TAR SPOT OF CORN: 2022 UPDATE AND MANAGEMENT OPTIONS IN THE FUTURE

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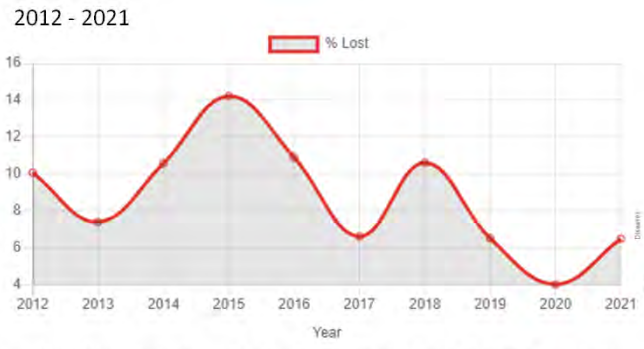
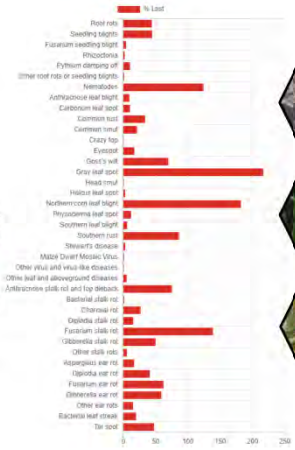
Yield Loss to Disease in United States Corn



Total percentage of estimated loss due to disease in U.S. corn from 2012 to 2021 (all diseases)



Data sources: Crop Protection Network. 2022. Estimates of corn, soybean, and wheat yield losses due to diseases and invertebrate pests: an online tool. Doi.org/10.31274/cpn-20191121-0
Mueller, D.S., et al. 2020. Corn yield loss estimates due to diseases in the United States and Ontario, Canada, from 2016 to 2019. Plant Health Progress. 21: 238-247. doi.org/10.1094/PHP-05-20-0038-RS

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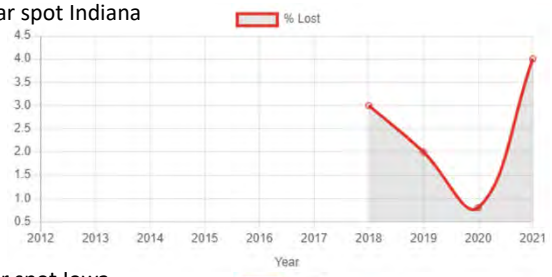
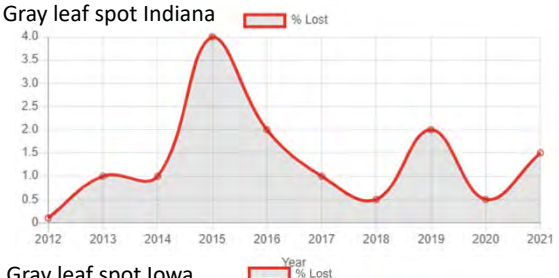
Estimated Losses

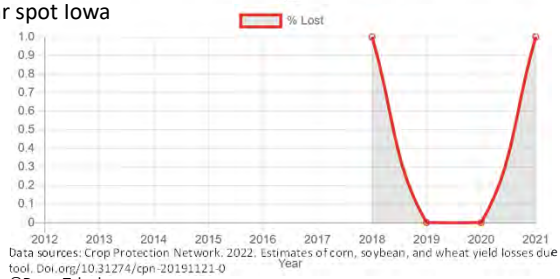
Tar spot Indiana



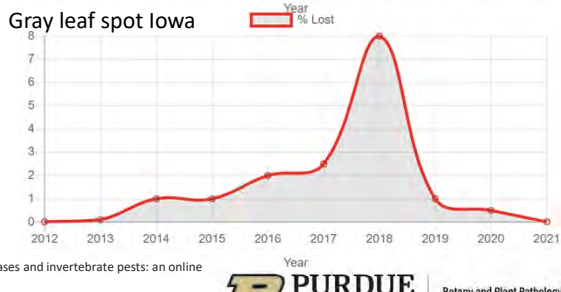
Gray leaf spot Indiana



Tar spot Iowa



Gray leaf spot Iowa



Data sources: Crop Protection Network. 2022. Estimates of corn, soybean, and wheat yield losses due to diseases and invertebrate pests: an online tool. Doi.org/10.31274/cpn-20191121-0

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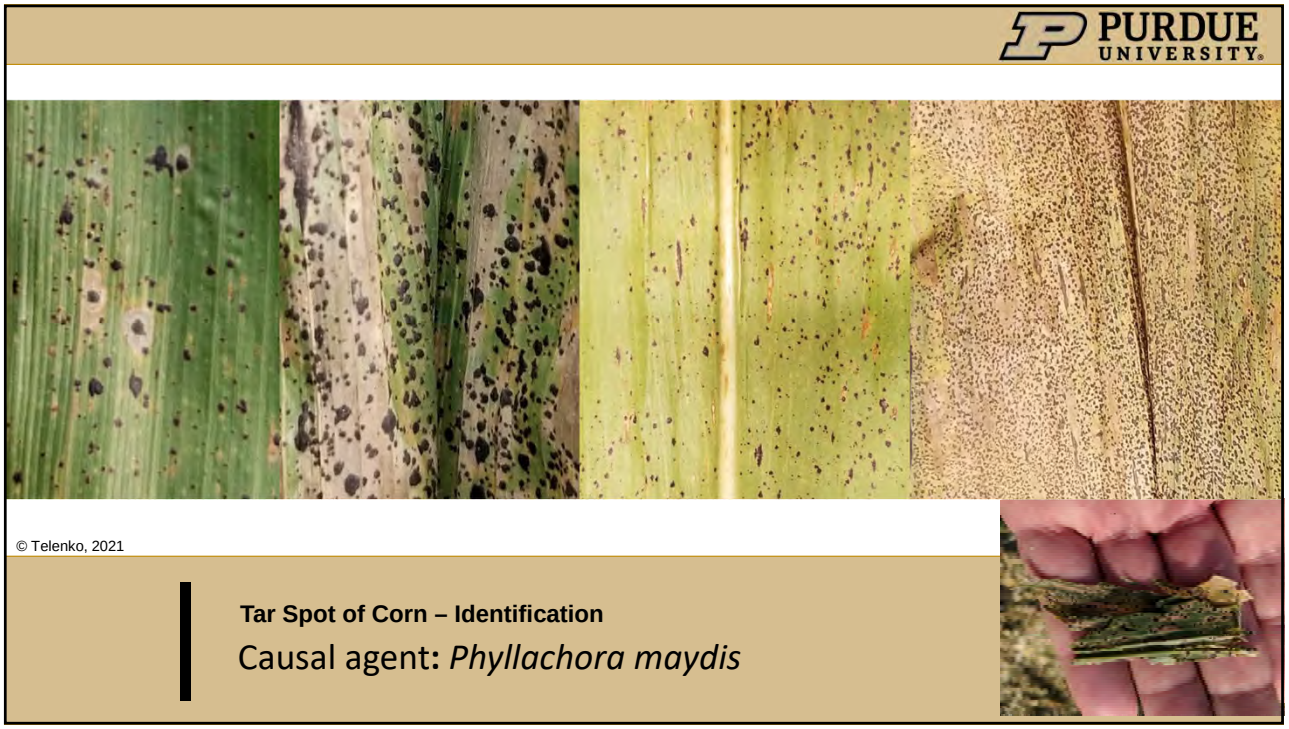
Tar spot of corn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Tar Spot of Corn – Identification
Causal agent: *Phyllachora maydis*


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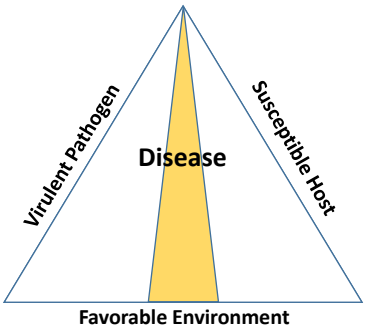
Disease Triangle

Virulent pathogen:
- Overwinter?
- Endemic – already present in soil/debris
- Spore movement



Susceptible host:
- Plant species
- Variety/hybrid susceptibility
- Growth stage

Favorable Environment:
- Temperature
- Moisture
- Leaf wetness

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Tar Spot Disease Cycle

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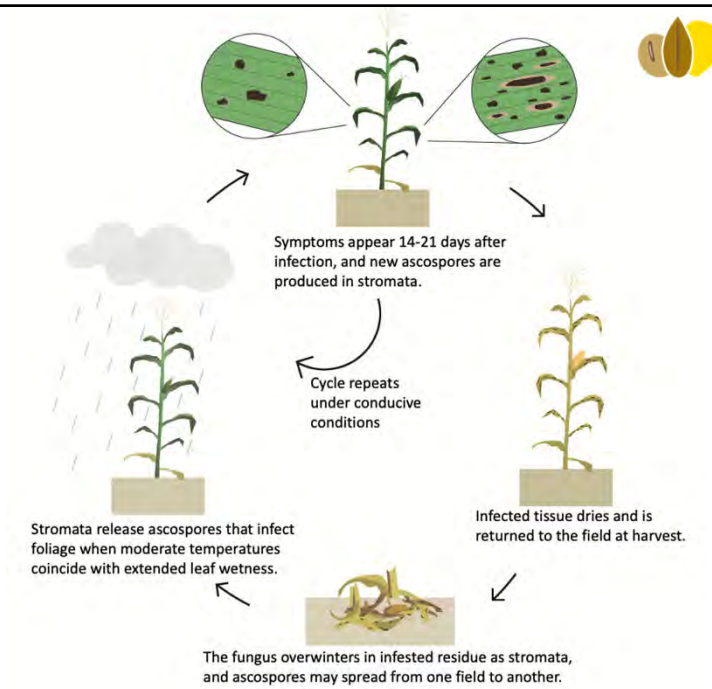
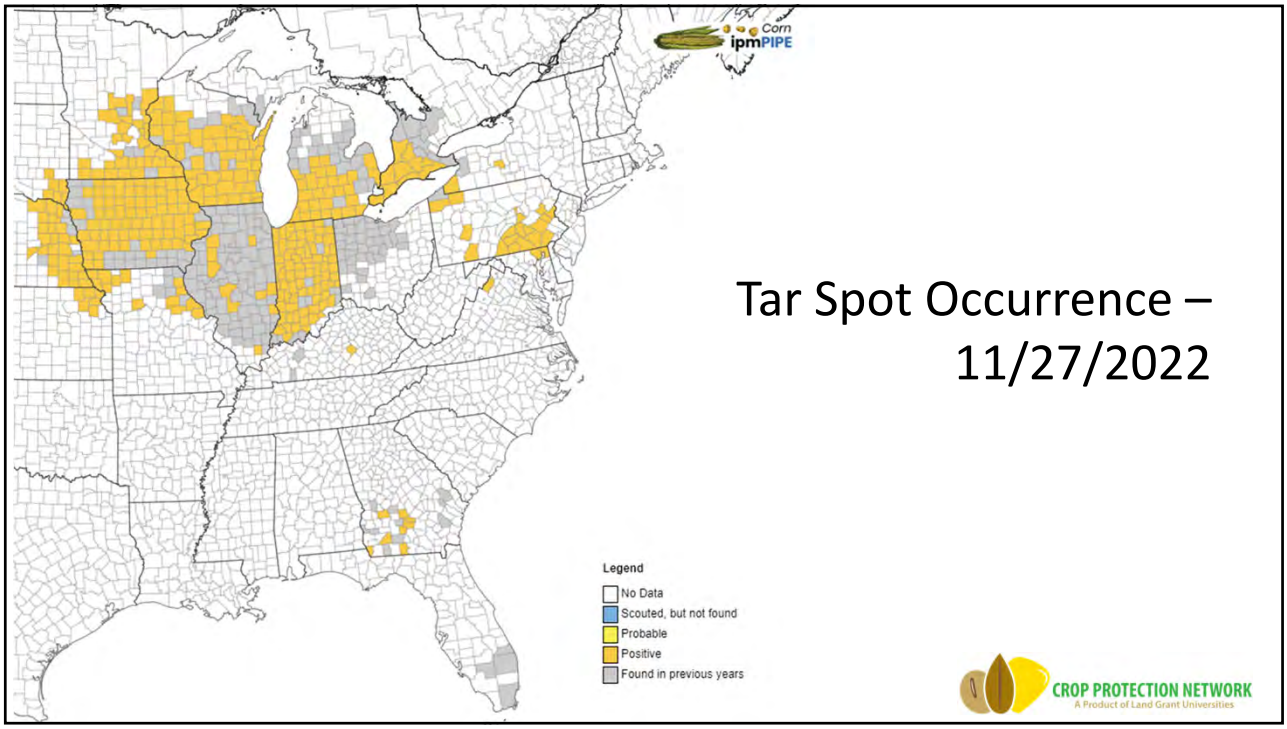
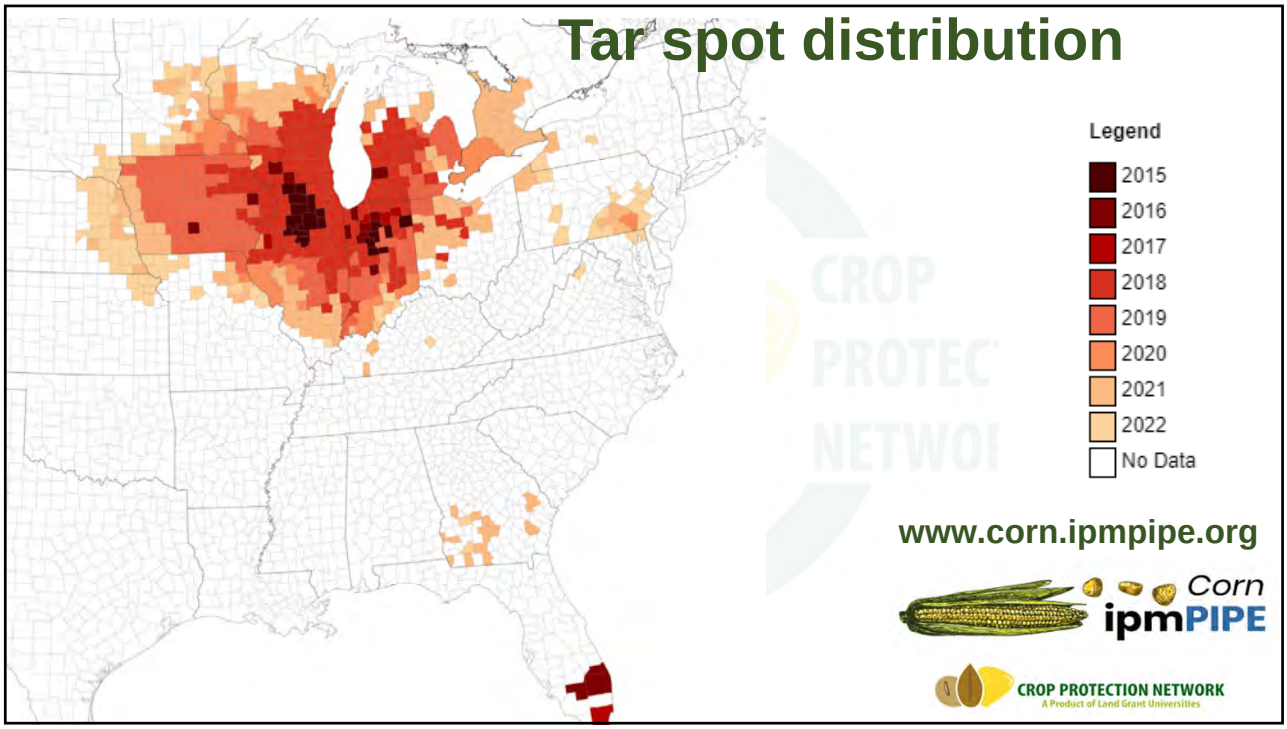




Tar Spot Occurrence – 11/27/2022

Tar Spot Yearly Distribution 2015 to 2022


Tar spot distribution
Legend
2015
2016
2017
2018
2019
2020
2021
2022
No Data
www.corn.ipmpipe.org
Corn
ipmPIPE
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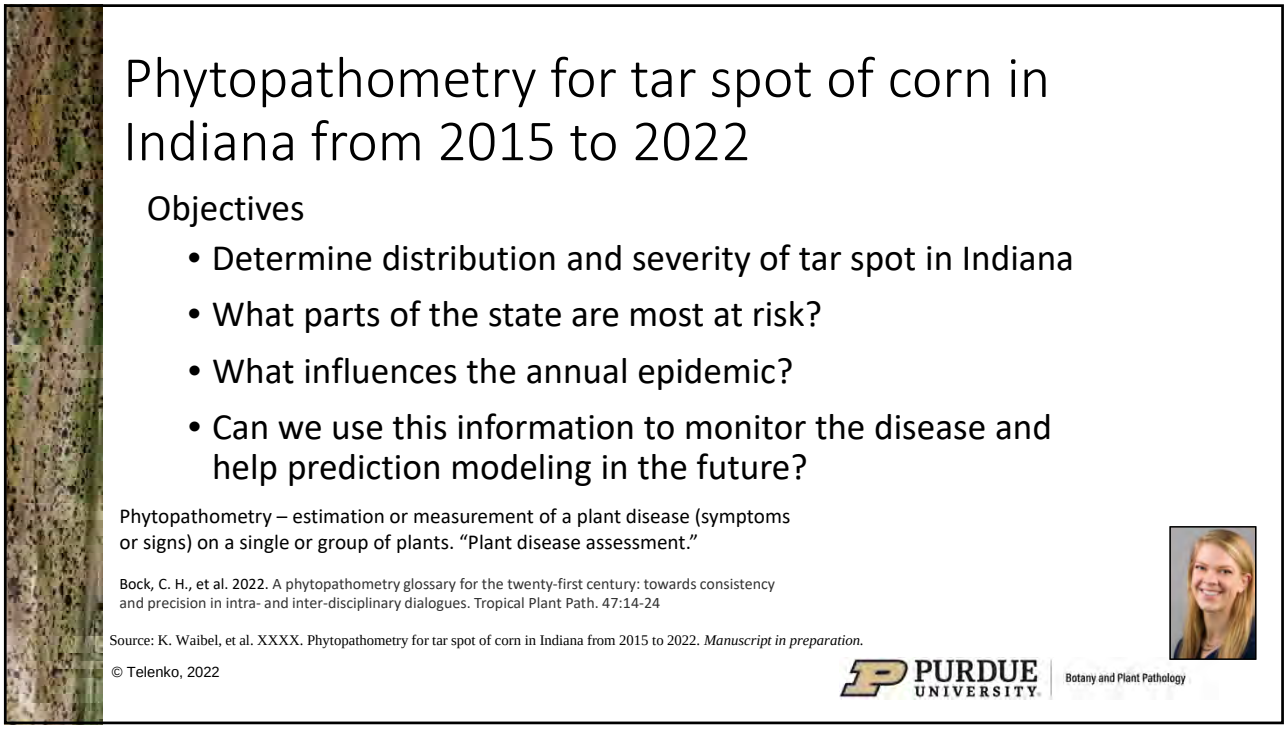
Phytopathometry for tar spot of corn in Indiana from 2015 to 2022
Objectives
• Determine distribution and severity of tar spot in Indiana
• What parts of the state are most at risk?
• What influences the annual epidemic?
• Can we use this information to monitor the disease and help prediction modeling in the future?
Phytopathometry – estimation or measurement of a plant disease (symptoms or signs) on a single or group of plants. "Plant disease assessment."
Bock, C. H., et al. 2022. A phytopathometry glossary for the twenty-first century: towards consistency and precision in intra- and inter-disciplinary dialogues. Tropical Plant Path. 47:14-24
Source: K. Waibel, et al. XXXX. Phytopathometry for tar spot of corn in Indiana from 2015 to 2022. Manuscript in preparation.
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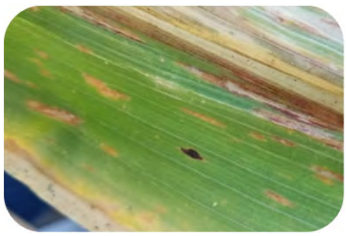
Range of Leaf Severity of Tar Spot

<1 % severity on leaf



1 % severity on leaf

5-7 % severity on leaf

>25 % severity on leaf

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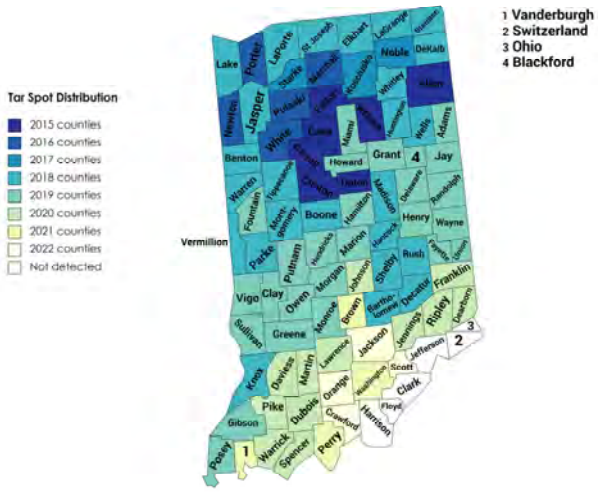
Tar spot of corn in Indiana from 2015 to 2022



2015 – 7 counties PPDL **FIRST REPORT US**
2016 – 5 new counties ples (13)
2017 – 3 new counties PPDL samples (16)
2018 - 25 new counties PPDL + survey (41)
2019 – 25 new counties PPDL + survey (66)
2020 – 12 new counties PPDL + survey (78)
2021 – 4 new counties PPDL + survey (82)
2022 – 4 new counties PPDL + survey (86) *updated 9/15*

INDIANA CORN Marketing Council

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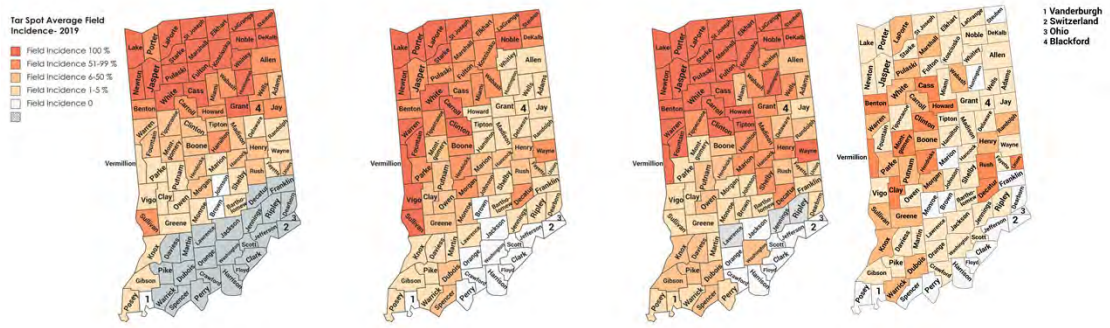
Survey of Tar Spot Average Field Incidence 2019-2021

End of Aug through early September

2019 2020 2021 2022



Source: K. Waibel, et al. XXXX. Phytopathometry for tar spot of corn in Indiana from 2015 to 2022. *Manuscript in preparation.*

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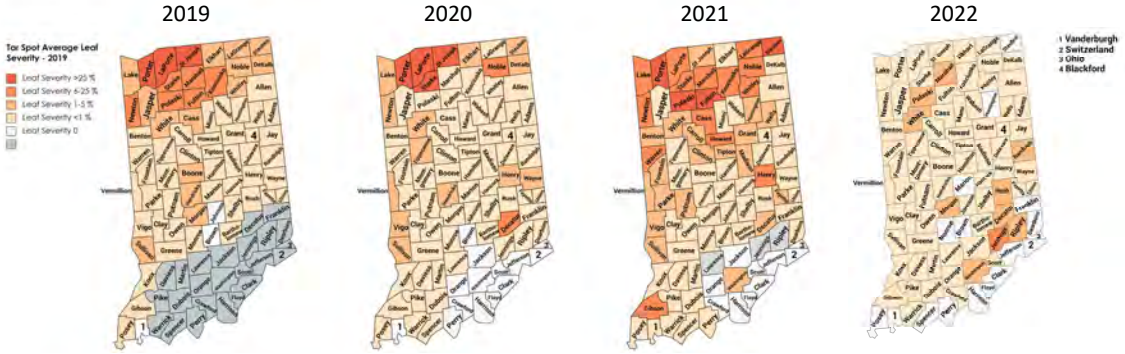
Survey of Tar Spot Average Leaf Severity 2019-2021

End of Aug through early September

2019 2020 2021 2022



Source: K. Waibel, et al. XXXX. Phytopathometry for tar spot of corn in Indiana from 2015 to 2022. *Manuscript in preparation.*

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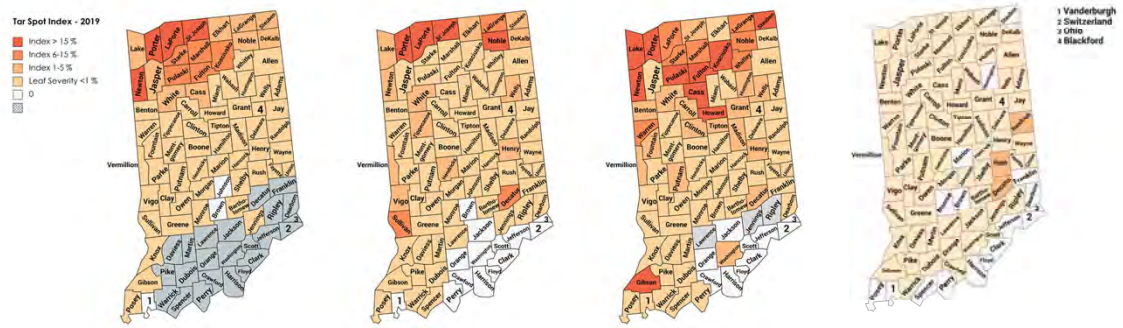
Survey of Tar Spot Index 2019-2021

End of Aug through early September

2019 2020 2021 2022



Source: K. Waibel, et al. XXXX. Phytopathometry for tar spot of corn in Indiana from 2015 to 2022. *Manuscript in preparation.*

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Drought Conditions 2019, 2020, 2021 and 2022

25 June 2019 30 June 2020 29 June 2021 28 June 2022

30 July 2019 28 July 2020 27 July 2021 26 July 2022

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Drought Conditions 2019, 2020, 2021 and 2022

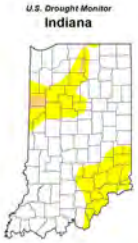
30 July 2019

28 July 2020

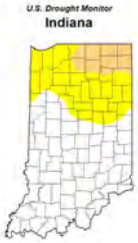
27 July 2021

26 July 2022

27 Aug 2019



25 Aug 2020



31 Aug 2021

30 Aug 2022

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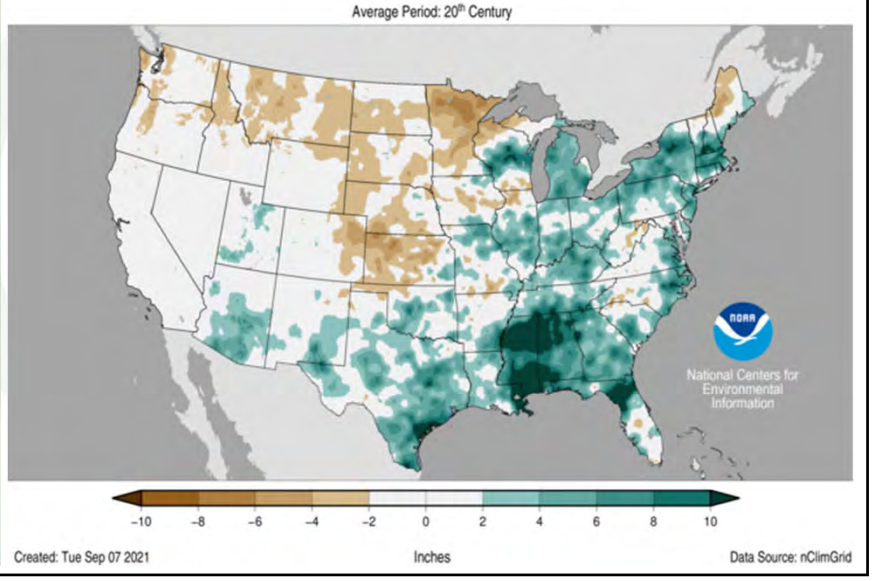
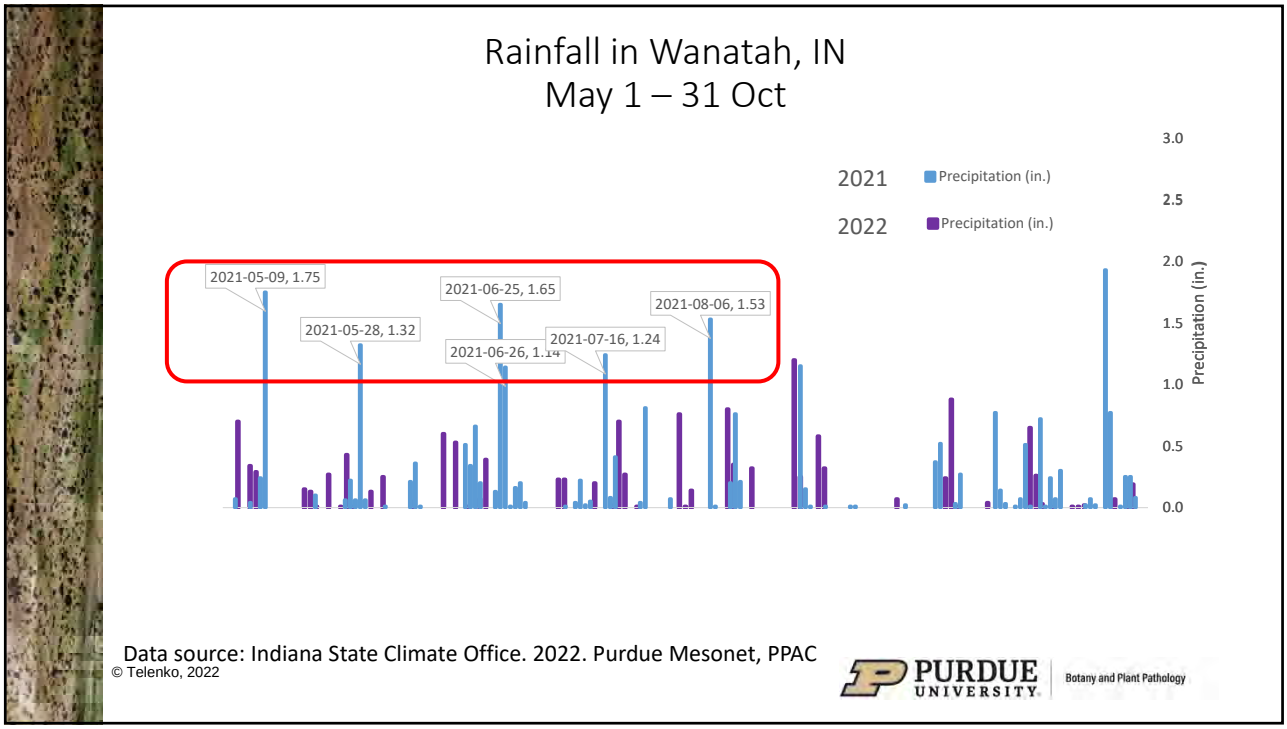
2021- Leaf wetness is a driving factor




Rainfall in Wanatah, IN
May 1 – 31 Oct
2021 Precipitation (in.)
2022 Precipitation (in.)
Precipitation (in.)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2021-05-09, 1.75
2021-05-28, 1.32
2021-06-25, 1.65
2021-06-26, 1.14
2021-07-16, 1.24
2021-08-06, 1.53
Data source: Indiana State Climate Office. 2022. Purdue Mesonet, PPAC
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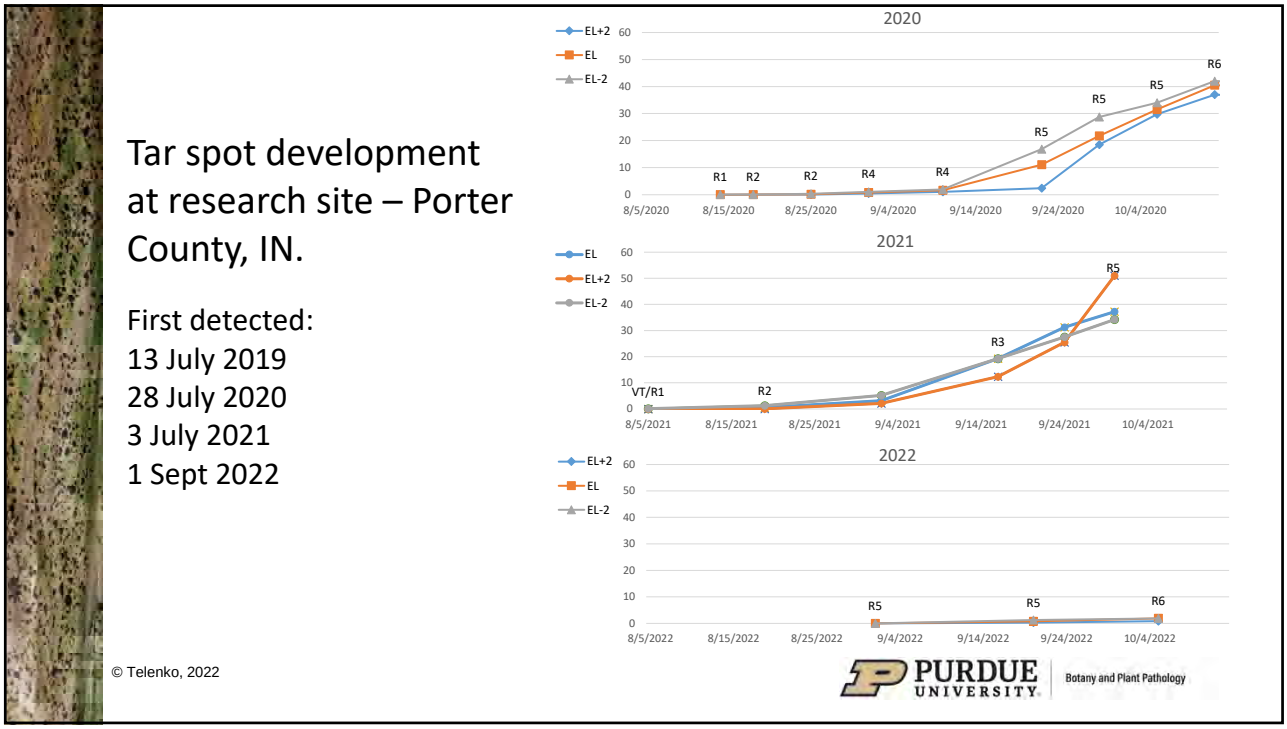
Tar spot development at research site – Porter County, IN.
First detected:
13 July 2019
28 July 2020
3 July 2021
1 Sept 2022
2020
EL+2
EL
EL-2
R1
R2
R2
R4
R4
R5
R5
R5
R6
8/5/2020
8/15/2020
8/25/2020
9/4/2020
9/14/2020
9/24/2020
10/4/2020
2021
EL
EL+2
EL-2
VT/R1
R2
R3
R5
8/5/2021
8/15/2021
8/25/2021
9/4/2021
9/14/2021
9/24/2021
10/4/2021
2022
EL+2
EL
EL-2
R5
R5
R6
8/5/2022
8/15/2022
8/25/2022
9/4/2022
9/14/2022
9/24/2022
10/4/2022
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Summary of Tar Spot Survey in Indiana

- Tar spot continues to spread in Indiana
  - 7 counties in 2015
  - 86 counties in 2022
- There is a range of severity in fields
  - Currently lower risk central and southern Indiana
  - High risk in northern Indiana
  - Pockets of disease in some areas, keep a close eye in the future
- Increasing inoculum for future epidemics
- Weather conditions will continue to play a signification role and influence annual risk

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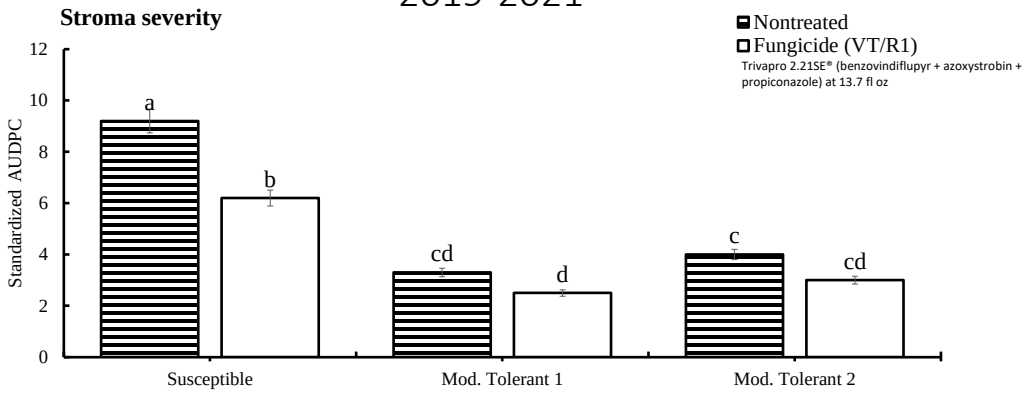
Fungicide Efficacy and Timing Trials

Integration hybrid and fungicide application for control of tar spot 2019-2021



Hybrid x fungicide interaction for stroma severity (AUDPC) (p=0.0001) and tar spot symptoms (AUDPC) (p=0.006). Values with different letters are significantly different based on least square means test ($\alpha = 0.05$) and indicates pairwise comparisons between nontreated and treated mean within hybrids. AUDPC was standardized by dividing AUDPC by the total length of the disease assessment period.

T. J. Ross, M. I. Chilvers, D. M. Smith[3], S. Sujoung[1], and D. E. P. Telenko[1] XXXX. Integration of tillage, tolerance, and fungicide application for control of tar spot on hybrid corn in the Midwest. *In preparation*

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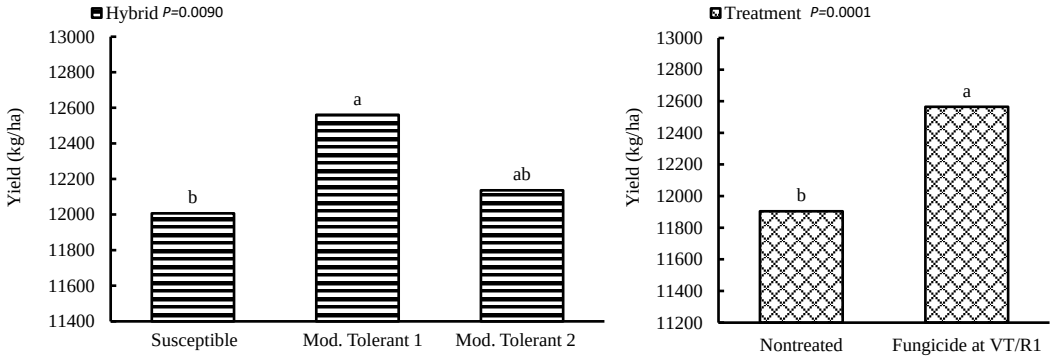
Integration hybrid and fungicide application for control of tar spot 2019-2021



Fungicide: Trivapro 2.21SE® (benzovindiflupyr + azoxystrobin + propiconazole) at 13.7 fl oz

T. J. Ross, M. I. Chilvers, D. M. Smith[3], S. Sujoung[1], and D. E. P. Telenko[1] XXXX. Integration of tillage, tolerance, and fungicide application for control of tar spot on hybrid corn in the Midwest. *In preparation*

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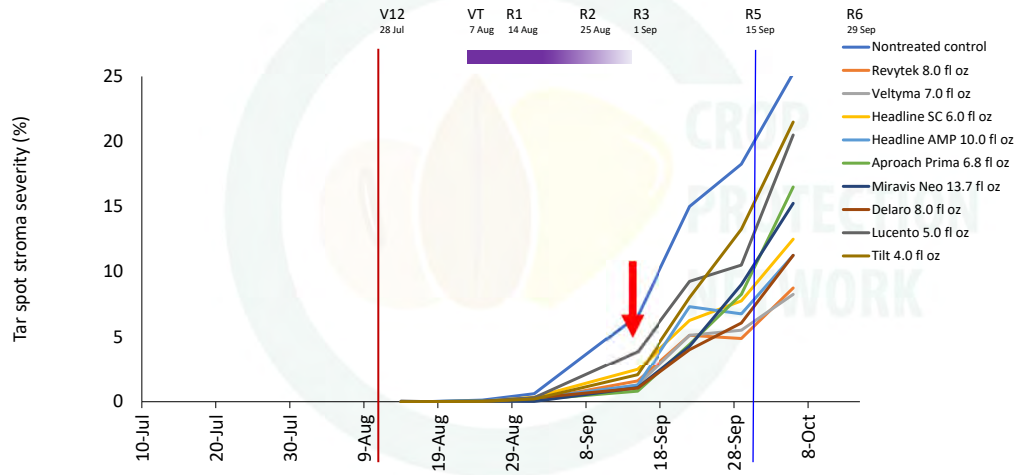
Fungicide Products Evaluated for Efficacy

FRAC Group	Active ingredient (%)	Trade name®	Application rate (fl oz/A)
3	prothioconazole (41.0%)	Proline 480SC®	5.7
3	propiconazole (41.8%)	Tilt 3.6EC®	4.0
11	pyraclostrobin (23.6%)	Headline 2.09SC®	6.0
3+7	flutrifol (19.3%) + bixafen (15.55%)	Lucento 4.17SC®	5.0
3+11	cyproconazole (7.17%) + picoxystrobin (17.94%)	Aproach Prima 2.34SC®	6.8
3+11	prothioconazole (16.0%) + trifloxystrobin (13.7%)	Delaro 325SC®	8.0
3+11	azoxystrobin (25.30%) + flutrifol (18.63%)	Topgard EQ 4.29SC®	7.0
3+11	mefentrifluconazole (17.6%) + pyraclostrobin (17.6%)	Veltyma 3.24S®	7.0
11+3	pyraclostrobin (13.6%) + metconazole (5.1%)	Headline AMP 1.68SC®	10.0
11+3	azoxystrobin (13.5%) + propiconazole (11.7%)	Quilt Xcel 2.2SE®	14.0
3+11+7	mefentrifluconazole (11.61%) + pyraclostrobin (15.49%) + fluxapyroxad (7.4%)	Revytek 3.33LC®	8.0
7+11+3	pydiflumetofen (7.0%) + azoxystrobin (9.3%) + propiconazole (11.6%)	Miravis Neo 2.5SE®	13.7
7+11+3	benzovindiflupyr (2.9%) + azoxystrobin (10.5%) + propiconazole (11.9%)	Trivapro 2.21SE®	13.7

*FRAC group – 3=Sterol biosynthesis inhibitor: DMI fungicides; 7=Inhibitor of respiration in complex II. SDH: SDHI or carboxamide fungicides; 11=inhibitor of respiration in complex III at QoI: QoI or strobilurins.

Source: Telenko et al. 2022. Fungicide efficacy on tar spot and yield of corn in the Midwestern United States. Plant Health Progress. *https://doi.org/10.1094/PHP-10-21-0125-RS Editor's Pick*

Uniform Fungicide Trial for Tar Spot Disease Progress Indiana 2020



Trial COR20-03
Location: PPAC
Hybrid: 'W2585SSRIB'
Fungicide applied: 7 Aug VT/R1

28 July - tar spot first detected

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Rapid development of tar spot in non-treated plots in Indiana 2019. Image on left taken 21 September and the same plot (right) 13 days later on 4 October

Source: Telenko et al. 2022. Fungicide efficacy on tar spot and yield of corn in the Midwestern United States. Plant Health Progress. https://doi.org/10.1094/PHP-10-21-0125-RS

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Multi-state Tar Spot Trials

Darcy Telenko, Marty Chilvers, Daren Mueller, Alison Robertson, Damon Smith, Albert Tenuta

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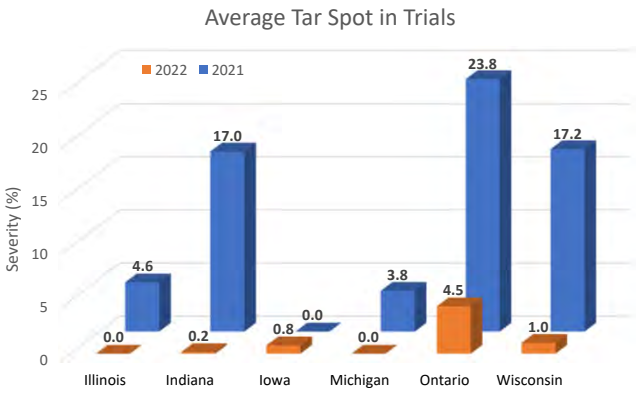
Tar Spot Levels in 2021 and 2022



Location	2021 Min	2021 Mean	2021 Max	2022 Min	2022 Mean	2022 Max
Illinois	0.0	4.6	10.0	.	.	.
Indiana	5.0	17.0	27.0	0	0.2	0.9
Iowa	.	.	.	0.2	0.8	1.8
Michigan	0.9	3.8	12.0	0	0.0	0.0
Ontario	5.9	23.8	50.0	0.3	4.5	16.3
Wisconsin	1.6	17.2	48.0	0.1	1.0	4.1

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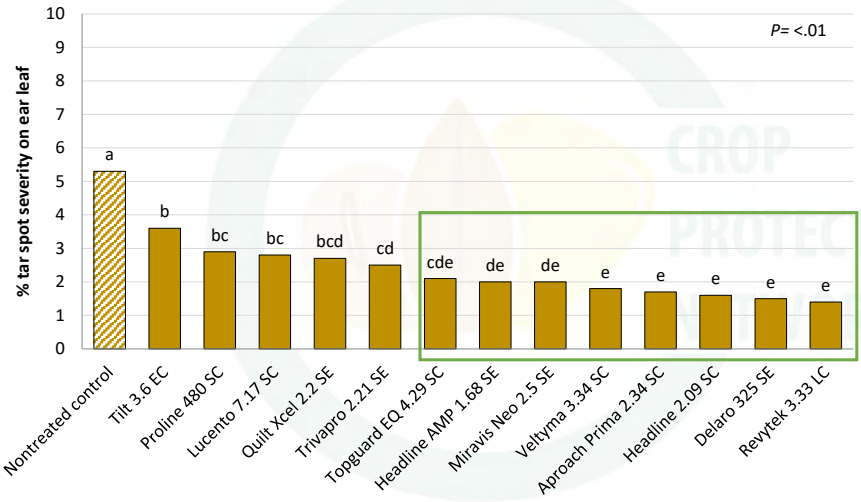
Uniform Fungicide Trial on Tar Spot – Disease Severity 2019 and 2020



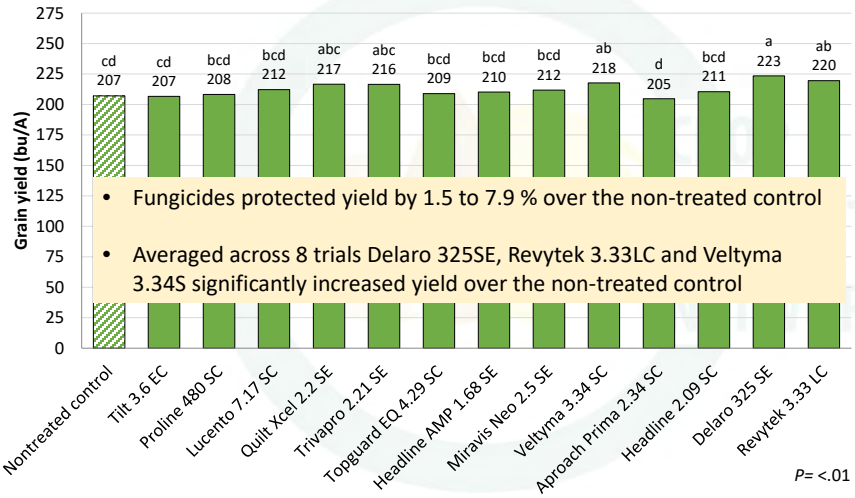
2019 and 2020 trials conducted in Illinois Indiana Michigan and Wisconsin (8 environments)

Range of tar spot in trials 1.6 to 23.3%

[y] Tar spot severity was rated by visually assessing the percentage of the symptomatic leaf area on the ear leaf on five plants per plot at the dent growth stage (R5).
[z] Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).

Source: Telenko et al. 2022. Fungicide efficacy on tar spot and yield of corn in the Midwestern United States. Plant Health Progress. https://doi.org/10.1094/PHP-10-21-0125-RS *Editor's Pick*

Uniform Fungicide Trial on Tar Spot – Yield 2019 and 2020



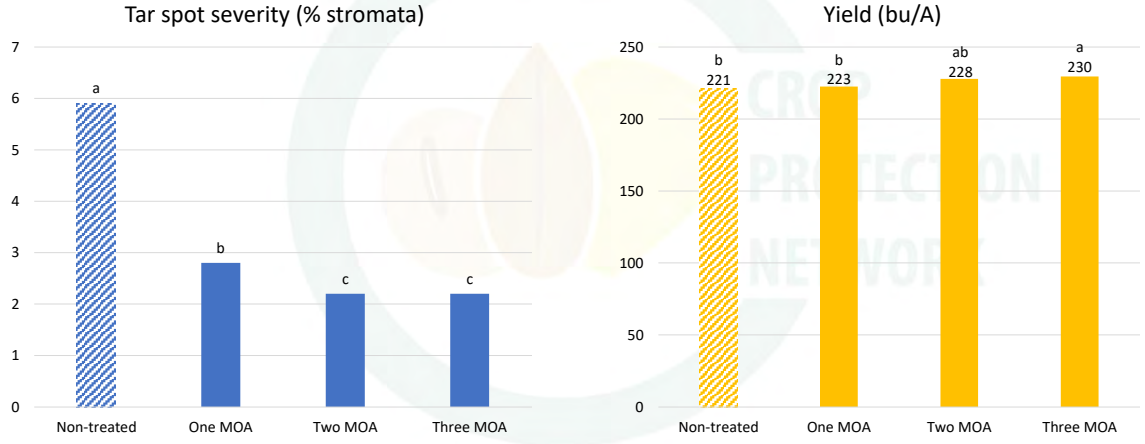
- Fungicides protected yield by 1.5 to 7.9 % over the non-treated control
- Averaged across 8 trials Delaro 325SE, Revytek 3.33LC and Veltyma 3.34S significantly increased yield over the non-treated control

2019 and 2020 trials conducted in Illinois, Indiana, Michigan, and Wisconsin (8 environments)

Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).

Source: Telenko et al. 2022. Fungicide efficacy on tar spot and yield of corn in the Midwestern United States. Plant Health Progress. *https://doi.org/10.1094/PHP-10-21-0125-RS Editor's Pick*

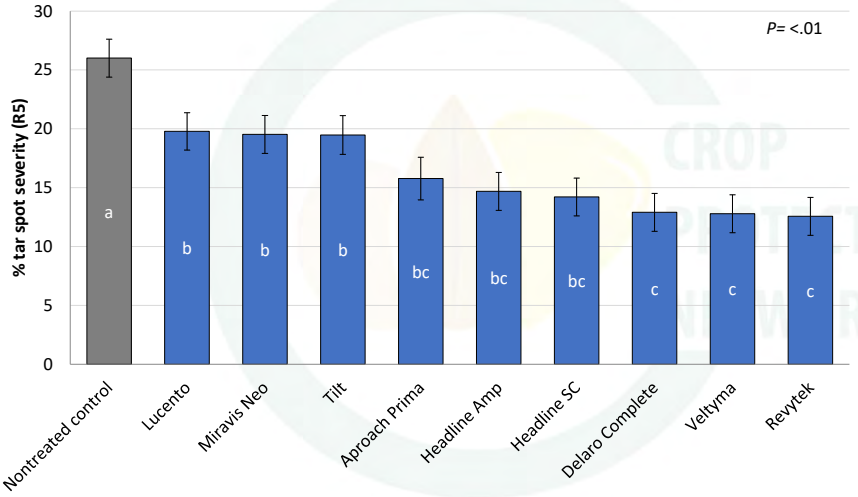
Effect of Mode of Action (MOA) on Tar Spot Severity and Grain Yield



2019 and 2020 trials conducted in Illinois, Indiana, Michigan, and Wisconsin (8 environments)

Source: Telenko et al. 2022. Fungicide efficacy on tar spot and yield of corn in the Midwestern United States. Plant Health Progress. *https://doi.org/10.1094/PHP-10-21-0125-RS Editor's Pick*

Uniform Fungicide Trial on Tar Spot – Disease Severity 2021

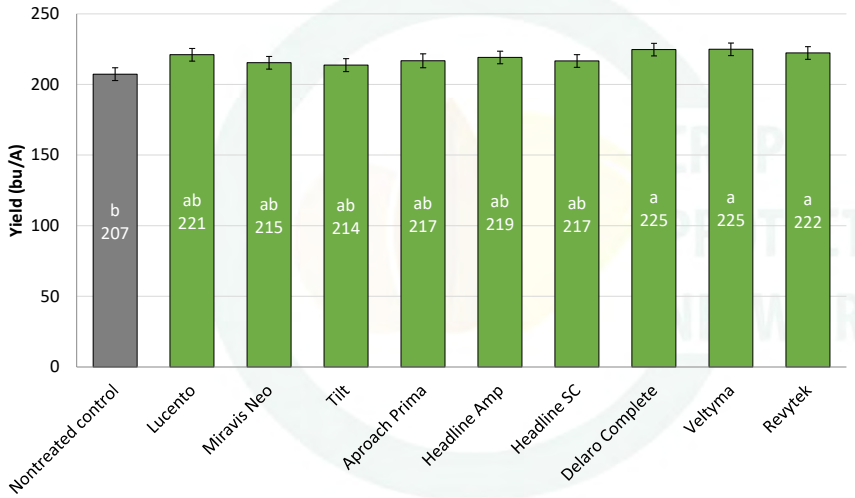


2021 trials conducted in Illinois, Indiana, Michigan, Wisconsin, and Ontario, CA (5 environments)

[y] Tar spot severity was rated by visually assessing the percentage of the symptomatic leaf area on the ear leaf at the dent growth stage (R5).
[z] Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).

Telenko, D. E. P., Chilvers, M. I., Ames, K., Byrne, A. M., Check, J. C., Da Silva, C. R., Ross†, T. J., Smith, D. L., and Tenuta, A. 2022. Fungicide efficacy during a severe epidemic of tar spot on corn in the United States and Canada. Plant Health Progress. doi.org/10.1094/PHP-02-22-0012-BR.

Uniform Fungicide Trial on Tar Spot – Yield 2021



2021 trials conducted in Illinois, Indiana, Michigan, Wisconsin, and Ontario, CA (5 environments)

P= 0.004

[z] Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).

Telenko, D. E. P., Chilvers, M. I., Ames, K., Byrne, A. M., Check, J. C., Da Silva, C. R., Ross†, T. J., Smith, D. L., and Tenuta, A. 2022. Fungicide efficacy during a severe epidemic of tar spot on corn in the United States and Canada. Plant Health Progress. doi.org/10.1094/PHP-02-22-0012-BR.

Uniform Fungicide Trials on Tar Spot, 2022

Treatment, rate/A and timing[z]
Nontreated control
Veltyma 7 fl oz at VT/R1
Aproach Prima 6.8 fl oz at VT/R1
Miravis Neo 13.7 fl oz at VT/R1
Delaro Complete 8 fl oz at VT/R1
Headline AMP 10 fl oz at VT/R1
Veltyma 7 fl oz at VT/R1 fb Headline AMP 10 fl oz at 3WAT
Aproach Prima 6.8 fl oz at VT/R1 fb Headline AMP 10 fl oz at 3WAT
Miravis Neo 13.7 fl oz at VT/R1 fb Headline AMP 10 fl oz at 3WAT
Delaro Complete 8 fl oz at VT/R1 fb Headline AMP 10 fl oz at 3WAT
Headline AMP 10 fl oz at VT/R1 fb Veltyma 7 fl oz at 3WAT
Headline AMP 10 fl oz at VT/R1 fb Aproach Prima 6.8 fl oz at 3WAT
Headline AMP 10 fl oz at VT/R1 fb Miravis Neo 13.7 fl oz at 3WAT
Headline AMP 10 fl oz at VT/R1 fb Delaro Complete 8 fl oz at 3WAT
Headline AMP 10 fl oz at VT/R1 fb Headline AMP 10 fl oz at 3WAT

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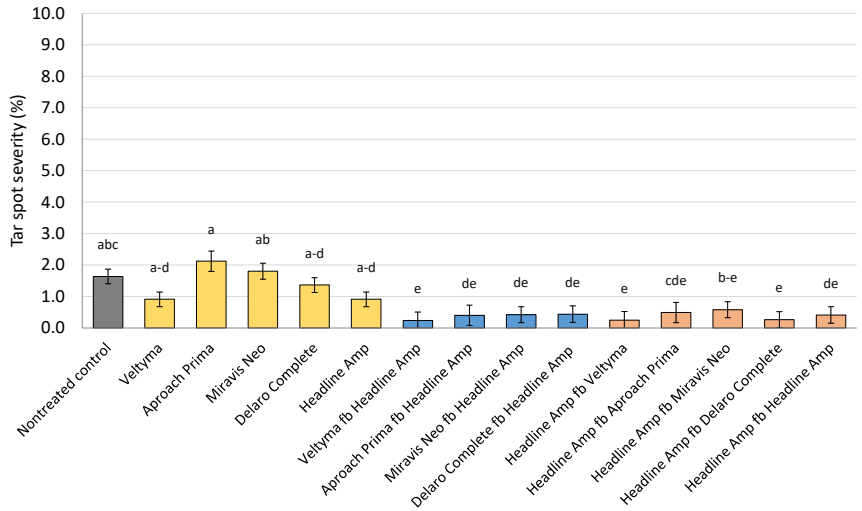
Uniform Fungicide Trials on Tar Spot – Disease Severity 2022



P= 0.0001

2022 trials conducted in Indiana, Michigan, Wisconsin, Iowa and Ontario, CA (5 environments)

[z] Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).
[y] Tar spot severity was rated by visually assessing the percentage of the symptomatic leaf area on the ear leaf at the mature growth stage (R6).

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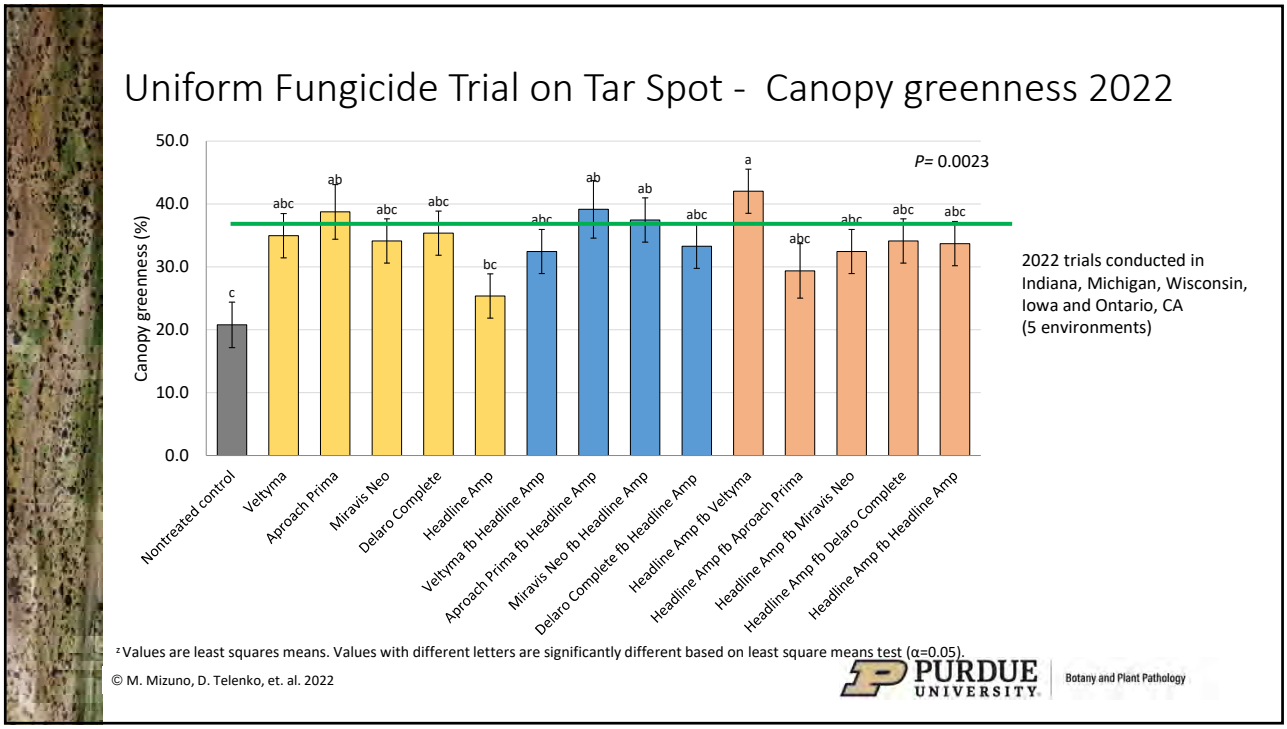
Uniform Fungicide Trial on Tar Spot - Canopy greenness 2022
Canopy greenness (%)
50.0
40.0
30.0
20.0
10.0
0.0
P= 0.0023
c
abc
ab
abc
abc
bc
abc
ab
ab
abc
a
abc
abc
abc
abc
Nontreated control
Veltyma
Aproach Prima
Miravis Neo
Delaro Complete
Headline Amp
Veltyma fb Headline Amp
Aproach Prima fb Headline Amp
Miravis Neo fb Headline Amp
Delaro Complete fb Headline Amp
Headline Amp fb Veltyma
Headline Amp fb Aproach Prima
Headline Amp fb Miravis Neo
Headline Amp fb Delaro Complete
Headline Amp fb Headline Amp
2022 trials conducted in Indiana, Michigan, Wisconsin, Iowa and Ontario, CA (5 environments)
ᶻ Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).
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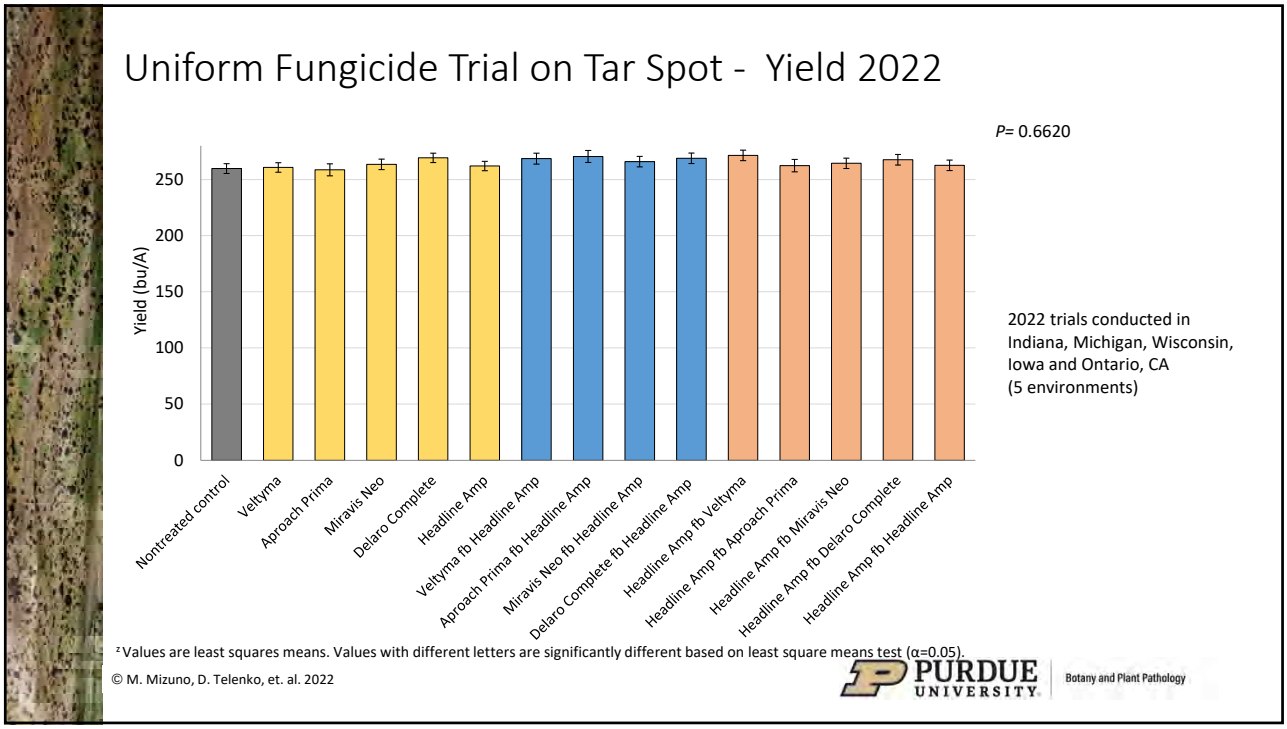
Uniform Fungicide Trial on Tar Spot - Yield 2022
Yield (bu/A)
250
200
150
100
50
0
P= 0.6620
Nontreated control
Veltyma
Aproach Prima
Miravis Neo
Delaro Complete
Headline Amp
Veltyma fb Headline Amp
Aproach Prima fb Headline Amp
Miravis Neo fb Headline Amp
Delaro Complete fb Headline Amp
Headline Amp fb Veltyma
Headline Amp fb Aproach Prima
Headline Amp fb Miravis Neo
Headline Amp fb Delaro Complete
Headline Amp fb Headline Amp
2022 trials conducted in Indiana, Michigan, Wisconsin, Iowa and Ontario, CA (5 environments)
ᶻ Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).
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Hybrid by Fungicide Timing Trials on Tar Spot -2022

Hybrids
W2583VT2P (tar spot susceptible)
P0589AMXT (tar spot tolerant)
Fungicide Programs
Nontreated control
Delaro Complete 8 fl oz/A at V10
Delaro Complete 8 fl oz/A at VT/R1
Delaro Complete 8 fl oz/A at R2
Delaro Complete 8 fl oz/A at R4
Delaro Complete 8 fl oz/A based on Tarspotter

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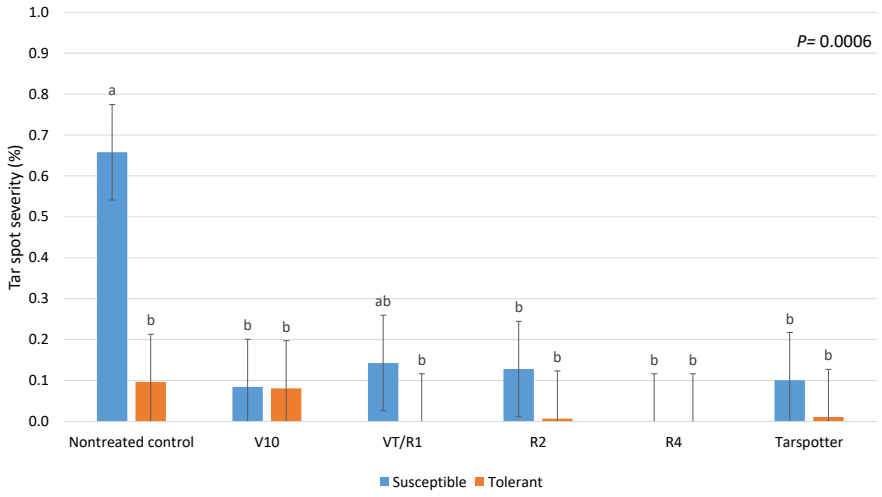
Hybrid by Fungicide – Disease Severity at R6 in 2022



2022 trials conducted in Indiana, Michigan, Wisconsin, and Ontario, CA (4 environments)

[z] Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).
[y] Tar spot severity was rated by visually assessing the percentage of the symptomatic leaf area on the ear leaf at the mature growth stage (R6).

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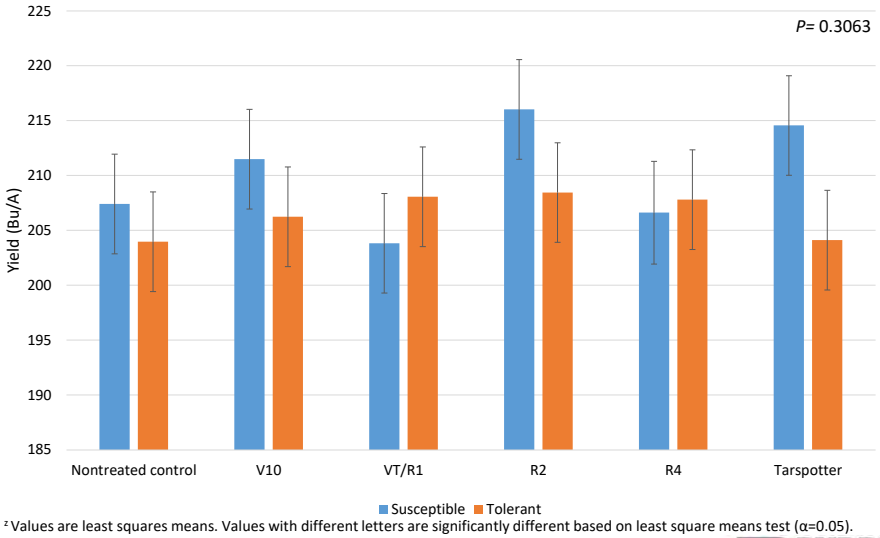
Hybrid by Fungicide – Yield 2022



2022 trials conducted in Indiana, Michigan, Wisconsin, and Ontario, CA (4 environments)

[z] Values are least squares means. Values with different letters are significantly different based on least square means test (α=0.05).

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Fungicide Efficacy Resource for Corn

CROP PROTECTION NETWORK
A Product of Land Grant Universities

Fungicide mode of action groups:
Group 11 QoI Strobilurins
Group 3 DMI Triazoles
Group 7 SDHI

Efficacy categories:
NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good;
E=Excellent; NL = Not Labeled for use against this disease;
U = Unknown efficacy or insufficient data to rank product

Fungicide Efficacy for Control of Corn Diseases Table (03/2021)

	Active ingredient (%)	Product/Trade name	Rate/A (fl oz)	Anthracnose leaf blight	Common rust	Eyespot	Gray leaf spot	Northern corn leaf blight	Southern rust	Tar spot[1]	Harvest restriction[2]
11	Azoxystrobin 22.9%	Quadris 2.08 SC, multiple generics	6.0 - 15.5	VG	E	VG	E	G	VG	NL	7 days
11	Pyraclostrobin 23.6%	Headline 2.09 EC/SC	6.0 - 12.0	VG	E	E	E	VG	VG	NL	7 days
11	Picoxystrobin	Aproach 2.08 SC	3.0 – 12.0	VG	VG-E	VG	F-VG	VG	G	G[3]	7 days
3	Flutriafol 20.9%	Xyway LFR 1.92 SC Xyway 3D 2.5 SC	LFR: 7.6-15.2 3D: 5.8-11.8	NL	U	NL	VG-E	VG	NL	NL	N/A
3	Propiconazole 41.8%	Tilt 3.6 EC, multiple generics	2.0 - 4.0	NL	VG	E	G	G	F	NL	30 days
3	Prothioconazole 41.0%	Proline 480 SC	5.7	U	VG	E	U	VG	G	NL	14 days
3	Tebuconazole 38.7%	Folicur 3.6 F, multiple generics	4.0 - 6.0	NL	U	NL	U	VG	F	NL	36 days
3	Tetraconazole 20.5%	Domark 230 ME	4.0 – 6.0	U	U	U	E	VG	G	G-VG[3]	R3 (milk)
11 3	Azoxystrobin 13.5% Propiconazole 11.7%	Quilt Xcel 2.2 SE, multiple generics	10.5 - 14.0	VG	VG-E	VG-E	E	VG	VG	G-VG[3]	30 days
7 11 3	Benzovindiflupyr 2.9% Azoxystrobin 10.5% Propiconazole 11.9%	Trivapro 2.21 SE	13.7	U	U	U	E	VG	E	G-VG	30 days
3 11	Cyproconazole 7.17% Picoxystrobin 17.94%	Aproach Prima 2.34 SC	3.4 – 6.8	U	U	U	E	VG	G	G-VG[3]	30 days

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Fungicide Timing – Indiana 2019, 2020, 2021

Fungicide: Trivapro 13.7 fl oz/A (benzovindiflupyr + azoxystrobin + propiconazole)

First detection of tar spot

Trials COR19-05/COR20-05/COR21-03
Location: PPAC
Hybrid: 'W2585SSRIB'

2019
- V7 – 8 Jul
- V9 – 15 Jul **13 Jul**
- V10 – 19 Jul
- VT/R1 – 7 Aug
- R2 – 23 Aug
- V7 fb VT – 8 Jul, 7 Aug
- Tarspotter – no app

2020
- V8 – 14 Jul
- V10 – 20 Jul
- VT/R1 – 7 Aug **28 Jul**
- R2 – 21 Aug
- R3 – 2 Sep
- R4 – 11 Sep
- R5 – 23 Sep
- V8 fb VT – 14 Jul,7 Aug
- Tarspotter – no app

2021 **3 Jul**
- V8 – 23 Jul
- V12 – 2 Aug
- R1 – 6 Aug
- R2 – 20 Aug
- R3 – 30 Aug
- R4 – 10 Sep
- R5 – 16 Sep
- V8 fb R1 – 23 Jul, 6 Aug
- Tarspotter – 2 Aug

V7-V12 Vegetative | VT-Tassel | R1-Silk | R2 – Blister | R3 – Milk | R4- Dough | R5 - Dent

*Photos courtesy of C. Gerber Dept. Agronomy

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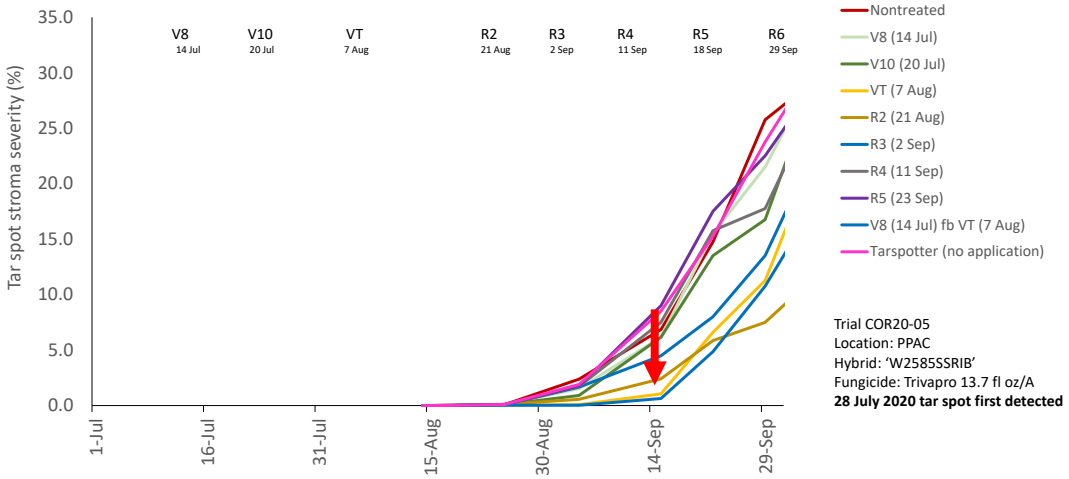
Fungicide Timing and Model Validation for Tar Spot in Corn – Disease Progress, Indiana 2020



Trial COR20-05
Location: PPAC
Hybrid: 'W2585SSRIB'
Fungicide: Trivapro 13.7 fl oz/A
28 July 2020 tar spot first detected

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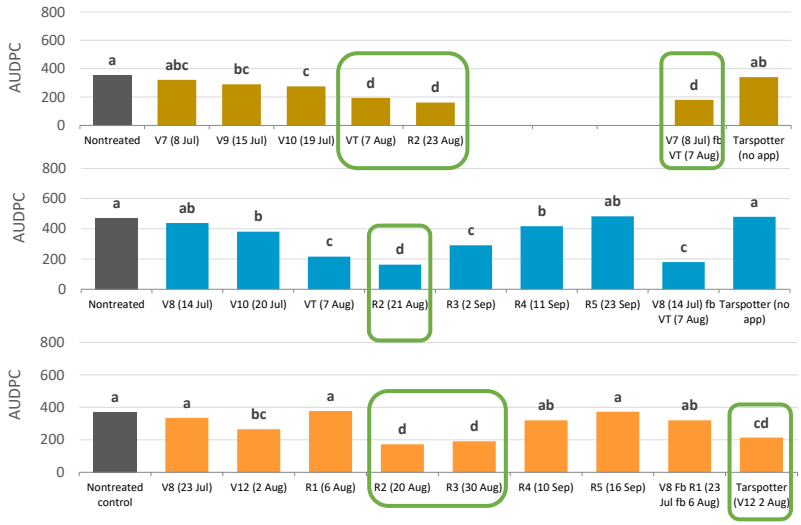
Fungicide Timing and Model Validation for Tar Spot in Corn – AUDPC on Ear Leaf in Indiana 2019, 2020 and 2021



2019

Trial COR19-05
Location: PPAC
Hybrid: 'W2585SSRIB'
Fungicide: Trivapro 13.7 fl oz/A
13 July 2019 tar spot first detected

2020

Trial COR20-05
Location: PPAC
Hybrid: 'W2585SSRIB'
Fungicide: Trivapro 13.7 fl oz/A
28 July 2020 tar spot first detected

2021

Trial COR21-03
Location: PPAC
Hybrid: 'W2585SSRIB'
Fungicide: Trivapro 13.7 fl oz/A
3 July 2021 tar spot first detected
Note on R1 – 1.5 inches rain from popup storm after application in 2021

Trivapro 13.7 fl oz/A

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Fungicide Programs for Tar Spot in Corn

V7-V12 Vegetative | VT-Tassel | R1-Silk | R2 – Blister | R3 – Milk | R4- Dough | R5 - Dent

 *Photos courtesy of C. Gerber Dept Agronomy

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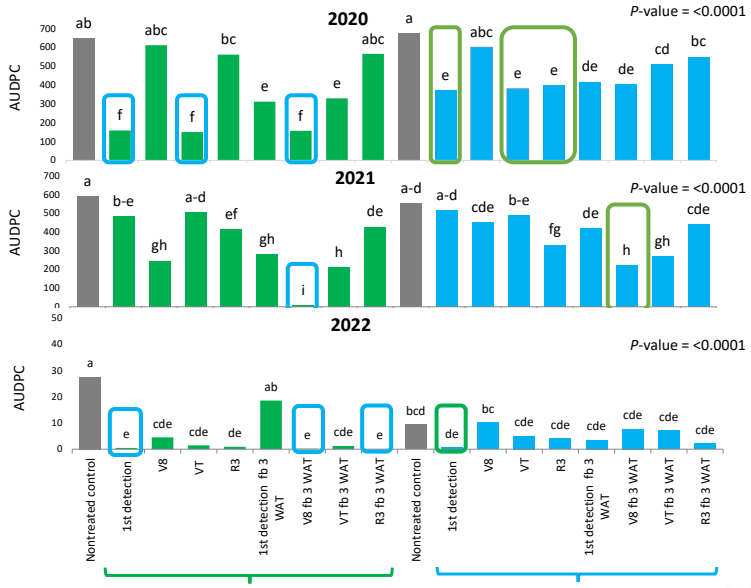
Fungicide Programs for Tar Spot in Corn



Trial COR20-15
Location: PPAC
Hybrid: 'W2585SSRIB'
28 July 2020 tar spot first detected

Trial COR21-06
Location: PPAC
Hybrid: 'W2585SSRIB'
3 July 2021 tar spot first detected

Trial COR22-05
Location: PPAC
Hybrid: 'W2585VT2P'
9 Sep 2022 tar spot first detected

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Fungicide Programs for Tar Spot in Corn – *COR21-06*

Nontreated control **vs** Veltyma 7 fl oz/A at V8 fb 3 WAT
30 Sep at R6 growth stage

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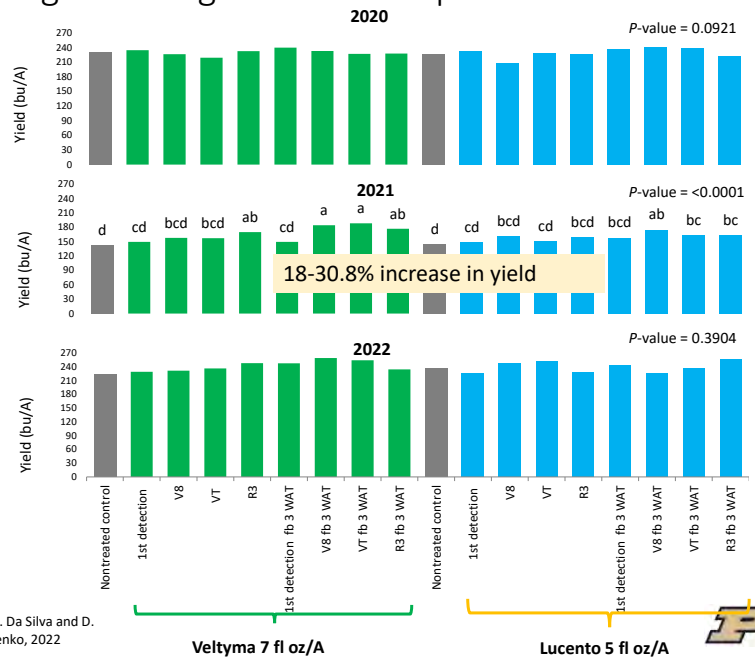
Fungicide Programs for Tar Spot in Corn - Yield



Trial COR20-15
Location: PPAC
Hybrid: 'W2585SSRIB'
28 July 2021 tar spot first detected

Trial COR21-06
Location: PPAC
Hybrid: 'W2585SSRIB'
3 July 2021 tar spot first detected

Trial COR22-05
Location: PPAC
Hybrid: 'W2585VT2P'
9 Sep 2022 tar spot first detected

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Summarizing Net Returns from Foliar Fungicides and Timing on Tar Spot Management in Indiana

Trials from 2019, 2020 and 2021
Northern Indiana in field with severe history of tar spot
vs.
Central Indiana in a field with low severity of tar spot

Ross, T. J., Thompson, N. M., Shim, S., Telenko, D. E. P. XXXX. Economic return of foliar fungicide and timing for tar spot of corn in Indiana. *In preparation*

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Site and year	Planting Date	Irrigation (Y/N)	Fungicide application date (Growth stage [z])	Date of 1st tar spot detection	Harvest Date
FUNGICIDE EFFICACY EXPERIMENT					
Wanatah 2019	8 Jun	Y	8 Aug (VT/R1)	2 Aug	28 Oct
Wanatah 2020	9 Jun	Y	7 Aug (VT/R1)	28 Jul	6 Nov
Wanatah 2021	27 May	Y	6 Aug (VT/R1)	9 Jul	4 Nov
West Lafayette 2019	4 Jun	N	4 Aug (VT/R1)	Not detected	15 Oct
West Lafayette 2020	25 May	N	25 Jul (VT/R1)	10 Aug	18 Oct
APPLICATION TIMING EXPERIMENT					
Wanatah 2019	8 Jun	N	19 Jul (V10), 7 Aug (VT/R1), and 22 Aug (R2)	31 Jul	28 Oct
Wanatah 2020	9 May	N	14 Jul (V8), 10 Jul (V10), 7 Aug (VT/R1), 21 Aug (R2), 2 Sep (R3), 11 Sep (R4), and 23 Sep (R5)	29 Aug	4 Nov
Wanatah 2021	27 May	N	23 Jul (V8), 2 Aug (V10), 6 Aug (VT/R1), 20 Aug (R2), 30 Aug (R3), 9 Aug (R4), and 16 Aug (R5)	9 Jul	4 Nov
West Lafayette 2019	4 Jun	N	11 Jul (V8), 17 Jul (V10), 4 Aug (VT/R1), and 16 Aug (R2)	4 Aug	15 Oct
West Lafayette 2020	25 May	N	7 Jul (V8), 13 Jul (V10), 25 Jul (VT/R1), 9 Aug (R2), 18 Aug (R3), 25 Aug (R4), and 9 Sep (R5)	15 Sep	18 Oct

[z] All fungicides were applied at the tassel/silk (VT/R1) corn growth stage for fungicide efficacy experiments and at eight-leaf (8-leaf), ten-leaf (V10), tassel-silk (VT/R1), blister (R2) milk (R3) dough (R4) and dent (R5) corn growth stage for fungicide timing experiments.

Ross, T. J., Thompson, N. M., Shim, S., Telenko, D. E. P. XXXX. Economic return of foliar fungicide and timing for tar spot of corn in Indiana. *In preparation*

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Net returns from foliar fungicides and timed applications on tar spot management in Indiana

To assess **yield response and net return**, site-years were groups into **two baseline disease severity condition groups:**

1. **High disease condition (TS high ≥ 5%)** – Tar spot severity in nontreated plots was ≥5%.
2. **Low disease condition (TS low < 5%)** – Tar spot severity in the nontreated plots was <5%.

Site-years	Severity of tar spot stroma (%)	Severity of tar spot foliar symptoms (%)	
FUNGICIDE EFFICACY TRIALS			
Wanatah 2019	29.6	41.8	TS high ≥ 5%
Wanatah 2020	30.7	75.3	
Wanatah 2021	33.0	100.0	
West Lafayette 2019	0.0	0.0	TS low < 5%
West Lafayette 2020	0.1	0.0	
FUNGICIDE TIMING TRIALS			
Wanatah 2019	27.1	69.5	TS high ≥ 5%
Wanatah 2020	29.2	55.9	
Wanatah 2021	35.5	92.3	
West Lafayette 2019	0.0	0.0	TS low < 5%
West Lafayette 2020	0.3	0.0	

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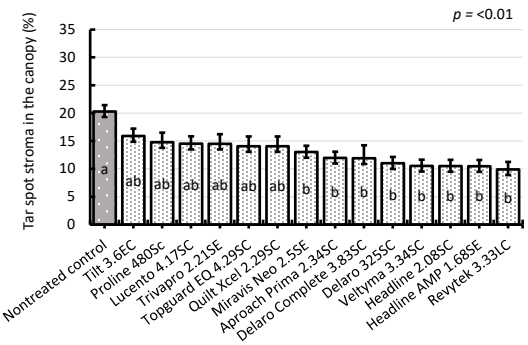
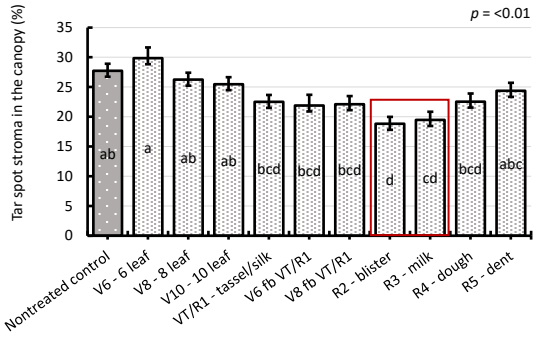
Net returns from foliar fungicides and application timing on tar spot management in Indiana





Field trials conducted at Wanatah and West Lafayette IN (5 environments).

Ross, T. J., Thompson, N. M., Shim, S., Telenko, D. E. P. XXXX. Economic return of foliar fungicide and timing for tar spot of corn in Indiana. *In preparation*

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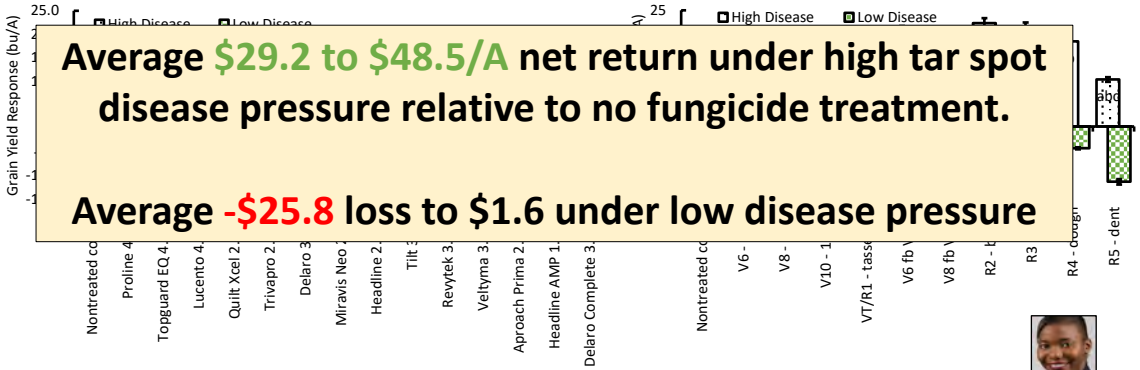
Net returns from foliar fungicides and application timing on tar spot management in Indiana

TS high - average yield increase 9.5 bu/A (range = -1.2 to 18.7 bu/A)
TS low – average yield increase 3.0 bu/A (range = -7.8 to 11.1 bu/A)

TS high - average yield increase 14.6 bu/A (range = 6.2 to 22.2 bu/A)
TS low – average yield increase - 2.7 bu/A (range = -11.9 to 9.3 bu/A)



Average $29.2 to $48.5/A net return under high tar spot disease pressure relative to no fungicide treatment.

Average -$25.8 loss to $1.6 under low disease pressure

Ross, T. J., Thompson, N. M., Shim, S., Telenko, D. E. P. XXXX. Economic return of foliar fungicide and timing for tar spot of corn in Indiana. *In preparation*

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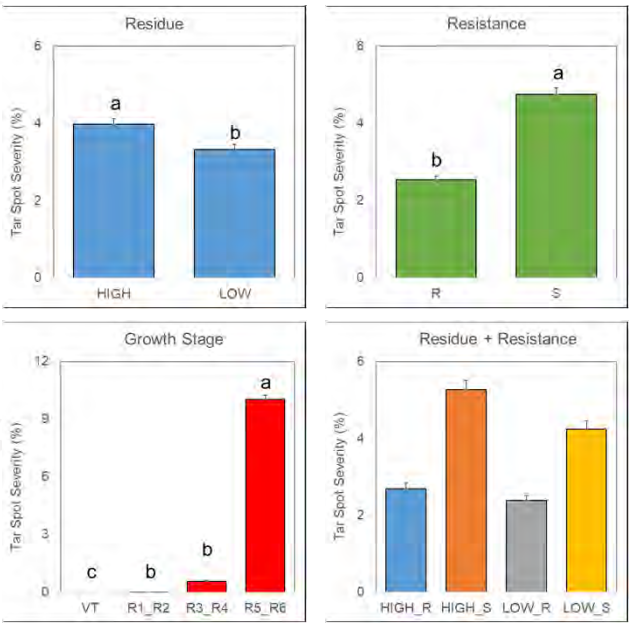
Survives in Corn Residue – Impact?

Tar Spot: Factor Effects (7 Field Trials)

- 2020: WI
- 2021: IA, IN, MI, WI
- Total: 7 field trials



NPMTI

The Tar Spot Take Home

- **Tar spot will continue to be an issue in Indiana**
  - Severity level will be a function of the hybrid, weather, and when epidemic initiates earlier vs. later in the season (episodic disease like white mold or Fusarium head blight)
  - The 2021 epidemic was problematic, because tar spot started in some fields before tasseling
  - **Fungus driven by weather –** a wet June and July in 2021 compared to 2019, 2020 and 2022.
  - Varying levels of tar spot occur across state due to weather
- **The tar spot fungus can overwinter in the upper Midwest**
  - High inoculum levels
  - Weather key (irrigation management)
  - Rotation may help a bit, not a sole solution
  - Tillage may help reduce or delay onset of disease (reducing residue) – inoculum can travel long distances, so tillage won't solve it all
- **Some hybrids are more resistant than others**
  - Resistance not tied to brand – Every hybrid stands on its own
  - Strong hybrid resistance can be overcome by a favorable disease environment (Manage irrigation!)
- **Fungicide application can reduce tar spot severity**
  - Product important (QoI + DMI or QoI + DMI + SDHI)
  - **Timing very important**
  - Application needs to occur close to the onset of the epidemic
  - Number of applications and optimal timing are going to vary by year (**Think Disease Triangle!**)
  - Tarspotter isn't perfect, but a valuable tool to help make the decision, and optimize, fungicide applications
  - If just spraying once and not interested in prediction, VT-R2 has been most consistent timing
  - Understand your farm – what disease are most of concern

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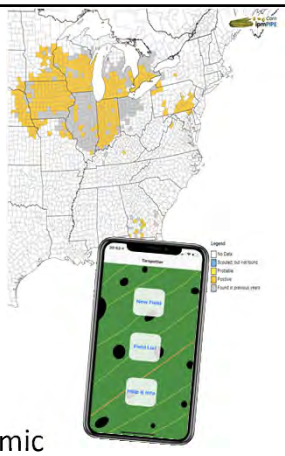
Recommendations: Tar Spot Disease Management



- **Assess risk – is it endemic in your area? Scout!!**
- **Talk to your seed salesperson about hybrid resistance**
- **Consider fungicides**
  - Mixed mode of action
  - **Timing very important, use maps and apps**
  - Application will need to occur close to the onset of the epidemic
  - If applying fungicides be sure to leave check strips
- **Manage irrigation**
- **Rotate to other crops and residue management**

Telenko, D., Chilvers, M., Kleczewski, N., Mueller, D., Plewa, D., Robertson, A., Smith, D., Tenuta, A., and Wise, K. 2020. Tar Spot. CPN 2012-W. doi.org/10.31274/cpn-20190620-008.

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QUESTIONS?

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