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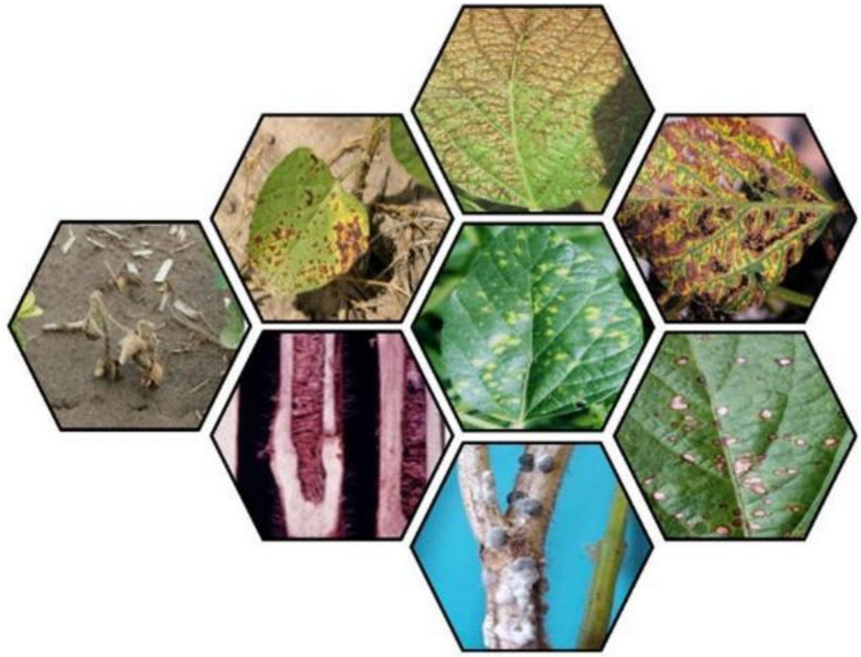

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# Applied Research in Field Crop Pathology for Indiana - 2020

## ACKNOWLEGEMENTS

This report is a summary of applied field crop pathology research trials conducted in 2020 under the direction of the Purdue Field Crop Pathology program in the Department of Botany and Plant Pathology at Purdue University. The authors wish to thank the Purdue Agronomy Research and Education Center, the Purdue Agricultural Centers, and the many cooperators and contributors who provided the resources needed to support the applied field crop pathology research program in Indiana. Special recognition is extended to Jeffrey Ravellette, Su Shim, and Camila Rocco da Silva for technical skills in managing field trials, data organization and processing, and help preparing this report; Mariama Brown, Tiffanna Ross, Natalia Piñeros, and Audrey Conrad graduate students who assisted with field trial data collection and analysis; Cayla Haupt, Emily Duncan, and Kaitlin Waibel, undergraduate student interns that assisted with field trial data collection and scouting; Dr. Tom Creswell, Dr. John Bonkowski, and Todd Abrahamson with the Purdue Plant Pest Diagnostic Laboratory (PPDL) for assistance in pathogen surveys and diagnosis; and Dr. Damon Smith and Dr. Daren Mueller for providing peer-review. Collectively, the contributions of colleagues, professionals, students, and growers were responsible for a highly successful and productive program to evaluate products and practices for disease management in field crops.

The authors would also like to thank the following for their support in 2020:

| | |
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# SUMMARY OF 2020 FIELD CROP DISEASE SEASON

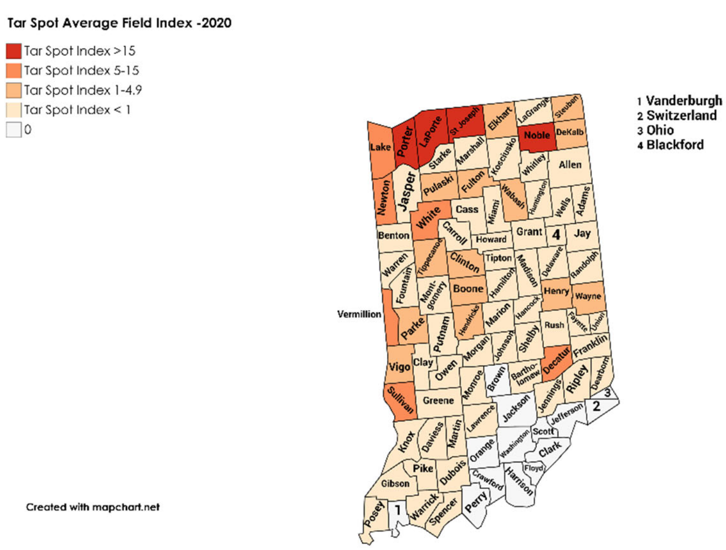
## CORN

In 2020, most diseases on corn in Indiana remained relatively low across the state, with a few exceptions, as listed below. Gray leaf spot, northern corn leaf blight, northern corn leaf spot and Diplodia 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 2020 following the localized epidemics experienced in 2018 and 2019. In 2020, Indiana continued to have localized epidemics, but they were not as widespread as seen previously. 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 second year of tar spot-directed research has been completed here in Indiana. As a cautionary note, it is important to have multiple years of data for verification, but the initial results do serve as a good starting point for making future management decisions.

The field crop pathology team made a large effort at the end of the season to scout for tar spot across the state. Twelve new counties were confirmed with tar spot in 2020, making 78 counties total in Indiana. Out of the 201 fields scouted, 151 were positive for tar spot (75.1%). 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 – the darker orange the county, the greater tar spot index observed in 2020. 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 central Indiana. The map also parallels the weather conditions and reports during 2020. It is important to document tar spot movement in the state, should favorable conditions arise, increasing tar spot disease risk across the remainder of the state.



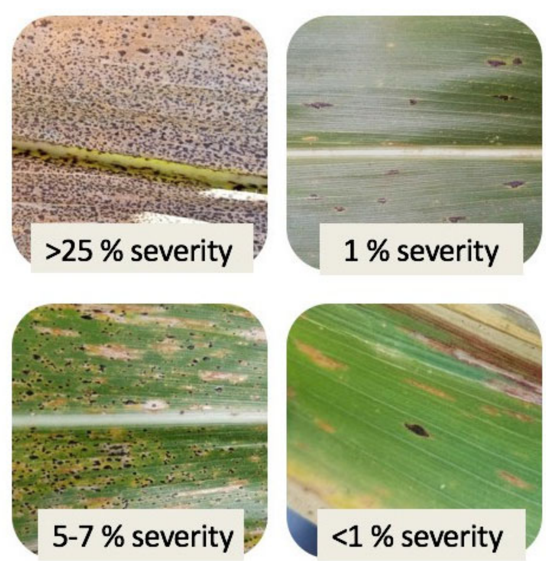




Figure 1. 2020 tar spot index for Indiana. The darker orange the county, the greater the field incidence and severity of tar spot in the fields in which it was found. The range of tar spot severity on leaves ->25%, 5-7%, 1% and <1%. Photo credit: D. Telenko.

# SUMMARY OF 2020 FIELD CROP DISEASE SEASON

### Southern corn rust:

Southern corn rust was first found in Indiana on July 25, 2020, and by the end of the season, a total of 59 counties were confirmed (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.

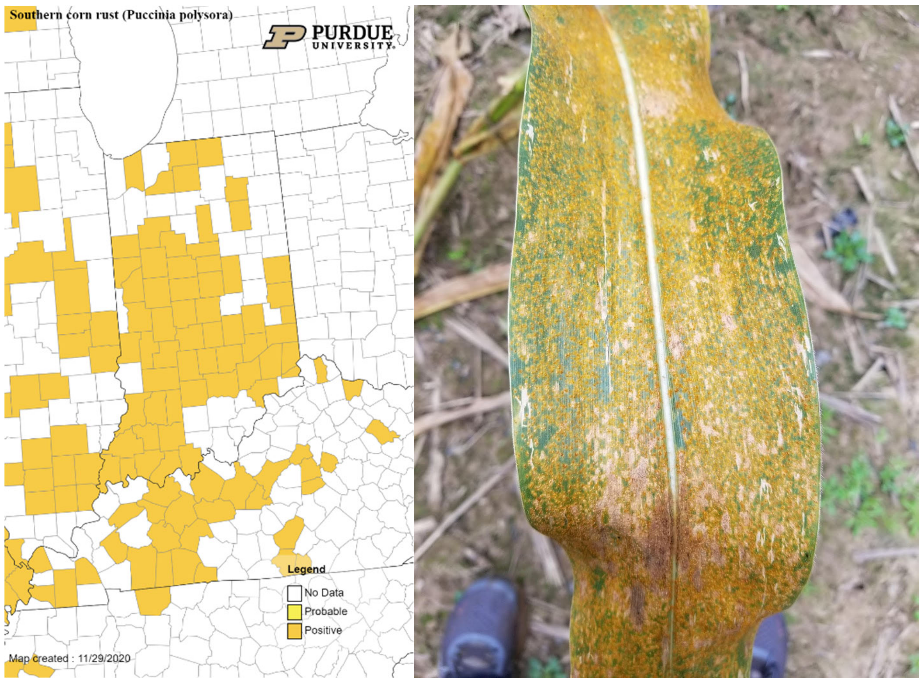



Figure 2. Southern corn rust map of confirmed (yellow) counties that had southern corn rust in Indiana in 2020 and a corn leaf with severe southern rust infection. Photos credit: D. Telenko, Map source: https://corn.ipmpipe.org/southerncornrust/

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 2021.** 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 a few spots of sudden death syndrome and white mold as well. In general, it was a quiet year for diseases in soybean.

### WHEAT

Fusarium head blight (FHB) or scab is one of the most impactful diseases of wheat and most challenging to prevent. In addition, FHB infection can cause the production of a mycotoxin called deoxynivalenol (DON or vomitoxin). The conditions in 2020 were moderately conducive to FHB development. Our research sites in both West Lafayette and Vincennes had moderate 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. This includes selection of varieties with moderate resistance and timely fungicide application at flowering. Other diseases observed in our wheat trials in 2020 included leaf rust, Septoria leaf and glume blotch, and stripe rust.

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

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**Comparison of fungicides applied at VT/R1 or R3 for foliar diseases in corn in central Indiana, 2020 (COR20-01.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 'P9998AM' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 25 May. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. In-furrow treatments were applied while planting at 24 May. Fungicides were applied on 25 July at the VT/R1 (tassel/silk) and 18 Aug at the R3 (milk) growth stage. Disease ratings were assessed on 25 Aug at beginning R5 (dent) and 9 Sep at late R6 (maturity) growth stages. Disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, five plants were assessed per plot and averaged before analysis. The two center rows of each plot were harvested on 6 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 test (LSD; α=0.05).

In 2020, gray leaf spot (GLS), northern corn leaf blight (NCLB), and Physoderma brown spot and stalk rot were the most prominent diseases in the trial and reached low severity. All fungicide programs significantly reduced gray leaf spot severity on the ear leaf compared to the nontreated controls on 25 Aug and 9 Sep, except Veltyma at R3 on 25 Aug (Table 1). All fungicides increased the percentage of stay green over nontreated controls. Lucento at VT/R1 and R3, Veltyma at VT/R1, Xyway in-furrow, resulted in greener plots than Veltyma at R3, Delaro at R3, and Quilt Xcel at R3, but these were not significantly different from any of the other treatments. There was no significant difference between treatments for 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] 25-Aug | GLS % severity[y] 9-Sep | Stay green[x] 9-Sep | Harvest moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | 1.8 ab | 7.9 a | 73.8 d | 21.5 | 55.0 | 198.6 |
| Lucento 4.17 SC 5.0 fl oz at VT/R1 | 0.2 fg | 0.3 d | 95.0 a | 20.4 | 54.6 | 202.4 |
| Trivapro 2.21 SE 13.7 fl oz at VT/R1 | 0.3 ef | 0.6 d | 87.5 abc | 21.3 | 54.4 | 195.7 |
| Miravis Neo 2.5 SE 13.7 fl oz at VT/R1 | 0.4 def | 0.3 d | 93.8 ab | 21.6 | 54.2 | 217.8 |
| Veltyma 3.34 S 7.0 fl oz at VT/R1 | 0.1 fg | 0.1 d | 95.0 a | 21.2 | 54.3 | 193.3 |
| Delaro 325 SC 8.0 fl oz at VT/R1 | 0.2 fg | 0.6 d | 93.8 ab | 21.7 | 54.5 | 216.5 |
| Quilt Xcel 2.2 SE 10.5 fl oz at VT/R1 | 0.5 def | 1.1 d | 91.3 abc | 20.9 | 54.4 | 196.5 |
| Headline AMP 1.68 SC 10.0 fl oz at VT/R1 | 0.2 fg | 0.7 d | 90.0 abc | 21.8 | 54.4 | 204.0 |
| Revytek 3.33 LC 8.0 fl oz at VT/R1 | 0.7 c-g | 0.2 d | 93.8 ab | 22.3 | 53.3 | 217.7 |
| Xyway LFR 15.2 fl oz in-furrow | 0.2 fg | 0.7 d | 95.0 a | 21.1 | 57.7 | 193.5 |
| Xyway LFR 8.35 fl oz in-furrow fb Lucento 4.17 SC 5.0 fl oz at VT/R1 | 0.1 g | 0.2 d | 90.0 abc | 21.9 | 54.1 | 208.4 |
| Lucento 4.17 SC 5.0 fl oz at R3 | 0.6 d-g | 0.9 d | 95.0 a | 20.9 | 54.7 | 205.7 |
| Trivapro 2.21 SE 13.7 fl oz at R3 | 1.0 b-g | 1.3 d | 87.5 abc | 21.4 | 54.8 | 209.5 |
| Miravis Neo 2.5 SE 13.7 fl oz at R3 | 1.0 a-d | 0.7 d | 87.5 abc | 20.8 | 54.3 | 203.2 |
| Veltyma 3.34 S 7.0 fl oz at R3 | 2.2 a | 1.7 cd | 83.8 c | 21.5 | 54.9 | 204.5 |
| Delaro 325 SC 8.0 fl oz at R3 | 1.2 a-e | 3.7 bc | 83.8 c | 21.2 | 54.5 | 203.9 |
| Quilt Xcel 2.2 SE 10.5 fl oz at R3 | 1.1 b-f | 1.6 d | 86.3 bc | 21.1 | 54.1 | 211.3 |
| Headline AMP 1.68 SC 10.0 fl oz at R3 | 0.8 c-g | 1.1 d | 87.5 abc | 21.2 | 54.6 | 201.0 |
| Revytek 3.33 LC 8.0 fl oz at R3 | 1.6 abc | 1.3 d | 83.8 c | 20.9 | 54.5 | 215.9 |
| Nontreated control | 0.7 c-g | 5.28 b | 75.0 d | 21.4 | 54.1 | 198.6 |
| *p*-value | 0.0006 | <.0001 | <.0001 | 0.0539 | 0.9097 | 0.5520 |
| LSD (0.05)[v] | 1.0 | 2.0 | 8.0 | NS[u] | NS | NS |

[z] Fungicide treatments applied on 25 July at VT/R1 (tassel/silk) and 18 Aug at the R3 (milk) growth stage. 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; five plants were assessed per plot and averaged before analysis. GLS = gray leaf spot. [x] Stay green visually assessed percentage (0-100%) of crop canopy green on 9 Sep. [w] Yields were adjusted to 15.5% moisture and harvested on 6 Oct. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

T. J. Ross, J. D. Ravellette, S. Shim, and D. E. P. Telenko
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Purdue University, West Lafayette, IN 47907

**Uniform fungicide trial for tar spot and other foliar diseases in corn in central Indiana, 2020 (COR20-02.ACRE).**

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 25 May using a John Deere 1700 six row planter. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 25 July at VT/R1 (tassel/silk) growth stage. Disease ratings were assessed on 25 Aug and 23 Sep at the early R4 (dough) and R5 (dent) growth stages respectively. Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on in the lower and upper canopy. The two center rows of each plot were harvested on 18 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 test (LSD; α=0.05).

Gray leaf spot (GLS) and tar spot were the most prominent diseases in the trial and reached low severity. All fungicide treatments reduced severity of GLS and tar spot, and increased percentage of stay green over the nontreated control (Table 2). Headline Amp had the highest percent of stay green plots on 23 Sep, but was only significantly different from Tilt. There was no significant difference between treatments for harvest moisture, test weight, and yield.

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

| Treatment[z] | Rate/A | GLS % severity lower canopy[y] 25-Aug | Tar spot % stroma[y] 23-Sep | Stay green[x] 23-Sep | Harvest moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated Control | | 15.0 a | 0.10 a | 48.8 c | 18.7 | 55.6 | 227.9 |
| Revytek 3.33 LC | 8.0 fl oz | 5.0 b | 0.03 b | 65.0 ab | 18.8 | 55.4 | 220.0 |
| Veltyma 3.34 SC | 7.0 fl oz | 4.5 b | 0.01 b | 62.5 ab | 18.8 | 56.0 | 227.0 |
| Headline 2.08 SC | 6.0 fl oz | 5.8 b | 0.03 b | 63.8 ab | 18.9 | 55.9 | 230.0 |
| Headline AMP 1.68 SE | 10.0 fl oz | 5.5 b | 0.03 b | 68.8 a | 18.9 | 56.4 | 222.2 |
| Aproach Prima 2.34 SC | 6.8 fl oz | 5.5 b | 0.01 b | 65.0 ab | 19.1 | 56.3 | 226.1 |
| Miravis Neo 2.5 SE | 13.7 fl oz | 6.3 b | 0.01 b | 60.0 abc | 18.3 | 56.1 | 222.6 |
| Delaro 325 SC | 8.0 fl oz | 7.5 b | 0.01 b | 53.8 bc | 18.8 | 56.5 | 219.7 |
| Lucento 4.1 SC | 5.0 fl oz | 5.5 b | 0.03 b | 62.5 ab | 18.5 | 56.5 | 222.9 |
| Tilt 3.6 EC 4 | 4.0 fl oz | 5.5 b | 0.03 b | 55.0 bc | 19.1 | 56.2 | 223.1 |
| *p*-value | | <.0001 | 0.0045 | 0.0346 | 0.8332 | 0.2581 | 0.6274 |
| LSD (0.05)[v] | | 3.38 | 0.04 | 11.41 | NS[u] | NS | NS |

[z] Fungicide treatments applied 25 July at VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on lower canopy on 25 Aug. GLS=gray leaf spot.
[x] Stay green visually assessed percentage (0-100%) of crop canopy green on 23 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 18 Oct.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

CORN (*Zea mays* 'W2585SSRIB')
Gray leaf spot; *Cercospora zeae-maydis*
Tar spot; *Phyllachora maydis*

C. R. Da Silva, J. D. Ravellette, S.Shim, and D. E. P. Telenko
Dept. Botany and Plant Pathology
Purdue University, West Lafayette, IN 47907

**Fungicide timing and model validation for tar spot in corn in central Indiana, 2020 (COR20-04.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 34,000 seeds/A on 25 May using a John Deere 1700 six row planter. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 1 Jul at the V8, on 13 Jul at the V10, on 25 Jul on the VT/R1 (tassel/silk), on 9 Aug at the R2 (blister), on 18 Aug at the R3 (milk), on 25 Aug at the R4 (dough), and on 9 Sep at the R5 (dent) growth stages. No applications were made based on the Tarspotter app. Gray leaf spot (GLS) was rated by visually assessing as percentage (0-100%) severity of disease on lower canopy on 25 Aug at R3 growth stage. Tar spot was assessed on 15 Sep at R5 (dent) 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 18 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 test (LSD; α=0.05).

Gray leaf spot (GLS) and tar spot were the most prominent diseases in the trial and reached low severity. All fungicide treatments reduced severity of GLS on 25 Aug in the lower canopy, and tar spot on 15 Sep on ear leaf over the nontreated control (Table 3). There was no significant difference between treatments for stay green, harvest moisture, test weight, and yield.

Table 3. Effect of fungicide foliar disease severity and yield.

| Treatments and rate/A[z] | Timing | GLS % severity[y] 25-Aug | Tar spot % stroma[x] 15-Sep | Stay green %[w] 23-Sep | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 9.3 a | 0.3 a | 58.8 | 19.3 | 55.9 | 215.2 |
| Trivapro 2.21 SE 13.7 fl oz | V8 | 1.5 e | 0.3 ab | 46.3 | 19.5 | 55.9 | 212.0 |
| Trivapro 2.21 SE 13.7 fl oz | V10 | 2.8 de | 0.3 abc | 60.0 | 20.1 | 56.0 | 209.5 |
| Trivapro 2.21 SE 13.7 fl oz | VT/R1 | 4.3 cd | 0.2 bcd | 63.8 | 19.6 | 56.0 | 208.2 |
| Trivapro 2.21 SE 13.7 fl oz | R2 | 5.5 bc | 0.1 de | 66.3 | 19.8 | 55.9 | 206.4 |
| Trivapro 2.21 SE 13.7 fl oz | R3 | 5.0 c | 0.0 e | 61.3 | 19.7 | 55.2 | 210.6 |
| Trivapro 2.21 SE 13.7 fl oz | R4 | 4.3 cd | 0.0 e | 58.8 | 19.8 | 56.0 | 209.7 |
| Trivapro 2.21 SE 13.7 fl oz | R5 | 4.5 cd | 0.1 cde | 60.0 | 19.8 | 56.0 | 203.3 |
| Trivapro 2.21 SE 13.7 fl oz | V8 fb VT | 1.0 e | 0.4 a | 60.0 | 19.3 | 56.0 | 203.4 |
| Trivapro 2.21 SE 13.7 fl oz | Tarspotter (no appl.) | 7.0 b | 0.2 abc | 51.3 | 18.8 | 56.18 | 207.0 |
| p-value | | <.0001 | 0.0002 | 0.3830 | 0.5399 | 0.3535 | 0.9046 |
| LSD (0.05)[u] | | 1.9 | 0.2 | NS[t] | NS | NS | NS |

[z] Fungicide treatments applied on 1 Jul at the V8, on 13 Jul at the V10, on 25 Jul on the VT/R1 (tassel/silk), on 9 Aug at the R2 (blister), on 18 Aug at the R3 (milk), on 25 Aug at the R4 (dough), and on 9 Sep at the R5 (dent) growth stages. No Tarspotter App treatment as the model never crossed the threshold. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. fb = followed by.
[y] Disease severity visually assessed percentage (0-100%) of lower canopy on 25 Aug. GLS = gray leaf spot.
[x] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf.
[w] Stay green visually assessed percentage (0-100%) of crop canopy green on 23 Sep.
[v] Yields were adjusted to 15.5% moisture and harvested on 18 Oct.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

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

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**Evaluation of fungicides for foliar disease in corn in central Indiana, 2020 (COR20-19.ACRE).**

Plots were established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The trial was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, with the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 25 May. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 24 Jun at V5/V6 growth stage, 17 Jul at V12, 25 Jul at R1 (silk), and 9 Aug at the R2 (blister) growth stage. Disease ratings were assessed on 25 Aug at R5 (dent) and 9 Sep at R6 (maturity) growth stages. Disease severity visually assessed as percentage (0-100%) of symptomatic leaf area on ear leaf, five plants were assessed per plot and averaged before analysis. The two center rows of each plot were harvested on 6 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 test (LSD; α=0.05).

In 2020, gray leaf spot (GLS) was the most prominent diseases in the trial and reached low severity. All fungicides significantly reduced GLS severity over nontreated control by 9 Sep, except Delaro Complete 458 SC applied at V5 was not different from nontreated control on 25 Aug and had significantly more disease than all other treatments on 9 Sep (Table 4). Harvest moisture was significantly higher under Trivapro, Miravis Neo and Veltyma treatments. There was no significant difference between treatments for test weight and corn yield.

Table 4. Effect of fungicide on foliar disease and corn yield.

| Treatment[z] | Rate/A | Timing | GLS % severity[y] 25-Aug | GLS % severity[y] 9-Sep | Harvest moisture % 6-Oct | Test weight lb/bu 6-Oct | Yield[x] bu/A 6-Oct |
|---|---|---|---|---|---|---|---|
| Nontreated control | | | 1.1 a | 2.5 a | 21.1 b | 54.0 | 195.7 |
| Miravis Neo 2.5 SE | 13.7 fl oz | V12 | 0.0 c | 0.1 c | 22.3 ab | 54.0 | 206.2 |
| Trivapro 2.21 SE | 13.7 fl oz | V12 | 0.2 bc | 0.4 c | 22.6 a | 53.4 | 200.9 |
| Miravis Neo 2.4 SE | 13.7 fl oz | R1 | 0.1 bc | 0.1 c | 22.7 a | 53.8 | 211.3 |
| Trivapro 2.21 SE | 13.7 fl oz | R1 | 0.1 bc | 0.3 c | 22.2 ab | 53.5 | 205.7 |
| Miravis Neo 2.4 SE | 13.7 fl oz | R2 | 0.5 b | 0.4 c | 22.2 ab | 53.6 | 205.2 |
| Delaro Complete 458 SC | 4.0 fl oz | V5 | 1.1 a | 1.1 b | 21.9 ab | 54.6 | 200.1 |
| Delaro Complete 458 SC | 8.0 fl oz | R1 | 0.2 bc | 0.3 c | 22.1 ab | 53.5 | 195.2 |
| Veltyma 3.34 S | 7.0 fl oz | R1 | 0.1 bc | 0.1 c | 23.1 a | 53.3 | 194.5 |
| *p*-value | | | <.0001 | <.0001 | 0.0197 | 0.3910 | 0.7295 |
| LSD (0.05)[w] | | | 0.4 | 0.4 | 1.29 | NS[v] | NS |

[z] Fungicide treatments applied on 24 Jun at V5/V6 growth stage,17 Jul at V12, 25 Jul at R1 (silk) and 9 Aug at R2 (blister) growth stage. All treatments applied at R1 or R2 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, five plants were assessed per plot and averaged before analysis. GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 6 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P34A79X')
Septoria brown spot; *Septoria glycines*
Cercospora leaf blight; *Cercospora kikuchii/C.flagellaris*

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**Evaluation of fungicides for foliar diseases on soybean in central Indiana, 2020 (SOY20-01.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 'P34A79X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 2 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 29 Jul at the R3(beginning pod) growth stage. Disease ratings were assessed on 25 Aug at the R5 (beginning seed) and 9 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. The two center rows were harvested on 16 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 Protected Least Significant Difference test (LSD; α=0.05).

In 2020, weather conditions were unfavorable for frogeye leaf spot (FLS). Septoria brown spot (SBS) and Cercospora leaf blight (CLB) were the most prominent diseases in the trial and reached a low severity. All fungicide treatments significantly reduced SBS severity over nontreated control on both 25 Aug and 9 Sep. All fungicide treatments significantly reduced CLB severity over nontreated control on 9 Sep, except for Quadris Top SBX, Lucento, and Trivapro. (Table 5). No significant treatment differences detected for soybean test weight and yield.

Table 5. Effect of fungicide on foliar diseases severity and soybean yield.

| Treatment[z] | Rate/A | SBS % severity[y] 25-Aug | SBS % severity[y] 9- Sep | CLB % severity[y] 9- Sep | Harvest Moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 3.1 a | 8.8 a | 0.4 ab | 10.3 bc | 56.3 | 62.9 |
| Preemptor 3.22 SC | 5.0 fl oz | 1.1 b | 0.9 c | 0.0 c | 10.5 ab | 56.1 | 60.7 |
| Topguard EQ 4.29 SC | 5.0 fl oz | 0.3 b | 1.6 bc | 0.0 c | 10.3 ab | 55.9 | 60.9 |
| Quadris Top SBX 3.76 SC | 7.0 fl oz | 0.6 b | 0.6 c | 0.2 bc | 10.1 c | 56.3 | 66.6 |
| Lucento 4.17 SC | 5.0 fl oz | 0.3 b | 0.9 c | 0.3 bc | 10.1 c | 56.4 | 64.9 |
| Miravis Top 1.67 SC | 13.7 fl oz | 0.1 b | 0.2 c | 0.0 c | 10.1 c | 56.3 | 66.5 |
| Priaxor Xemium SC | 4.0 fl oz | 0.6 b | 0.8 c | 0.0 c | 10.3 abc | 56.2 | 64.6 |
| Trivapro 2.21 SE | 13.0 fl oz | 1.0 b | 0.8 c | 0.5 a | 10.3 bc | 56.1 | 61.0 |
| Delaro 325 SC | 8.0 fl oz | 0.4 b | 0.9 c | 0.0 c | 10.7 a | 56.4 | 62.3 |
| Headline AMP 1.68 SC | 10.0 fl oz | 1.0 b | 3.0 b | 0.0 c | 10.4 abc | 56.2 | 62.3 |
| Veltyma 3.34 S | 7.0 fl oz | 0.3 b | 0.8 c | 0.1 c | 10.2 bc | 56.3 | 64.9 |
| Revytek 3.33 LC | 8.0 fl oz | 0.2 b | 0.4 c | 0.0 c | 10.4 abc | 56.2 | 61.2 |
| P(F) | | 0.0002 | <.0001 | 0.0044 | 0.0458 | 0.8710 | 0.4602 |
| LSD (0.05)[w] | | 1.09 | 1.8 | 0.27 | 0.4 | 0.6 | NS[v] |

[z] Fungicide treatments applied on 29 Jul at the R3 (beginning pod) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. fb = followed by.
[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on 25 Aug and 9 Sep. SBS = Septoria brown spot in the lower canopy; CLB = Cercospora leaf blight in the upper canopy.
[x] Yields were adjusted to 13% moisture and harvested on 16 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P35T75X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
Cercospora leaf blight; *Cercospora kikuchii/C.flagellaris*

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**Evaluation of fungicides for foliar diseases on soybean in central Indiana, 2020 (SOY20-13.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 'P35T75X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 2 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 29 Jul at the R3 (beginning pod) growth stage. Disease ratings were assessed on 9 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies. The two center rows were harvested on 14 Oct and yields were adjusted to 13% 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 2020, weather conditions were unfavorable for soybean disease. Frogeye leaf spot (FLS), Septoria brown spot (SBS) and Cercospora leaf blight (CLB) were the most prominent diseases in the trial and reached a low severity. All fungicides reduced FLS, SBS and CLB on 9 Sep over nontreated control (Table 6). Miravis top and Revytek had the lowest amount of SBS, but were not significantly different from Lucento, Lucento plus Quadris, and Delaro. No significant treatment effects detected for soybean harvest moisture, test weight, and yield.

Table 6. Effect of fungicide on foliar disease severity and soybean yield.

| Treatment[z] | Rate/A | FLS % severity[y] 9-Sep | SBS % severity[y] 9-Sep | CLB % severity[y] 9-Sep | Harvest moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 0.1 a | 7.5 a | 0.1 a | 11.4 | 56.5 | 54.5 |
| Topguard EQ | 5.0 fl oz | 0.0 b | 2.5 b | 0.0 b | 11.5 | 56.4 | 58.0 |
| Lucento 4.17 SC | 5.0 fl oz | 0.0 b | 1.9 bc | 0.0 b | 11.3 | 56.7 | 57.9 |
| Lucento 4.17 SC<br>+ Quadris 2.08 SC | 5.0 fl oz<br>6.0 fl oz | 0.0 b | 0.9 bc | 0.0 b | 11.4 | 56.5 | 55.5 |
| Miravis Top 1.67 SC | 13.7 fl oz | 0.0 b | 0.1 c | 0.0 b | 11.4 | 56.1 | 57.9 |
| Revytek 3.33 LC | 8.0 fl oz | 0.0 b | 0.5 c | 0.0 b | 11.5 | 56.7 | 56.9 |
| Delaro 325 SC | 8.0 fl oz | 0.0 b | 0.8 bc | 0.0 b | 11.5 | 56.5 | 54.5 |
| *p*-value | | <.0001 | <.0001 | 0.0327 | 0.5540 | 0.7546 | 0.6860 |
| LSD (0.05)[w] | | 0.0 | 2.0 | 0.03 | NS[v] | NS | NS |

[z] Fungicide treatments applied on 29 Jul at the R3 growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25%.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms on 9 Sep. FLS = frogeye leaf spot rated in upper canopy; SBS = Septoria brown spot rated in the lower canopy; CLB= Cercospora leaf blight rated in the upper canopy.
[x] Yields were adjusted to 13% moisture and harvested on 14 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P25A27X' & 'P24T76E' )
Sudden death syndrome; *Fusarium virguliforme*
Soybean cyst nematode; *Heterodera glycines*

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**Compare the efficacy of seed treatments in soybean in central Indiana, 2020 (SOY20-17.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 'P25A27X' (resistant) and 'P24T76E' (susceptible) were planted in 30-inch row spacing at a rate of 8 seeds/ft on 5 Jun. Seed treatments were applied on seeds before planting. Ten roots per plot were sampled from border rows at R4 on 24 Aug, gently washed and rated for root rot severity on scale of 0-100%. Disease ratings were assessed on 25 Aug at the R5 (beginning pod/full pod). 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 14 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, very little disease developed in plots. Sudden death syndrome (SDS) was the most prominent disease in the trial but only reached low severity. Soybean cyst nematode (SCN) egg count in spring soil samples ranged from 300-700 eggs/100 cc soil, a low to moderate range. There was no significant difference between seed treatments for SDS incidence and severity rated on 25 Aug (Table 7). There was no significant differences between seed treatments for root rot on 24 Aug. There were significant differences between seed treatments and variety for harvest moisture and test weight. There was no significant difference between seed treatments and variety for soybean yield.

Table 7. Effect of seed treatment on SDS, root rot, and yield of soybean.

| Treatment[z] | Variety | SDS DI[y] 25-Aug | SDS DS[y] 25-Aug | SDS Index[y] 25-Aug | Root rot %[x] 24-Aug | Harvest moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|---|---|---|
| Nontreated control | P25A27X | 0.1 | 0.1 | 0.01 | 4.6 | 11.4 c | 55.2 ab | 52.5 |
| ILEVO | P25A27X | 0.0 | 0.0 | 0.00 | 3.9 | 11.5 bc | 55.5 a | 54.0 |
| Saltro | P25A27X | 0.0 | 0.0 | 0.00 | 4.0 | 11.6 b | 55.2 ab | 56.3 |
| Nontreated control | P24T76E | 0.0 | 0.0 | 0.00 | 5.3 | 11.9 a | 55.2 ab | 55.2 |
| ILEVO | P24T76E | 0.0 | 0.0 | 0.00 | 5.0 | 11.9 a | 55.0 bc | 53.9 |
| Saltro | P24T76E | 0.3 | 0.5 | 0.06 | 5.0 | 11.9 a | 54.8 c | 58.4 |
| *p*-value | | 0.4890 | 0.4890 | 0.4890 | 0.3592 | <.0001 | 0.0396 | 0.8113 |
| LSD (0.05)[v] | | NS[u] | NS | NS | NS | 0.1 | 0.4 | NS |

[z] Seed treatments were pre-applied to the seed of varieties of 'P25A27X' (resistant) and 'P24T76E'(susceptible).
[y] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). Disease incidence refers to the percentage of plants with disease symptoms, and disease severity (DS) was rated using a 1-9 scale where 1 refers to low disease pressure and 9 refers to premature death of the plant. SDS Index was then calculated using the equation: DX= (DI x DS)/9.
[x] Ten roots per plot were sampled from border rows at R4, gently washed and rated for root rot severity on scale of 0-100%.
[w] Yields were adjusted to 13% moisture and harvested on 14 Oct.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P35T75X')
Frogeye leaf spot; *Cercospora sojina*
Septoria brown spot; *Septoria glycines*
Cercospora leaf blight; *Cercospora kikuchii/ C.flagellaris*

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**Evaluation of fungicides for foliar diseases on soybean in central Indiana, 2020 (SOY20-21.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 'P35T75X' was planted in 30-inch row spacing at a rate of 140,000 seeds/A on 2 June. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 29 Jul at the R3 growth stage. Disease ratings were assessed on 9 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS), Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. The two center rows were harvested on 16 Oct and yields were adjusted to 13% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2020, weather conditions were unfavorable for soybean disease. Frogeye leaf spot (FLS), Septoria brown spot (SBS) and Cercospora leaf blight (CLB) were the most prominent diseases in the trial and reached a low severity. There were no differences between nontreated control and all fungicide treatments for FLS on 9 Sep (Table 8). All fungicides reduced SBS on 20 Sep over nontreated control. CLB was reduced by all fungicide treatments on 20 Sep over nontreated control, except Miravis Neo and Trivapro. No significant treatment effects detected for soybean harvest moisture, test weight, and yield.

Table 8. Effect of fungicide on foliar disease severity and yield.

| Treatment[z] | Rate/A | FLS % severity[y] 9-Sep | SBS % severity[y] 9-Sep | CLB % severity[y] 9-Sep | Harvest moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated check | | 0.05 | 7.5 a | 0.5 ab | 10.2 | 56.7 | 59.9 |
| Miravis Neo 2.5 SE | 13.7 fl oz | 0.00 | 0.3 b | 0.2 bc | 10.0 | 56.2 | 63.5 |
| Miravis Top 1.67 SC | 13.7 fl oz | 0.00 | 0.4 b | 0.0 d | 10.0 | 56.2 | 61.8 |
| Miravis Neo 2.5 SE<br>+ Endigo ZCX | 13.7 fl oz<br>4.0 fl oz | 0.00 | 0.5 b | 0.4 a-c | 10.1 | 56.1 | 64.5 |
| Miravis Top 1.67 SC<br>+ Endigo ZCX | 13.7 fl oz<br>4.0 fl oz | 0.00 | 0.4 b | 0.1 cd | 10.1 | 56.3 | 66.9 |
| Delaro Complete 458 SC | 8.0 fl oz | 0.00 | 0.5 b | 0.0 d | 10.3 | 56.2 | 61.5 |
| Lucento 4.17 SC | 5.0 fl oz | 0.00 | 0.9 b | 0.0 d | 10.3 | 56.4 | 60.3 |
| Priaxor 4.17 SC | 4.0 fl oz | 0.00 | 0.8 b | 0.1 cd | 10.6 | 56.8 | 61.8 |
| Revytek 3.33 LC | 8.0 fl oz | 0.03 | 0.9 b | 0.0 d | 10.3 | 56.6 | 57.2 |
| Trivapro 2.21 SE | 13.7 fl oz | 0.00 | 0.9 b | 0.6 a | 10.1 | 56.2 | 65.4 |
| *p*-value | | 0.0678 | <.0001 | 0.0117 | 0.2859 | 0.5116 | 0.1542 |
| LSD (0.05)[w] | | NS[v] | 1.36 | 0.37 | NS | NS | NS |

[z] Fungicide treatments applied on 29 Jul at the R3 growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v, except Delaro Complete 458 SC which contained induce 0.12 % v/v.
[y] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms. FLS = frogeye leaf spot in upper canopy; SBS = Septoria brown spot in lower canopy; CLB=Cercospora leaf blight in upper canopy.
[x] Yields were adjusted to 13% moisture and harvest on 16 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

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

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**Evaluation of fungicides for white mold in soybean in central Indiana, 2020 (SOY20-31.ACRE).**

A trial was established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows were used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were used. Soybean variety 'P34A79X' was planted in 30-inch row spacing at a rate of 10 seeds/ft on 24 May. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 25 May at 1 DAP, 2 June at VE/VC (emergence/cotyledon), 24 June at V3/V4, 1 July at V5, 8 July at R1 (beg. bloom),15 July R2 (full bloom), and 29 July at R3/R4 (beginning seed/full pod) growth stage. Injury was assessed as percent cupped and puckered plants per plot on 17 Jul. Disease severity was assessed on 15 Sep at the R6 (full pod) growth stages. White mold was rated by visually scoring 30 random plants in each plot as 0 (no symptoms), 1 (only lateral braches with lesions), 2 (lesions on main stem infection, but little to no effect on pod-fill), or 3 (lesions on main stem resulting in poor pod fill or plant death) and then the white mold index (DSI) was calculated, DSI = 100 all plants 3, DSI=0 all plants 0 (Grau, et al. 1992). The two center rows were harvested on 14 Oct and yields were adjusted to 13% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2020) and means were compared using Fisher's Protected Least Significant Difference test (LSD; α=0.05).

In 2020, weather conditions were unfavorable for soybean disease. White mold was present in the trial but only reached low levels. Injury severity was significantly increased for Cobra at all timing on 17 July (Table 9). There was no significant difference between fungicide treatments and nontreated control for white mold on 15 Sep. Cobra plus Oxidate applied at V4/V5 and at R3 led to increased canopy yellowing on 15 Sep over nontreated controls, although this treatment was not significantly different from the Cobra plus Endura program applied at V4/V5 and at R3 or the Oxidate program applied at R1, R2 and R3. There was no significant effect of treatments on soybean yield.

Table 9. Effect of fungicide on foliar diseases severity, soybean injury, and yield.

| Treatment, rate/A and timing[z] | Injury %[y] 17-Jul | White mold DSI Index[x] 15-Sep | Yellow %[w] 15-Sep | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | 0.0 c | 2.5 | 11.3 bcd | 10.6 | 55.9 | 68.2 |
| Endura 70 WDG 8.0 oz at R1 fb Endura 70 WDG 8.0 oz at R3 | 0.0 c | 2.5 | 6.8 d-g | 10.6 | 56.0 | 72.4 |
| Lektivar 16.0 fl oz at R1 fb Lektivar 16.0 fl oz at R3 | 0.0 c | 2.5 | 7.5 d-g | 10.6 | 55.6 | 75.2 |
| Cobra 6.0 fl oz + OxiDate 5.0, 1% v/v at V4-V5 fb Cobra 6.0 fl oz + OxiDate 5.0, 1% v/v at R3 | 3.3 b | 2.2 | 16.3 a | 10.6 | 55.9 | 69.7 |
| Endura 70 WDG 6.0 oz + Priaxor Xemium 4 fl oz at R1 fb Endura 70 WDG 6.0 oz + Priaxor Xemium 4.0 fl oz at R3 | 0.0 c | 1.4 | 3.0 g | 10.6 | 55.7 | 70.6 |
| Cobra 6.0 fl oz at R1 | 23.8 a | 1.4 | 5.5 efg | 10.6 | 55.9 | 69.9 |
| Cobra 6.0 fl oz at V4/V5 | 4.0 b | 1.1 | 7.5 d-g | 10.6 | 55.9 | 72.0 |
| Cobra 6.0 fl oz + Endura 70 WDG 8.0 oz at V4/V5 fb Cobra 6.0 fl oz + Endura 70 WDG 8.0 oz at R3 | 3.3 b | 2.5 | 12.5 abc | 10.6 | 55.4 | 70.3 |
| Endura 70 WDG 8.0 oz at R3 | 0.0 c | 2.2 | 6.3 efg | 10.6 | 55.8 | 69.9 |
| Xyway LFR 15.2 fl oz In-furrow | 0.0 c | 1.7 | 4.8 fg | 10.5 | 56.1 | 71.2 |
| Xyway LFR 15.2 fl oz Banded over row after planting | 0.5 c | 2.2 | 7.5 d-g | 10.6 | 55.8 | 70.4 |
| Lucento 4.17 SC 5.5 fl oz at V4-V5 | 0.0 c | 1.4 | 10.0 b-e | 10.6 | 55.8 | 72.0 |
| Endura 70 WDG 8.0 oz broadcast after planting | 0.0 c | 1.1 | 8.8 c-f | 10.6 | 55.8 | 75.0 |
| Endura 70 WDG 8.0 oz at V2-V3 | 0.0 c | 2.2 | 8.8 c-f | 10.6 | 55.9 | 70.2 |
| Endura 70 WDG 8.0 oz at R3 (drop nozzle) | 0.0 c | 2.8 | 6.3 efg | 10.6 | 55.9 | 72.5 |
| Lektivar 16.0 fl oz at R3 (drop nozzle) | 0.0 c | 1.7 | 10.0 b-e | 10.6 | 56.0 | 75.0 |
| OxiDate 5.0 1% v/v at R1 fb OxiDate 5.0 1% v/v at R2 fb OxiDate 5.0 1% v/v at R3 | 0.0 c | 1.1 | 13.8 ab | 10.6 | 55.7 | 73.4 |
| Nontreated control | 0.0 c | 0.6 | 8.8 c-f | 10.6 | 56.1 | 74.9 |
| *p*-value | <.0001 | 0.8969 | 0.0001 | 0.7088 | 0.8366 | 0.3868 |
| LSD (0.05)[u] | 2.0 | NS[t] | 4.9 | NS | NS | NS |

[z] Fungicide treatments applied on 25 May, 2 June, 24 June, 1 July, 8 July, 15 July, and 29 July at the 1 DAP, VE/VC (emergence/cotyledon), V3/V4 (third/forth node), V5 (fifth node), R1 (beginning bloom), R2 (full bloom), and R3/R4 (beginning seed/full pod) growth stage. All plots inoculated with *S. sclerotiorum*. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Injury assessed percent cupped and puckered plants per plot on 17 Jul. [x] White mold was rated by visually scoring 30 random plants in each plot as 0 (no symptoms), 1 (only lateral braches with lesions), 2 (lesions on main stem infection, but little to no effect on pod-fill), or 3 (lesions on main stem resulting in poor pod fill or plant death) and then the white mold index (DSI) was calculated, DSI = 100 all plants 3, DSI=0 all plants 0 (Grau, et al. 1992). [w] Yellow visually assessed percentage (0-100%) of crop canopy on 15 Sep. [v] Yields were adjusted to 13% moisture and harvested on 14 Oct. [u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [t] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* `P34A79X`)
White Mold; *Sclerotinia sclerotiorum*

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**Evaluation of fungicides for white mold in soybean in central Indiana, 2020 (SOY20-32.ACRE).**

Plots were established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows were used for evaluation. Standard practices for soybean production in Indiana were used. The previous crop was corn. The soybean hybrid 'P34A79X 'was planted in 30-inch row spacing at a rate of 100,000 seeds/A and 160,000 seeds/A on 1 June. All plots were inoculated with *Sclerotinia sclerotiorum* at 1.25 g/ft within the seedbed at planting. Standard practices for non-irrigated soybean production in Indiana were followed. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in apart at 3.6 mph. Fungicides were applied on 1 July, 29 July, and 13 Aug at V4/V5 (fourth trifoliolate/fifth trifoliolate), R3 (beginning pod), and R5 (beginning seed) growth stage, respectively. Disease severity was assessed on 15 Sep at R6 (full pod) growth stage. White mold was rated by visually scoring 30 random plants in each plot as 0 (no symptoms), 1 (only lateral braches with lesions), 2 (lesions on main stem infection, but little to no effect on pod-fill), or 3 (lesions on main stem resulting in poor pod fill or plant death) and then the white mold index (DSI) was calculated, DSI = 100 all plants 3, DSI=0 all plants 0 (Grau, et al. 1992). The two center rows were harvested on 16 Oct and yields were adjusted to 13% moisture. Data were subjected to mixed model analysis of variance (SAS 9.4, 2020) and means were compared using Fisher's Protected Least Significant Difference test (LSD; α=0.05).

In 2020, weather conditions were unfavorable for soybean disease. White mold was present in the trial but only reached low levels. There was no significant difference between fungicide treatments and nontreated control for white mold symptoms on 15 Sep (Table 10). There was no significant effect of treatment on moisture, test weight or soybean yield.

Table 10. Effect of fungicide on foliar diseases severity and soybean yield.

| Treatment, rate/A and timing[z] | White mold DSI Index[y] 15-Sep | Harvest moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|
| 100,000 seeds/A, Nontreated control | 0.0 | 10.6 | 56.2 | 71.9 |
| 100,000 seeds/A, Endura 70 WDG 8.0 oz at R3 | 0.0 | 10.6 | 56.6 | 74.7 |
| 100,000 seeds/A, Endura 70 WDG 8.0 oz at R5 | 0.8 | 10.7 | 56.3 | 74.3 |
| 100,000 seeds/A, Cobra 6.0 fl oz at V4/V5 | 0.0 | 10.8 | 56.4 | 73.2 |
| 160,000 seeds/A, Nontreated control | 0.0 | 10.6 | 56.2 | 75.6 |
| 160,000 seeds/A, Endura 70 WDG 8.0 oz at R3 | 0.0 | 10.8 | 56.3 | 79.2 |
| 160,000 seeds/A, Endura 70 WDG 8.0 oz at R5 | 0.3 | 10.6 | 56.4 | 72.0 |
| 160,000 seeds/A, Cobra 6.0 fl oz at V4/V5 | 0.3 | 10.9 | 56.4 | 77.4 |
| 100,000 seeds/A, Fertilizer, Nontreated control | 0.3 | 10.7 | 56.5 | 72.9 |
| 100,000 seeds/A, Fertilizer, Endura 70 WDG 8.0 oz at R3 | 0.3 | 10.5 | 56.4 | 68.4 |
| 100,000 seeds/A, Fertilizer, Endura 70 WDG 8.0 oz at R5 | 0.0 | 10.6 | 56.3 | 71.8 |
| 100,000 seeds/A, Fertilizer, Cobra 6.0 fl oz at V4/V5 | 0.8 | 10.6 | 56.4 | 69.5 |
| 160,000 seeds/A, Fertilizer, Nontreated control | 0.6 | 10.7 | 56.3 | 76.5 |
| 160,000 seeds/A, Fertilizer, Endura 70 WDG 8.0 oz at R3 | 0.0 | 10.5 | 56.5 | 71.7 |
| 160,000 seeds/A, Fertilizer, Endura 70 WDG 8.0 oz at R5 | 0.0 | 10.6 | 56.5 | 71.8 |
| 160,000 seeds/A, Fertilizer, Cobra 6.0 fl oz at V4/V5 | 0.0 | 10.6 | 56.1 | 74.4 |
| *p*-value | 0.7767 | 0.8015 | 0.8183 | 0.3786 |
| LSD (0.05)[w] | NS[v] | NS | NS | NS |

[z] Fungicide treatments applied on 1 July at V4/V5 (fourth trifoliolate/fifth trifoliolate), 29 July at R3 (beginning pod), and 13 Aug at R5 growth stage. All plots inoculated with *S. sclerotiorum*. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. [y] Disease severity was assessed on 15 Sep at the R6 (full pod) growth stages. White mold was rated by visually scoring 30 random plants in each plot as 0 (no symptoms), 1 (only lateral braches with lesions), 2 (lesions on main stem infection, but little to no effect on pod-fill), or 3 (lesions on main stem resulting in poor pod fill or plant death) and then the white mold index (DSI) was calculated, DSI = 100 all plants 3, DSI=0 all plants 0 (Grau, et al. 1992). [x] Yields were adjusted to 13% moisture and harvested on 16 Oct. [w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [v] NS = not significant (α=0.05).

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

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**Fusarium head blight (FHB) uniform fungicide trial in central Indiana, 2020 (WHT20-01.ACRE).**

Plots were established at the Purdue Agronomy Center for Research and Education (ACRE) in Tippecanoe County, IN. The experiment was a randomized complete block design with four replications. Plots were 7.5-ft wide and 20-ft long, consisted of 12 rows spaced 7.5 in. apart, and the center of each plot was used for evaluation. The previous crop was corn. Prior to planting, the field was disked and chisel plowed on 9 Oct 2019, and cultivated on 10 Oct 2019. Nitrogen MAP (11-52-0) at 300 lb/A was applied on 9 Oct 2019 and nitrogen (28%) at 30 gal/A was applied on 7 Mar 2020. On 15 Oct 2019 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 28 Apr 2020 for weed management. 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 and directed forward and backward at 45 degree angle, at 3.6 mph. Fungicides were applied on 21 May 2020 at Feekes growth stage 10.3, 29 May 2020 at the Feekes growth stage 10.5.1, and 3 Jun 2020 at Feekes growth stage 10.5.3. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 29 May. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot. Disease ratings were assessed on 17 June 2020. 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 of Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 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 test (LSD; α=0.05).

In 2020, weather conditions were moderately favorable for Fusarium head blight (FHB), leaf blotch, and glume blotch diseases. Fusarium head blight was the most prominent disease. FHB incidence, severity and index were reduced by all fungicide treatments over the nontreated control on 17 Jun (Table 11). Miravis Ace applied at Feekes 10.3 resulted in the lowest FHB percent incidence and index, but was not significantly different from all other fungicide treatments or timings. All fungicides and timings reduced percent incidence of leaf blotch over nontreated control. There were no differences in treatments from nontreated control for percent glume blotch and percent FDK (Tables 11 and 12). The concentration of deoxynivalenol (DON) was significantly reduced over the nontreated control by all treatments, while Caramba applied at 10.5.1 had higher levels of DON than fungicide programs of Miravis Ace applied at 10.5.1, 10.5.3, and Miravis Ace at 10.5.1 followed by Prosaro or Caramba at 10.5.3 (Table 12). There was no difference in wheat moisture, test weight or yield.

Table 11. Effect of fungicide on Fusarium head blight and foliar diseases in wheat.

| Treatment[z] | Rate/A | Timing | FHB % incidence[y] 17-Jun | FHB % severity[y] 17-Jun | FHB Index[x] 17-Jun | Leaf blotch % severity[w] 17-Jun | Glume blotch % severity[w] 17-Jun |
|---|---|---|---|---|---|---|---|
| Nontreated control | | | 65.0 a | 18.3 a | 11.6 a | 8.7 a | 0.4 |
| Prosaro 421 SC | 6.5 fl oz | 10.5.1 | 29.5 bc | 11.1 b | 3.3 bc | 4.9 b | 0.1 |
| Caramba 90 EC | 13.5 fl oz | 10.5.1 | 37.1 bc | 11.1 b | 4.5 bc | 2.8 b | 0.4 |
| BAS 84000F | 7.3 fl oz | 10.5.1 | 32.1 bc | 10.6 b | 3.7 bc | 3.6 b | 0.4 |
| USF0115 | 10.3 fl oz | 10.5.1 | 32.5 bc | 11.1 b | 3.9 bc | 2.4 b | 0.4 |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.3 | 23.8 c | 7.5 b | 1.8 c | 2.9 b | 0.0 |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.1 | 25.0 bc | 10.9 b | 2.7 bc | 3.7 b | 0.4 |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.3 | 34.6 bc | 9.2 b | 3.4 bc | 3.3 b | 0.0 |
| Miravis Ace 5.2 SC<br>fb Prosaro 421 SC | 13.7 fl oz<br>6.5 fl oz | 10.5.1<br>10.5.3 | 30.0 bc | 10.9 b | 3.3 bc | 3.3 b | 0.0 |
| Miravis Ace 5.2<br>fb Caramba 90 EC | 13.7 fl oz<br>13.5 fl oz | 10.5.1<br>10.5.3 | 26.7 bc | 8.8 b | 2.4 bc | 2.9 b | 0.4 |
| Miravis Ace 5.2<br>fb Folicur 3.6 F | 13.7 fl oz<br>4.0 fl oz | 10.5.1<br>10.5.3 | 25.4 bc | 7.9 b | 2.0 c | 3.1 b | 0.8 |
| *p*-value | | | <.0001 | 0.0006 | <.0001 | 0.0070 | 0.7876 |
| LSD (0.05)[v] | | | 12.7 | 3.9 | 2.3 | 2.85 | NS[u] |

[z] Fungicides treatments applied at Feekes 10.3, 10.5.1, and 10.5.3 all treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (40,000-100,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot on 29 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 Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [u] NS = not significant (α=0.05).

Table 12. Effect of fungicide on deoxynivalenol (DON), Fusarium damaged kernels (FDK), and yield of wheat.

| Treatment[z] | Rate/A | Timing | DON[y] ppm 7-Jul | FDK[x] % 7-Jul | Harvest moisture % 7-Jul | Test weight lb/bu 7-Jul | Yield[w] bu/A 7-Jul |
|---|---|---|---|---|---|---|---|
| Nontreated control | | | 0.548 a | 5.1 | 13.0 | 58.8 | 96.0 |
| Prosaro 421 SC | 6.5 fl oz | 10.5.1 | 0.209 bc | 4.9 | 13.6 | 58.4 | 92.1 |
| Caramba 90 EC | 13.5 fl oz | 10.5.1 | 0.363 b | 4.8 | 13.7 | 58.3 | 91.0 |
| BAS 84000F | 7.3 fl oz | 10.5.1 | 0.205 bc | 5.0 | 13.3 | 58.3 | 99.5 |
| USF0115 | 10.3 fl oz | 10.5.1 | 0.205 bc | 5.0 | 12.9 | 59.1 | 98.5 |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.3 | 0.278 bc | 5.5 | 13.7 | 58.6 | 95.4 |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.1 | 0.188 c | 4.3 | 13.4 | 59.2 | 99.0 |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.3 | 0.150 c | 5.3 | 14.0 | 58.7 | 94.4 |
| Miravis Ace 5.2 SC fb Prosaro 421 SC | 13.7 fl oz<br>6.5 fl oz | 10.5.1<br>10.5.3 | 0.158 c | 4.9 | 13.7 | 58.9 | 98.3 |
| Miravis Ace 5.2 fb Caramba 90 EC | 13.7 fl oz<br>13.5 fl oz | 10.5.1<br>10.5.3 | 0.148 c | 5.5 | 13.7 | 58.5 | 96.1 |
| Miravis Ace 5.2 fb Folicur 3.6 F | 13.7 fl oz<br>4.0 fl oz | 10.5.1<br>10.5.3 | 0.210 bc | 4.9 | 13.6 | 58.6 | 98.0 |
| *p*-value | | | 0.0013 | 0.1775 | 0.0531 | 0.1928 | 0.4282 |
| LSD (0.05)[v] | | | 0.17 | NS[u] | NS | NS | NS |

[z] Fungicides treatments applied at Feekes 10.3, 10.5.1, and 10.5.3 all treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. All plots inoculated with *Fusarium graminearum* spore suspension (40,000-100,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot on 29 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 7 Jul.

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

[u] NS = not significant (α=0.05).

WHEAT (*Triticum aestivum*); 'P25R40' and 'P25R61'
Fusarium head blight; *Fusarium graminearum*
Stagnospora leaf blotch; *Stagnospora nodorum*

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**Fusarium head blight (FHB) integrated management trial in central Indiana, 2020 (WHT20-02.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 9 Oct 2019, and cultivated on 10 Oct 2019. Nitrogen MAP (11-52-0) at 300 lb/A was applied on 9 Oct 2019 and nitrogen (28%) at 30 gal/A was applied on 7 Mar 2020. On 15 Oct 2019 wheat cultivars P25R40 (scab susceptible) and P25R61 (scab moderately resistant) were 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 28 Apr 2020 for weed management. 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 and directed forward and backward at 45 degree angle, at 3.6 mph. Fungicides were applied on 21 May 2020 at Feekes growth stage 10.3, 29 May 2020 at the Feekes growth stage 10.5.1, and 3 Jun 2020 at Feekes growth stage 10.5.3. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 29 May, except nontreated, non-inoculated control. The spore suspension (50,000 spores/ml) was applied at 300 ml/plot. Disease ratings were assessed on 17 June 2020. 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 of Stagnospora leaf blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot. Values for each plot were averaged before analysis. 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 Tukey-HSD (α=0.05).

In 2020, weather conditions were moderately favorable for Fusarium head blight (FHB) and leaf blotch diseases. Fusarium head blight was the most prominent disease. Main effects of variety and fungicide treatment are presented. FHB incidence, severity and index, and leaf blotch were lowest in the moderately resistant variety P25R61 (Table 13). FHB percent incidence and index were reduced by all fungicide treatments over the nontreated inoculated control on 17 Jun. Only treatments of Prosaro and Miravis Ace applied at Feekes 10.3 resulted in the lowest FHB percent severity, and leaf blotch was reduced by the Miravis Ace applied at Feekes 10.3. The concentration of deoxynivalenol (DON) was significantly reduced over the nontreated, inoculated control by Miravis Ace applied at Feekes 10.5.1, but this was not different from the nontreated, non-inoculated control (Table 14). There were no significant differences in percent FDK. Wheat test weight and yield were highest in the variety P25R40. Miravis Ace applied at Feekes 10.3 had significantly higher test weight than both nontreated controls, while Prosaro applied at Feekes 10.5.1 increased yield over the nontreated, non-inoculated control, but was not different from the other fungicide programs or nontreated, inoculated control.

Table 13. Effect of variety and fungicide on Fusarium head blight (FHB) and foliar diseases in wheat.

| Treatment[z] | Rate/A | Timing | FHB % incidence[y] 17-Jun | FHB % severity[y] 17-Jun | FHB Index[x] 17-Jun | Leaf blotch % severity[w] 17-Jun |
|---|---|---|---|---|---|---|
| *Variety* | | | | | | |
| P25R40 | | | 41.0 a[v] | 14.8 a | 6.5 a | 5.7 a |
| P25R61 | | | 14.2 b | 8.4 b | 1.2 b | 3.7 b |
| *Fungicide program* | | | | | | |
| Nontreated control, inoculated control | | | 41.9 a | 15.8 a | 8.1 a | 7.7 a |
| Prosaro 421 SC | 6.5 fl oz | 10.5.1 | 29.6 b | 9.3 b | 3.2 b | 2.6 b |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.1 | 20.4 b | 9.0 b | 2.1 b | 4.9 ab |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.3 | 21.5 b | 11.0 ab | 2.5 b | 4.2 ab |
| Miravis Ace 5.2 SC<br>fb Folicur 3.6 F | 13. fl oz<br>4 fl oz | 10.5.1<br>10.5.3 | 26.3 b | 10.2 ab | 2.9 b | 4.4 ab |
| Nontreated, non-inoculated control | | | 26.3 b | 14.4 ab | 4.4 b | 4.3 ab |
| Variety P(F) | | | <.0001 | <.0001 | <.0001 | 0.0156 |
| Treatment P(F) | | | <.0001 | 0.0060 | <.0001 | 0.0259 |
| Var*Trt P(F) | | | 0.0147 | 0.0280 | <.0001 | 0.1179 |

[z] Fungicides treatments applied at Feekes 10.3, 10.5.1, and 10.5.3 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, except nontreated, non-inoculated control. Spore suspension applied at 300 ml/plot on 29 May. [x] 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 Stagnospora leaf visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot. [v] Means followed by the same letter are not significantly different based on Tukey-HSD (α=0.05).

Table 14. Effect of variety and fungicide on deoxynivalenol (DON), Fusarium damaged kernels (FDK), and yield of wheat.

| Treatment[z] | Rate/A | Timing | DON[y] ppm 7-Jul | FDK[x] % 7-Jul | Harvest moisture % 7-Jul | Test weight lb/bu 7-Jul | Yield[w] bu/A 7-Jul |
|---|---|---|---|---|---|---|---|
| Variety | | | | | | | |
| P25R40 | | | 0.212 | 6.0 | 13.3 | 59.0 a | 98.3 a |
| P25R61 | | | 0.248 | 6.2 | 13.2 | 57.5 b | 93.2 b |
| Fungicide program | | | | | | | |
| Nontreated control, inoculated control | | | 0.335 ab[v] | 6.6 | 12.9 b | 58.0 bc | 94.4 ab |
| Prosaro 421 SC | 6.5 fl oz | 10.5.1 | 0.263 ab | 6.1 | 13.1 ab | 58.6 ab | 100.1 a |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.1 | 0.089 b | 5.8 | 13.5 a | 58.4 abc | 96.4 ab |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.3 | 0.373 a | 5.6 | 13.2 a | 58.7 a | 97.8 ab |
| Miravis Ace 5.2 SC fb Folicur 3.6 F | 13. fl oz<br>4 fl oz | 10.5.1<br>10.5.3 | 0.240 ab | 6.1 | 13.5 ab | 58.3 abc | 96.0 ab |
| Nontreated, non-inoculated control | | | 0.083 b | 6.4 | 13.2 a | 57.8 c | 89.8 b |
| | | Variety P(F) | 0.5047 | 0.3700 | 0.0715 | <.0001 | 0.0071 |
| | | Treatment P(F) | 0.0147 | 0.1657 | 0.0138 | 0.0032 | 0.0508 |
| | | Var*Trt P(F) | 0.8107 | 0.8792 | 0.5677 | 0.6101 | 0.8113 |

[z] Fungicides treatments applied at Feekes 10.3, 10.5.1, and 10.5.3 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, except nontreated, non-inoculated control. Spore suspension applied at 300 ml/plot on 29 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 7 Jul.

[v] Means followed by the same letter are not significantly different based on Tukey-HSD (α=0.05).

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

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**Evaluation of foliar fungicides for wheat disease management in central Indiana, 2020a (WHT20-05a.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 9 Oct 2019, and cultivated on 10 Oct 2019. Nitrogen MAP (11-52-0) at 300 lb/A was applied on 9 Oct 2019 and nitrogen (28%) at 30 gal/A was applied on 7 Mar 2020. On 15 Oct 2019 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 28 Apr 2020 for weed management. 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 and directed forward and backward at 45 degree angle, at 3.6 mph. Fungicides were applied on 29 May 2020 at the Feekes growth stage 10.5.1. All plots were inoculated with a mixture of isolates of *Fusarium graminearum* endemic to Indiana on 29 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 16 June 2020. 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 of Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 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 test (LSD; α=0.05).

In 2020, weather conditions were moderately favorable for Fusarium head blight (FHB), leaf blotch, and glume blotch diseases. Fusarium head blight was the most prominent disease. FHB incidence was not reduced by any fungicide over nontreated control on 16 Jun (Table 15). FHB severity was significantly reduced by all fungicide treatments over nontreated control. There were no differences in FHB Index, % leaf blotch or % glume blotch. The concentration of deoxynivalenol (DON) was not significantly reduced over the nontreated control for all treatments (Table 16). There was no difference in wheat moisture, test weight or yield.

Table 15. Effect of fungicide on Fusarium head blight and foliar diseases in wheat.

| Treatment[z] | Rate/A | FHB % incidence[y] 16-Jun | FHB % severity[y] 16-Jun | FHB Index[x] 16-Jun | Leaf blotch % severity[w] 16-Jun | Glume blotch % severity[w] 16-Jun |
|---|---|---|---|---|---|---|
| Nontreated control | | 22.5 | 19.6 a | 4.3 | 6.0 | 4.6 |
| Prosaro 422 SC | 8.2 fl oz | 28.3 | 13.6 ab | 3.9 | 3.4 | 2.5 |
| Miravis Ace 275 SC | 13.7 fl oz | 21.3 | 11.2 b | 2.3 | 4.7 | 1.7 |
| USF0115 400 SC | 10.3 fl oz | 28.8 | 8.2 b | 2.3 | 4.8 | 2.5 |
| Caramba 90 EC | 13.5 fl oz | 30.8 | 10.8 b | 3.4 | 4.6 | 0.8 |
| BAS 84999F | 7.3 fl oz | 27.1 | 9.7 b | 2.8 | 3.5 | 2.5 |
| *p*-value | | 0.1416 | 0.0146 | 0.2724 | 0.6647 | 0.3438 |
| LSD (0.05)[v] | | NS[u] | 5.99 | NS | NS | NS |

[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 (40,000-100,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 29 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 Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

Table 16. Effect of fungicide on DON, Fusarium damaged kernels (FDK), and yield in wheat.

| Treatment[z] | Rate/A | DON[y] ppm 7-Jul | FDK[x] % 7-Jul | Harvest moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | | 0.3 | 4.0 | 12.4 | 58.3 | 94.6 |
| Prosaro 422 SC | 8.2 fl oz | 0.2 | 4.0 | 12.5 | 58.6 | 92.7 |
| Miravis Ace 275 SC | 13.7 fl oz | 0.2 | 3.9 | 12.9 | 58.8 | 94.5 |
| USF0115 400 SC | 10.3 fl oz | 0.2 | 3.9 | 12.5 | 58.5 | 99.5 |
| Caramba 90 EC | 13.5 fl oz | 0.3 | 4.3 | 12.9 | 58.1 | 91.4 |
| BAS 84999F | 7.3 fl oz | 0.1 | 4.1 | 12.3 | 58.1 | 97.5 |
| *p*-value | | 0.4000 | 0.9873 | 0.4014 | 0.5703 | 0.4595 |
| LSD (0.05)[v] | | NS[u] | NS | NS | NS | NS |

[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 (40,000-100,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 300 ml/plot with handheld sprayer on 29 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 7 Jul.

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

[u] NS = not significant (α=0.05).

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

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**Evaluation of foliar fungicides for wheat disease management in central Indiana, 2020b (WHT20-05b.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 9 Oct 2019, and cultivated on 10 Oct 2019. Nitrogen MAP (11-52-0) at 300 lb/A was applied on 9 Oct 2019 and nitrogen (28%) at 30 gal/A was applied on 7 Mar 2020. On 15 Oct 2019 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 28 Apr 2020 for weed management. 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 and directed forward and backward at 45 degree angle, at 3.6 mph. Fungicides were applied on 29 May 2020 at the Feekes growth stage 10.5.1. Disease ratings were assessed on 16 June 2020. 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: (total FHB incidence multiplied by average FHB severity)/60 per plot. Disease severity of Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch. Values for each plot were averaged before analysis. The eight center rows of each plot were harvested with a Kincaid plot combine on 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 test (LSD; α=0.05).

In 2020, weather conditions were moderately favorable for Fusarium head blight (FHB), leaf blotch, and glume blotch diseases. FHB was the most prominent disease. FHB incidence and index were reduced by Badge SC at both 1 and 1.8 pt/A as compared to the nontreated control (Table 17). There were no differences in FHB percent severity, percent leaf blotch or percent glume blotch. The concentration of deoxynivalenol (DON) was not significantly reduced over the nontreated control for all treatments (Table 18). There was no difference in wheat moisture, test weight or yield.

Table 17. Effect of fungicide on Fusarium head blight and foliar diseases in wheat.

| Treatment[z] | Rate/A | FHB % incidence[y] 16-Jun | FHB % severity[y] 16-Jun | FHB Index[x] 16-Jun | Leaf blotch %[w] 16-Jun | Glume blotch %[w] 16-Jun |
|---|---|---|---|---|---|---|
| Nontreated control | | 49.6 a | 24.0 | 11.6 a | 9.6 | 7.5 |
| Badge SC | 1.0 pt | 25.4 b | 19.6 | 4.9 b | 9.0 | 2.5 |
| Badge SC | 1.8 pt | 26.3 b | 19.9 | 5.0 b | 4.8 | 6.3 |
| *p*-value | | 0.0042 | 0.6598 | 0.0021 | 0.2461 | 0.1282 |
| LSD (0.05)[v] | | 12.0 | NS[u] | 2.93 | NS | NS |

[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.
[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: (total FHB incidence multiplied by average FHB severity)/100 per plot.
[w] Disease severity of Stagnospora leaf and glume blotch was rated by visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot for leaf blotch and five heads per plot for glume blotch.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

Table 18. Effect of fungicide on DON, Fusarium damaged kernels (FDK), and yield in wheat.

| Treatment[z] | Rate/A | DON[y] ppm 7-Jul | FDK[x] % 7-Jul | Harvest moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | | 0.5 | 5.0 | 12.2 | 58.3 | 96.6 |
| Badge SC | 1.0 pt | 0.7 | 4.4 | 12.5 | 59.1 | 92.2 |
| Badge SC | 1.8 pt | 0.5 | 5.0 | 12.2 | 58.4 | 95.9 |
| *p*-value | | 0.4067 | 0.5997 | 0.4384 | 0.5730 | 0.3680 |
| LSD (0.05)[v] | | NS[u] | NS | NS | NS | NS |

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

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

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**Uniform fungicide comparison for tar spot in corn in northwestern Indiana, 2020 (COR20-03.PPAC).**

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. 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 7 Aug at the VT/R1 growth stage. Disease ratings were assessed on 22 Sept at the R5 (dent) and 13 Oct at the R6 (maturity) growth stages. Disease severity was rated by visually assessing the percentage of symptomatic leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus 2 leaves (EL-2), and ear leaf plus 2 leaves (EL+2). The values of the five leaves for each plot were averaged before analysis. The two center rows of each plot were harvested on 6 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 test (LSD; α=0.05).

In 2020, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate to high severity. All fungicides significantly reduced the percentage of stroma and the percent chlorotic and necrotic symptoms of tar spot on the EL-2, EL, and EL+2 over the non-treated control on 22 Sep (Table 19). Aproach Prima and Miravis Neo had the lowest percentage of stroma on the ear leaf minus two on 22 Sep, but was not significantly different from Revytek, Veltyma, Headline AMP and Delaro. All fungicides significantly reduced the percentage of stroma and chlorotic and necrotic symptoms on the EL-2, EL, and EL+2 as compared to the non-treated control on 13 Oct (Table 20). All fungicide treatments significantly increased the percentage of stay green canopy over the non-treated control on 13 Oct (Table 21). Veltyma had the highest percentage of stay green canopy but was not significantly different from Revytek, Aproach Prima, Miravis and Delaro. No significant differences between treatments for test weight and yield of corn.

Table 19. Effect of fungicide on tar spot.

| Treatment[z] | Rate/A | Tar spot % stroma[y] EL-2 22-Sep | Tar spot % stroma[y] EL 22-Sep | Tar spot % stroma[y] EL+2 22-Sep | Tar spot % chlor/nec[x] EL-2 22-Sep | Tar spot % chlor/nec[x] EL 22-Sep | Tar spot % chlor/nec[x] EL+2 22-Sep |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 21.0 a | 15.0 a | 10.8 a | 5.7 a | 1.9 a | 0.9 a |
| Revytek 3.33 LC | 8.0 fl oz | 8.3 cde | 5.1 cde | 4.8 cd | 0.2 b | 0.1 c | 0.0 b |
| Veltyma 3.34 S | 7.0 fl oz | 9.8 b-e | 5.1 cde | 3.5 d | 1.0 b | 0.1 c | 0.1 b |
| Headline 2.08 SC | 6.0 fl oz | 11.0 bcd | 6.3 b-e | 5.1 cd | 1.2 b | 0.3 b | 0.1 b |
| Headline AMP 1.68 SE | 10.0 fl oz | 9.1 b-e | 7.3 bcd | 5.0 cd | 0.6 b | 0.2 c | 0.1 b |
| Aproach Prima 2.34 SC | 6.8 fl oz | 4.9 e | 4.4 de | 4.6 cd | 0.2 b | 0.0 c | 0.1 b |
| Miravis Neo 2.5 SE | 13.7 fl oz | 4.6 e | 4.3 de | 6.1 c | 0.0 b | 0.0 c | 0.0 b |
| Delaro 325 SC | 8.0 fl oz | 6.7 de | 4.0 e | 3.7 d | 0.4 b | 0.1 c | 0.0 b |
| Lucento 4.17 SC | 5.0 fl oz | 14.0 b | 9.3 b | 6.9 bc | 2.4 b | 0.9 b | 0.3 b |
| Tilt 3.6 EC | 4.0 fl oz | 12.5 bc | 8.0 bc | 9.1 ab | 0.4 b | 0.1 c | 0.1 b |
| *p*-value | | <.0001 | <.0001 | <.0001 | 0.0096 | 0.0003 | 0.0002 |
| LSD (0.05)[w] | | 5.2 | 3.1 | 2.4 | 2.8 | 0.7 | 0.3 |

[z] Fungicide treatments applied on 7 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[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] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 20. Effect of fungicide on tar spot.

| Treatment[z] | Rate/A | Tar spot % stroma[y] EL-2 13-Oct | Tar spot % stroma[y] EL 13-Oct | Tar spot % stroma[y] EL+2 13-Oct | Tar spot % chlor/nec[x] EL-2 13-Oct | Tar spot % chlor/nec[x] EL 13-Oct | Tar spot % chlor/nec[x] EL+2 13-Oct |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 35.0 a | 32.0 a | 25.0 a | 96.8 a | 78.5 a | 50.5 a |
| Revytek 3.33 LC | 8.0 fl oz | 5.7 d | 5.6 d | 4.4 c | 32.8 d | 12.0 c | 8.9 b |
| Veltyma 3.34 S | 7.0 fl oz | 5.3 d | 4.4 d | 4.6 c | 39.3 cd | 9.8 c | 13.1 b |
| Headline 2.08 SC | 6.0 fl oz | 8.3 d | 9.1 cd | 6.6 c | 42.8 bcd | 17.5 c | 12.0 b |
| Headline AMP 1.68 SE | 10.0 fl oz | 7.4 d | 7.0 cd | 5.4 c | 40.3 bcd | 13.6 c | 9.4 b |
| Aproach Prima 2.34 SC | 6.8 fl oz | 18.8 c | 10.8 c | 6.9 c | 54.8 b | 15.0 c | 12.5 b |
| Miravis Neo 2.5 SE | 13.7 fl oz | 14.0 c | 8.0 cd | 6.3 c | 48.0 bc | 14.1 c | 11.3 b |
| Delaro 325 SC | 8.0 fl oz | 6.1 d | 6.5 cd | 5.2 c | 36.5 cd | 14.8 c | 9.8 b |
| Lucento 4.17 SC | 5.0 fl oz | 28.0 b | 20.1 b | 9.7 b | 83.8 a | 41.5 b | 16.8 b |
| Tilt 3.6 EC | 4.0 fl oz | 29.0 b | 21.2 b | 11.5 b | 88.5 a | 41.8 b | 21.4 b |
| *p*-value | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 |
| LSD (0.05)[w] | | 5.7 | 4.9 | 2.7 | 15.2 | 11.7 | 12.9 |

[z] Fungicide treatments applied on 7 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[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] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 21. Effect of fungicide on stay green and corn yield.

| Treatment[z] | Rate/A | Stay green[y] % 22-Sep | Stay green[y] % 13-Oct | Moisture % 6-Nov | Test weight lb/bu 6-Nov | Yield[x] bu/A 6-Nov |
|---|---|---|---|---|---|---|
| Nontreated control | | 85.0 | 17.5 e | 22.9 | 51.4 | 203.9 |
| Revytek 3.33 LC | 8.0 fl oz | 88.8 | 52.5 ab | 24.2 | 50.5 | 239.4 |
| Veltyma 3.34 S | 7.0 fl oz | 90.0 | 53.8 a | 24.3 | 50.6 | 240.4 |
| Headline 2.08 SC | 6.0 fl oz | 90.0 | 43.8 cd | 24.2 | 50.7 | 230.7 |
| Headline AMP 1.68 SE | 10.0 fl oz | 90.0 | 45.0 bcd | 24.2 | 50.7 | 223.1 |
| Aproach Prima 2.34 SC | 6.8 fl oz | 90.0 | 47.5 abc | 24.4 | 50.9 | 233.8 |
| Miravis Neo 2.5 SE | 13.7 fl oz | 90.0 | 52.5 ab | 24.7 | 50.5 | 228.0 |
| Delaro 325 SC | 8.0 fl oz | 91.3 | 48.8 abc | 24.7 | 50.6 | 238.1 |
| Lucento 4.17 SC | 5.0 fl oz | 90.0 | 41.3 cd | 24.0 | 51.1 | 231.6 |
| Tilt 3.6 EC | 4.0 fl oz | 90.0 | 37.5 d | 24.2 | 51.0 | 221.8 |
| *p*-value | | 0.2047 | <.0001 | 0.0119 | 0.3853 | 0.0626 |
| LSD (0.05)[w] | | NS[v] | 8.1 | . | NS | NS |

[z] Fungicide treatments applied on 7 Aug at the VT/R1 (tassel/silk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Stay green visually assess the percentage (0-100%) in the plot on 22 Sep and 13 Oct.
[x] Yields adjusted to account for wind damage that caused stand loss in plots where it occurred.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

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

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**Uniform fungicide timing and tar spot model validation in corn in northwestern Indiana, 2020 (COR20-05.PPAC).**

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 14 July, 20 July, 7 Aug, 21 Aug, 2 Sep, 11 Sep and 23 Sep at the V8 (eight-leaf), V10 (10-leaf), VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent), V8 followed by VT (V8 fb VT) growth stages, respectively. A prediction model based treatment was include in the trial, but the model never triggered a fungicide application during the season at PPAC, therefore this treatment provided an additional nontreated control for comparison. Disease ratings were assessed on 22 Sept at the R5 (dent) and 6 Oct at the R6 (maturity) growth stages. 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 at the ear leaf (EL), ear leaf minus 2 leaves (EL-2), and ear leaf plus 2 leaves (EL+2). The values of the five leaves 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. 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 favorable for disease at the end of the season, but did not trigger the Tarspotter application. Tar spot was first detected in the trial on 4 Aug and was the most prominent disease in the trial-reaching moderate to high severity. Trivapro applied at the V8 fb VT, R2, VT/R1 and R3 significantly reduced tar spot stroma over the nontreated control on the EL-2 and EL+2 on 22 Sep (Table 22). Chlorotic and necrotic symptoms of tar spot on the EL-2 and EL+2 on 22 Sep were significantly reduced by Trivapro applications made at VT/R1, R2 and V8 fb VT, but no significant differences were detected on the EL. By 6 Oct, Trivapro application at the R2 growth stage had significantly reduce the percentage of stroma on all leaves when compared with other treatments and nontreated control (Table 23). On 6 Oct, significantly less chlorotic and necrotic symptoms were detected on all leaves for Trivapro applications made at VT/R1, R2, R3 and V8 fb VT. Trivapro applied at V8 fb VT, V1/R1 and R2 significantly increased the percent stay green of the corn over the nontreated control on both 22 Sep and 6 Oct (Table 24). No differences in yield was detected between treatments.

Table 22. Effect of fungicide on tar spot.

| Treatment and rate/A[z] | Timing | Tar spot % stroma[y] EL-2 22-Sep | Tar spot % stroma[y] EL 22-Sep | Tar spot % stroma[y] EL+2 22-Sep | Tar spot % chlor/nec[x] EL-2 22-Sep | Tar spot % chlor/nec[x] EL 22-Sep | Tar spot % chlor/nec[x] EL+2 22-Sep |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 26.0 ab | 14.8 a | 7.5 abc | 14.2 bc | 7.0 | 2.2 a |
| Trivapro 13.7 fl oz | V8 | 25.5 ab | 15.5 a | 8.3 abc | 17.3 abc | 4.6 | 2.0 ab |
| Trivapro 13.7 fl oz | V10 | 22.0 bc | 13.5 a | 8.8 ab | 14.6 abc | 5.1 | 1.1 bcd |
| Trivapro 13.7 fl oz | VT/R1 | 11.0 d | 6.6 b | 5.7 bcd | 1.4 d | 0.9 | 0.3 d |
| Trivapro 13.7 fl oz | R2 | 10.5 d | 5.9 b | 3.6 d | 1.5 d | 0.2 | 0.2 d |
| Trivapro 13.7 fl oz | R3 | 19.0 c | 8.0 b | 5.1 cd | 8.8 cd | 1.9 | 0.7 cd |
| Trivapro 13.7 fl oz | R4 | 26.8 a | 15.8 a | 8.3 abc | 21.6 ab | 7.5 | 2.2 a |
| Trivapro 13.7 fl oz | R5 | 28.8 a | 17.5 a | 8.8 ab | 15.5 abc | 4.6 | 1.7 abc |
| Trivapro 13.7 fl oz | V8 fb VT | 5.6 e | 4.9 b | 6.1 bcd | 0.7 d | 0.4 | 0.3 d |
| Trivapro 13.7 fl oz | Model/NTC | 28.5 a | 15.3 a | 9.5 a | 26.2 a | 9.4 | 1.4 abc |
| p-value | | <.0001 | <.0001 | 0.0150 | 0.0009 | 0.1074 | 0.0008 |
| LSD (0.05)[w] | | 4.4 | 4.5 | 3.3 | 12.0 | NS[v] | 1.1 |

[z] Fungicide treatments applied on 14 July, 20 July, 7 Aug, 21 Aug, 2 Sep, 11 Sep and 23 Sep at the V8, V10, VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent) growth stages respectively and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by. Model/NTC = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide application to this treatment.
[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] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

Table 23. Effect of fungicide on tar spot

| Treatment and rate/A[z] | Timing | Tar spot % stroma[y] EL-2 6-Oct | Tar spot % stroma[y] EL 6-Oct | Tar spot % stroma[y] EL+2 6-Oct | Tar spot % chlor/nec[x] EL-2 6-Oct | Tar spot % chlor/nec[x] EL 6-Oct | Tar spot % chlor/nec[x] EL+2 6-Oct |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 32.8 ab | 29.5 ab | 25.3 ab | 81.0 a | 56.3 a | 30.5 a |
| Trivapro 13.7 fl oz | V8 | 31.8 abc | 30.5 ab | 24.0 ab | 74.0 ab | 53.5 ab | 17.5 bc |
| Trivapro 13.7 fl oz | V10 | 31.0 abc | 29.8 bc | 21.5 bc | 68.0 ab | 53.8 ab | 23.5 ab |
| Trivapro 13.7 fl oz | VT/R1 | 25.5 d | 23.0 c | 19.0 cd | 29.6 cd | 14.5 c | 7.8 cd |
| Trivapro 13.7 fl oz | R2 | 13.8 f | 11.8 e | 9.0 e | 15.4 d | 7.8 c | 3.2 d |
| Trivapro 13.7 fl oz | R3 | 25.5 d | 23.5 c | 16.3 d | 39.3 c | 21.3 c | 6.9 cd |
| Trivapro 13.7 fl oz | R4 | 28.5 cd | 27.5 b | 19.3 cd | 61.8 b | 39.5 b | 12.3 cd |
| Trivapro 13.7 fl oz | R5 | 29.5 bc | 29.3 ab | 21.5 bc | 74.3 ab | 57.0 a | 26.5 ab |
| Trivapro 13.7 fl oz | V8 fb VT | 21.8 e | 18.5 d | 15.8 d | 20.0 d | 10.3 c | 5.5 d |
| Trivapro 13.7 fl oz | Model/NTC | 33.8 a | 31.3 a | 26.5 a | 73.0 ab | 53.5 ab | 26.8 ab |
| p-value | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 |
| LSD (0.05)[w] | | 3.3 | 3.7 | 4.2 | 19.0 | 15.3 | 11.0 |

[z] Fungicide treatments applied on 14 July, 20 July, 7 Aug, 21 Aug, 2 Sep, 11 Sep and 23 Sep at the V8, V10, VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent) growth stages respectively and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by. Model/NTC = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide application to this treatment.
[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). [v] Model = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide application to this treatment.
[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] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 24. Effect of fungicide on stay green and corn yield.

| Treatment and rate/A[z] | Timing | Stay green[y] % 22-Sep | Stay green[y] % 6-Oct | Moisture % 4-Nov | Test weight lb/bu 4-Nov | Yield[x] bu/A 4-Nov |
|---|---|---|---|---|---|---|
| Nontreated control | | 75.0 bcd | 12.5 f | 22.4 | 53.3 | 181.8 |
| Trivapro 13.7 fl oz | V8 | 80.0 a-d | 27.5 e | 23.1 | 52.8 | 179.0 |
| Trivapro 13.7 fl oz | V10 | 85.0 abc | 27.5 e | 23.0 | 53.5 | 188.0 |
| Trivapro 13.7 fl oz | VT/R1 | 90.0 a | 42.5 a | 24.7 | 52.9 | 193.3 |
| Trivapro 13.7 fl oz | R2 | 87.5 ab | 42.5 a | 24.3 | 52.9 | 193.9 |
| Trivapro 13.7 fl oz | R3 | 83.8 abc | 35.0 bcd | 24.5 | 53.4 | 185.4 |
| Trivapro 13.7 fl oz | R4 | 73.8 cd | 37.5 abc | 23.9 | 53.2 | 185.6 |
| Trivapro 13.7 fl oz | R5 | 70.0 d | 28.8 de | 22.7 | 53.3 | 183.7 |
| Trivapro 13.7 fl oz | V8 fb VT | 90.0 a | 41.3 ab | 23.9 | 53.2 | 191.0 |
| Trivapro 13.7 fl oz | Model/NTC | 75.0 bcd | 31.3 cde | 22.8 | 53.0 | 179.5 |
| p-value | | 0.0182 | <.0001 | 0.0587 | 0.7079 | 0.5435 |
| LSD (0.05)[w] | | 12.6 | 6.3 | NS[v] | NS | NS |

[z] Fungicide treatments applied on 14 July, 20 July, 7 Aug, 21 Aug, 2 Sep, 11 Sep and 23 Sep at the V8, V10, VT/R1 (silk), R2 (blister) R3 (milk), R4 (dough), and R5 (dent) growth stages respectively and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by. Model/NTC = tar spot weather-based model application. The tar spot model did not cross the action threshold in Indiana during the season; therefore, no fungicide application to this treatment.
[y] Stay green visually assessed percentage (0-100%) of crop canopy stay green on 22 Sep and 6 Oct.
[x] Yields were adjusted to 15.5% moisture and harvested on 4 Nov.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

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

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**Fungicide comparison for foliar diseases in corn in northwestern Indiana, 2020 (COR20-14.PPAC).**

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. Standard practices for non-irrigated grain corn production in Indiana were followed. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 8 Jul at V7, 28 Jul at V13, and 8 Aug at the VT/R1 (tassel/silk), 21 Aug at the R2 (milk), 2 Sep at the R3 (dough) growth stages. Disease ratings were assessed on 17 Sep and 29 Sep at the R5 (dent) and R6 (maturity) growth stages, respectively. Tar spot was rated by visually assessing the percentage of stroma, and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf (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 4 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 test (LSD; α=0.05).

Tar spot was the most prominent diseases in the trial and reached moderate severity. All fungicides significantly reduced tar spot stroma severity on the EL-2, EL, and EL+2 over nontreated except Fortix NXT at 6 fl oz and Fortix 3.22 SC at 5 fl oz applied at V7 on 17 Sep (Table 25). All fungicides reduced chlorosis and necrosis on EL-2 and EL, except Fortix NXT at 6 fl oz and Fortix 3.22 SC at 5 fl oz applied at V7, no chlorosis or necrosis was noted on EL+2 on 17 Sep. Tar spot stroma severity on all leaves on 29 Sep was significantly reduced over nontreated by all fungicide programs, except Fortix NXT at 6 fl oz and Fortix 3.22 SC at 5 fl oz applied at V7 (Table 26). All fungicides reduced chlorosis and necrosis on the EL-2 and EL, except the Fortix applications at V7. On the EL+2 Miravis Neo applied at VT/R1, R2, and R3; Trivapro applied at R2; Aproach Prima applied at VT/R1; Aproach applied at V7 fb Aproach Prima at VT/R1; Dexter Xcel applied at VT/R1; and Headline AMP applied at VT/R1 reduced chlorosis and necrosis over nontreated on 29 Sep. All fungicide treatments significantly increased the percent stay green over the nontreated controls on both 29 Sep and 7 Oct, except for Fortix 3.22 SC at V7 and Miravis Neo at V13 on 7 Oct. No significant differences between treatments for lodging and test weight (Table 27). Miravis Neo applied at R2, Trivapro applied at VT/R1, Dexter Xcel applied at VT/R1, and Headline APM applied at VT/R1 significantly increase yield over nontreated controls.

Table 25. Effect of fungicide on tar spot.

| Treatment[z] | Rate/A | Timing | Tar spot % stroma[y] EL-2 17-Sep | Tar spot % stroma[y] EL 17-Sep | Tar spot % stroma[y] EL+2 17-Sep | Tar spot % chlo/necr[x] EL-2 17-Sep | Tar spot % chlo/necr[x] EL 17-Sep |
|---|---|---|---|---|---|---|---|
| Nontreated control | | | 10.1 a | 6.0 a | 2.3 b | 2.4 ab | 1.2 a |
| Miravis Neo 2.5 SC | 13.7 fl oz | V13 | 2.7 bcd | 1.8 bc | 1.6 b | 0.1 c | 0.0 c |
| Miravis Neo 2.5 SC | 13.7 fl oz | VT/R1 | 1.1 cd | 0.7 c | 0.4 c | 0.0 c | 0.0 c |
| Miravis Neo 2.5 SC | 13.7 fl oz | R2 | 2.6 cd | 1.0 c | 0.3 c | 0.3 c | 0.0 c |
| Miravis Neo 2.5 SC | 13.7 fl oz | R3 | 5.4 b | 2.7 b | 1.9 b | 1.0 bc | 0.2 bc |
| Trivapro 2.21 SE | 13.7 fl oz | VT/R1 | 0.9 cd | 0.5 c | 0.4 c | 0.0 c | 0.0 c |
| Trivapro 2.21 SE | 13.7 fl oz | R2 | 2.8 bcd | 0.7 c | 0.2 c | 0.5 bc | 0.0 c |
| Aproach Prima 2.34 SC | 6.8 fl oz | VT/R1 | 0.6 cd | 0.6 c | 0.4 c | 0.0 c | 0.0 c |
| Aproach 2.08 SC<br>fb Aproach Prima 2.34 SC | 6.0 fl oz<br>6.8 fl oz | V8<br>VT/R1 | 0.6 d | 0.3 c | 0.2 c | 0.1 c | 0.0 c |
| Fortix NXT | 6.0 fl oz | VT/R1 | 1.1 cd | 0.5 c | 0.2 c | 0.0 c | 0.0 c |
| Zolera ODX | 5.0 fl oz | VT/R1 | 1.5 cd | 0.5 c | 0.2 c | 0.2 c | 0.0 c |
| Dexter Xcel | 48.0 fl oz | VT/R1 | 0.9 cd | 0.6 c | 0.2 c | 0.0 c | 0.0 c |
| Zolera FX | 5.0 fl oz | VT/R1 | 1.3 cd | 0.6 c | 0.4 c | 0.0 c | 0.0 c |
| Fortix NXT | 6.0 fl oz | V7 | 10.3 a | 5.8 a | 3.0 a | 4.3 a | 0.1 bc |
| Fortix 3.22 SC | 5.0 fl oz | V7 | 10.1 a | 6.2 a | 3.2 a | 3.9 a | 0.8 ab |
| Headline AMP 1.68 SC | 10.0 fl oz | VT/R1 | 3.4 bc | 1.5 bc | 0.6 c | 0.0 c | 0.0 c |
| Nontreated control | | | 10.9 a | 7.2 a | 3.1 a | 3.6 a | 1.2 a |
| *p*-value | | | <.0001 | <.0001 | <.0001 | <.0001 | 0.0163 |
| LSD (0.05)[w] | | | 2.8 | 1.5 | 0.7 | 2.0 | 0.8 |

[z] Fungicide treatments applied on 8 July at V7 growth stage, 28 Jul at V13, 8 Aug at VT/R1, 21 Aug at R2 and 2 Sep at R3 growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot 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] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 26. Effect of fungicide on tar spot.

| Treatment[z] | Rate/A | Timing | 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 % chlo/necr[x] EL-2 29-Sep | Tar spot % chlo/nec[x] EL 29-Sep | Tar spot % chlo/necr[x] EL+2 29-Sep |
|---|---|---|---|---|---|---|---|---|
| Nontreated control | | | 29.0 a | 18.9 a | 7.7 a | 77.3 a | 36.8 a | 14.3 a |
| Miravis Neo 2.5 SC | 13.7 fl oz | V13 | 12.0 c | 6.3 c | 4.0 cd | 40.0 b | 13.6 b | 5.8 bcd |
| Miravis Neo 2.5 SC | 13.7 fl oz | VT/R1 | 4.0 d | 3.1 cd | 2.1 de | 24.8 bcd | 11.2 b | 4.5 cd |
| Miravis Neo 2.5 SC | 13.7 fl oz | R2 | 4.3 d | 1.9 d | 1.0 ef | 21.8 bcd | 9.2 b | 4.0 d |
| Miravis Neo 2.5 SC | 13.7 fl oz | R3 | 12.2 c | 4.4 cd | 1.9 ef | 37.4 bc | 11.9 b | 4.7 cd |
| Trivapro 2.21 SE | 13.7 fl oz | VT/R1 | 3.9 d | 3.4 cd | 2.1 ef | 22.3 bcd | 7.4 b | 7.1 bcd |
| Trivapro 2.21 SE | 13.7 fl oz | R2 | 3.0 d | 1.6 d | 0.3 f | 31.5 bcd | 7.0 b | 3.9 d |
| Aproach Prima 2.34 SC | 6.8 fl oz | VT/R1 | 3.1 d | 2.2 d | 1.5 ef | 22.1 bcd | 8.9 b | 5.2 cd |
| Aproach 2.08 SC<br>fb Aproach Prima 2.34 SC | 6.0 fl oz<br>6.8 fl oz | V8<br>VT/R1 | 3.5 d | 2.3 d | 1.8 ef | 25.4 bcd | 9.2 b | 2.9 d |
| Fortix NXT | 6.0 fl oz | VT/R1 | 3.4 d | 1.0 d | 0.9 ef | 16.6 d | 5.8 b | 5.9 bcd |
| Zolera ODX | 5.0 fl oz | VT/R1 | 2.7 d | 1.3 d | 0.5 ef | 18.4 cd | 5.6 b | 3.7 d |
| Dexter Xcel | 48.0 fl oz | VT/R1 | 2.4 d | 1.7 d | 0.8 ef | 25.1 bcd | 5.7 b | 2.2 d |
| Zolera FX | 5.0 fl oz | VT/R1 | 1.7 d | 1.3 d | 1.2 ef | 25.6 bcd | 10.5 b | 6.8 bcd |
| Fortix NXT | 6.0 fl oz | V7 | 22.4 b | 20.0 a | 7.3 ab | 60.8 a | 30.8 a | 9.6 abc |
| Fortix 3.22 SC | 5.0 fl oz | V7 | 23.9 b | 14.6 b | 5.7 bc | 68.3 a | 28.4 a | 9.8 abc |
| Headline AMP 1.68 SC | 10.0 fl oz | VT/R1 | 4.8 d | 2.7 d | 2.3 de | 31.6 bcd | 9.3 b | 4.4 cd |
| Nontreated control | | | 31.3 a | 21.3 a | 7.3 ab | 65.5 a | 32.4 a | 10.6 ab |
| *p*-value | | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | 0.0037 |
| LSD (0.05)[w] | | | 4.3 | 3.6 | 1.8 | 20.7 | 9.2 | 5.4 |

[z] Fungicide treatments applied on 8 July at V7 growth stage, 28 Jul at V13, 8 Aug at VT/R1 (silk), 21 Aug at R2 and 2 Sep at R3 growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by. [y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), ear leaf plus two (EL+2). [x] Tar spot 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] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 27. Effect of fungicide on stay green, lodging, and corn yield.

| Treatment[z] | Rate/A | Timing | Stay green[y] % 29-Sep | Stay green[y] % 7-Oct | Lodging[x] % 29-Sep | Harvest Moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|---|---|---|
| Nontreated control | | | 60.0 e | 26.3 de | 5.0 | 22.1 f | 52.5 | 179.5 c-f |
| Miravis Neo 2.5 SC | 13.7 fl oz | V13 | 72.5 bc | 31.3 bcd | 0.0 | 23.4 c-f | 52.7 | 193.9 abc |
| Miravis Neo 2.5 SC | 13.7 fl oz | VT/R1 | 78.8 ab | 38.8 ab | 0.0 | 25.3 ab | 52.9 | 187.0 bcd |
| Miravis Neo 2.5 SC | 13.7 fl oz | R2 | 76.3 ab | 41.3 a | 0.0 | 25.3 ab | 52.0 | 197.5 ab |
| Miravis Neo 2.5 SC | 13.7 fl oz | R3 | 75.0 ab | 40.0 a | 2.5 | 24.1 a-e | 52.2 | 179.8 c-f |
| Trivapro 2.21 SE | 13.7 fl oz | VT/R1 | 78.8 ab | 37.5 ab | 0.0 | 24.5 a-d | 52.5 | 200.0 ab |
| Trivapro 2.21 SE | 13.7 fl oz | R2 | 78.8 ab | 41.3 a | 5.0 | 24.6 abc | 52.6 | 181.7 cde |
| Aproach Prima 2.34 SC | 6.8 fl oz | VT/R1 | 78.8 ab | 42.5 a | 0.0 | 25.5 a | 52.4 | 185.3 c-e |
| Aproach 2.08 SC<br>fb Aproach Prima 2.34 SC | 6.0 fl oz<br>6.8 fl oz | V8<br>VT/R1 | 80.0 a | 40.0 a | 0.0 | 25.0 ab | 51.5 | 192.7 abc |
| Fortix NXT | 6.0 fl oz | VT/R1 | 78.8 ab | 41.3 a | 0.0 | 24.6 abc | 52.3 | 181.4 cde |
| Zolera ODX | 5.0 fl oz | VT/R1 | 78.8 ab | 38.8 ab | 0.0 | 24.5 a-d | 53.1 | 192.1 abc |
| Dexter Xcel | 48.0 fl oz | VT/R1 | 78.8 ab | 41.3 a | 2.5 | 24.4 a-d | 52.3 | 202.2 a |
| Zolera FX | 5.0 fl oz | VT/R1 | 78.8 ab | 36.3 abc | 2.5 | 24.1 b-e | 53.3 | 176.6 def |
| Fortix NXT | 6.0 fl oz | V7 | 67.5 cd | 28.8 cd | 0.0 | 22.9 ef | 52.8 | 180.7 c-f |
| Fortix 3.22 SC | 5.0 fl oz | V7 | 61.3 de | 20.0 e | 2.5 | 23.2 def | 53.3 | 171.4 ef |
| Headline AMP 1.68 SC | 10.0 fl oz | VT/R1 | 77.5 ab | 42.5 a | 2.5 | 24.4 a-d | 52.6 | 199.8 ab |
| Nontreated control | | | 57.5 e | 23.8 de | 10.0 | 22.6 f | 52.4 | 165.8 f |
| *p*-value | | | <.0001 | <.0001 | 0.4486 | <.0002 | 0.4875 | 0.0001 |
| LSD (0.05)[v] | | | 7.2 | 7.8 | NS[u] | 1.4 | NS | 15.1 |

[z] Fungicide treatments applied on 8 July at V7 growth stage, 28 Jul at V13, 8 Aug at VT/R1 (silk), 21 Aug at R2 and 2 Sep at R3 growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by. [y] Stay green visually assessed percentage (0-100%) of crop canopy green on 29 Sep and 7 Oct. [x] Lodging = percentage of lodged stalks when pushed from shoulder height to the 45° from vertical. [w] Yields were adjusted to 15.5% moisture and harvested on 4 Nov. [v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

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

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**Fungicide efficacy and timing for tar spot in corn in northwestern Indiana, 2020 (COR20-15.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 6 Jun using a GPS guided John Deere 1700 six row planter. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 14 July at V8, 5 Aug at V8 plus 3 weeks after treatment (WAT), 5 Aug at first detection of tar spot, 7 Aug at VT (tassel/silk), 27 Aug at first detection plus 3 WAT, 27 Aug at VT plus 3 WAT, 2 Sep at R3 (milk), and 23 Sep at R3 plus 3 WAT. Disease ratings were assessed on 6 Oct at R6 (maturity) growth stage. Tar spot was rated by visually assessing the percentage of stroma, 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 6 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 test (LSD; α=0.05).

In 2020, weather conditions were favorable for disease. Tar spot was first detected in the trial on 28 Jul and was the most prominent disease in the trial-reaching moderate to high severity. Veltyma and Lucento applied at the first detection of tar spot, VT and V8 fb 3 WAT significantly reduced tar spot stroma over the nontreated control on the ear leaf 6 Oct (Table 28). Chlorotic and necrotic symptoms of tar spot on the ear leaf on 6 Oct were significantly reduced by Veltyma applications made at applied at the first detection of tar spot, VT, first detection fb 3 WAT, V8 fb 3 WAT and VT fb 3 WAT and by Lucento when applied at the first detection of tar spot, VT, R3, first detection fb 3 WAT, V8 fb 3 WAT and VT fb 3 WAT. Veltyma and Lucento significantly increased the percentage of stay green canopy over the nontreated control on 6 Oct, except when applied at V8. No difference between treatments and nontreated control were detected for harvest moisture, test weight and corn yield.

Table 28. Effect of fungicide on tar spot, stay green, and corn yield.

| Treatment, rate/A, and timing[z] | Tar spot % severity[y] 6-Oct | Tar spot % chlor/nec[x] 6-Oct | Stay green[w] % 6-Oct | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | 31.5 ab | 52.3 ab | 23.8 i | 23.9 | 51.5 | 220.5 |
| Veltyma 3.34 S 7.0 fl oz at first detection | 9.0 g | 1.3 g | 80.0 a | 24.5 | 50.5 | 224.8 |
| Veltyma 3.34 S 7.0 fl oz at V8 | 31.3 ab | 41.8 bc | 30.0 hi | 24.0 | 51.1 | 219.4 |
| Veltyma 3.34 S 7.0 fl oz at VT | 8.3 g | 0.7 g | 76.3 ab | 23.9 | 50.8 | 219.4 |
| Veltyma 3.34 S 7.0 fl oz at R3 | 27.8 bc | 23.4 de | 43.8 efg | 23.9 | 51.1 | 218.9 |
| Veltyma 3.34 S 7.0 fl oz at first detection fb 3 WAT | 16.5 f | 4.6 g | 65.0 bc | 24.2 | 50.8 | 225.7 |
| Veltyma 3.34 S 7.0 fl oz at V8 fb 3 WAT | 9.5 g | 1.0 g | 77.5 a | 24.0 | 50.5 | 228.7 |
| Veltyma 3.34 S 7.0 fl oz at VT fb 3 WAT | 19.5 ef | 5.9 fg | 55.0 cde | 23.7 | 50.9 | 223.5 |
| Veltyma 3.34 S 7.0 fl oz at R3 fb 3 WAT | 31.3 ab | 34.0 cd | 28.8 hi | 23.4 | 50.7 | 221.0 |
| Nontreated control | 33.0 a | 61.5 a | 22.5 i | 22.5 | 51.4 | 220.1 |
| Lucento 7.17 SC 5.0 fl oz at first detection | 21.8 de | 9.5 efg | 56.3 cd | 24.5 | 50.7 | 225.5 |
| Lucento 7.17 SC 5.0 fl oz at V8 | 30.5 ab | 29.8 cd | 31.3 hi | 23.3 | 51.4 | 213.2 |
| Lucento 7.17 SC 5.0 fl oz at VT | 20.8 ef | 6.4 efg | 48.8 def | 23.2 | 51.2 | 225.6 |
| Lucento 7.17 SC 5.0 fl oz at R3 | 20.0 ef | 9.3 efg | 43.8 efg | 23.6 | 51.3 | 218.1 |
| Lucento 7.17 SC 5.0 fl oz at first detection fb 3 WAT | 23.3 de | 7.8 efg | 53.8 cde | 24.4 | 51.7 | 224.0 |
| Lucento 7.17 SC 5.0 fl oz at V8 fb 3 WAT | 23.3 de | 11.4 efg | 53.8 cde | 23.7 | 50.7 | 233.5 |
| Lucento 7.17 SC 5.0 fl oz at VT fb 3 WAT | 25.5 cd | 23.1 def | 38.8 fgh | 24.2 | 51.1 | 219.8 |
| Lucento 7.17 SC 5.0 fl oz at R3 fb 3 WAT | 30.3 ab | 33.0 cd | 33.8 ghi | 23.9 | 50.9 | 216.1 |
| *p*-value | <.0001 | <.0001 | <.0001 | 0.1621 | 0.4319 | 0.8278 |
| LSD (0.05)[u] | 13.4 | 61.6 | 17.7 | NS[t] | NS | NS |

[z] Fungicides were applied on 14 July at V8, 5 Aug at V8 plus 3 weeks after treatment (WAT), 5 Aug at first detection of tar spot, 7 Aug at VT (tassel/silk), 27 Aug at first detection plus 3 WAT, 27 Aug at VT plus 3 WAT, 2 Sep at R3 (milk), and 23 Sep at R3 plus 3 WAT. All treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. Fb = followed by and 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. [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] Stay green visually assessed percentage (0-100%) of crop canopy green on 6 Oct. [v] Yields adjusted to account for wind damage that caused stand loss in plots where it occurred and harvested on 6 Nov. [u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05). [t] NS = not significant (α=0.05).

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

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**Evaluation of fungicides and application timing for tar spot in corn in northwestern Indiana, 2020 (COR20-23.PPAC).**

Plots were established at the Pinney Purdue Agricultural Center (PPAC) in Porter 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 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 9 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 8-Jul at V7 and on 8-Aug at VT/R1 (tassel/silk) growth. Disease ratings were assessed on 22-Sep and 7 Oct at R5 (dent) and R6 (maturity), respectively. Disease severity and chlorosis/necrosis was rated by visually assessing the percentage of symptomatic leaf area on five plants in each plot at the ear leaf (EL), ear leaf minus two (EL-2), and ear leaf plus two (EL+2). Values for each plot were averaged before analysis. Percent lodging were determined from 10 plants in each plot when pushed from shoulder height to 45° from vertical. The two center rows of each plot were harvested on 6 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 test (LSD; α=0.05).

In 2020, tar spot reached moderate severity. All fungicide programs significantly reduced tar spot on 7 Oct on ear leaf (Table 29). All fungicide programs reduced tar spot chlorotic and necrotic symptoms on 7 Oct. All fungicide program increased percent green over nontreated control on 7 Oct. Veltyma resulted in the highest percentage of green foliage over other treatments, but was only significantly different from Aproach Prima and Trivapro. There were no significant differences between treatments for harvest moisture, test weight and yield of corn.

Table 29. Effect of fungicide on tar spot, stay green, and corn yield.

| Treatment[z] | Rate/A | Timing | Tar spot % stroma[y] 7-Oct | Tar spot % chlor/nec[x] 7-Oct | Stay green[w] % 7-Oct | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|---|---|
| Nontreated control | | | 25.6 a | 44.8 a | 47.5 d | 24.3 | 50.6 | 225.8 |
| Trivapro 2.21 SE | 13.7 fl oz | VT/R1 | 4.8 b | 3.9 b | 82.5 bc | 24.7 | 50.6 | 221.7 |
| Aproach Prima 2.34 SC | 6.8 fl oz | VT/R1 | 4.9 b | 2.7 b | 81.3 c | 24.3 | 50.7 | 229.1 |
| Aproach 2.08 SC @<br>fb Aproach Prima 2.34 SC | 6 fl oz<br>6.8 fl oz | V7<br>VT/R1 | 4.8 b | 3.3 b | 85.0 abc | 25.0 | 50.3 | 225.8 |
| Delaro Complete 458 SC | 8 fl oz | VT/R1 | 5.0 b | 6.5 b | 87.5 ab | 24.9 | 50.6 | 240.0 |
| Delaro Complete 458 SC | 12 fl oz | VT/R1 | 2.6 b | 1.8 b | 85.0 abc | 24.7 | 50.2 | 221.9 |
| Veltyma 3.34 S | 7 fl oz | VT/R1 | 2.4 b | 0.9 b | 88.8 a | 24.7 | 50.4 | 227.0 |
| Miravis Neo 2.5 SE | 13.7 fl oz | VT/R1 | 4.7 b | 1.5 b | 83.8 abc | 24.6 | 50.7 | 225.3 |
| *p*-value | | | <.0001 | <.0001 | <.0001 | 0.2803 | 0.4227 | 0.4019 |
| LSD (0.05)[u] | | | 3.0 | 7.9 | 5.2 | NS[t] | NS | NS |

[z] Fungicide treatments were applied on 8-Jul at V7 (tassel) and on 8-Aug at VT/R1 (tassel/silk) growth treatments and 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.
[x] Tar spot chlorotic and necrotic symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf.
[w] Stay green visually assessed percentage (0-100%) of crop canopy green on 7 Oct.
[v] Yields were adjusted to 15.5% moisture and harvested on 6 Nov.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

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

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**Evaluation of fungicide efficacy and timing for tar spot of corn in northwestern Indiana, 2020 (COR20-27.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 9 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 20 Jul, 8 Aug, and 20 Aug at the V10, VT/R1 (tassel/silk), and R2 (milk) growth stages, respectively. Disease ratings were assessed on 7 Oct at R6 (maturity) growth stages. 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). Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 6 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 test (LSD; α=0.05).

In 2020, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached moderate to high severity. All fungicide programs reduced tar spot stromata on 7 Oct over nontreated control (Table 30). Veltyma applied at VT/R1 and R2, and Delaro plus Luna Privilege applied at VT/R1 had lowest amount of tar spot on the ear leaf, but were not significantly different from Miravis Neo applied at VT/R1 and R2 or Delaro plus Luna Privilege applied at R2. All fungicides applied at VT/R1 and R2 significantly reduced tar spot stroma and chlorotic and necrotic symptoms over those fungicides applied at V10, except Veltyma at V10 on 7 Oct. All fungicide programs increased stay green on 7 Oct over the nontreated control. Fungicides applied at VT/R1 or R2 were still 70% or more green by 7 Oct. No significant differences in test weight. Veltyma and Miravis Neo applied at VT/R1 or R2 resulted in in higher harvest moisture than nontreated. Corn yield was highest in plots treated with Miravis Neo and Delaro plus Luna Privilege applied at both VT/R1 and R2, but these were not significantly different from Veltyma applied at VT/R1 or R2.

Table 30. Effect of fungicide on tar spot, stay green, and corn yield.

| Treatment and rate/A[z] | Timing | Tar spot % stroma[y] 7-Oct | Tar spot % chlor/nec[x] 7-Oct | Stay green[w] % 7-Oct | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated control | | 23.0 a | 44.0 a | 45.0 d | 25.0 c | 49.7 | 201.4 d |
| Veltyma 7.0 fl oz | V10 | 6.0 d | 5.2 d | 60.0 b | 25.5 abc | 49.5 | 202.6 cd |
| Miravis Neo 13.7 fl oz | V10 | 17.8 b | 28.0 b | 50.0 cd | 25.6 abc | 49.5 | 207.3 bcd |
| Delaro 8.0 fl oz + Luna Privilege 2.0 fl oz | V10 | 12.5 c | 18.3 c | 52.5 c | 25.2 bc | 49.4 | 209.3 a-d |
| Veltyma 7.0 fl oz | VT/R1 | 1.0 e | 0.2 d | 76.3 a | 25.7 ab | 49.3 | 209.1 a-d |
| Miravis Neo 13.7 fl oz | VT/R1 | 4.1 de | 1.8 d | 70.0 a | 26.0 a | 49.4 | 214.5 ab |
| Delaro 8.0 fl oz + Luna Privilege 2.0 fl oz | VT/R1 | 1.6 e | 0.5 d | 76.3 a | 25.5 abc | 54.6 | 215.7 ab |
| Veltyma 7.0 fl oz | R2 | 1.6 e | 0.7 d | 71.3 a | 25.9 a | 49.2 | 211.1 a-d |
| Miravis Neo 13.7 fl oz | R2 | 3.8 de | 2.0 d | 75.0 a | 25.8 ab | 49.5 | 218.1 a |
| Delaro 8.0 fl oz + Luna Privilege 2.0 fl oz | R2 | 2.6 de | 1.0 d | 75.0 a | 25.7 abc | 49.4 | 212.6 abc |
| *p*-value | | <.0001 | <.0001 | <.0001 | <.0001 | 0.4527 | 0.0405 |
| LSD (0.05)[u] | | 3.6 | 7.7 | 6.8 | 0.6 | NS[t] | 10.18 |

[z] Fungicides were applied on 20 Jul, 8 Aug, and 20 Aug at the V10, VT/R1 (tassel/silk), and R2 (milk) growth stages, respectively. All fungicide treatments contained BAS 92740S @ 6.4 fl oz/A.
[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 chlorotic and necrotic symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf.
[w] Stay green visually assessed percentage (0-100%) of crop canopy green on 7 Oct.
[v] Yields were adjusted to 15.5% moisture and harvested on 6 Nov.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

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

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**Evaluation of fungicide efficacy for tar spot of corn in northwestern Indiana, 2020 (COR20-28.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 9 Jun. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 8 Aug at VT/R1 (tassel/silk) growth stages. Disease ratings were assessed on 7 Oct at R6 (maturity) growth stages. 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 6 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 test (LSD; α=0.05).

In 2020, weather conditions were favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate level. All fungicide programs reduced tar spot stromata over the nontreated control (Tables 31). Veltyma at 7 fl oz had the lowest percent stromata, but was not significantly different from Revytek, Delaro plus Luna Privilege, or Veltyma at 9 fl oz. All fungicides reduced chlorotic and necrotic symptoms on all leaves on 7 Oct. Lucento had significantly more symptoms than all other fungicide treatments. All fungicide programs increased stay green on 7 Oct. The Revytek treatment was the greenest, but was not significantly different from Veltyma at both 7 and 9 fl oz, Miravis Neo, and Delaro plus Luna Privilege. All fungicide treatments increased yield over the nontreated control. Corn yield was highest in plots with Revytek, but this was not significantly different from Veltyma at both 7 and 9 fl oz, Headline AMP, Miravis Neo, and Delaro plus Luna Privilege.

Table 31. Effect of fungicide on tar spot, stay green, and corn yield.

| Treatment and rate/A[z] | Tar spot % stroma[y] 7-Oct | Tar spot % chlor/nec[x] 7-Oct | Stay green[w] % 7-Oct | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | 28.8 a | 52.8 a | 37.5 d | 24.4 c | 50.5 | 200.7 d |
| Veltyma 3.34 S 7.0 fl oz | 1.5 e | 0.4 d | 81.3 ab | 25.3 ab | 49.8 | 230.3 abc |
| Revytek 3.33 LC 8.0 fl oz | 2.4 de | 0.5 d | 82.5 a | 25.3 ab | 49.9 | 237.6 a |
| Headline AMP 1.68 SC 10.0 fl oz | 4.4 cd | 1.8 cd | 75.0 b | 25.1 b | 49.6 | 230.3 abc |
| Miravis Neo 2.5 SE 13.7 fl oz | 5.5 bc | 2.5 bc | 76.3 ab | 25.1 b | 49.9 | 224.7 abc |
| Delaro 325 SC 8.0 fl oz + Luna Privilege 2.0 fl oz | 2.6 de | 1.0 cd | 78.8 ab | 25.3 ab | 49.6 | 233.1 ab |
| Lucento 4.17 SC 5.0 fl oz | 6.7 b | 3.7 b | 66.3 c | 25.1 b | 50.2 | 222.2 bc |
| Trivapro 2.21 SE 13.7 fl oz | 5.0 bc | 1.3 cd | 75.0 b | 25.4 ab | 49.6 | 216.1 c |
| Veltyma 3.34 S 9.0 fl oz | 2.6 de | 0.3 d | 80.0 ab | 25.7 a | 49.9 | 223.5 abc |
| *p*-value | <.0001 | <.0001 | <.0001 | 0.0155 | 0.1189 | 0.0019 |
| LSD (0.05)[u] | 2.1 | 1.9 | 6.6 | 0.6 | NS[t] | 15.0 |

[z] Fungicide treatments applied on 8 Aug at VT/R1 (tassel/silk) growth stage. All 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.
[x] Tar spot chlorotic and necrotic symptoms visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf.
[w] Stay green visually assessed percentage (0-100%) of crop canopy green on 7 Oct.
[v] Yields were adjusted to 15.5% moisture and damage by wind, and harvested on 6 Nov.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

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

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**Assessment of fungicides applied at R3 for tar spot in corn in northwestern Indiana, 2020 (COR20-29.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 corn production practices for Indiana were followed. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 8 Jun. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 2 Sep at the R3 (milk) growth stage. Disease ratings were assessed on 29 Sep and 7 Oct at R5 (dent) and R6 (mature), respectively. Disease severity and chlorosis/necrosis was rated by visually assessing the percentage of symptomatic leaf area on five plants in each plot at the ear leaf. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 4 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 test (LSD; α=0.05).

In 2020, tar spot reached moderate severity. All fungicides reduced percent tar spot stroma over nontreated control, except for Domark plus Badge on 29 Sep (Table 32). Affiance and Domark treatments resulted in the lowest amount of tar spot over other fungicide treatments on 29 Sep, but were not significantly different from Affiance plus Badge treatment. Percentage green canopy was significantly increased in all treatments on 7 Oct over nontreated control. There was no significant treatment effect on moisture and test weight of corn. Domark was the only treatment that significantly increased yield over nontreated control.

Table 32. Effect of fungicide on tar spot, stay green, and corn yield.

| Treatment and rate/A[z] | Tar spot % severity[y] 29-Sep | Tar spot % chlor/nec[x] 29-Sep | Stay green[w] % 7-Oct | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | 21.0 a | 31.5 | 18.8 b | 22.0 | 52.1 | 170.0 b |
| Affiance 1.5 SC 10.0 fl oz | 9.3 c | 13.6 | 31.3 a | 22.8 | 52.6 | 177.7 ab |
| Domark 230 ME 6.0 fl oz | 7.7 c | 14.0 | 31.3 a | 22.7 | 52.0 | 184.6 a |
| Affiance 1.5 SC 10.0 fl oz + Badge SC 2.0 pt | 13.4 bc | 19.0 | 31.3 a | 23.0 | 51.9 | 176.6 ab |
| Domark 230 ME 6.0 fl oz + Badge SC 2.0 pt | 16.1 ab | 19.6 | 27.5 a | 22.2 | 51.4 | 173.7 b |
| p-value | 0.0043 | 0.3438 | 0.0182 | 0.5258 | 0.4677 | 0.0363 |
| LSD (0.05)[u] | 6.4 | NS[t] | 7.8 | NS | NS | 8.7 |

[z] Fungicide treatments applied on 2-Sep the R3 (milk) growth stage and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf.
[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] Stay green visually assess the percentage (0-100%) in the plot on 7-Oct.
[v] Yields adjusted to account for wind damage that caused stand loss in plots where it occurred.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

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

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**Evaluation of Xyway 3D system for tar spot of corn in northwestern Indiana, 2020 (COR20-30.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. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 7 Jun. Standard practices for non-irrigated corn production in Indiana were followed. In-furrow applications were applied at planting using Kincaid planter. 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 7 Jun at planting, 2 July at V6, and 7 Aug at the VT/R1 (tassel/silk) growth stages. Disease ratings were assessed on 29 Sept at R6 (maturity) growth stages. 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. 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 favorable for disease. Tar spot was the most prominent diseases in the trial and reached moderate severity. The Xyway 3D fb Lucento, Topguard fb Lucento, Lucento and Veltyma programs significantly reduced the severity of tar spot stroma over nontreated control on 29 Sep (Table 33). No treatments reduced tar spot chlorotic and necrotic symptoms over nontreated control. Xyway 5.9 fl oz in-furrow fb Lucento, and Veltyma were the greenest plots on 7 Oct, but were not significantly different from Topguard fb Lucento. There was no significant difference between treatments for harvest moisture and test weight. Xyway fb Lucento, Topguard fb Lucento, Lucento, and Veltyma increased yield over nontreated control, but were not significantly different from the other fungicide programs.

Table 33. Effect of fungicide treatment on tar spot, stay green, and corn yield.

| Treatment, rate/A and timing[z] | Tar spot % stroma[y] 29-Sep | Tar spot % chlo/necr[x] 29-Sep | Stay green[w] % 7-Oct | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | 13.7 ab | 14.9 bcd | 27.5 c | 24.1 | 53.1 | 179.5 c |
| Xyway 3D 5.9 fl oz in-furrow | 18.0 a | 24.3 ab | 27.5 c | 21.6 | 53.7 | 190.5 abc |
| Xyway 3D 11.8 fl oz in-furrow | 13.8 ab | 18.0 abc | 31.3 bc | 23.3 | 52.2 | 187.9 abc |
| Xyway 3D 5.9 fl oz in-furrow fb Lucento 4.17 SC 5.0 fl oz @VT | 6.2 c | 9.9 cd | 38.8 a | 23.2 | 52.1 | 195.7 a |
| Headline EC 6.9 fl oz in-furrow | 15.6 ab | 18.3 abc | 31.3 bc | 22.7 | 52.4 | 187.7 abc |
| Topguard EQ 5.0 fl oz @V6 fb Lucento 4.17 SC 5.0 fl oz @VT | 6.3 c | 12.7 cd | 36.3 ab | 24.7 | 52.3 | 191.6 ab |
| Delaro 325 SC 4.0 fl oz @ V6 | 12.4 b | 26.5 a | 27.5 c | 22.8 | 52.4 | 182.4 bc |
| Lucento 4.17 SC 5.0 fl oz @ VT | 5.6 c | 5.0 d | 36.3 ab | 23.9 | 52.3 | 196.8 a |
| Veltyma 3.34 S 7.0 fl oz @ VT | 2.0 c | 8.2 cd | 41.3 a | 23.6 | 51.9 | 199.3 a |
| *p*-value | <.0001 | 0.0084 | 0.0003 | 0.1427 | 0.0550 | 0.0346 |
| LSD (0.05)[u] | 5.4 | 11.3 | 6.3 | NS[t] | NS | 12.0 |

[z] Fungicides were applied on 7 Jun at planting, 2 July at the V6 and 8 Aug at the VT/R1 (tassel/silk) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v. FB = followed by.
[y] Tar spot stroma visually assessed percentage (0-100%) of leaf area on five plants in each plot at the ear leaf.
[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] Stay green visually assessed percentage (0-100%) of crop canopy green on 7 Oct.
[v] Yields were adjusted to 15.5% moisture and harvested on 3 Nov.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

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

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**Fungicide evaluation for tar spot of corn in northwestern Indiana, 2020 (COR20-31.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. Corn hybrid 'W2585SSRIB' was planted in 30-inch row spacing at a rate of 34,000 seeds/A on 9 Jun. Standard practices for non-irrigated grain corn production in Indiana were followed. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 8 Aug at VT/R1 (tassel/silk) growth stage. Disease ratings were assessed on 7 Oct at R6 (maturity) growth stage. Tar spot was rated by visually assessing the percentage of stroma and percentage of symptomatic tissues (chlorosis and necrosis) per leaf on five plants in each plot at the ear leaf. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 6 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 test (LSD; α=0.05).

In 2020, weather conditions were favorable for disease. Tar spot was the most prominent disease in the trial and reached moderate severity. All fungicide applications significantly reduced the severity of tar spot stroma and chloric and necrotic symptoms on the ear leaf on 7 Oct over nontreated control (Table 34). All fungicide programs increased stay green on 7 Oct. No significant differences found between treatments and nontreated control for harvest moisture, test weight, and corn yield.

Table 34. Effect of fungicide treatment on tar spot, stay green, and corn yield.

| Treatment and rate/A[z] | Tar spot % stroma[y] 7-Oct | Tar spot % chlo/necr[x] 7-Oct | Stay green[w] % 7-Oct | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control | 23.0 a | 30.8 a | 41.3 e | 25.8 | 49.6 | 205.7 |
| Topguard EQ 4.29 SC 5.0 fl oz | 4.2 b | 2.9 b | 62.5 bcd | 26.3 | 49.0 | 197.8 |
| Lucento 4.17 SC 5.0 fl oz | 5.0 b | 3.9 b | 55.0 d | 25.9 | 49.2 | 214.5 |
| Lucento 4.17 SC 5.0 fl oz + Quadris 6.0 fl oz | 4.0 bc | 3.8 b | 60.0 bcd | 26.0 | 49.3 | 208.9 |
| Veltyma 3.34 S 7.0 fl oz | 1.8 c | 1.6 b | 75.0 a | 25.5 | 50.4 | 204.3 |
| Miravis Neo 2.5 SE 13.7 fl oz | 3.9 bc | 3.5 b | 56.3 cd | 26.0 | 49.0 | 212.5 |
| Trivapro 2.21 SE 13.7 fl oz | 4.5 b | 1.5 b | 63.8 bc | 25.9 | 49.4 | 208.2 |
| Delaro 325 SC 8.0 fl oz | 4.0 bc | 1.8 b | 66.3 b | 25.5 | 49.3 | 205.8 |
| *p*-value | <.0001 | <.0001 | <.0001 | 0.2058 | 0.0130 | 0.8053 |
| LSD (0.05)[u] | 2.3 | 5.6 | 8.5 | NS[t] | NS | NS |

[z] Fungicides were applied 8 Aug at the VT/R1 (tassel/silk) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[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] Stay green visually assessed percentage (0-100%) of crop canopy green on 7 Oct.
[v] Yields were adjusted to 15.5% moisture and harvested on 6 Nov.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

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

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**Fungicide comparison for white mold in soybean in northwestern Indiana, 2020 (SOY20-02.PPAC).**

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 6.7-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'P34A79X' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 5 Jun. Inoculum of *S. sclerotiorum* was applied on the seedbed at 1.25 g/ft at planting. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 20 Jul at the R1 (beginning bloom) growth stage and 5 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 31 Aug and 10 Sep at the R5 (beginning seed) and R6 (full seed) growth stages, 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 2 Nov 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, very little disease developed in plots. There was no significant differences between fungicide treatments and nontreated control for all disease ratings on 31 Aug and 10 Sep (Table 35). Aproach plus Aproach Prima program application at R1 fb R1 +14d, Miravis Neo at R1, A21573 at R1, A21573 at R1 fb R1+14d, Aproach Prima at R1 fb R1+14d, Aproach at R1 fb R1+14d, and Revytek at R1 resulted in the greenest canopies and lowest defoliation on 24 Sep. There was no significant effect of treatment on moisture, test weight, or soybean yield.

Table 35. Effect of fungicide on white mold incidence, moisture, test weight, and yield of soybean.

| Treatment[z] | White mold[y] 31-Aug | White mold[y] 10-Sep | Green[x] % 24-Sep | Defoliation[w] % 24-Sep | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated control | 0.5 | 2.8 | 46.3 de | 8.8 a | 12.5 | 56.7 | 67.5 |
| Contans WG 4.0 lb @ plant | 0.5 | 3.0 | 46.3 de | 8.8 a | 12.0 | 55.8 | 67.5 |
| Double Nickel 2.0 qt @ R1 | 0.0 | 3.8 | 46.3 de | 7.5 ab | 12.0 | 55.9 | 67.4 |
| Contans WG 4.0 lb @ planting fb Double Nickel 2.0 qt @ R1 | 0.0 | 1.3 | 46.3 de | 8.8 a | 12.1 | 56.0 | 69.3 |
| Miravis Neo 20.8 fl oz @ R1 | 0.3 | 4.0 | 56.3 a | 5.0 b | 12.1 | 55.8 | 69.1 |
| A21573C 13.7 fl oz @ R1 | 0.3 | 2.3 | 53.8 abc | 5.0 b | 12.0 | 56.0 | 69.7 |
| A21573C 13.7 fl oz @ R1 fb A21573C 13.7 fl oz @ R3 | 0.8 | 2.3 | 55.0 ab | 5.0 b | 12.0 | 55.9 | 70.9 |
| Aproach Prima 6.8 fl oz @ R1 fb Aproach Prima 6.8 fl oz @R1 + 14 d | 0.5 | 3.0 | 50.0 a-e | 5.0 b | 12.0 | 55.9 | 70.8 |
| Aproach 3.0 fl oz + Aproach Prima 6.8 fl oz @ R1 fb Aproach 3.0 fl oz + Aproach Prima 6.8 fl oz @ R1 + 14 d | 0.3 | 0.8 | 56.3 a | 5.0 b | 12.0 | 56.0 | 72.0 |
| Aproach 9.0 fl oz @ R1 fb Aproach 9.0 fl oz @ R1 + 14 d | 0.0 | 1.8 | 52.5 a-d | 5.0 b | 12.0 | 56.1 | 70.1 |
| Endura 12.5 oz @ R1 | 0.0 | 1.5 | 45.0 e | 7.5 ab | 12.0 | 56.0 | 69.2 |
| Priaxor Xemium 8.0 fl oz @ R1 | 0.8 | 4.5 | 48.8 b-e | 7.5 ab | 12.0 | 55.7 | 69.3 |
| Acropolis 23.0 fl oz @ R1 | 0.3 | 5.0 | 47.5 cde | 8.8 a | 12.0 | 56.3 | 67.1 |
| Revytek 15.0 fl oz @ R1 | 0.5 | 5.8 | 51.3 a-e | 5.0 b | 12.1 | 56.0 | 69.2 |
| *p*-value | 0.6359 | 0.1189 | 0.0032 | 0.0198 | 0.5582 | 0.3739 | 0.2175 |
| LSD (0.05)[u] | NS[t] | NS | 6.60 | 3.22 | NS | NS | NS |

[z] Fungicide treatments applied on 20 Jul at the R1 (beginning bloom) growth stage and 5 Aug at the R3 (beginning pod) growth stage, respectively. All treatments contained a non-ionic surfactant (Induce) at a rate of 0.12% v/v. All plots inoculated with *S. sclerotiorum*.
[y] White mold disease assessed by counting the number of plants/plot with symptoms.
[x] Green visually assessed the percentage (0-100%) in the plot on 24 Sep.
[w] Defoliation = percentage of leaf loss in plot.
[v] Yields were adjusted to 13% moisture and harvested on 2 Nov.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'KSC33RX70C')
Sudden death syndrome; *Fusarium virguliforme*
Soybean cyst nematode; *Heterodera glycines*

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**Comparison of seed treatments for sudden death syndrome in soybean in Indiana, 2020 (SOY20-03.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 soybean production in Indiana were followed. Soybean variety 'KSC33RX70C' was planted in 30-inch row spacing at a rate of 8 seeds/ft on 6 Jun. All plots were inoculated with isolates of *Fusarium virguliforme* within the seedbed at 1.25 g/ft on 6 Jun. Seed treatments were applied on seeds before planting. Disease ratings were assessed on 31 Aug and 9 Sep at the R5 (beginning seed) and R6 (full seed) growth stages, respectively. 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 2 Nov 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, very little disease developed in plots. Sudden death syndrome (SDS) was the most prominent disease in the trial but only reached low severity. Soybean cyst nematode (SCN) egg count in spring soil samples from field site was 0 -700 eggs/100 cc soil, a low to moderate range. There was no significant difference between seed treatments for all disease ratings on 10 Sep (Table 36). There were no significant differences between seed treatments for stay green, defoliation, harvest moisture, test weight and yield.

Table 36. Effect of fungicide on foliar diseases severity and soybean yield.

| Treatment[z] | SDS DI[y] 10-Sep | SDS DS[y] 10-Sep | SDS Index[y] 10-Sep | Stay green[x] 24-Sep | Defoliation[w] % 24-Sep | Harvest moisture % | Test weight lb/bu | Yield[v] bu/A |
|---|---|---|---|---|---|---|---|---|
| Base | 3.8 | 0.8 | 0.4 | 38.8 | 7.5 | 12.6 | 56.4 | 65.2 |
| ILEVO | 2.8 | 1.0 | 0.3 | 43.8 | 6.3 | 12.5 | 56.5 | 64.6 |
| BAS780 06 F | 5.3 | 1.3 | 0.9 | 43.8 | 6.3 | 12.6 | 56.6 | 64.3 |
| Saltro | 5.0 | 1.0 | 0.6 | 45.0 | 6.3 | 12.6 | 56.6 | 63.3 |
| BIOst + Mertect + Heads Up | 5.3 | 1.3 | 0.9 | 42.5 | 8.8 | 12.5 | 56.3 | 62.8 |
| BASF494 | 5.0 | 1.3 | 0.7 | 43.8 | 5.0 | 12.5 | 56.6 | 62.5 |
| ILEVO + 725AWS | 5.0 | 1.0 | 0.6 | 42.5 | 5.0 | 12.6 | 56.3 | 65.9 |
| *p*-value | 0.7197 | 0.7268 | 0.7309 | 0.2253 | 0.5161 | 0.6913 | 0.3764 | 0.6391 |
| LSD (0.05)[u] | NS[t] | NS | NS | NS | NS | NS | NS | NS |

[z] Seed treatments were pre-applied to the seed before planting. All plots were inoculated with isolates of *Fusarium virguliforme* within the seedbed at 1.25 g/ft on 6 Jun.
[y] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). DI refers to the percentage of plants with disease symptoms, and 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.
[x] Stay green visually assessed the percentage (0-100%) in the plot on 24 Sep.
[w] Defoliation = percentage of leaf loss in plot.
[v] Yields were adjusted to 13% moisture and harvested on 2 Nov.
[u] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'GH3319E3')
Sudden death syndrome; *Fusarium virguliforme*
Soybean cyst nematode; *Heterodera glycines*

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**Evaluation of seed treatments for soybean sudden death syndrome in northwestern Indiana, 2020 (SOY20-22.PPAC).**

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'GH3319E3' was planted in 30-inch row spacing at a rate of 8 seeds/ft on 6 Jun. All plots were inoculated with *Fusarium virguliforme* at 1.25 g per ft within the seedbed at planting. Seed treatments were pre-applied to the seeds before planting. Disease ratings were assessed on 10 Sep at R6 (full seed) growth stage. 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 2 Nov 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, very little disease developed in plots. Sudden death syndrome (SDS) was the most prominent disease, but only reached low severity. Soybean cyst nematode (SCN) egg count in spring soil samples ranged from 0-700 eggs/100 cc soil, a low to moderate range. No treatment differences were detected for SDS DI and SDS DS on 10 Sep (Table 37). ILeVO and BAS780 06 F seed treatments reduced SDS index over nontreated control on 10 Sep. There were no significant differences between seed treatments for harvest moisture, test weight and yield of soybean.

Table 37. Effect of seed treatment on SDS and yield of soybean.

| Treatment[z] | SDS DI[y] 10-Sep | SDS DS[y] 10-Sep | SDS Index[y] 10-Sep | Harvest moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|---|---|
| Base | 6.3 | 2.0 | 1.3 a | 12.8 | 55.9 | 62.8 |
| ILEVO | 3.8 | 0.8 | 0.5 b | 12.8 | 55.8 | 61.6 |
| BAS780 06 F | 3.8 | 0.8 | 0.5 b | 12.8 | 55.7 | 61.5 |
| *p*-value | 0.2963 | 0.0805 | 0.0261 | 0.5787 | 0.8976 | 0.7791 |
| LSD (0.05)[w] | NS[v] | NS | 0.60 | NS | NS | NS |

[z] Seed treatments were pre-applied to the seeds and provided to plant.
[y] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). Disease incidence refers to the percentage of plants with disease symptoms, and disease severity (DS) was rated using a 1-9 scale where 1 refers to low disease pressure and 9 refers to premature death of the plant. SDS Index was then calculated using the equation: DX= (DI x DS)/9.
[x] Yields were adjusted to 13% moisture and harvested on 2 Nov.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

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

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**Comparison of fungicides for white mold in soybean in northwestern Indiana, 2020 (SOY20-26.PPAC).**

A trial was established at the Pinney Purdue Agricultural Center (PPAC) in Porter County, IN. The experiment was a randomized complete block design with four replications. Plots were 6.7-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'P34A79X' was planted in 20-inch row spacing at a rate of 8 seeds/ft on 5 Jun. Inoculum of *S. sclerotiorum* was applied on the seedbed at 1.25 g/ft at planting. The field was overhead irrigated weekly at 1 in. unless weekly rainfall was 1 in. or higher to encourage disease. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 20 Jul at the R1 (beginning bloom) growth stage and 5 Aug at the R3 (beginning pod) growth stage. Disease ratings were assessed on 31 Aug and 10 Sep at the R5 (beginning seed) and R6 (full seed) growth stages, 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 2 Nov 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, very little disease developed in plots. White mold was present in the trial but only reached low severity. There was no significant differences between fungicide treatments and nontreated control for all disease ratings on 31 Aug and 10 Sep (Tables 38). There was no significant effect of treatment on moisture, test weight, or soybean yield.

Table 38. Effect of fungicide on white mold incidence, moisture, test weight, and yield of soybean.

| Treatment[z] | Rate/A | Timing | White mold[y] 31-Aug | White mold[y] 10-Sep | Harvest moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|---|---|---|
| Nontreated control | | | 0.8 | 1.3 | 12.3 | 45.6 | 70.6 |
| Propulse 400 SC | 7.0 fl oz | R1 | 0.3 | 1.5 | 12.0 | 45.6 | 68.1 |
| USF0411 458 SC | 8.0 fl oz | R1 | 0.5 | 1.8 | 12.0 | 45.3 | 68.0 |
| USF0411 458 SC fb USF0411 458 SC | 8.0 fl oz | R1 fb R3 | 0.3 | 2.3 | 11.9 | 45.2 | 68.0 |
| *p*-value | | | 0.3272 | 0.8060 | 0.2881 | 0.5517 | 0.219 |
| LSD (0.05)[w] | | | NS[v] | NS | NS | NS | NS |

[z] Fungicide treatments applied on 20 Jul at the R1 (beginning bloom) growth stage and 5 Aug at the R3 (beginning pod) growth stage, respectively. All treatments contained a non-ionic surfactant (Induce) at a rate of 0.12% v/v. All plots inoculated with *S. sclerotiorum*.
[y] White mold disease assessed by counting the number of plants/plot with symptoms.
[x] Yields were adjusted to 13% moisture and harvest on 2 Nov.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P25A27X' & 'P24T76E' )
Sudden death syndrome; *Fusarium virguliforme*
Soybean cyst nematode; *Heterodera glycines*

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**Evaluation of varieties and seed treatment in soybean in northwestern Indiana, 2020 (SOY20-30.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 soybean production in Indiana were followed. Soybean variety 'P25A27X' (resistant) & 'P24T76E' (susceptible) were planted in 30-inch row spacing at a rate of 8 seeds/ft on 5 Jun. Seed treatments were applied on seeds before planting: resistant nontreated control, resistant ILEVO (0.15 mg/seed), resistant Saltro (standard rate), susceptible nontreated control, susceptible ILeVO (0.15 mg/seed) and susceptible Saltro (standard rate). Disease ratings were assessed on 31 Aug at the R5 (beginning pod/full pod) growth stage. Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS). Disease incidence refers to the percentage (0-100%) of plants with disease symptoms, and disease severity 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 2 Nov 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 Protected Least Significant Difference test (LSD; α=0.05).

In 2020, very little disease developed in plots. Sudden death syndrome (SDS) was the most prominent disease in the trial but only reached low severity. Soybean cyst nematode (SCN) egg count in spring soil samples ranged from 0-500 eggs/100 cc soil, a low to moderate range. P25A27X (resistant) had significantly lower levels of SDS incidence and index over the susceptible variety, P24T76E (Table 39). There was no significant difference among seed treatments and nontreated control in each variety. There were no significant differences between seed treatments and variety for harvest moisture, test weight and yield.

Table 39. Effect of fungicide on foliar diseases severity and soybean yield.

| Treatment and variety[z] | SDS DI[y] 31-Aug | SDS DS[y] 31-Aug | SDS Index[y] 31-Aug | Harvest moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|---|---|
| Nontreated control, P25A27X | 1.8 b | 0.5 | 0.2 b | 11.9 | 55.3 | 57.9 |
| ILEVO, P25A27X | 2.0 b | 0.5 | 0.2 b | 11.9 | 55.3 | 64.1 |
| Saltro, P25A27X | 1.3 b | 0.8 | 0.2 b | 12.1 | 55.4 | 61.3 |
| Nontreated control, P24T76E | 10.0 a | 1.3 | 1.3 a | 11.8 | 55.2 | 58.1 |
| ILEVO, P24T76E | 10.0 a | 1.5 | 1.4 a | 11.7 | 55.3 | 56.5 |
| Saltro, P24T76E | 7.5 a | 1.3 | 1.0 a | 11.8 | 55.3 | 60.3 |
| *p*-value | 0.0049 | 0.1701 | <.0001 | 0.1695 | 0.9346 | 0.1348 |
| LSD (0.05)[w] | 5.5 | NS[v] | 0.5 | NS | NS | NS |

[z] Seed treatments were applied to the seeds before planting on 5 Jun: resistant nontreated control, resistant ILEVO (0.15 mg/seed), resistant Saltro (standard rate), susceptible nontreated control, susceptible ILEVO (0.15 mg/seed) and susceptible Saltro (standard rate).
[y] Sudden death syndrome (SDS) in each plot was rated for disease incidence (DI) and disease severity (DS) on 31 Aug. Disease incidence (DI) refers to the percentage (0-100%) 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 calculated using the equation: DX = (DI x DS)/9.
[x] Yields were adjusted to 13% moisture and harvested on 2 Nov.
[w] Means followed by the same letter are not significantly different based on Fisher's Protected Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α = 0.05).

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

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**Evaluation of fungicides for foliar diseases on corn in southwestern Indiana, 2020 (COR20-18.SWPAC).**

A trial was established at the Southwest Purdue Agricultural Center (SWPAC) in Knox County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for grain corn production in Indiana were followed. Corn hybrid 'P9998AM' was planted in 30-inch row spacing at a rate of 27,000 seeds/A on 22 May. All fungicide applications were applied at 15 gal/A and 40 psi using a Lee self-propelled sprayer equipped with a 10-ft boom, fitted with six TJ-VS 8002 nozzles spaced 20-in. apart at 3.6 mph. Fungicides were applied on 18 Jul at the VT/R1 (tassel/silk) growth stage and 6 Aug at the R3 (milk) growth stage. Disease ratings was assessed on 1 Sep at the R5 (dent) growth stage. Disease severity was rated by visually assessing the percentage of symptomatic leaf area of the ear leaf on five leaves in each plot. Values for each plot were averaged before analysis. The two center rows of each plot were harvested on 2 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 Protected Least Significant Difference test (LSD; α=0.05).

In 2020, weather conditions were favorable for disease. Southern rust (SR) and gray leaf spot (GLS) were the most prominent diseases in the trial and reached moderate severity. All fungicides at both VT/R1 and R3 application timings significantly reduced SR and GLS as compared to the nontreated control (Table 40). No significant differences were detected between fungicide treatments and nontreated control for yield.

Table 40. Effect of fungicide on foliar diseases severity and corn yield.

| Treatment, rate/A and timing[z] | SR % severity[y] 1-Sep | GLS % severity[y] 1-Sep | Harvest moisture % | Test weight lb/bu | Yield[x] bu/A |
|---|---|---|---|---|---|
| Nontreated control | 16.9 a | 5.1 a | 15.8 c | 58.5 ab | 223.6 |
| Lucento 4.17 SC 5.0 fl oz at VT/R1 | 3.0 c-g | 0.5 de | 16.9 ab | 57.9 a-g | 216.2 |
| Trivapro 2.21 SE 13.7 fl oz at VT/R1 | 1.3 f | 1.1 b-e | 17.1 ab | 57.5 efg | 213.3 |
| Miravis Neo 2.5 SE 13.7 fl oz at VT/R1 | 6.1 bc | 0.6 de | 16.8 ab | 58.5 a | 221.4 |
| Veltyma 3.34 S 7.0 fl oz at VT/R1 | 3.6 b-g | 0.2 e | 16.5 bc | 57.7 c-g | 224.1 |
| Delaro 325 SC 8.0 fl oz at VT/R1 | 4.4 b-f | 0.6 de | 16.8 ab | 58.3 abc | 225.6 |
| Quilt Xcel 2.2 SE 10.5 fl oz at VT/R1 | 5.0 b-e | 0.4 de | 17.0 ab | 58.2 a-d | 218.0 |
| Headline AMP 1.68 SC 10.0 fl oz at VT/R1 | 3.5 b-g | 1.1 b-e | 16.7 ab | 58.1 a-e | 204.3 |
| Revytek 3.33 LC 8.0 fl oz at VT/R1 | 3.2 b-g | 0.2 e | 17.0 ab | 57.9 a-g | 215.3 |
| Lucento 4.17 SC 5.0 fl oz at R3 | 1.2 fg | 1.0 b-e | 16.9 ab | 58.2 a-d | 216.5 |
| Trivapro 2.21 SE 13.7 fl oz at R3 | 0.4 g | 1.3 cde | 17.2 ab | 57.3 g | 224.0 |
| Miravis Neo 2.5 SE 13.7 fl oz at R3 | 2.5 d-g | 1.8 bc | 16.7 b | 57.4 fg | 214.7 |
| Veltyma 3.34 S 7.0 fl oz at R3 | 1.5 fg | 0.8 cde | 17.0 ab | 57.6 d-g | 221.9 |
| Delaro 325 SC 8.0 fl oz at R3 | 5.5 bcd | 1.1 b-e | 16.6 b | 57.9 b-g | 221.9 |
| Quilt Xcel 2.2 SE 10.5 fl oz at R3 | 6.3 b | 2.0 b | 16.6 b | 58.0 a-f | 215.7 |
| Headline AMP 1.68 SC 10 fl oz at R3 | 1.8 efg | 2.1 b | 16.7 b | 57.9 b-g | 225.6 |
| Revytek 3.33 LC 8.0 fl oz at R3 | 1.4 fg | 0.7 cde | 17.5 a | 57.5 efg | 213.3 |
| *p*-value | <.0001 | <.0001 | 0.0364 | 0.0049 | 0.2111 |
| LSD (0.05)[w] | 3.2 | 1.1 | 0.7 | 0.7 | NS[v] |

[z] Fungicide treatments applied on 18 Jul at the VT/R1 growth stage and 6 Aug at the R3 growth stage, and all treatments contained a non-ionic surfactant at a rate of 0.25% v/v.
[y] Disease severity visually assessed percentage (0-100%) of symptomatic leaf area on ear leaf; five plants were assessed per plot and averaged before analysis. SR=southern rust; and GLS = gray leaf spot.
[x] Yields were adjusted to 15.5% moisture and harvested on 6 Oct.
[w] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P32A87L')
Septoria brown spot; *Septoria glycines*
Cercospora leaf blight; *Cercospora kikuchii/C.flagellaris*

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**Evaluation of fungicides for foliar diseases on soybean in southwestern Indiana, 2020 (SOY20-18.SWPAC).**

A trial was established at the Southwest Purdue Agricultural Center (SWPAC) in Knox County, IN. The experiment was a randomized complete block design with four replications. Plots were 10-ft wide and 30-ft long, consisted of four rows, and the two center rows used for evaluation. The previous crop was corn. Standard practices for soybean production in Indiana were followed. Soybean variety 'P32A87L' was planted in 30-inch row spacing at a rate of 150,000 seeds/A on 26 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 24 Jul at the R3 (beginning pod) growth stage. Disease ratings were assessed on 19 Aug at the R5 (beginning seed) growth stage. Cercospora leaf blight (CLB), and Septoria brown spot (SBS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. The two center rows were harvested on 30 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 test (LSD; α=0.05).

In 2020, weather conditions were unfavorable for soybean disease. Septoria brown spot (SBS) and Cercospora leaf blight (CLB) were the most prominent diseases in the trial and reached a low severity. No significant treatment differences detected for SBS and CLB severity, soybean harvest moisture, test weight, and yield (Table 41).

Table 41. Effect of fungicide on foliar disease severity and soybean yield.

| Treatment [z] | Rate/A | CLB % severity[y] 19-Aug | SBS % severity[y] 19-Aug | Harvest moisture % 30-Sep | Test weight lb/bu 30-Sep | Yield [x] bu/A 30-Sep |
|---|---|---|---|---|---|---|
| Nontreated control | | 0.00 | 0.33 | 11.3 | 55.7 | 60.6 |
| Preemptor 3.22 SC | 5.0 fl oz | 0.00 | 0.08 | 11.5 | 55.3 | 59.1 |
| Topguard EQ | 5.0 fl oz | 0.00 | 0.05 | 11.8 | 55.7 | 60.4 |
| Quadris Top SBX | 7.0 fl oz | 0.00 | 0.05 | 11.4 | 55.4 | 59.5 |
| Lucento 4.17 SC | 5.0 fl oz | 0.00 | 0.03 | 11.7 | 55.6 | 60.2 |
| Miravis Top 1.67 SC | 13.7 fl oz | 0.03 | 0.00 | 11.8 | 55.1 | 64.1 |
| Priaxor 4.17 SC | 4.0 fl oz | 0.00 | 0.05 | 11.2 | 55.3 | 59.6 |
| Trivapro 2.21 SE | 13.7 fl oz | 0.00 | 0.05 | 11.1 | 55.5 | 54.3 |
| Delaro 325 SC | 8.0 fl oz | 0.00 | 0.03 | 11.7 | 55.4 | 60.0 |
| Headline AMP 1.68 SC | 10.0 fl oz | 0.00 | 0.03 | 11.7 | 55.7 | 61.7 |
| Veltyma 3.34 S | 7.0 fl oz | 0.00 | 0.00 | 11.7 | 55.7 | 57.4 |
| Revytek 3.33 LC | 8.0 fl oz | 0.00 | 0.10 | 11.8 | 55.4 | 62.1 |
| *p*-value | | 0.4671 | 0.1284 | 0.7266 | 0.9121 | 0.3456 |
| LSD (0.05)[w] | | NS[v] | NS | NS | NS | NS |

[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] Foliar disease incidence rated on scale of 0-100% of plants within a plot with disease symptoms. CLB= Cercospora leaf blight rated in the upper canopy. SBS = Septoria brown spot rated in the lower canopy.
[x] Yields were adjusted to 13% moisture and harvested 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).
[v] NS = not significant (α=0.05).

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

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**Fusarium head blight (FHB) uniform fungicide trial in southwestern Indiana, 2020 (WHT20-03.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 on 10 Oct, 15 Oct, and 16 Oct 2019. Nitrogen (46-0-0) at 50 lb/A plus Potash (0-0-60) at 200 lbs/A was applied on 14 Oct 2019. AMS (21-0-0-24) at 100 lbs/A plus Boron 14.3% at 7 lbs/A plus Nitrogen (46-0-0) at 200 lb/A was applied on 21 Feb 2020. On 19 Oct 2019 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 1 Apr 2020 for weed management. 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 and directed forward and backward at 45 degree angle, at 3.6 mph. Fungicides were applied on 7 May at the Feekes 10.3, on 22 May at the Feekes 10.5.1 and on 26 May at the Feekes 10.5.4. 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 215 ml/plot at the Feekes 10.5.1. Disease ratings were assessed on 8 June 2020. 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 of leaf blotch was rated by visually assessing the percentage of symptomatic 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 25 June 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 2020, weather conditions were moderately favorable for Fusarium head blight (FHB) and leaf blotch. FHB was the most prominent disease in the trial. All fungicides reduced FHB percent incidence, severity and index, and leaf blotch percent severity (Table 42). Miravis Ace applied at 10.5.4 resulted in the highest level of FHB percent incidence, severity and index when compared to all other fungicide programs. The concentration of the mycotoxin deoxynivalenol (DON) was significantly reduced by all fungicide programs over the nontreated control, Caramba at 10.5.4 had the highest level of DON of the fungicide programs, but was not different from Miravis Ace applied at Feekes 10.3 or 10.5.4 (Table 43). The percentage of FDK was significantly reduced by all fungicide programs over nontreated control. Harvest moisture and test weight was lowest in the nontreated control, but was not different from treatments of Prosaro, Caramba, or BAS 84000F applied at Feekes 10.5.1. There were no significant differences between treatments for wheat yield.

Table 42. Effect of fungicide on Fusarium head blight (FHB) and leaf blotch.

| Treatment, rate/A, and timing[z] | FHB % incidence[y] 8-Jun | FHB % severity[y] 8-Jun | FHB Index[x] 8-Jun | Leaf blotch % severity[w] 8-Jun |
|---|---|---|---|---|
| Nontreated control | 95.0 a | 38.8 a | 37.0 a | 16.0 a |
| Prosaro 421 SC 6.5 fl oz at 10.5.1 | 65.6 bc | 15.1 bc | 9.6 bc | 2.5 b |
| Caramba 90 EC 13.5 fl oz at 10.5.1 | 58.1 bc | 13.7 bc | 8.0 c | 3.1 b |
| BAS 84000F 7.3 fl oz at 10.5.1 | 54.2 c | 12.0 c | 6.5 c | 2.9 b |
| USF0115 10.3 fl oz at 10.5.1 | 51.3 c | 14.8 bc | 7.5 c | 2.6 b |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.3 | 58.8 c | 15.3 bc | 9.2 bc | 3.0 b |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 | 60.0 bc | 15.3 bc | 9.3 bc | 2.3 b |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.4 | 74.6 b | 17.1 b | 13.2 b | 3.8 b |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.4 | 57.9 c | 11.3 c | 6.5 c | 3.4 b |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 EC 13.5 fl oz at 10.5.4 | 58.3 c | 10.9 c | 6.5 c | 3.3 b |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.5.4 | 58.8 c | 13.1 c | 7.7 c | 1.4 b |
| *p*-value | 0.0002 | <.0001 | <.0001 | <.0001 |
| LSD (0.05)[v] | 15.4 | 4.9 | 5.0 | 4.6 |

[z] All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. Plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 215 ml/plot with handheld sprayer on 22 May. fb = followed by.
[y] Fusarium head blight (FHB) incidence was measured as the number of infected heads out of 60 in each plot and calculated as a percentage and FHB severity was rated by visually assessing the percentage of the infected head from infected heads out of 100.
[x] FHB index was calculated as: (total FHB incidence multiplied by average FHB severity)/100 per plot.
[w] Disease severity of leaf blotch was rated by visually assessing the percentage of symptomatic tissue on five flag leaves per plot.
[v] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).

Table 43. Effect of fungicide on deoxynivalenol (DON), Fusarium damaged kernels (FDK), and wheat yield.

| Treatment, rate/A, and application timing[z] | DON[y] ppm 25-Jun | FDK[x] % 25-Jun | Harvest moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|
| Nontreated control | 4.8 a | 11.38 a | 12.5 d | 56.9 e | 74.5 |
| Prosaro 421 SC 6.5 fl oz at 10.5.1 | 1.1 d | 9.38 b | 12.9 d | 57.5 cde | 84.7 |
| Caramba 90 EC 13.5 fl oz at 10.5.1 | 3.1 b | 8.92 b | 12.8 d | 57.5 b-e | 76.0 |
| BAS 84000F 7.3 fl oz at 10.5.1 | 1.3 cd | 8.00 b | 12.7 d | 57.2 de | 79.9 |
| USF0115 10.3 fl oz at 10.5.1 | 0.9 d | 7.88 b | 13.3 c | 58.5 abc | 81.1 |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.3 | 2.5 bc | 8.00 b | 13.3 c | 58.3 abc | 81.5 |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 | 1.3 cd | 8.00 b | 13.8 ab | 58.0 a-d | 78.6 |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.4 | 2.1 bcd | 8.75 b | 13.5 bc | 58.2 abc | 78.7 |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Prosaro 421 SC 6.5 fl oz at 10.5.4 | 0.9 d | 7.63 b | 14.0 a | 59.0 a | 82.0 |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Caramba 90 EC 13.5 fl oz at 10.5.4 | 1.3 cd | 7.63 b | 14.0 a | 58.5 ab | 79.7 |
| Miravis Ace 5.2 SC 13.7 fl oz at 10.5.1 fb Folicur 3.6 F 4.0 fl oz at 10.5.4 | 1.4 cd | 7.63 b | 13.8 ab | 59.0 a | 79.5 |
| *p*-value | <.0001 | 0.0059 | <.0001 | 0.0019 | 0.2454 |
| LSD (0.05)[v] | 1.2 | 1.8 | 0.36 | 1.0 | NS[u] |

[z] All treatments contained a non-ionic surfactant (Preference) at a rate of 0.125% v/v. Plots inoculated with *Fusarium graminearum* spore suspension (50,000 spores/ml) after the treatment at Feekes 10.5.1. Spore suspension applied at 215 ml/plot with handheld sprayer on 22 May. FB = followed by.

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

[x] FDK visual estimative = percentage of Fusarium damaged kernels out of subsample take from each plot.

[w] Yields were adjusted to 13.5% moisture and harvested on 25 Jun.

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

[u] NS = not significant (α=0.05).

WHEAT (*Triticum aestivum*); 'P25R40', 'P25R61'
Fusarium head blight; *Fusarium graminearum*
Stagnospora leaf blotch; *Stagnospora nodorum*

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**Fusarium head blight (FHB) integrated management trial in southwestern Indiana, 2020 (WHT20-04.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 on 10 Oct, 15 Oct, and 16 Oct 2018. Nitrogen (46-0-0) at 50 lbs/A plus Potash (0-0-60) at 200 lbs/A was applied on 14 Oct 2019. AMS (21-0-0-24) at 100 lbs/A plus Boron 14.3% at 7 lbs/A plus Nitrogen (46-0-0) at 200 lbs/A was applied on 21 Feb 2020. On 19 Oct 2019 wheat cultivars P25R40 and P25R61 were 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 1 Apr 2020 for weed management. 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 and directed forward and backward at 45degree angle, at 3.6 mph. Fungicides were applied on 7 May at the Feekes 10.3, on 22 May at the Feekes 10.5.1 and on 26 May at the Feekes 10.5.4. 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 215 ml/plot at Feekes 10.5.1. Disease ratings were assessed on 8 June 2020. 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 of leaf blotch was rated by visually assessing the percentage of symptomatic 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 25 June 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 Tukey-HSD (α=0.05).

In 2020, weather conditions were moderately favorable for Fusarium head blight (FHB) and leaf blotch. FHB was the most prominent disease in the trial. Main effects of variety and fungicide treatment are presented. FHB incidence, severity and index, DON and percent FDK were lowest in the moderately resistant variety P25R61 (Tables 44 and 45). FHB percent incidence, percent severity, and index, and percent leaf blotch were reduced by all fungicide treatments over the nontreated controls on 8 Jun (Table 44). The concentration of deoxynivalenol (DON) was significantly reduced by all the fungicides over the nontreated, non-inoculated control, but not the nontreated, inoculated control (Table 45). Applications of Prosaro and Miravis Ace fb Folicur had the lowest percent FDK, but were not significantly different from all other fungicide treatments. Wheat test weight was higher in variety P25R40, and yields were highest in P25R40. Harvest moisture was significantly higher in treatments that included Miravis Ace, and test weight was highest with Miravis Ace followed by Folicur. Miravis Ace applied at 10.3 and the program of Miravis Ace followed by Folicur had increased yield over the nontreated controls, but these were not significantly different from the other fungicide programs.

Table 44. Effect of variety and fungicide on Fusarium head blight (FHB) and leaf blotch in wheat.

| Treatment[z] | Rate/A | Timing | FHB % incidence[y] 8-Jun | FHB % severity[y] 8-Jun | FHB Index[x] 8-Jun | Leaf blotch % severity[w] 8-Jun |
|---|---|---|---|---|---|---|
| *Variety* | | | | | | |
| P25R40 | | | 73.3 a[v] | 27.3 a | 21.7 a | 4.2 |
| P25R61 | | | 38.6 b | 9.7 b | 4.0 b | 3.8 |
| *Fungicide program* | | | | | | |
| Nontreated control, inoculated control | | | 72.7 a | 30.0 a | 25.3 a | 9.0 a |
| Prosaro 421 SC | 6.5 fl oz | 10.5.1 | 52.9 b | 15.6 b | 9.6 b | 1.6 b |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.1 | 48.5 b | 14.3 b | 8.2 b | 1.1 b |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.3 | 37.3 b | 13.2 b | 6.0 b | 1.0 b |
| Miravis Ace 5.2 SC fb Folicur 3.6 F | 13. fl oz 4.0 fl oz | 10.5.1 10.5.4 | 48.4 b | 12.4 b | 7.0 b | 0.8 b |
| Nontreated, non-inoculated control | | | 75.8 a | 25.6 a | 21.1 a | 10.4 a |
| | | Variety P(F) | <.0001 | <.0001 | <.0001 | 0.6329 |
| | | Treatment P(F) | <.0001 | <.0001 | <.0001 | <.0001 |
| | | Var*Trt P(F) | 0.8682 | <.0001 | <.0001 | 0.5770 |

[z] Fungicides treatments applied at Feekes 10.3, 10.5.1, and 10.5.4 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, except nontreated, non-inoculated control. Spore suspension applied at 215 ml/plot on 29 May.

[x] 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 Stagnospora leaf visually assessing the percentage of symptomatic leaf tissue on five flag leaves per plot.

[v] Means followed by the same letter are not significantly different based on Tukey-HSD (α=0.05).

Table 45. Effect of variety and fungicide on deoxynivalenol (DON), Fusarium damaged kernels (FDK), and yield of wheat.

| Treatment[z] | Rate/A | Timing | DON[y] ppm 25-Jun | FDK[x] % 25-Jun | Harvest moisture % | Test weight lb/bu | Yield[w] bu/A |
|---|---|---|---|---|---|---|---|
| Variety | | | | | | | |
| P25R40 | | | 2.67 a[v] | 8.4 a | 13.4 | 57.7 a | 78.8 b |
| P25R61 | | | 0.85 b | 6.9 b | 13.4 | 56.0 b | 92.3 a |
| Fungicide program | | | | | | | |
| Nontreated control, inoculated control | | | 1.99 b | 8.4 ab | 12.9 c | 56.4 b | 81.0 b |
| Prosaro 421 SC | 6.5 fl oz | 10.5.1 | 1.20 b | 6.8 c | 13.2 b | 53.7 ab | 86.8 ab |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.5.1 | 1.20 b | 7.4 bc | 13.8 a | 57.1 ab | 86.5 ab |
| Miravis Ace 5.2 SC | 13.7 fl oz | 10.3 | 1.45 b | 7.1 bc | 13.8 a | 57.2 ab | 89.3 a |
| Miravis Ace 5.2 SC<br>fb Folicur 3.6 F | 13.7 fl oz<br>4.0 fl oz | 10.5.1<br>10.5.4 | 1.27 b | 6.8 c | 14.1 a | 57.7 a | 88.2 a |
| Nontreated, non-inoculated control | | | 3.46 a | 9.3 a | 12.8 c | 56.1 b | 81.5 b |
| Variety P(F) | | | <.0001 | <.0001 | 0.3919 | <.0001 | <.0001 |
| Treatment P(F) | | | 0.0002 | <.0001 | <.0001 | 0.0042 | 0.0004 |
| Var*Trt P(F) | | | 0.0376 | 0.0001 | 0.6025 | 0.3097 | 0.6860 |

[z] Fungicides treatments applied at Feekes 10.3, 10.5.1, and 10.5.4 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, except nontreated, non-inoculated control. Spore suspension applied at 215 ml/plot on 29 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 25 Jun.

[v] Means followed by the same letter are not significantly different based on Tukey-HSD (α=0.05).

CORN (*Zea mays* 'P0157AM')
Southern rust; *Puccinia polysora*
Northern corn leaf blight; *Setosphaeria turcica*
Gray leaf spot; *Cercospora zeae-maydis*

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**Field-scale fungicide timing comparison for foliar diseases on corn diseases in central Indiana, 2020 (COR20-09.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 feet 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 'P0157AM' was planted in 30-inch row spacing at a rate of 30,000 seeds/A on 6 May. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. All fungicides were applied on 25 Jun at V6, on 10 Jul at V10, and on 30 Jul at VT/R1 (tassel/silk) growth stages. Southern rust (SR), northern corn leaf blight (NCLB), and gray leaf spot (GLS) were assessed on 11 Sep at the R6 (maturity) 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. Values for each plot were averaged before analysis. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were compared using Fisher's Protected Least Significant Difference test (LSD; α=0.05).

In 2020, southern rust (SR), northern corn leaf blight (NCLB), and gray leaf spot (GLS) were the most prominent diseases in the trial. Application timings (V10 and VT/R1) of Delaro reduced GLS on the ear leaf (Table 46). There was no difference for SR and NCLB on the ear leaf. There was no significant between treatments for stay green, moisture, or yield of corn.

Table 46. Effect of fungicide on foliar diseases severity, stay green, and corn yield.

| Treatment[z] | Rate/A | Timing | SR % severity[y] 11-Sep | NCLB % severity[y] 11-Sep | GLS % severity[y] 11-Sep | Stay green[x] 11-Sep | Harvest moisture % 28-Oct | Yield[w] bu/A 28-Oct |
|---|---|---|---|---|---|---|---|---|
| Nontreated control | | | 0.6 | 1.4 | 3.3 a | 61.3 | 17.3 | 210.3 |
| Delaro 325 SC | 8.0 fl oz | V6 | 0.7 | 1.4 | 2.9 a | 58.8 | 17.5 | 213.0 |
| Delaro 325 SC | 8.0 fl oz | V10 | 0.3 | 0.6 | 1.0 b | 60.0 | 17.4 | 200.9 |
| Delaro 325 SC | 8.0 fl oz | VT/R1 | 0.3 | 1.4 | 1.0 b | 66.3 | 17.6 | 205.5 |
| *p*-value | | | 0.2089 | 0.4250 | 0.0073 | 0.5062 | 0.0597 | 0.1361 |
| LSD (0.05)[v] | | | NS[u] | NS | 1.4 | NS | NS | NS |

[z] Fungicide treatments applied on 25 Jun at V6, on 10 Jul at V10, and on 30 Jul at 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 assessed per plot and averaged. SR = southern rust; NCLB = northern corn leaf blight; GLS = gray leaf spot.
[x] Stay green visually assessed percentage (0-100%) of crop canopy green on 11 Sep.
[w] Yields were adjusted to 15.5% moisture and harvested on 28 Oct.
[v] Means follow by the same letter are not significantly based on Fisher's Protected Least Significant Difference test (LSD; α=0.05).
[u] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P32A87LL')
Septoria brown spot; *Septoria glycines*
Cercospora leaf blight; *Cercospora kikuchii/C.flagellaris*

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**Field-scale fungicide timing comparison for foliar diseases on soybean in central Indiana, 2020 (SOY20-10.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 460-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 'P32A87LL' was planted in 15 inches row spacing at a rate of 150,000 seeds/A on 12 May. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer with Trimble CFX monitor for rate and section control and RTK guidance. Fungicides were applied on 25 Jun at the V4, 30 Jul at the R3 (beginning pod), and 21 Aug at the R5 (beginning seed) growth stages. Disease ratings were assessed on 11 Sep at the R6 (full seed) growth stage. Septoria brown spot (SBS) and Cercospora leaf blight (CLB) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper and lower canopies, respectively. Data were subjected to mixed model analysis of variance (SAS 9.4, 2019) and means were separated using Fisher's Least Significant Difference test (LSD; α=0.05).

In 2020, very little disease developed in plots. Septoria brown spot (SBS) and Cercospora leaf blight (CLB) were the most prominent diseases but only reached low severity. Delaro applied at the R5 growth stage reduced of SBS in upper and lower canopy as compared to nontreated control on 11 Sep (Table 47). There was no significant difference for CLB in the upper canopy. There was no significant treatment effect on stay green, defoliation, moisture, and corn yield.

Table 47. Effect of fungicide on foliar diseases severity, stay green, defoliation, and soybean yield.

| Treatment[z] | Rate/A | Timing | SBS % sev. upper canopy[y] 11-Sep | SBS % sev. lower canopy[y] 11-Sep | CLB % sev. upper canopy[y] 11-Sep | Stay green[x] % 11-Sep | Defoliation[w] % 11-Sep | Moisture % 5-Oct | Yield[v] lb/A 5-Oct |
|---|---|---|---|---|---|---|---|---|---|
| Nontreated control | | | 10.0 a | 8.8 a | 0.0 | 56.3 | 13.0 | 14.4 | 70.8 |
| Delaro 325 SC | 12.0 fl oz | V4 | 7.5 a | 10.0 a | 0.0 | 63.8 | 7.8 | 14.5 | 70.8 |
| Delaro 325 SC | 12.0 fl oz | R3 | 10.0 a | 8.8 a | 0.0 | 61.3 | 9.3 | 14.3 | 70.9 |
| Delaro 325 SC | 12.0 fl oz | R3 | 3.0 b | 1.5 b | 1.5 | 70.0 | 6.3 | 14.4 | 70.0 |
| *p*-value | | | 0.0160 | 0.0050 | 0.2594 | 0.1787 | 0.4236 | 0.3903 | 0.9708 |
| LSD (0.05)[u] | | | 4.3 | 4.2 | NS[t] | NS | NS | NS | NS |

[z] Fungicide treatments applied on 25 Jun at the V4, 30 Jul at the R3 (beginning pod), and 21 Aug at the R5 (beginning seed) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity visually rated on scale of 0-100% of upper and lower canopy with disease symptoms. SBS = Septoria brown spot; CLB = Cercospora leaf blight.
[x] Stay green visually assessed percentage (0-100%) in the plot on 11 Sep.
[w] Defoliation = percentage of leaf loss in plot.
[v] Yields were adjusted to 13% moisture and harvested on 5 Oct.
[u] Means follow by the same letter are not significantly based on Fisher's Protected Least Significant Difference test (LSD; α=0.05).
[t] NS = not significant (α=0.05).

CORN (*Zea mays* 'P0157AM')

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**Field-scale fungicide timing comparison for foliar diseases on corn in northeastern Indiana, 2020 (COR20-10.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 360-ft long, consisted of four rows, and the center rows used for evaluation. The previous crop was soybean. Standard practices for non-irrigated grain corn production in Indiana were followed. Corn hybrid 'P0157AM' was planted in 30-inch row spacing at a rate of 32,000 seeds/A on 6 May. Fungicide treatments applied on 25 Jun at V6, 13 Jul at V10, 20 July at VT/R1, 4 Aug at R2, and 18 Aug at R4 growth stages. Little to no diseases were detected in the trial. The trial was harvested on 7 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 test (LSD; α=0.05).

In 2020, very little disease developed in plots. Gray leaf spot (<10%), tar spot (0.01%), southern rust (0.01%), and northern corn leaf blight (<1%) were noted at R6, but not rated. There was no significant effect of fungicide timing on moisture and yield (Table 48).

Table 48. Effect of fungicide on corn yield.

| Treatment[z] | Rate/A | Timing | Harvest moisture % | Yield[y] bu/A |
|---|---|---|---|---|
| Nontreated control | | | 16.4 | 195.2 |
| Headline AMP 1.68 SC | 10.0 fl oz | V6 | 16.6 | 203.7 |
| Headline AMP 1.68 SC | 10.0 fl oz | V10 | 16.5 | 198.5 |
| Headline AMP 1.68 SC | 10.0 fl oz | VT/R1 | 16.6 | 200.1 |
| Headline AMP 1.68 SC | 10.0 fl oz | R2 | 16.3 | 196.1 |
| Headline AMP 1.68 SC | 10.0 fl oz | R4 | 16.4 | 195.9 |
| *p*-value | | | 0.8887 | 0.7188 |
| LSD (0.05)[x] | | | NS[w] | NS |

[z] Fungicide treatments applied on 25 Jun at V6, 13 Jul at V10, 20 July at VT/R1, 4 Aug at R2, and 18 Aug at R4 growth stages.
[y] Yields were adjusted to 15.5% moisture and harvested on 7 Nov.
[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[w] NS = not significant (α=0.05).

SOYBEAN (*Glycine max* 'P35T75X')

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**Field-scale fungicide timing for foliar diseases on soybean in northeastern Indiana, 2020 (SOY20-12.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 400-ft long. The previous crop was corn. Standard practices for non-irrigated soybean production in Indiana were followed. Soybean variety 'P35T75X' was drilled in 7.5-inch row spacing at a rate of 150,000 seeds/A on 8 May. Fungicides were applied on 29 Jun at the V4, 13 Jul at R1, 4 Aug at the R3 (beginning pod), and 18 Aug at the R5 growth stage. Little to no disease developed in the field. The soybeans were harvested on 16 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, very little disease developed in plots. There was no significant effect of treatment on soybean yield (Table 49).

Table 49. Effect of fungicide timing on soybean yield.

| Treatment[z] | Rate /A | Timing | Harvest moisture % | Yield[y] bu/A |
|---|---|---|---|---|
| Nontreated control | | | 11.0 b | 75.2 |
| Miravis Top 1.67 SC | 13.7 fl oz | V4 | 11.2 b | 75.3 |
| Miravis Top 1.67 SC | 13.7 fl oz | R1 | 11.5 a | 76.5 |
| Miravis Top 1.67 SC | 13.7 fl oz | R3 | 11.1 b | 76.1 |
| Miravis Top 1.67 SC | 13.7 fl oz | R5 | 11.2 a | 78.0 |
| *p*-value | | | 0.0222 | 0.7681 |
| LSD (0.05)[x] | | | 0.27 | NS[w] |

[z] Fungicide treatments applied 10 Jul at the V4 (forth-leaf), 6 Aug at the R3 (beginning pod), and 29 Aug at the R5 (beginning seed) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Yields were adjusted to 13% moisture and harvested on 16 Oct.
[x] Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference test (LSD; α=0.05).
[w] NS = not significant (α=0.05).

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

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**Field-scale fungicide timing comparison for foliar diseases on corn in southeastern Indiana, 2020 (COR20-11.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 550 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 12-in. row spacing at a rate of 30,000 seeds/A on 13 May. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. Fungicides were applied on 26 June at the V6, 8 July at the V10, and 28 July at the late R1 (silking) growth stages. Disease ratings were assessed on 7 Sep at the R6 (maturity) growth stage. Southern rust (SR) and gray leaf spot (GLS) were rated for disease severity by visually assessing the percentage of symptomatic leaf area on the ear leaf on 7 Sep. 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 Protected Least Significant Difference test (LSD; α=0.05).

In 2020, very little disease developed in plots. Southern rust (SR) and gray leaf spot (GLS) were the most prominent diseases but reached low severity. There were no significant differences between fungicide application timing and nontreated control for SR and GLS on 7 Sep (Table 50). There was no significant treatment effect on corn yield.

Table 50. Effect of fungicide timing on foliar diseases severity and corn yield.

| Treatment[z] | Rate/A | Timing | SR % severity[y] 7-Sep | GLS % severity[y] 7-Sep | Harvest moisture % 21-Sep | Yield[x] bu/A 21-Sep |
|---|---|---|---|---|---|---|
| Nontreated control | | | 3.8 | 4.8 | 24.9 b | 210.3 |
| Lucento 4.17 SC | 5.0 fl oz | V6 | 5.6 | 7.1 | 25.7 a | 210.4 |
| Lucento 4.17 SC | 5.0 fl oz | V10 | 3.9 | 4.2 | 25.5 a | 212.7 |
| Lucento 4.17 SC | 5.0 fl oz | R1 | 2.8 | 4.1 | 25.5 a | 210.4 |
| *p*-value | | | 0.4537 | 0.6492 | 0.0085 | 0.9032 |
| LSD (0.05)[w] | | | NS[v] | NS | 0.45 | NS |

[z] Fungicide treatments applied on 26 June at the V6, 8 July at the V10, and 28 July at the late R1 (silking) 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. SR = southern rust; GLS =gray leaf spot.
[x] Yields were adjusted to 15.5 % moisture and harvested on 21 Sep.
[w] Means follow by the same letter are not significantly based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant α=0.05).

SOYBEAN (*Glycine max* 'P34A79X')
Frogeye leaf spot; *Cercospora sojina*
Cercospora leaf blight; *Cercospora kikuchii/C.flagellaris*

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**Field-scale fungicide timing comparison for foliar diseases on soybean in southeastern Indiana, 2020 (SOY20-11.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 700-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. Soybean variety 'P34A79X' was planted in 12-in. row spacing at a rate of 30,000 seeds/A on 8 Jun. All fungicide applications were applied at 20 gal/A and 40 psi using Apache 720 sprayer. Fungicides were applied on 8 Jun at the V4, 7 Aug at the R3 (beginning pod), and 26 Aug at the R5 (beginning seed) growth stages. Disease ratings were assessed on 7 Sep at the R6 (full seed) growth stage. Frogeye leaf spot (FLS) and Cercospora leaf blight (CLB) were rated for disease severity by visually assessing the percentage of symptomatic leaf area in the upper canopy on 7 Sep. Soybeans were harvested on 6 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 Protected Least Significant Difference test (LSD; α=0.05).

In 2020, very little disease developed in plots. Frogeye leaf spot (FLS) and Cercospora leaf blight (CLB) were the most prominent diseases but only reached low severity. There was no significant treatment differences on severity of FLS and CLB (Table 51). Lucento applied at R3, R5 had significantly higher soybean yield over the nontreated control, and Lucento applied at V4.

Table 51. Effect of fungicide on foliar diseases severity and soybean yield.

| Treatment[z] | Rate/A | Timing | FLS % severity[y] 7-Sep | CLB % severity[y] 7-Sep | Yield[x] bu/A 6-Oct |
|---|---|---|---|---|---|
| Nontreated control | | | 0.4 | 0.1 | 70.0 b |
| Lucento 4.17 SC | 5.0 fl oz | V4 | 0.3 | 0.1 | 70.0 b |
| Lucento 4.17 SC | 5.0 fl oz | R3 | 0.5 | 0.3 | 79.7 a |
| Lucento 4.17 SC | 5.0 fl oz | R5 | 0.0 | 0.0 | 76.1 a |
| *p*-value | | | 0.2797 | 0.7375 | 0.0002 |
| LSD (0.05)[w] | | | NS[v] | NS | 3.257 |

[z] Fungicide treatments applied on 8 Jun at the V4, 7 Aug at the R3 (beginning pod), and 26 Aug at the R5 (beginning seed) growth stages and all treatments contained a non-ionic surfactant (Preference) at a rate of 0.25% v/v.
[y] Foliar disease severity visually rated on scale of 0-100% of canopy with disease symptoms. FLS = Frogeye leaf spot; CLB = Cercospora leaf blight.
[x] Yields were adjusted to 13% moisture and harvested on 6 Oct.
[w] Means follow by the same letter are not significantly based on Fisher's Least Significant Difference test (LSD; α=0.05).
[v] NS = not significant α=0.05).

# APPENDIX –WEATHER DATA

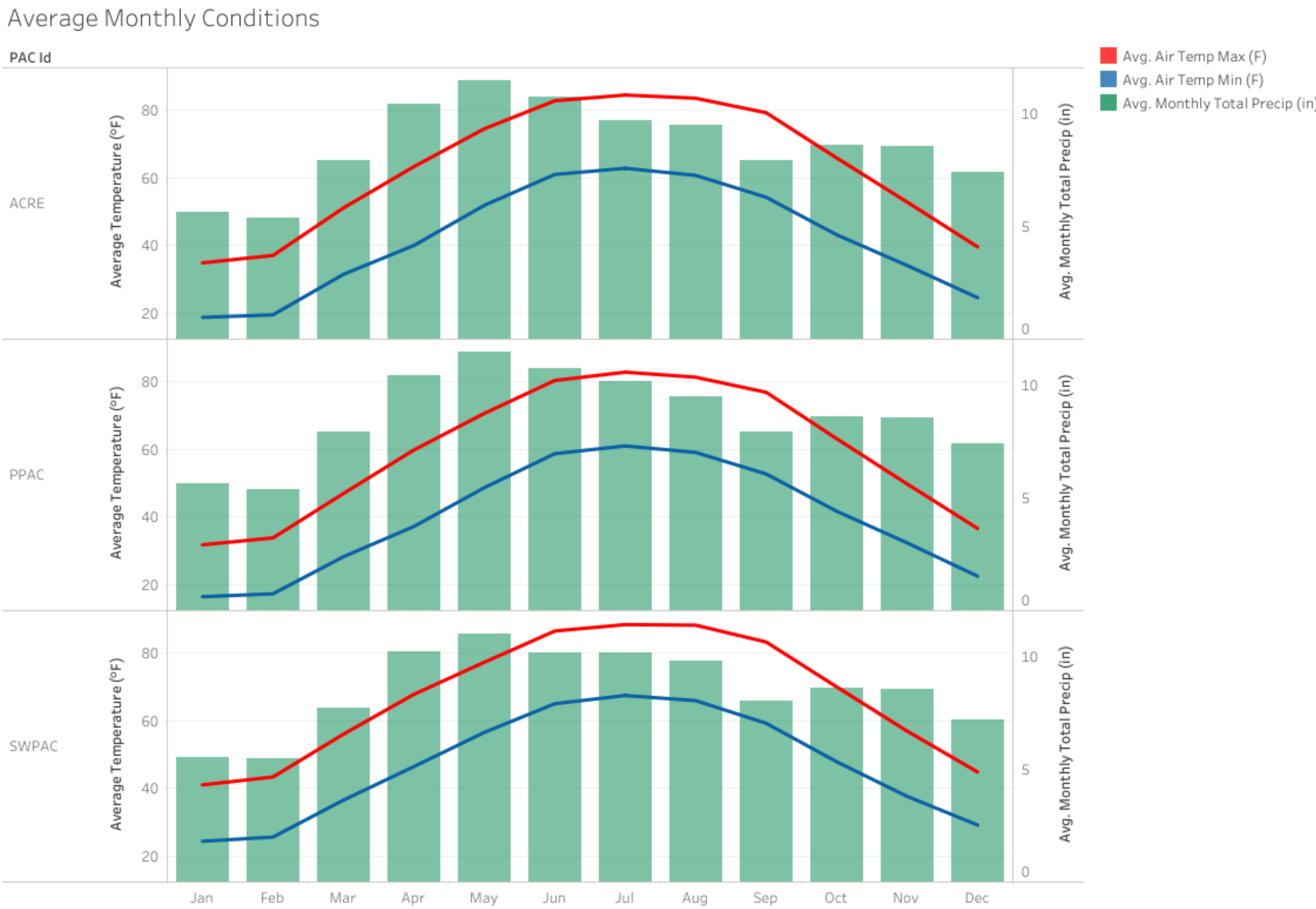


Figure 3. Average air temperatures and total precipitation at research sites in Indiana. Image courtesy of Dr. Beth Hall and Jonathan Weaver. Indiana State Climate Office.

Table 52. Average monthly conditions at the Purdue Agronomy Center for Research and Education (ACRE), Pinney Purdue Agricultural Center (PPAC), and Southwest Purdue Agricutlural Center (SWPAC) in Indiana, 2020.

| | ACRE | | | PPAC | | | SWPAC | | |
|---|---|---|---|---|---|---|---|---|---|
| Months | Temp. min[x]. °F | Temp. max[x]. °F | Total precipit[y]. (in) | Temp. min[x]. °F | Temp. max[x]. °F | Total precipit[y]. (in) | Temp. min[x]. °F | Temp. max[x]. °F | Total precipit[y]. (in) |
| January | 18.73 | 34.85 | 5.60 | 16.39 | 31.74 | 5.60 | 24.34 | 41.01 | 5.51 |
| February | 19.48 | 37.03 | 5.37 | 17.25 | 33.77 | 5.37 | 25.57 | 43.34 | 5.44 |
| March | 31.45 | 51.07 | 7.89 | 28.21 | 46.90 | 7.89 | 36.50 | 55.99 | 7.70 |
| April | 39.98 | 63.28 | 10.43 | 37.15 | 59.77 | 10.43 | 46.42 | 67.78 | 10.18 |
| May | 51.86 | 74.49 | 11.44 | 48.63 | 70.59 | 11.44 | 56.53 | 77.26 | 10.99 |
| June | 60.98 | 82.76 | 10.73 | 58.68 | 80.32 | 10.73 | 65.01 | 86.50 | 10.14 |
| July | 62.80 | 84.47 | 9.69 | 60.97 | 82.78 | 10.15 | 67.43 | 88.40 | 10.15 |
| August | 60.71 | 83.51 | 9.46 | 59.04 | 81.29 | 9.46 | 65.92 | 88.22 | 9.76 |
| September | 54.24 | 79.24 | 7.91 | 52.68 | 76.83 | 7.91 | 59.22 | 83.26 | 8.01 |
| October | 43.14 | 65.87 | 8.59 | 41.67 | 63.12 | 8.59 | 47.85 | 69.99 | 8.59 |
| November | 34.08 | 52.83 | 8.51 | 32.31 | 49.73 | 8.51 | 37.62 | 56.91 | 8.51 |
| December | 24.56 | 39.57 | 7.40 | 22.47 | 36.59 | 7.40 | 29.14 | 44.82 | 7.18 |

[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 at the Purdue Agronomy Center for Research and Education (ACRE), Pinney Purdue Agricultural Center (PPAC) and Southwest Purdue Agricultural Center (SWPAC). [y] Average minimum and maximum temperatures for each month. [x] Total precipitation for each month.

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