratings on 8 Sep (Table 50). There was no significant effect of treatment on moisture or test weight. 160,000 seed/A plus fertilizer resulted in the highest yields as compared to 100,000 seed/A with no fertilizer.

Table 50. Effect of fungicide on white mold incidence, moisture, test weight, and soybean yield.

Treatment, rate/A, and timing[z]	Fertilizer	Seeding rate seed/A	White mold #/plot[y] 8 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	None	100,000	0.3	10.6	57.4	48.6 e
Endura 70 WDG 8.0 fl oz at R3	None	100,000	0.0	10.4	57.3	50.1 b-e
Endura 70 WDG 8.0 fl oz at Sporecaster	None	100,000	0.0	10.3	57.5	49.4 cde
Cobra 6.0 fl oz at V3	None	100,000	0.0	10.6	56.9	49.1 de
Non-treated control	None	160,000	0.0	10.4	56.7	53.9 a-d
Endura 70 WDG 8.0 fl oz at R3	None	160,000	0.5	10.5	57.0	54.4 abc
Endura 70 WDG 8.0 fl oz at Sporecaster	None	160,000	1.0	10.5	57.0	55.1 ab
Cobra 6.0 fl oz at V3	None	160,000	0.5	10.5	56.8	54.5 abc
Non-treated control	150 lb N	100,000	0.0	10.4	57.3	52.9 a-e
Endura 70 WDG 8.0 fl oz at R3	150 lb N	100,000	0.3	10.6	56.8	51.2 b-e
Endura 70 WDG 8.0 fl oz at Sporecaster	150 lb N	100,000	0.5	10.6	57.2	50.1 b-e
Cobra 6.0 fl oz at V3	150 lb N	100,000	0.0	10.9	57.4	51.0 b-e
Non-treated control	150 lb N	160,000	0.5	10.4	57.1	56.5 a
Endura 70 WDG 8.0 fl oz at R3	150 lb N	160,000	0.3	10.6	56.4	57.6 a
Endura 70 WDG 8.0 fl oz at Sporecaster	150 lb N	160,000	0.3	10.4	57.0	53.6 a-e
Cobra 6.0 fl oz at V3	150 lb N	160,000	0.0	10.5	57.0	50.7 b-e
p-value[w]			*0.6431*	*0.1858*	*0.0740*	*0.0200*

[z] Fungicide treatments applied on 24 Jun at V3 growth stage, 17 Jul at the R1 (beginning bloom) growth stage (based on Sporecaster), and 30 Jul at the R3 (beginning pod) growth stage. All plots inoculated with *S. sclerotiorum*.
[y] White mold disease assessed by counting the number of plants/plots with symptoms on 8 Sep.
[x] Yields were adjusted to 13% moisture and harvest on 1 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
White mold; *Sclerotinia sclerotiorum*

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Evaluation of fungicides for white mold in soybean in northwestern Indiana, 2021 (SOY21-25.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 sunflower. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 24 May. 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 CO_2 backpack sprayer equipped with a 10-ft boom, fitted with four or six TJ-VS 8002 nozzles spaced 20 or 30-in. apart at 3 mph. Fungicides were applied on 17 Jul at the R1 (begining bloom) growth stage and 30 Jul at the R3 (beginning pod) growth stage. Disease ratings were assessed on 8 Sep at R6 (full seed) growth stage. White mold disease assessed by counting the number of plants in each plot with symptoms. The center rows of each plot were harvested on 1 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. White mold was present in the trial, but only remained at low levels. There were no significant differences between fungicide treatments and the non-treated control for disease ratings on 8 Sep (Table 51). There was no significant effect of treatment on moisture, test weight or soybean yield.

Table 51. Effect of fungicide on white mold incidence, moisture, test weight, and soybean yield.

Treatment, rate/A, and timing[z]	White mold #/plot[y] 8 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	1.5	11.1	58.0	55.6
Delaro Complete 458 SC 8.0 fl oz at R1	1.8	12.0	56.5	56.5
Delaro Complete 458 SC 8.0 fl oz at R1 fb R3	1.3	11.4	57.2	56.4
Delaro Complete 458 SC 8.0 fl oz at R3	1.0	11.9	56.2	58.8
p-value[w]	*0.9317*	*0.6951*	*0.2592*	*0.7590*

[z] Fungicide treatments applied on 17 Jul at the R1 (beginning bloom) growth stage and 30 Jul at the R3 (beginning pod) growth stage, respectively. All plots inoculated with *S. sclerotiorum*.
[y] White mold disease assessed by counting the number of plants/plots with symptoms on 8 Sep.
[x] Yields were adjusted to 13% moisture and harvest on 1 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
White mold; *Sclerotinia sclerotiorum*

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Evaluation of fungicides for white mold in soybean in northwestern Indiana, 2021 (SOY21-27.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 sunflower. Standard practices for soybean production in Indiana were followed. Soybean variety 'P35T15E' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 24 May. 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 CO_2 backpack sprayer equipped with a 10-ft boom, fitted with four or six TJ-VS 8002 nozzles spaced 20 or 30-in. apart at 3 mph. Fungicides were applied on 17 Jul at the R1 (begining bloom) growth stage and 30 Jul at the R3 (beginning pod) growth stage. Disease ratings were assessed on 8 Sep at R6 (full seed) growth stage. White mold disease assessed by counting the number of plants in each plot with symptoms. The center rows of each plot were harvested on 1 Oct and yields were adjusted to 13% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. White mold was present in the trial, but only remained at low levels. There were no significant differences between fungicide treatments and the non-treated control for disease ratings on 8 Sep (Table 52). There was no significant effect of treatment on moisture, test weight or soybean yield.

Table 52. Effect of fungicide on white mold incidence, moisture, test weight, and soybean yield.

Treatment, rate/A, and timing[z]	White mold #/plot[y] 8 Sep	Harvest moisture %	Test weight lb/bu	Yield[x] bu/A
Non-treated control	1.3	11.7	56.7	49.8
Double Nickel 55 0.5 lb at R1	0.8	11.4	56.5	51.6
Double Nickel 55 0.5 lb at R1 and R3	1.0	11.5	56.9	52.0
LifeGard WG 1.0 oz at R1 and R3	4.0	11.5	57.0	50.2
LifeGard WG 2.0 oz at R1 and R3	2.0	11.4	57.1	52.2
Endura 70 WDG 8.0 oz at R1	0.5	11.5	57.8	53.6
p-value[w]	*0.1100*	*0.9114*	*0.3530*	*0.7654*

[z] Fungicide treatments applied on 17 Jul at the R1 (beginning bloom) growth stage and 30 Jul at the R3 (beginning pod) growth stage, respectively. All plots inoculated with *S. sclerotiorum*.
[y] White mold disease assessed by counting the number of plants/plots with symptoms 8 Set.
[x] Yields were adjusted to 13% moisture and harvest on 1 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea mays* 'P0574AMXT')
Southern rust; *Puccinia polysora*
Gray leaf spot; *Cercospora zeae-maydis*

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Evaluation of fungicides for foliar diseases in corn southwestern Indiana, 2021 (COR21-14.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 grain corn production in Indiana were followed. Corn hybrid 'P0574AMXT' was planted in 30-inch row spacing at a rate of 27,000 seeds/A on 14 May. All fungicide applications were applied at 15 gal/A and 40 psi using a CO2 backpack sprayer equipped with a 10-ft boom, fitted with four TJ-VS 8002 nozzles spaced 30-in. apart at 3.0 mph. Fungicides were applied on 13 Jul at the R1 (silk) growth stage and 28 Jul at R3 (milk) growth stage. Disease ratings was assessed on 9 Sep at the R6 (maturity) growth stage. Disease severity was rated by visually assessing the percentage of symptomatic leaf area of the ear leaf on five leaves in each plot. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 22 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Gray leaf spot (GLS) and southern rust (SR) were the most prominent diseases in the trial and reached moderate severity. All fungicides applied at R1 reduced GLS over the non-treated controls (Table 53). Headline Amp, Trivapro, Delaro Complete, and Lucento applied at R1, and all fungicides applied at R3 reduced SR as compared to the non-treated controls. All fungicide applied at R1 and R3 increased % canopy greenness over the non-treated controls, except Headline AMP at R1 and R3. There were no significant differences between treatments for harvest moisture, test weight, and corn yield.

Table 53. Effect of fungicide on foliar diseases severity and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 9 Sep	SR % severity[y] 9 Sep	Canopy % green[x] 9 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control 1	8.2 a	6.1 a	37.5 d	14.1	57.4	219.3
Headline AMP 1.68 SC 10.0 fl oz at R1	1.8 ef	4.0 bc	50.0 bc	14.1	57.6	228.6
Veltyma 3.34 S 7.0 fl oz at R1	1.4 f	4.9 ab	56.3 ab	14.1	57.6	225.6
Trivapro 2.21 SE 13.7 fl oz at R1	2.3 def	1.4 e	51.3 b	14.1	57.5	221.7
Delaro Complete 458 SC 8.0 fl oz at R1	2.2 def	3.9 bc	51.3 b	14.1	57.3	216.9
Lucento 7.17 SC 5.0 fl oz at R1	1.3 f	0.9 e	52.5 b	14.2	57.4	214.4
Non-treated control 2	5.3 bc	5.9 a	41.3 cd	14.1	57.6	219.7
Headline AMP 1.68 SC 10 fl oz at R3	6.2 ab	3.9 bc	47.5 bc	14.1	57.5	227.2
Veltyma 3.34 S 7.0 fl oz at R3	4.2 bcd	3.6 bc	56.3 ab	14.3	57.6	216.0
Trivapro 2.21 SE 13.7 fl oz at R3	5.3 bc	1.1 e	62.5 a	14.2	57.6	223.0
Delaro Complete 458 SC 8.0 fl oz at R3	4.1 cd	3.2 cd	48.8 bc	14.1	57.3	214.0
Lucento 7.17 SC 5.0 fl oz at R3	3.8 cde	1.6 de	55.0 ab	14.1	57.5	220.2
p-value[v]	*0.0001*	*0.0001*	*0.0008*	*0.7069*	*0.9998*	*0.5652*

[z] Fungicide treatments were applied at on 13 Jul at R1 (silk) and 28 Jul at R3 (milk) growth stages. 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; with five plants were assessed per plot and ratings averaged before analysis on 9 Sep. GLS = Gray leaf spot; SR = Southern rust.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 9 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 22 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea mays* 'P0574AMXT')
Southern rust; *Puccinia polysora*
Gray leaf spot; *Cercospora zeae-maydis*

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Fungicide comparison for foliar diseases in corn southwestern Indiana, 2021 (COR21-22.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 grain corn production in Indiana were followed. Corn hybrid 'P0574AMXT' was planted in 30-inch row spacing at a rate of 27,000 seeds/A on 14 May. All fungicide applications were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with four TJ-VS 8002 nozzles spaced 30-in. apart at 3.0 mph. Fungicides were applied on 19 Jul at the R1 (silk) growth stage. Disease ratings was assessed on 9 Sep at the R6 (physiological maturity) growth stage. Disease severity was rated by visually assessing the percentage of symptomatic leaf area of the ear leaf on five leaves in each plot. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 22 Oct and yields were adjusted to 15.5% moisture. All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were favorable for disease. Gray leaf spot (GLS) and southern rust (SR) were the most prominent diseases in the trial and reached moderate severity. All fungicides application timings significantly reduced SR and GLS compared to the non-treated control on 9 Sep (Table 54). All fungicide treatments increased % canopy greenness over the non-treated control, except Trivapro at 10.3 fl oz and Miravis Neo at 13.7 fl oz. There were no significant differences between treatments for harvest moisture, test weight and corn yield.

Table 54. Effect of fungicide on foliar disease severity and corn yield.

Treatment[z]	GLS % severity[y] 9 Sep	SR % severity[y] 9 Sep	Canopy % green[x] 9 Sep	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	7.1 a	10.4 a	35.0 c	14.1	57.8	211.6
Quadris 250 SC 4.52 fl oz + Aprovia 5.13 fl oz +Inspire 2.08 SC 5.13 fl oz	3.6 bc	0.5 cd	52.5 ab	14.2	57.8	223.9
Quadris 250 SC 6.02 fl oz + Aprovia 6.84 fl oz +Inspire 2.08 SC 6.84 fl oz	3.1 c	0.1 d	47.5 ab	14.2	57.8	218.6
Trivapro 2.21 SE 10.3 fl oz	4.0 bc	0.9 cd	43.8 bc	14.2	57.9	210.9
Trivapro 2.21 SE 13.7 fl oz	5.2 ab	0.6 cd	47.5 ab	14.5	58.1	213.9
A23089 325 SC 10.3 fl oz	4.0 bc	2.1 bcb	48.8 ab	14.1	58.0	216.9
A23089 325 SC 13.7 fl oz	3.0 c	2.6 bc	55.0 a	14.2	58.0	220.6
Miravis Neo 2.5 SE 10.3 fl oz	3.5 bc	3.8 b	55.0 a	14.1	58.2	218.5
Miravis Neo 2.5 SE 13.7 fl oz	3.2 c	2.3 bcd	43.8 bc	14.3	57.9	212.5
A23120 340.2 SC 13.7 fl oz	4.5 bc	1.1 cd	47.5 ab	14.2	58.0	217.0
p-value[v]	*0.0085*	*0.0001*	*0.0319*	*0.5552*	*0.9521*	*0.1361*

[z] Fungicide treatments applied on 19 Jul at the R1 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; with five plants were assessed per plot and ratings averaged before analysis on 9 Sep. GLS = gray leaf spot; SR=southern rust.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 9 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 22 Oct.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P35T15E')
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, 2021 (SOY21-19.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 soybean production in Indiana were followed. Soybean variety P35T15E was planted in 30-inch row spacing at a rate of 175,000 seed/A on 15 May. All fungicide 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 28 Jul at the R3 (beginning pod) growth stage. The two center rows were harvested on 19 Oct and yields were adjusted to 13% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2020, weather conditions were unfavorable for soybean disease, therefore little to no foliar disease developed. No significant treatment differences were detected for harvest moisture, test weight, and yield of soybean (Table 55).

Table 55. Effect of fungicide on soybean yield.

Treatment, rate/A, and timing[z]	Harvest moisture %	Test Weight lb/bu	Yield[x] bu/A
Non-treated control	14.2	51.9	89.3
Preemptor 3.22 SC/Fortix 5.0 fl oz at R3	14.3	51.6	92.6
Topguard EQ 4.29 5.0 fl oz at R3	14.0	52.1	94.8
Quadris Top SBX 7.0 fl oz at R3	14.4	51.8	90.1
Lucento 4.17 SC 5.0 fl oz at R3	14.2	52.1	93.0
Miravis Top 1.67 SC 13.7 fl oz at R3	14.5	52.4	93.5
Priaxor Xemium 4.0 fl oz at R3	14.1	52.7	90.2
Trivapro2.21 SE 13.0 fl oz at R3	14.1	52.3	91.7
Delaro 325 SC 8.0 fl oz at R3	14.4	57.0	92.7
Headline 2.09 SC 10.0 fl oz at R3	14.4	52.5	90.9
Veltyma 3.34 S 7.0 fl oz at R3	14.5	51.4	92.2
Revytek 8.0 fl oz at R3	14.3	51.5	91.3
p-value	*0.1711*	*0.4948*	*0.7237*

[z] Fungicide treatments applied on 24 Jul at the R3 growth stage, and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25%.
[y] Yields were adjusted to 13% moisture and harvest on 30 Sep.
[w] 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*

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Evaluation of foliar fungicides for scab management in southwestern Indiana, 2021 (WHT21-04.SWPAC).

Plots were 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 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 disked and chisel plowed on 7 Oct 2020. Nitrogen (46%) at 50 lb/A was applied on 7 Mar 2020. On 17 Oct 2020 wheat cultivar P25R40 was drilled at 7.5 in. spacing. Harmony Extra at 0.8 oz/A plus AMS at 2 lb/A plus NIS at 0.25% v/v was applied on 25 Mar 2020 for weed management. All fungicide applications were applied at 15 gal/A and 40 psi using a CO2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45 degree angle, at 3.0 mph. Fungicides were applied on 11 May and 17 May 2021 at the Feekes growth stage 10.5.1 and 10.5.1 + 5 d, respectively. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 12 May. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot with the CO_2 handheld sprayer. Disease ratings were assessed on 2 June 2021. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 60 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: (% FHB incidence multiplied by average FHB severity)/100 per plot. Disease severity on leaves were rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 22 Jun and yields were adjusted to 13.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD; α=0.05).

In 2021, weather conditions were not favorable for Fusarium head blight (FHB) and leaf blotch diseases. FHB was the most prominent disease and there was little to no leaf blotch detected. FHB incidence and FHB Index were reduced by all fungicides over the non-treated control on 2 Jun (Table 56). FHB severity was reduced by all fungicides, except Prosaro, Sphaerex, Miravis Ace at 10.5.1, and Miravis Ace fb Folicur. The concentration of deoxynivalenol (DON) was reduced over the non-treated control for all treatments (Table 57). There were no treatment differences in Fusarium damaged kernels (FDK), moisture, test weight or yield of wheat.

Table 56. Effect of fungicide on Fusarium head blight and foliar diseases in wheat.

Treatment and rate/A[z]	FHB % incidence[y]	FHB % severity[y]	FHB Index[x]	Leaf blotch % severity[w]
Non-treated control	82.1 a	5.0 a	4.2 a	0.41
Prosaro 421 SC 6.5 fl oz at 10.5.1	43.8 c	3.0 ab	1.4 bcd	0.01
Caramba 90 EC 13.5 fl oz at 10.5.1	63.8 b	2.6 b	1.8 bc	0.01
Sphaerex (BAS 84000F) 7.3 fl oz at 10.5.1	52.5 bc	4.2 ab	2.1 b	0.00
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	20.8 d	3.6 ab	0.7 cd	0.01
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1+ 5 d	10.4 d	2.2 b	0.2 d	0.01
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.1 + 5 d	17.5 d	2.4 b	0.4 d	0.05
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 EC 13.5 fl oz 10.5.1 + 5 d	23.3 d	2.1 b	0.5 cd	0.01
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.51 + 5 d	22.5 d	2.8 ab	0.6 cd	0.00
p-value[v]	*0.0001*	*0.1711*	*0.0001*	*0.4832*

[z] Fungicides treatments applied on 11 May and 17 May 2021 at the Feekes growth stage 10.5.1 and 10.5.1 + 5 d, respectively. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 12 May.
[y] Fusarium head bright (FHB) incidence was measured as the number of infected heads out of 60 plants in each plot and calculated as a percentage and FHB severity was rated by visually assessing the percentage of the infected head on 2 Jun.
[x] FHB index was calculated as: (total FHB incidence multiplied by average FHB severity)/100 per plot. FHB=Fusarium head blight.
[w] Disease severity of leaf blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot on 2 Jun.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05). [u] NS = not significant (α=0.05).

Table 57. Effect of fungicide on DON, Fusarium damaged kernels (FDK) and yield in wheat.

Treatment and rate/A[z]	DON (ppm)[y] 22 Jun	% FDK[x] 22 Jun	Harvest moisture %	Test weight lb/bu	Yield[w] bu/A
Non-treated control	2.9 a	17.0	16.0	16.5	115.3
Prosaro 421 SC 6.5 fl oz at 10.5.1	0.9 b	15.8	15.5	16.5	111.6
Caramba 90 EC 13.5 fl oz at 10.5.1	0.8 bc	15.8	16.7	16.9	119.0
Sphaerex (BAS 84000F) 7.3 fl oz at 10.5.1	0.7 bcd	17.3	16.4	17.0	117.9
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	0.6 bcd	12.5	17.0	19.4	117.1
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1+ 5 d	0.5 bcd	13.3	16.9	18.2	119.0
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.1 + 5 d	0.3 d	12.5	17.3	19.1	119.9
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 EC 13.5 fl oz 10.5.1 + 5 d	0.4 cd	14.5	17.0	18.1	119.3
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.51 + 5 d	0.4 cd	15.8	16.2	17.2	114.6
p-value[v]	*0.0001*	*0.1546*	*0.9405*	*0.0356*	*0.9908*

[z] Fungicides treatments applied on 11 May and 17 May 2021 at the Feekes growth stage 10.5.1 and 10.5.1 + 5 d, respectively. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 12 May.

[y] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab.

[x] FDK = percentage of Fusarium damaged kernels.

[w] Yields were adjusted to 13.5% moisture and harvested on 22 Jun.

[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

WHEAT (*Triticum aestivum*); 'P25R40 and P25R61'
Fusarium head blight; *Fusarium graminearum*

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Evaluation of foliar fungicides and varieties for scab management in southwestern Indiana, 2021 (WHT21-05.SWPAC).

Plots were established at the Southwest Purdue Agricultural Center (SWPAC) in Knox County, IN. The experiment was a strip-plot 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 disked and chisel plowed on 7 Oct 2020. Nitrogen (46%) at 50 lb/A was applied on 7 Mar 2020. On 17 Oct 2020 wheat cultivar P25R40 was drilled at 7.5 in. spacing. Harmony Extra at 0.8 oz/A plus AMS at 2 lb/A plus NIS at 0.25% v/v was applied on 25 Mar 2020 for weed management. All fungicide applications were applied at 15 gal/A and 40 psi using a CO2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart and directed forward and backward at 45 degree angle, at 3.0 mph. Fungicides were applied on 11 May and 17 May 2021 at the Feekes growth stage 10.5.1 and 10.5.1 + 5 d, respectively. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 12 May. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot with the CO_2 handheld sprayer. Disease ratings were assessed on 2 June 2021. Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 60 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: (% FHB incidence multiplied by average FHB severity)/100 per plot. Disease severity on leaves were rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 22 Jun and yields were adjusted to 13.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2021, weather conditions were not favorable for Fusarium head blight (FHB) and leaf blotch diseases. FHB was the most prominent disease. FHB incidence, severity and Index were reduced by all fungicides over the non-treated, inoculated control in both varieties on 2 Jun (Table 58). There were no differences detected for leaf blotch. The concentration of deoxynivalenol (DON) was reduced over the non-treated control for all treatments in both varieties (Table 59). Fungicides reduced Fusarium damaged kernals (FDK) in the scab susceptible variety, P25R40, but there were no differences in the resistant variety, P25R61. Moisture and test weights were higher in Miravis Ace fb Folicur in the P25R40 vareity, no differences between treatments in P25R61. There were no significant differences between treatments in test weight and yield of wheat for either variety.

Table 58. Effect of variety and fungicide on Fusarium head blight and foliar diseases in wheat.

	FHB % incidence[y]		FHB % severity[y]		FHB Index[x]		Leaf blotch % severity[w]	
Variety or treatment and rate/A[z]	**P25R40**	**P25R61**	**P25R40**	**P25R61**	**P25R40**	**P25R61**	**P25R40**	**P25R61**
Non-treated control, inoculated control	89.2 a	68.8 a	5.2 a	2.1 a	4.7 a	1.4 a	0.5	2.0
Prosaro 421 SC 6.5 fl oz at 10.5.1	58.3 b	40.8 bc	2.9 bc	1.5 bc	1.6 c	0.6 bc	0.5	0.3
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	34.2 c	19.6 c	2.2 c	1.1 c	0.7 d	0.2 c	1.3	0.0
Miravis Ace 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.5.1 + 5 d	32.1 a	17.1 c	1.9 c	1.4 bc	0.6 d	0.3 c	1.5	0.0
Non-treated, non-inoculated control	82.5 c	54.2 ab	3.9 b	1.8 ab	3.2 b	1.0 ab	0.3	2.5
p-value	*0.0001*	*0.0026*	*0.0003*	*0.0277*	*0.0001*	*0.0051*	*0.8225*	*0.0547*

[z] Fungicides treatments applied on 11 May and 17 May 2021 at the Feekes growth stage 10.5.1 and 10.5.1 + 6 d, respectively. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 12 May.
[y] FHB incidence was measured as the number of infected heads out of 60 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: (FHB incidence multiplied by average FHB severity)/100 per plot.
[w] Disease severity of leaf blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

Table 59. Effect of fungicide on DON, Fusarium damaged kernels (FDK) and yield in wheat.

Treatment and rate/A[z]	DON (ppm)[y]		% FDK[x]		Harvest moisture		Test weight		Yield[w]	
	P25R40	P25R61	P25R40	P25R61	P25R40	P25R61	P25R40	P25R61	P25R40	P25R61
Non-treated control, inoculated control	1.83 a	0.52 a	15.0 ab	16.5	16.0 b	15.9	55.6 c	54.1 ab	96.2	90.8
Prosaro 421 SC 6.5 fl oz at 10.5.1	0.91 b	0.19 b	10.8 b	15.8	16.6 b	17.6	56.5 b	55.3 a	104.0	96.0
Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1	0.57 b	0.10 b	10.0 b	13.8	16.8 b	17.8	57.3 a	55.8 a	105.8	97.2
Miravis Ace 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.5.1 + 5 d	0.23 b	0.08 b	12.8 b	12.5	18.0 a	16.9	57.1 ab	56.7 a	108.9	99.4
Non-treated, non-inoculated control	2.67 a	0.65 a	18.8 a	15.8	16.1 b	16.5	55.4 c	50.4 b	101.0	100.2
p-value	*0.0008*	*0.0015*	*0.0432*	*0.1551*	*0.0030*	*0.3187*	*0.0003*	*0.0390*	*0.5901*	*0.4993*

[z] Fungicides treatments applied on 11 May and 17 May 2021 at the Feekes growth stage 10.5.1 and 10.5.1 + 6 d, respectively. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 12 May.

[y] Analysis of the mycotoxin deoxynivalenol (DON) completed by the University of Minnesota DON Testing Lab.

[x] FDK = percentage of Fusarium damaged kernels.

[w] Yields were adjusted to 13.5% moisture and harvested on 22 Jun.

[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (Zea mays 'SCS989AM')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*
Southern rust; *Puccinia polysora*

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Field-scale evaluation of fungicides for foliar disease in corn in central Indiana, 2021 (COR21-09.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 500-ft long, consisted of twelve 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. Corn hybrid 'P0574AMXT' was planted in 30-inch row spacing at a rate of 30,000 seeds/A on 21 May. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. Fungicides were applied on 28 Jun at V6, and on 21 Jul at the VT/R1 (tassel/silk) growth stages. Weather conditions prevented a V10 application. Southern rust (SR), tar spot, and gray leaf spot (GLS) were assessed on 1 Sep at the R5 (Dent) growth stage. Disease severity was rated by visually assessing the percentage of symptomatic leaf area on ten plants in each plot at the ear leaf. Ten plants in three locations were assessed in each plot and averaged before analysis. The twelve rows of each plot were harvest on 16 Nov and yields were adjusted to 15.5 % moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were moderately favorable for disease. Gray leaf spot (GLS) was the most prominent disease in the trial and reached low severity, tar spot and southern rust were also detected a low level. The Delaro treatment at V6 application significantly reduced GLS severity over the non-treated control (Table 60). Percent canopy green was significantly higher in the V6 plots over the VT/R1 application. There was no significant difference between treatments for tar spot and SR severity, harvest moisture, and corn yield.

Table 60. Effect of fungicide on foliar diseases severity, canopy green and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 1 Sep	SR % severity[y] 1 Sep	Canopy green[x] 1 Sep	Harvest moisture %	Yield[w] bu/A
Non-treated control	2.1 a	0.01	68.8 bc	17.7	207.2
Non-treated control	1.6 a	0.00	75.0 ab	17.8	209.3
Delaro 325 SC 8.0 fl oz at V6	0.6 b	0.04	78.8 a	17.9	212.6
Delaro 325 SC 8.0 fl oz at VT/R1	1.9 a	0.04	67.5 c	17.7	210.0
p-value[v]	*0.0083*	*0.1764*	*0.0314*	*0.3694*	*0.3707*

[z] Fungicide treatments were applied on 28 Jun at V6, and on 21 Jul 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.
[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf. Ten leaves were assessed per plot and averaged. SR = southern rust; GLS = gray leaf spot.
[x] Canopy greenness visually assessed percentage (0-100%) of crop canopy green on 1 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 16 Nov.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (Glycine max 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
Downy mildew; *Peronospora manshurica*

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Field-scale fungicide timing comparison for foliar diseases on soybean in central Indiana, 2021 (SOY21-10.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 30-ft wide and 480-ft long, consisted of twenty-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 'P35T15E' was planted in 15 inches row spacing at a rate of 150,000 seeds/A on 25 May. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer with Trimble CFX monitor. Fungicides were applied on 27 Jul at the R3 (beginning pod) growth stage and 10 Aug at the R5 (beginning seed) growth stage. Weather conditions prevented a V4 application. Disease ratings were assessed on 1 Sep at the R6 (full seed) growth stage. Septoria brown spot (SBS), frogeye leaf spot (FLS), and downy mildew (DM) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The soybeans were harvested on 5 Nov and yields were adjusted to 13% moisture. All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Septoria brown spot (SBS) and frogeye leaf spot (FLS) were the most prominent diseases and reached low severity. There was no significant difference between treatments and non-treated controls for disease severity and harvest moisture (Table 61). Delaro applied at R5 has the highest yield, but was not significantly different from non-treated control 2 and Delaro applied at R3.

Table 61. Effect of fungicide on foliar disease severity and soybean yield

Treatment, rate/A, and timing[z]	FLS % severity[y] Upper canopy 1 Sep	FLS % severity[y] Lower canopy 1 Sep	DM % severity[y] Upper canopy 1 Sep	SBS % severity[y] Lower canopy 1 Sep	Harvest moisture %	Yield[x] bu/A
Non-treated control 1	0.3	0.1	0.2	2.3	14.2	67.6 b
Non-treated control 2	0.6	0.2	0.4	2.9	14.3	70.5 a
Delaro 325 SC 12 fl oz at R3	0.4	0.1	0.4	2.8	14.2	69.6 ab
Delaro 325 SC 12 fl oz at R5	0.5	0.1	0.4	2.5	14.2	71.3 a
p-value[w]	*0.6085*	*0.7778*	*0.8918*	*0.2091*	*0.5935*	*0.0364*

[z] Fungicide treatments applied on 27 Jul at the R3 (beginning pod) growth stage and 10 Aug at the R5 (beginning seed) growth stages. Weather conditions prevented a V4 application and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity visually rated on scale of 0-100% of upper and lower canopy with disease symptoms on 1 Sep. SBS = Septoria brown spot; FLS=Frogeye leaf spot; DM=Downy mildew.
[x] Yields were adjusted to 13% moisture and harvested on 5 Nov.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea* mays 'P0574AMXT')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*
Southern rust; *Puccinia polysora*

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Field-scale fungicide timing comparison for foliar diseases on corn in northeastern Indiana, 2021 (COR21-10.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 30-ft wide and 400-ft long, consisted of twelve rows, and the two center rows used for evaluation. The previous crop was soybean. Standard practices for non-irrigated corn production in Indiana were followed. Corn hybrid P0574AMXT was planted in 30-inch row spacing at a rate of 32,000 seeds/A on 16 May. Fungicide treatments applied on 6 Jul, 13 Jul, 21 Jul, 27 Aug, and 3 Aug at the V6, V10, VT/R1 (tassel/silk), R2 (blister), and R3 (milk) growth stages, respectively. Disease ratings were assessed on 30 Aug at the R5 (dent) growth stages. Gray leaf spot (GLS), tar spot, and southern rust (SR) were rated for disease severity by visually assessing the percentage (0-100%) of symptomatic leaf area on the ear leaf on ten plants at three locations in each plot. The trial was harvested on 19 Oct and yields were adjusted to 15.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, weather conditions were moderately favorable for disease. Gray leaf spot (GLS), southern rust (SR), and tar spot were the most prominent diseases in the trial and reached low severity. All Headline Amp application significantly reduced tar spot, SR, and GLS severity over the non-treated control on 30 Aug, except for R3 application on GLS (Table 62). Harvest moisture was significantly higher with all fungicide timings over non-treated control. There was no significant effect of fungicide timing on yield of corn.

Table 62. Effect of fungicide on foliar diseases severity and corn yield.

Treatment, rate/A, and timing[z]	Tar Spot % stroma[y] 30 Aug	SR % severity[y] 30 Aug	GLS % severity[y] 30 Aug	Harvest moisture %	Yield[x] bu/A
Non-treated control	0.9 a	0.8 a	1.0 a	18.8 c	220.0
Headline AMP 1.68 SC 10.0 fl oz at V6	0.5 b	0.1 b	0.1 c	19.2 b	230.6
Headline AMP 1.68 SC 10.0 fl oz at V10	0.5 b	0.1 b	0.1 c	19.5 a	227.1
Headline AMP 1.68 SC 10.0 fl oz at VT/R1	0.3 b	0.1 b	0.3 c	19.5 a	230.9
Headline AMP 1.68 SC 10.0 fl oz at R2	0.2 b	0.2 b	0.6 b	19.4 ab	226.6
Headline AMP 1.68 SC 10.0 fl oz at R3	0.2 b	0.1 b	0.8 a	19.5 a	225.6
p-value[w]	*0.0036*	*0.0001*	*0.0001*	*0.0002*	*0.1095*

[z] Fungicide treatments applied on 6 Jul, 13 Jul, 21 Jul, 27 Aug, and 3 Aug at the V6, V10, VT/R1 (tassel/silk), R2 (blister), and R3 (milk) growth stages, respectively.
[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on the ear leaf. Ten leaves were assessed per plot and averaged on 30 Aug. GLS = gray leaf spot. SR = southern rust.
[x] Yields were adjusted to 15.5% moisture and harvested on 19 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on least square means test (α=0.05).

CORN (Zea mays 'SCS989AM')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*
Southern rust; *Puccinia polysora*

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Evaluation of Xyway 2x2 application at planting for foliar diseases in corn in northeastern Indiana, 2021 (COR21-19.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 nine replications. Plots were 30-ft wide and 400-ft long, consisted of twelve rows, and the two center rows used for evaluation. The previous crop was soybean. Standard practices for non-irrigated corn production in Indiana were followed. Corn variety 'SCS89AM' was planted in 30-in. row spacing at a rate of 32,000 seeds/A on 16 May. Xyway fungicide was applied with the starter fertilizer with a 2x2 two by two-inch configuration (two inches below and two inches to the side of the seed furrow) in 15 GPA with a 12:3 mixture of 28% N and ammonium thiosulfate at planting. Disease ratings were assessed on 24 Aug at the R5 (dent) growth stage. Gray leaf spot (GLS), tar spot, and southern rust (SR) were rated for disease severity by visually assessing the percentage (0-100%) of symptomatic leaf area on the ear leaf on ten plants at three locations in each plot. The trial was harvested on 10 Oct and yields were adjusted to 15.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, gray leaf spot was the most prominent disease and reached low severity. The 2x2 application of Xyway had significantly lower gray leaf spot severity and higher % canopy green compared to the non-treated control (Table 63). There were no significant differences between treatments for tar spot and southern rust severity, and corn yield.

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

Treatment and rate/A[z]	GLS % severity[y] 24 Aug	SR % severity[y] 24 Aug	Tar spot % stroma[x] 24 Aug	Canopy % green[w] 24 Aug	Yield[v] bu/A
Non-treated control	1.1 a	0.3	0.2	73.8 b	193.0
Xyway LFR 15.2 fl oz 2x2	0.4 b	0.2	0.2	79.3 a	192.9
p-value [u]	*0.0001*	*0.2367*	*0.3972*	*0.0120*	*0.9708*

[z] Xyway treatments applied in starter fertilizer with 2x2 inch spacing from the seed in 15 GPA with a 12:3 mixture of 28% N and ammonium thiosulfate on 16 May.
[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf on 24 Aug. GLS=gray leaf spot. SR=southern rust.
[x] Tar spot stroma visually assessed percentage (0-100%) of leaf area on ear leaf on 24 Aug.
[w] Canopy greenness visually assessed percentage (0-100%) of canopy green on 24 Aug.
[v] Yields were adjusted to 15.5 % moisture and harvested on 10 Oct.
[u] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (Glycine max 'P35T15E')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
Downy mildew; *Peronospora manshurica*
Sudden death syndrome; *Fusarium virguliforme*

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Field-scale fungicide timing for foliar diseases on soybean in northeastern Indiana, 2021 (SOY21-12.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 30-ft wide and 380-ft long. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P35T15E' was drilled in 7.5-inch row spacing at a rate of 150,000 seeds/A on 18 May. Fungicides were applied at the beginning flower (R1), beginning pod (R3), beginning pod (R5), and R3 followed by (fb) R5 growth stages. Disease ratings were assessed on 30 Aug at the late R5 growth stage. Septoria brown spot (SBS), frogeye leaf spot (FLS), and downy mildew were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies in three locations in each plot. The soybeans were harvested on 1 Oct and yields were adjusted to 13% moisture. All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). All disease and yield data were analyzed using a mixed model analysis of variance, and means were separated using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Septoria brown spot (SBS) and frogeye leaf spot (FLS) were the most prominent diseases and reached low severity. All timings of Miravis Top significantly reduced FLS severity in the upper and lower canopy over the non-treated control, except Miravis at R3 fb R5 in lower canopy (Table 64). In addition, a single application of Miravis at R1, R3 and R5 reduced GLS over 2 applications starting at R3 fb R5. No differences were detected between treatments for downy mildew and SBS severity. Miravis Top applied at R1 increased yield over the non-treated control, but was not significantly different from the R5 or R3 fb R5 application timings.

Table 64. Effect of fungicide timing on foliar disease severity and soybean yield.

Treatment, rate/A, and timing[z]	FLS % severity[y] Upper canopy 30 Aug	DM % severity[y] Upper canopy 30 Aug	SBS % severity[y] Lower canopy 30 Aug	FLS % severity[y] Lower canopy 30 Aug	Harvest moisture %	Yield[x] bu/A
Non-treated control	2.1 a	0.2	5.8	0.9 a	12.8 a	62.6 bc
Miravis Top 1.67 SC 13.7 oz at R1	0.1 c	0.1	4.2	0.3 b	13.0 a	69.2 a
Miravis Top 1.67 SC 13.7 oz at R3	0.5 c	0.1	5.7	0.3 b	12.2 b	59.2 c
Miravis Top 1.67 SC 13.7 oz at R5	0.3 c	0.2	5.3	0.3 b	12.7 ba	64.3 abc
Miravis Top 1.67 SC 13.7 oz at R3 fb R5	1.4 b	0.3	5.7	0.7 a	13.2 a	66.0 ab
p-value[w]	*0.0001*	*0.1953*	*0.5875*	*0.0002*	*0.0242*	*0.0260*

[z] Fungicide treatments applied at beginning flower (R1), beginning pod (R3), beginning pod (R5), and R3 followed by (fb) R5 growth stages. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity visually rated on scale of 0-100% of the upper and lower canopy with disease symptoms 30 Aug. SBS = Septoria brown spot; FLS=Frogeye leaf spot; DM=Downy mildew.
[x] Yields were adjusted to 13% moisture and harvested on 1 Oct.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

CORN (*Zea* mays 'P0574AM')
Gray leaf spot; *Cercospora zeae-maydis*

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Field-scale evaluation of fungicide timing for foliar disease in corn in southeastern Indiana, 2021 (COR21-11.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 30-ft wide and 800-ft long, consisted of twelve rows, and the two center rows used for evaluation. The previous crop was soybean. Standard practices for non-irrigated corn production in Indiana were followed. Corn variety 'P0574AM' was planted in 30-in. row spacing at a rate of 29,880 seeds/A on 27 Apr. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. Fungicides were applied on 17 June at the V8 growth stage, 7 July at the V10 growth stage, and 20 July at the VT (tassel) growth stage. Disease ratings were assessed on 28 Jul at the R2 (blister) growth stage and on 12 Aug at the R4 (late dough) growth stage. Gray leaf spot was rated for disease severity by visually assessing the percentage (0-100%) of symptomatic leaf area on the ear leaf. Ten plants in three locations were assessed in each plot and averaged before analysis. The twelve rows of each plot were harvest on 28 Sep and yields were adjusted to 15.5% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, gray leaf spot was the most prominent disease and reached moderate severity. On 28 Jul, the V8 and V10 treatments reduced gray leaf spot severity over the VT application and the non-treated control (Table 65). All treatments significantly reduced gray leaf spot severity over the non-treated control on 12 Aug with the V10 application having significantly less gray leaf spot compared to the V8 and VT applications. No significant differences between treatments were detected for % canopy green on 7 Sep. There was no significant difference between treatments for harvest moisture and corn yield.

Table 65. Effect of fungicide on foliar diseases and corn yield.

Treatment, rate/A, and timing[z]	GLS % severity[y] 28 Jul	GLS % severity[y] 12 Aug	Canopy % green[x] 12 Aug	Harvest moisture %	Yield[w] bu/A
Non-treated control	6.2 a	14.2 a	53.8	14.0	186.5
Lucento 4.17 SC 5.0 fl oz at V8	4.1 b	9.6 b	51.3	14.3	189.7
Lucento 4.17 SC 5.0 fl oz at V10	2.2 c	2.9 c	63.8	14.4	192.3
Lucento 4.17 SC 5.0 fl oz at VT	6.5 a	9.5 b	73.8	14.6	191.3
p-value[v]	*0.0009*	*0.0001*	*0.2762*	*0.2762*	*0.6325*

[z] Fungicide treatments applied on 17 Jun at V8, 7 July at V10, and 20 Jul at VT (tassel) growth stages. 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 at R2 (blister) on 28 Jul and R4 (late dough) on 12 Aug. GLS= gray leaf spot.
[x] Canopy greenness visually assessed percentage (0-100%) of canopy green on 7 Sep.
[w] Yields were adjusted to 15.5 % moisture and harvested on 28 Sep.
[v] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (Glycine max 'P34T21SE')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
Downy mildew; *Peronospora manshurica*

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Field-scale fungicide timing comparison for foliar diseases on soybean in southeastern Indiana, 2021 (SOY21-11.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 30-ft wide and 600-ft long, consisted of 24 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 'P34T21SE' was planted in 15-in. row spacing at a rate of 134,000 seeds/A on 4 Apr. All fungicide applications were applied at 20 gal/A and 40 psi. Fungicides were applied on 17 Jun at V4, 20 Jul at R3 (beginning pod), and 11 Aug at the R5 (beginning seed) growth stages. Disease ratings were assessed on 12 Aug at R5 growth stage. Frogeye leaf spot and downy mildew were rated in upper canopy and Septoria brown spot rated in the lower canopy. Disease severity of each disease was visually assessing the percentage (0-100%) of symptomatic leaf area in canopy in three locations in each plot on 12 Aug. All ratings were averaged in each plot before analysis. Soybean plots were harvested on 28 Sep and yields were adjusted to 13% moisture. Data were subjected to a generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. Frogeye leaf spot (FLS), downy mildew (DM) and Septoria brown spot (SBS) reached low severity. There were no significant differences between treatments for frogeye leaf spot and downy mildew (Table 66). The Lucento applied at V4 resulted in the lowest level of Septoria brown spot in the lower canopy compared to all treatments. No significant differences were observed for soybean yield.

Table 66. Effect of fungicide on foliar disease severity and soybean yield.

Treatment, rate/A, and timing[z]	FLS % severity[y] Upper canopy 12 Aug	DM % severity[y] Upper canopy 12 Aug	SBS % severity[y] Lower canopy 12 Aug	Yield[x] bu/A
Non-treated control	0.00	0.1	8.8 a	53.5
Lucento 4.17 SC 5.0 fl oz at V4	0.01	0.1	2.8 b	53.6
Lucento 4.17 SC 5.0 fl oz at R3	0.01	0.2	7.8 a	56.4
Lucento 4.17 SC 5.0 fl oz at R5	0.01	0.1	6.1 a	53.4
p-value[w]	*0.8193*	*0.2259*	*0.0047*	*0.0741*

[z] Fungicide treatments applied on 17 Jun at V4, 20 Jul at R3 (beginning pod), and 11 Aug at R5 (beginning seed) growth stages and 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 canopy with disease symptoms. FLS = frogeye leaf spot in upper canopy; DM= downy mildew; SBS = Septoria brown spot on 12 Aug.
[x] Yields were adjusted to 13% moisture and harvest on 28 Sep.
[w] All data were analyzed in SAS 9.4 (SAS Institute, Cary, NC). A generalized linear mixed model analysis of variance was performed using PROC GLIMMIX. Values are least squares means and values with different letters are significantly different based on Fisher's Least Significant Difference (LSD, α=0.05).

SOYBEAN (*Glycine max* 'P34A79X')
Frogeye leaf spot; *Cercospora sojina*
White mold; *Sclerotinia sclerotiorum*

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Evaluation of the interaction between white mold biofungicides and synthetic foliar fungicides in soybean in Indiana, 2021 (SOY21-05.PPAC & SOY21-08.ACRE).

Trials were established at the Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN and the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiments were 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 were used for evaluation. The previous crop was sunflower. Standard practices for soybean production in Indiana were followed. Soybean variety 'P34A79X' was planted in 20-in row spacing at a rate of 8 seeds/ft on 15 May at ACRE and 24 May at PPAC. All plots were inoculated with *Sclerotinia sclerotiorum* at 1.25 g/ft within the seedbed at planting and sclerotia at 5 g/plot were spread between the middle two rows prior to emergence. All treatments were applied at 15 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart. Contans (*Coniothyrium minitans*) was applied on 15 May at ACRE and 26 May at PPAC prior to emergence. At ACRE Double Nickel LC (*Bacillus amyloliquefaciens*) was applied on 13 Jul at the R2 (full bloom) growth stage, Approach, Endura, and Omega were applied on 14 Jul at the R2 (full bloom) growth stage. At PPAC Double Nickel, Approach, Endura, and Omega were applied on 19 Jul at the R2 (full bloom) growth stage. Disease ratings were assessed on 7 Sep at ACRE and 9 Sep at PPAC at the R6 (full seed) growth stage. Frogeye leaf spot (FLS) severity were rated by visually assessing the percentage (0-100%) of symptomatic tissue per leaf in the upper canopy on ten plants per plot. Values for the 10 plants were averaged before analysis. Canopy greenness and defoliation were rated on 14 Sep at ACRE and 19 Sep at PPAC. Canopy greenness was rated by visually assessing the percentage (0-100%) of crop canopy that remained green, and defoliation was rated by visually assessing the percentage (1-100%) of crop canopy where the leaves had senesced and dropped. The two center rows of each plot were harvested on 18 Oct at ACRE and 1 Oct at PPAC and yields were adjusted to 13% moisture. Data were analyzed using a mixed model analysis of variance (SAS 9.4), and means were separated usingFisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. White mold (*Sclerotinia sclerotiorum*) was not observed in the plots. Frogeye leaf spot (FLS) was the most prominent disease in the trial but only reached low severity. Contans followed by (fb) Endura and Double Nickel fb Endura had the lowest FLS severity, but were not statistically different from the non-treated control (Table 67). Contans fb Endura and Contans fb Omega had the highest canopy greenness, but were not statistically different from Aproach, Endura, Omega, Contans fb Aproach, Double Nickel fb Aproach, Double Nickel fb Endura, Double Nickel fb Omega, and Contans fb Double Nickle. There was no significant effect of treatment on defoliation, moisture, test weight, or soybean yield.

Table 67. Effect of treatment on disease, canopy greenness and defoliation in soybean.

Treatment, rate/A[z]	FLS % severity[y]	Canopy % green[x]	Defoliation %[w]	Moisture %	Test weight lbs/bu	Yield bu/A[v]
Non-treated control	0.6 abc	38.0 bcd	48.6	12.4	54.9	52.7
Contans WG 2.0 lb	0.8 ab	35.6 d	47.5	12.2	54.9	53.3
Double Nickel LC 2.0 qt	0.5 bc	37.5 dc	49.4	12.2	55.1	52.0
Aproach 2.08 SC 12.0 fl oz	0.9 a	39.4 a-d	48.8	12.5	55.1	52.7
Endura 70 WDG 8.0 oz	0.6 abc	38.5 a-d	48.3	12.5	54.6	50.9
Omega 500 F 12.0 fl oz	1.0 a	42.4 abc	44.4	12.4	60.5	53.9
Contans WG 2.0 lb fb Aproach 2.08 SC 12.0 fl oz	0.7 abc	42.5 abc	45.6	12.1	54.9	54.1
Contans WG 2.0 lb fb Endura 70 WDG 8.0 oz	0.4 c	43.8 a	43.8	12.4	54.8	54.3
Contans WG 2.0 lb fb Omega 500 F 12.0 fl oz	0.7 abc	43.8 a	41.9	12.3	55.1	54.0
Double Nickel LC 2.0 qt fb Aproach 2.08 SC 12.0 fl oz	0.7 abc	40.4 a-d	48.4	12.1	55.0	52.3
Double Nickel LC 2.0 qt fb Endura 70 WDG 8.0 oz	0.4 c	39.4 a-d	48.1	12.7	55.1	48.2
Double Nickel LC 2.0 qt fb Omega 500 F 12.0 fl oz	0.6 abc	42.7 abc	44.3	12.4	55.0	53.1
Contans WG 2.0 lb fb Double Nickel LC 2.0 qt	0.7 abc	41.9 abc	45.1	12.2	54.7	52.0
p-value	*0.0213*	*0.0199*	*0.0533*	*0.2905*	*0.3143*	*0.9283*

[z] Contans was applied on 15 May at ACRE and 26 May at PPAC prior to emergence. At ACRE Double Nickel was applied on 13 Jul at the R2 (full bloom) growth stage, Approach, Endura, and Omega were applied on 14 Jul at the R2 (full bloom) growth stage. At PPAC Double Nickel, Approach, Endura, and Omega were applied on 19 Jul at the R2 (full bloom) growth stage. All plots were inoculated with *S. sclerotiorum* at 1.25 g/ft within the seedbed at planting. fb = followed by. [y] FLS severity was rated by visually assessing the percentage (1-100%) of symptomatic tissue (lesions) per leaf in the upper canopy on ten plants per plot. Values for the 10 plants were averaged before analysis. On 7 and 9 Sep at ACRE and PPAC, respectively. [x] Canopy greenness was rated by visually assessing the percentage (1-100%) of crop canopy still green on 14 and 19 Sep at ACRE and PPAC, respectively. [w] Defoliation was rated by visually assessing the percentage (1-100%) of crop canopy where the leaves had senesced and dropped. [v]Yields were adjusted to 13% moisture and harvested on 18 Oct at ACRE and 1 Oct at PPAC. [v] All data were analyzed using PROC GLIMMIX in SAS 9.4 (SAS Institute, Cary, NC). Means followed by the same letter are not significantly different based on Fisher's least significant difference test (LSD; α=0.05).

SOYBEAN (*Glycine max* 'P34A79X')
Frogeye leaf spot; *Cercospora sojina*
White mold; *Sclerotinia sclerotiorum*

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Evaluation of the interaction between white mold biofungicides and postemergence herbicides in soybean in Indiana, 2021 (SOY21-04.PPAC & SOY21-07.ACRE).

Trials were established at the Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN and the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiments were 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 were used for evaluation. The previous crop was sunflower at ACRE and soybean at PPAC. Soybean variety 'P34A79X' was planted in 20-in row spacing at a rate of 8 seeds/ft on 15 May at ACRE and 25 May at PPAC. All plots were inoculated with *Sclerotinia sclerotiorum* at 1.25 g/ft within the seedbed at planting. Contans and Double Nickel were applied at 15 gal/A and 40 psi and First Rate and RoundUp PowerMax were applied at 20 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart. XtendiMax was applied at 20 gal/A and 30 psi using CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TTI 11003 nozzles spaced 20-in apart. Contans was applied on 15 May at ACRE and 26 May at PPAC prior to emergence. First Rate, RoundUp PowerMax, and XtendiMax were applied on 16 Jun at ACRE and 20 Jun at PPAC at the V2 (second vegetative) growth stage, Double Nickel was applied on 13 Jul at ACRE at the R2 (full bloom) growth stage and 30 Jul at PPAC at the R3 (beginning pod) growth stage. Disease ratings were assessed on 23 Aug, 1 Sep, and 7 Sep at ACRE and 26 Aug, 2 Sep, and 9 Sep at PPAC at the R6 (full seed) growth stage. Frogeye leaf spot (FLS) severity were rated by visually assessing the percentage (0-100%) of symptomatic tissue per leaf in the upper canopy on ten plants per plot. Values for the 10 plants were averaged before analysis. Canopy greenness and defoliation were rated on 14 Sep at ACRE and 19 Sep at PPAC. Canopy greenness was rated by visually assessing the percentage (0-100%) of crop canopy that remained green and defoliation was rated by visually assessing the percentage (1-100%) of crop canopy where the leaves had senesced and dropped. The two center rows of each plot were harvested on 18 Oct at ACRE and 29 Sep at PPAC and yields were adjusted to 13% moisture. Data were analyzed using a mixed model analysis of variance (SAS 9.4), and means were separated usingFisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. White mold (*Sclerotinia sclerotiorum*) was not observed in the plots. Frogeye leaf spot (FLS) was the most prominent disease in the trial but only reached low severity. There were no significant differences between treatments when compared to the non-treated control for FLS severity or defoliation (Table 68). XtendiMax had the highest canopy greenness, but was not statistically different from the non-treated control. There was no significant effect of treatment on moisture or test weight. Soybean yield was highest in the Contans fb RoundUp PowerMax and RoundUp PowerMax fb Double Nickel treatments, but were not statistically different from the First Rate, RoundUp PowerMax, XtendiMax, Contans fb First-Rate, First-Rate fb Double Nickel, or XtendiMax fb Double Nickel treatments.

Table 68. Effect of treatment on disease, canopy greenness and defoliation in soybean.

Treatment and rate/A[z]	FLS %[y]	Canopy % green[x]	Defoliation %[w]	Moisture %	Test weight lbs/bu	Yield bu/A[v]
Non-treated control	1.2	40.3 abc	51.2	12.9	54.7	43.5 d
Contans WG 2.0 lbs	0.6	41.3 ab	48.2	13.4	54.9	44.9 dc
Double Nickel LC 2.0 qt	1.0	36.6 bc	48.0	13.3	55.0	45.6 dc
First Rate WG 0.6 oz	0.7	39.9 abc	43.8	13.1	54.8	52.4 ab
RoundUp PowerMax EC 22.0 fl oz	0.8	38.2 abc	45.8	13.3	54.9	50.8 abc
XtendiMax EC 22.0 fl oz	1.1	43.2 a	45.5	13.0	54.8	48.1 a-d
Contans WG 2.0 lbs fb First Rate WG 0.6 oz	1.1	35.6 c	45.6	13.2	55.1	48.8 a-d
Contans WG 2.0 lbs fb RoundUp PowerMax EC 22.0 fl oz	1.0	36.2 bc	44.2	13.1	55.3	54.0 a
Contans WG 2.0 lbs fb XtendiMax EC 22.0 fl oz	1.1	40.7 ab	43.8	13.3	55.2	46.6 bcd
First Rate WG 0.6 oz fb Double Nickel LC 2.0 qt	0.7	35.7 c	44.7	13.2	55.0	52.2 ab
RoundUp PowerMax EC 22 fl oz fb Double Nickel LC 2.0 qt	1.2	37.1 cb	44.4	12.9	54.4	54.0 a
XtendiMax EC 22.0 fl oz fb Double Nickel LC 2.0 qt	0.8	34.5 c	50.4	12.9	54.6	49.8 a-d
p-value[u]	*0.1338*	*0.0312*	*0.2752*	*0.8826*	*0.7324*	*0.0295*

[z] Contans was applied on 15 May at ACRE and 26 May at PPAC prior to emergence. First Rate, RoundUp PowerMax and XtendiMax were applied on 16 Jun at ACRE and 20 Jun at PPAC at the V2 (second vegetative) growth stage, Double Nickel was applied on 13 Jul at ACRE at the R2 (full bloom) growth stage and 30 Jul at PPAC at the R3 (beginning pod) growth stage. All plots were inoculated with *S. sclerotiorum* at 1.25 g/ft within the seedbed at planting. fb = followed by. [y] FLS severity was rated by visually assessing the percentage (1-100%) of symptomatic tissue (lesions) per leaf in the upper canopy on ten plants per plot. Values for the 10 plants were averaged before analysis.
[x] Canopy greenness was rated by visually assessing the percentage (1-100%) of crop canopy still green.
[w] Defoliation was rated by visually assessing the percentage (1-100%) of crop canopy where the leaves had senesced and dropped.
[v] Yields were adjusted to 13% moisture and harvested on 18 Oct at ACRE and 29 Sep at PPAC.
[u] All data were analyzed using PROC GLIMMIX in SAS 9.4 (SAS Institute, Cary, NC). Means followed by the same letter are not significantly different based on Fisher's least significant difference test (LSD; α=0.05).

SOYBEAN (*Glycine max* 'P34A79X')
Frogeye leaf spot; *Cercospora sojina*
White mold; *Sclerotinia sclerotiorum*

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Evaluation of the interaction between white mold biofungicides and preemergence herbicides in soybean in Indiana, 2021 (SOY21-03.PPAC & SOY21-06.ACRE).

Trials were established at the Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN and the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiments were 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 were used for evaluation. The previous crop was sunflower at ACRE and soybean at PPAC. Soybean variety 'P34A79X' was planted in 20-in row spacing at a rate of 8 seeds/ft on 15 May at ACRE and 25 May at PPAC. All plots were inoculated with *Sclerotinia sclerotiorum* at 1.25 g/ft within the seedbed at planting. Contans and Double Nickel were applied at 15 gal/A and 40 psi and Valor, Dual Magnum, and Metribuzin were applied at 20 gal/A and 40 psi using a CO_2 backpack sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart. Contans, Valor, Dual Magnum, and Metribuzin were applied on 15 May at ACRE and 26 May at PPAC prior to emergence. Double Nickel was applied on 13 Jul at ACRE at the R2 (full bloom) growth stage and on 30 Jul at PPAC at the R3 (beginning pod) growth stage. Disease ratings were assessed on 7 Sep at ACRE and 9 Sep at PPAC at the R6 (full seed) growth stage. Frogeye leaf spot (FLS) severity were rated by visually assessing the percentage (0-100%) of symptomatic tissue per leaf in the upper canopy on ten plants per plot. Values for the 10 plants were averaged before analysis. Canopy greenness and defoliation were rated on 14 Sep at ACRE and 19 Sep at PPAC. Canopy greenness was rated by visually assessing the percentage (0-100%) of crop canopy that remained green, and defoliation was rated by visually assessing the percentage (1-100%) of crop canopy where the leaves had senesced and dropped. The two center rows of each plot were harvested on 10 Oct at ACRE and 29 Sep at PPAC and yields were adjusted to 13% moisture. Data were analyzed using a mixed model analysis of variance (SAS 9.4), and means were separated usingFisher's Least Significant Difference (LSD, α=0.05).

In 2021, very little disease developed in plots. White mold (*Sclerotinia sclerotiorum*) was not observed in the plots. Frogeye leaf spot (FLS) was the most prominent disease in the trials but only reached low severity. There were no significant differences between treatments when compared to the non-treated control for FLS severity, canopy greenness, or defoliation (Table 69). There was no significant effect of treatment on moisture, test weight, or soybean yield.

Table 69. Effect of treatment on disease, canopy greenness and defoliation in soybean.

Treatment and rate/A[z]	FLS % severity[y]	Canopy % green[x]	Defoliation %[w]	Moisture %	Test weight lbs/bu	Yield bu/A[v]
Non-treated control	0.60	41.32	45.87	12.85	55.47	48.71
Contans WG 2.0 lb	0.87	41.85	47.26	12.47	55.12	50.23
Double Nickel LC 2.0 qt	0.92	41.88	50.63	12.40	55.39	50.76
Valor WG 3.0 fl oz	0.90	40.63	51.25	12.39	55.40	48.77
Dual Magnum EC 2.6 pt	0.72	44.38	47.50	12.41	55.33	50.26
Metribuzin DF 1.0 pt	0.96	40.84	47.19	12.39	55.50	52.58
Contans WG 2.0 lb fb Valor WG 3.0 fl oz	0.85	44.38	48.13	12.85	55.31	52.12
Contans WG 2.0 lb fb Dual Magnum EC 2.6 pt	0.55	41.69	46.07	12.63	55.36	48.78
Contans WG 2.0 lb fb Metribuzin DF 1.0 pt	0.58	41.88	48.75	12.41	55.43	49.21
Valor WG 3.0 fl oz fb Double Nickel LC 2.0 qt	0.81	44.38	46.88	12.61	55.45	52.80
Dual Magnum EC 2.6 pt fb Double Nickel LC 2.0 qt	0.85	42.50	47.50	12.53	55.36	50.01
Metribuzin DF 1.0 pt fb Double Nickel LC 2.0 qt	0.94	42.50	48.13	12.56	55.54	53.16
p-value[u]	*0.4808*	*0.9380*	*0.9637*	*0.1305*	*0.9467*	*0.2390*

[z] Contans, Valor, Dual Magnum, and Metribuzin were applied on 15 May at ACRE and 26 May at PPAC prior to emergence. Double Nickel was applied on 13 Jul at the R2 (full bloom) growth stage at ACRE and on 30 Jul at the R3 (beginning pod) growth stage at PPAC. All plots were inoculated with *S. sclerotiorum* at 1.25 g/ft within the seedbed at planting. fb = followed by.
[y] Frogeye leaf spot (FLS) severity was rated by visually assessing the percentage (1-100%) of symptomatic tissue (lesions) per leaf in the upper canopy on ten plants per plot. Values for the 10 plants were averaged before analysis.
[x] Canopy greenness was rated by visually assessing the percentage (1-100%) of crop canopy still green.
[w] Defoliation was rated by visually assessing the percentage (1-100%) of crop canopy where the leaves had senesced and dropped.
[v] Yields were adjusted to 13% moisture and harvested on 10 Oct at ACRE and 29 Sep at PPAC.
[u] All data were analyzed using PROC GLIMMIX in SAS 9.4 (SAS Institute, Cary, NC). Means followed by the same letter are not significantly different based on Fisher's least significant difference test (LSD; 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. https://ag.purdue.edu/indiana-state-climate/. Taken from Purdue Mesonet stations.

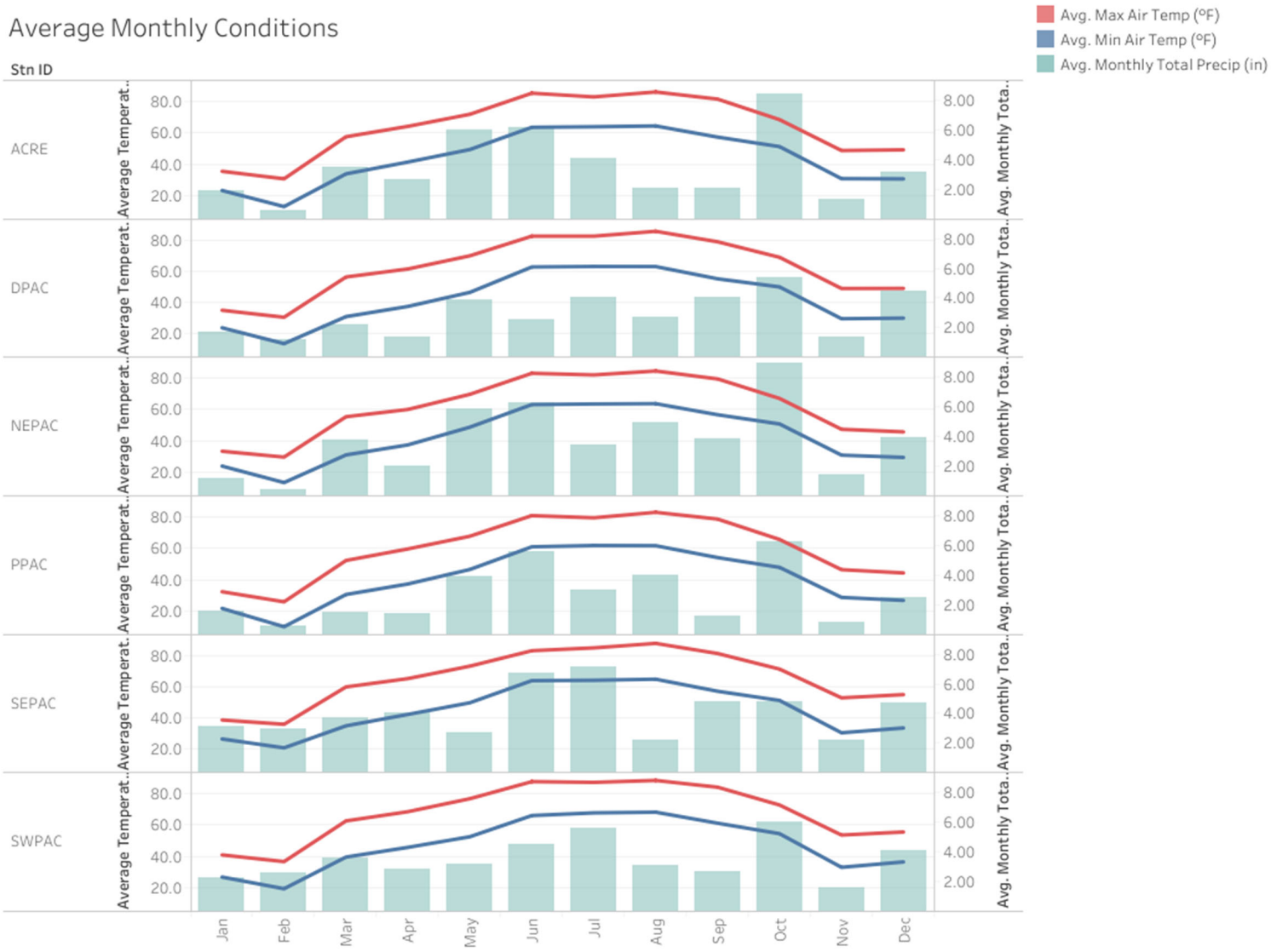

Table 70. Average monthly conditions at the Purdue Agronomy Center for Research and Education (ACRE), Pinney Purdue Agricultural Center (PPAC), Southwest Purdue Agricutlural Center (SWPAC), Davis Purdue Agricutlural Center (DPAC), Northeast Purdue Agricutlural Center (NEPAC), and Southeast Purdue Agricutlural Center (SEPAC) in Indiana, 2021[z].

Months	ACRE			PPAC			SWPAC		
	Temp. min.[y] °F	Temp. max.[y] °F	Total precipit.[x] (in)	Temp. min.[y] °F	Temp. max.[y] °F	Total precipit.[x] (in)	Temp. min.[y] °F	Temp. max.[y] °F	Total precipit.[x] (in)
January	35.5	23.3	1.95	32.3	21.7	1.58	40.9	26.8	2.26
February	30.7	13.1	0.62	25.9	10.1	0.58	36.6	19.4	2.60
March	57.5	33.9	3.53	52.2	30.6	1.49	62.5	39.5	3.55
April	64.1	41.4	2.65	59.6	37.3	1.39	68.4	45.7	2.80
May	71.7	49.3	6.04	67.6	46.5	3.92	76.6	52.4	3.15
June	85.2	63.5	6.21	80.7	60.9	5.63	87.4	65.9	4.50
July	82.8	63.8	4.12	79.3	61.7	2.99	87.0	67.6	5.57
August	85.9	64.3	2.07	82.8	61.6	4.03	88.2	68.0	3.08
September	81.4	57.2	2.12	78.5	54.1	1.23	83.9	61.0	2.65
October	68.3	51.2	8.41	65.6	47.8	6.28	72.6	54.4	5.97
November	48.7	30.8	1.35	46.4	28.7	0.84	53.5	33.0	1.60
December	49.1	30.7	3.18	44.3	26.8	2.52	55.4	36.4	4.11

Months	DPAC			NEPAC			SEPAC		
	Temp. min.[y] °F	Temp. max.[y] °F	Total precipit.[x] (in)	Temp. min.[y] °F	Temp. max.[y] °F	Total precipit.[x] (in)	Temp. min.[y] °F	Temp. max.[y] °F	Total precipit.[x] (in)
January	34.9	23.7	1.68	33.4	23.9	1.13	38.6	26.4	3.15
February	30.5	13.5	1.18	29.6	13.4	0.44	35.9	20.7	2.97
March	56.3	30.9	2.21	55.3	31.0	3.72	59.8	34.9	3.74
April	61.4	37.4	1.34	59.9	37.4	2.04	65.2	42.2	4.01
May	69.9	46.4	3.88	69.5	48.7	5.80	73.2	49.7	2.73
June	82.5	62.7	2.54	82.9	63.0	6.24	83.1	63.9	6.73
July	82.5	63.0	4.02	81.9	63.4	3.45	84.9	64.1	7.13
August	85.6	63.0	2.69	84.4	63.6	4.96	87.8	64.8	2.19
September	78.9	55.1	4.08	79.3	56.6	3.87	81.3	57.1	4.79
October	68.9	49.9	5.40	66.9	50.7	8.90	71.3	51.2	4.79
November	48.9	29.5	1.36	47.3	30.9	1.39	52.8	30.4	2.18
December	49.0	29.9	4.48	45.7	29.4	3.95	54.9	33.5	4.69

[z] Data courtesy of Indiana State Climate Office. Beth Hall and Jonathan Weaver. https://ag.purdue.edu/indiana-state-climate/. Taken from Purdue Mesonet stations

[y] Average minimum and maximum temperatures for each month.

[x] Total precipitation for each month.