Tar spot research update

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Twitter: KSUCropdiseases

Need help with a plant issue?

- Plant Disease Diagnostic Lab
  - Collection & Shipping Guidelines
  - Services & Fees
- Wheat & Alfalfa
- Field Crops
- Fruits & Vegetables
- Trees, Shrubs & Ornamentals
- Turf

Contact Us

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1712 Claflin Road
Manhattan, KS 66506

785-532-6176

Helping You Get to the Root of the Problem

The K-State Plant Disease Diagnostic Lab provides timely diagnostics of plant pathogenic fungi, bacteria, viruses, and fungal-like organisms. Our mission is to provide this service to K-State Research and Extension personnel, consultants, commercial producers, landscape companies, and homeowners both within and outside of Kansas. After plant diagnosis, we will provide research-based resources and connect you with one of our experts to answer any questions.

Ready to get started?

Collect your samples and ship them to our lab today. If you have questions about your submission or our processes, email us for specific help.

Sample Collection & Shipping

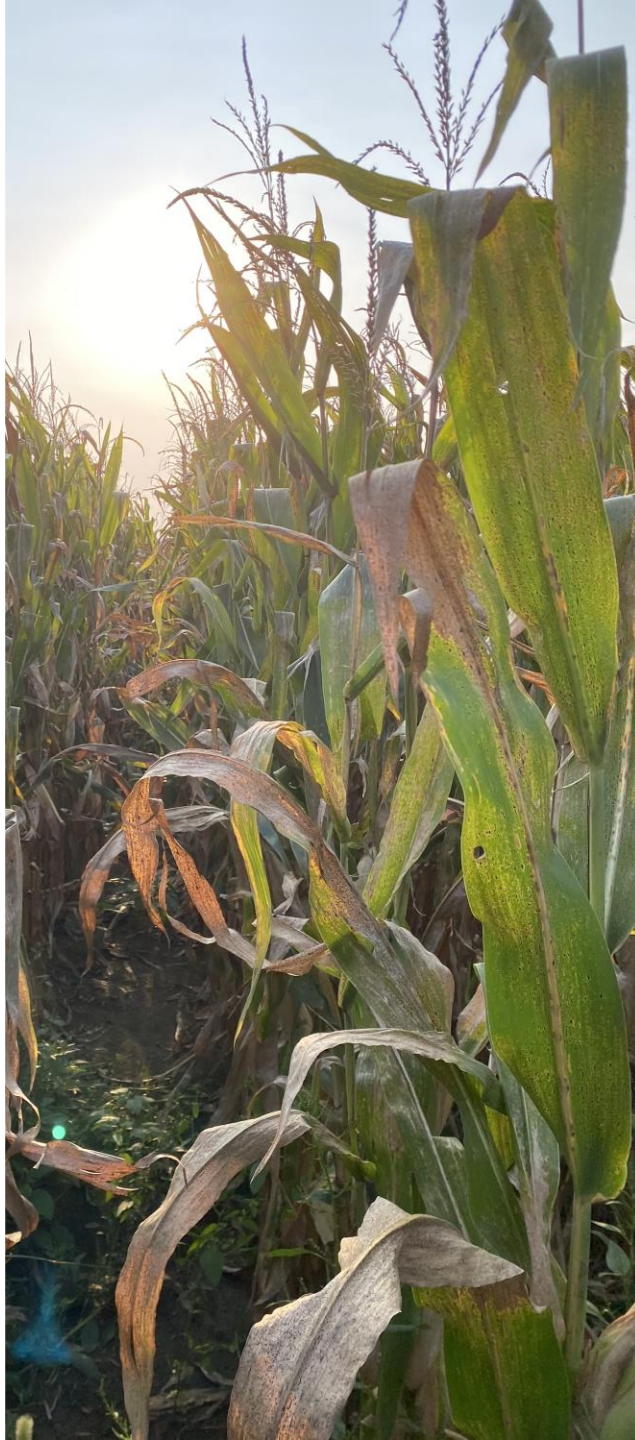
Pay your invoice online

Looking for something else?

Our lab specializes in disease identification in plants. If you need help with other plant issues or identification, please check out these K-State resources:

Kansas Tar Spot Update

- First report on June 26, 2023 (9/15/2022)
- V8 growth stage
- Several fields in Doniphan County
- Prevalence and severity were much higher than in the 2022 season
- Yield losses +30 bu/a



Tar spot of corn

- Fungus *Phyllachora maydis*
- First identified in Mexico in 1904
- Obligated pathogen
  - Requires a living host to grow and reproduce
- Multiple cycles of the disease can occur during the growing season
- Any growth stage is susceptible to infection
  - In the US, disease symptoms have been observed as early as V3 growth stage

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Tar spot overwinters on corn residue

- This disease is favored by mild temperature (60F to 73F), high relative humidity (>75%), and a prolonged leaf wetness period (>7h).
- Severity of tar spot is dependent on the weather.
- Irrigated corn may be at particularly high risk for yield or silage loss.

This pathogen produces small, round to irregular diamond-shaped, raised black structures called stromata

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Signs of Tar Spot disease (stroma/stromata) can be found on both surfaces of corn leaves:

Upper

Lower

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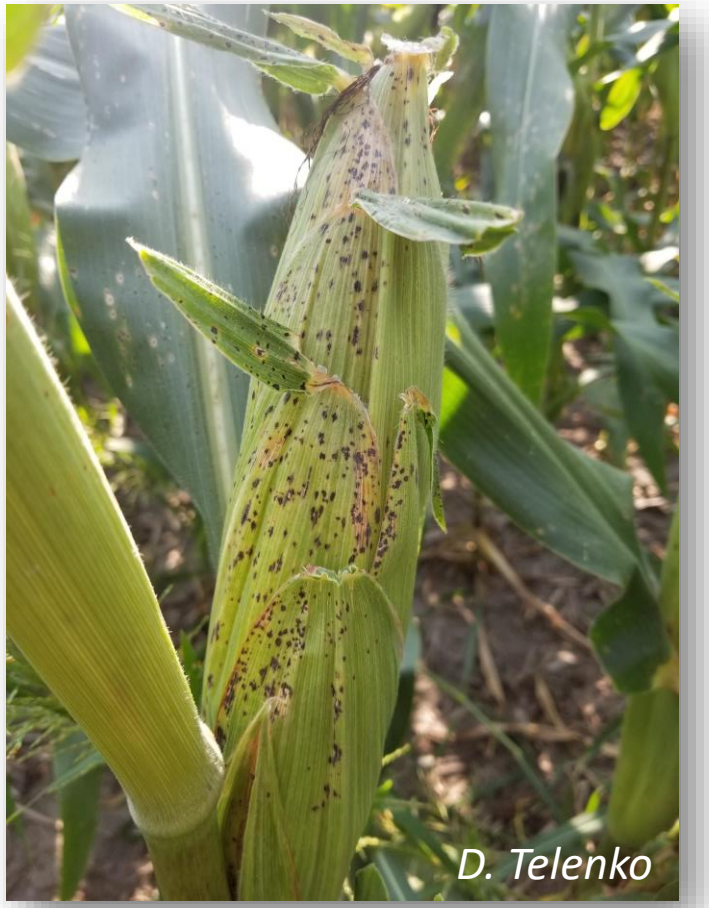
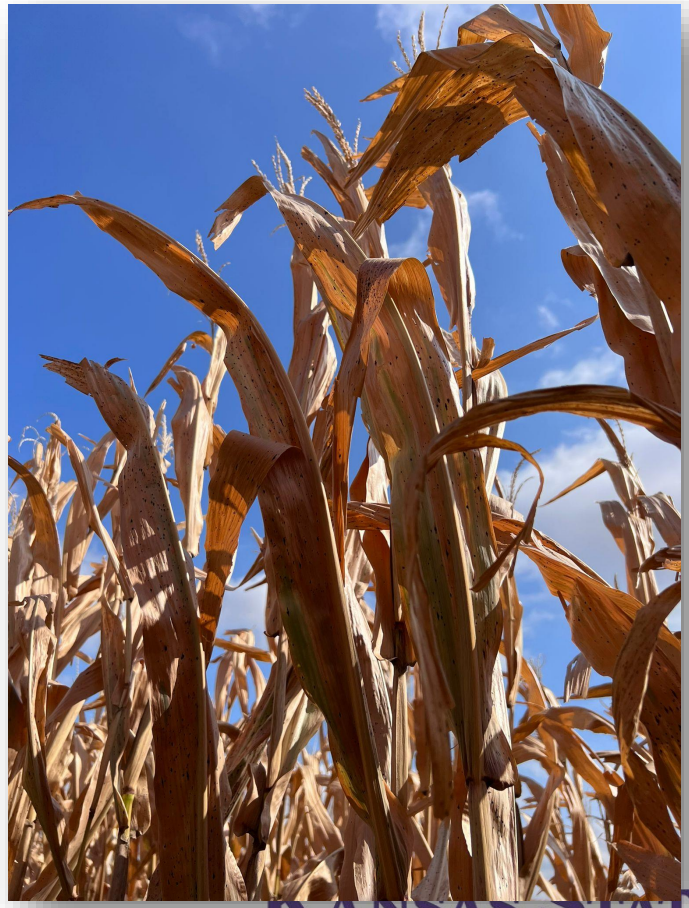
Stroma may also be observed on leaf sheaths, husks, and tassels





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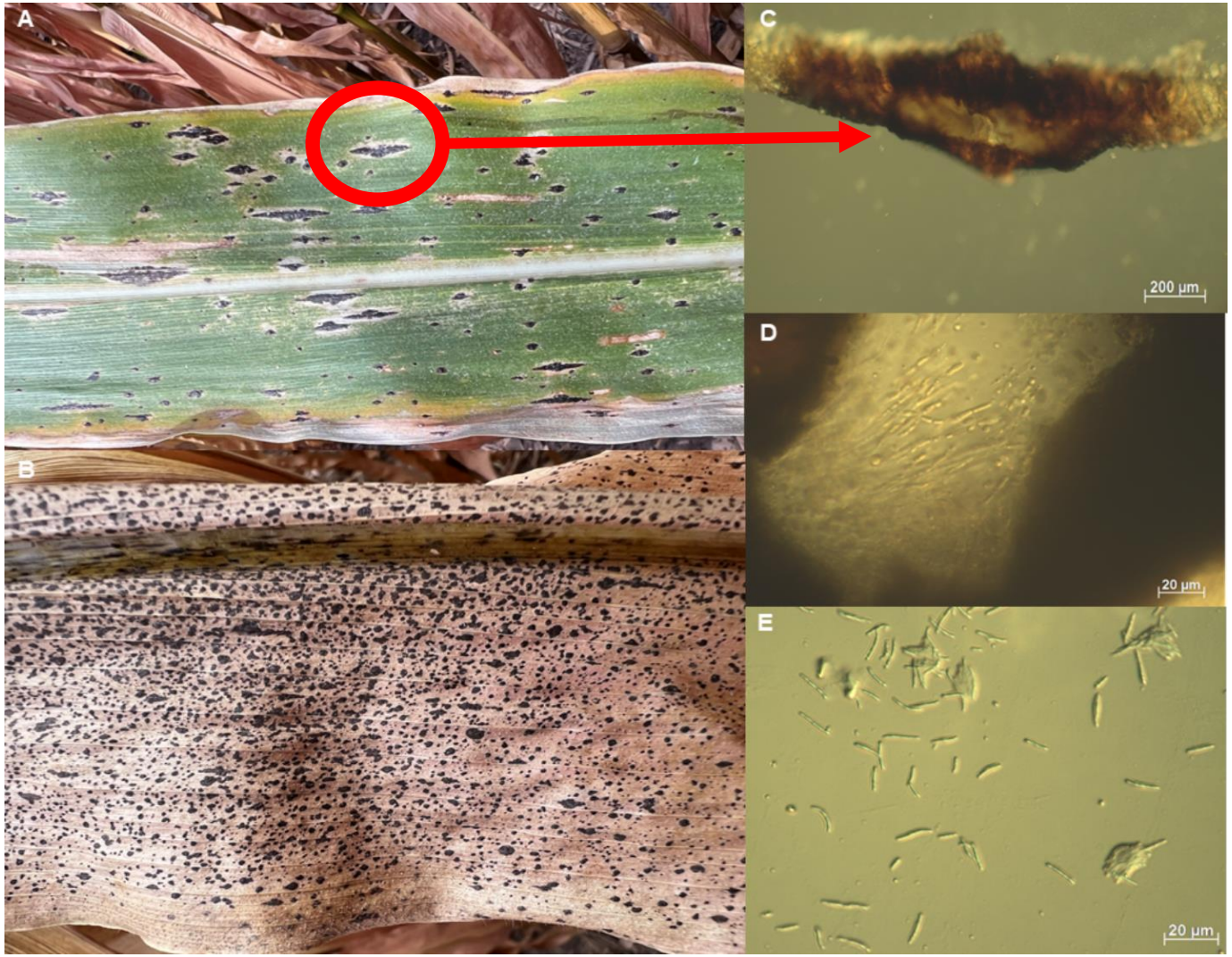
What is a stroma/stromata?



Transversal hand section of a stroma

Transversal hand section of a stroma with a pycnidium and conidia

Long narrow conidia

Moura et al. 2023.

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Distribution

- First detected in US in 2015
- To date, it has been reported in Illinois, Indiana, Wisconsin, Michigan, Minnesota, Kentucky, Iowa, Ohio, Florida, Georgia, Pennsylvania, New York, Nebraska, Missouri, South Dakota, and now Kansas.
- First observations in our neighboring states, Nebraska and Missouri, were made in the 2021 season.

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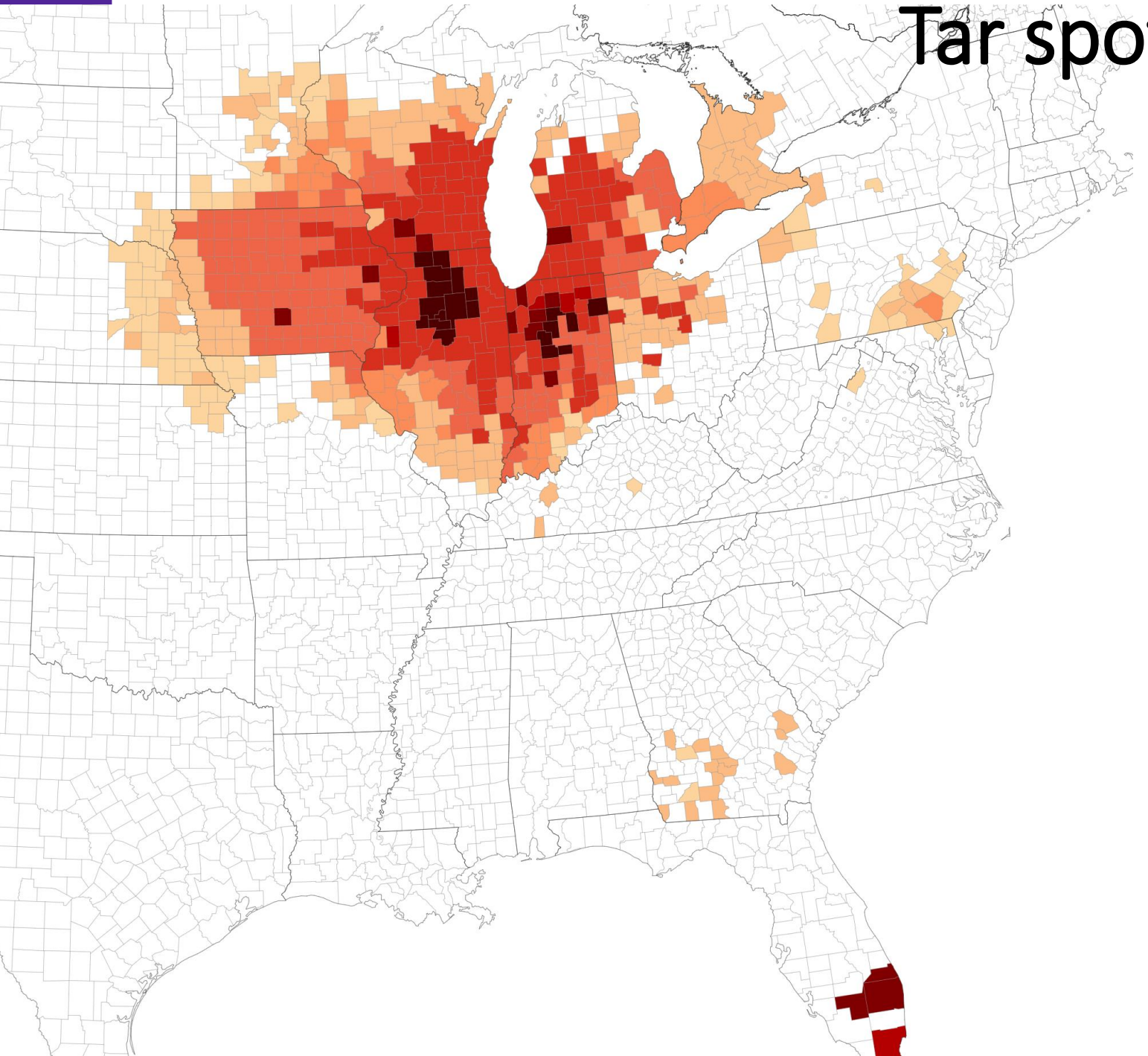
Corn
ipmPIPE
Tar Spot Yearly Distribution 2015 to 2022
Legend
No Data
Species Reported

Tar spot distribution



www.corn.ipmpipe.org

Corn ipmPIPE

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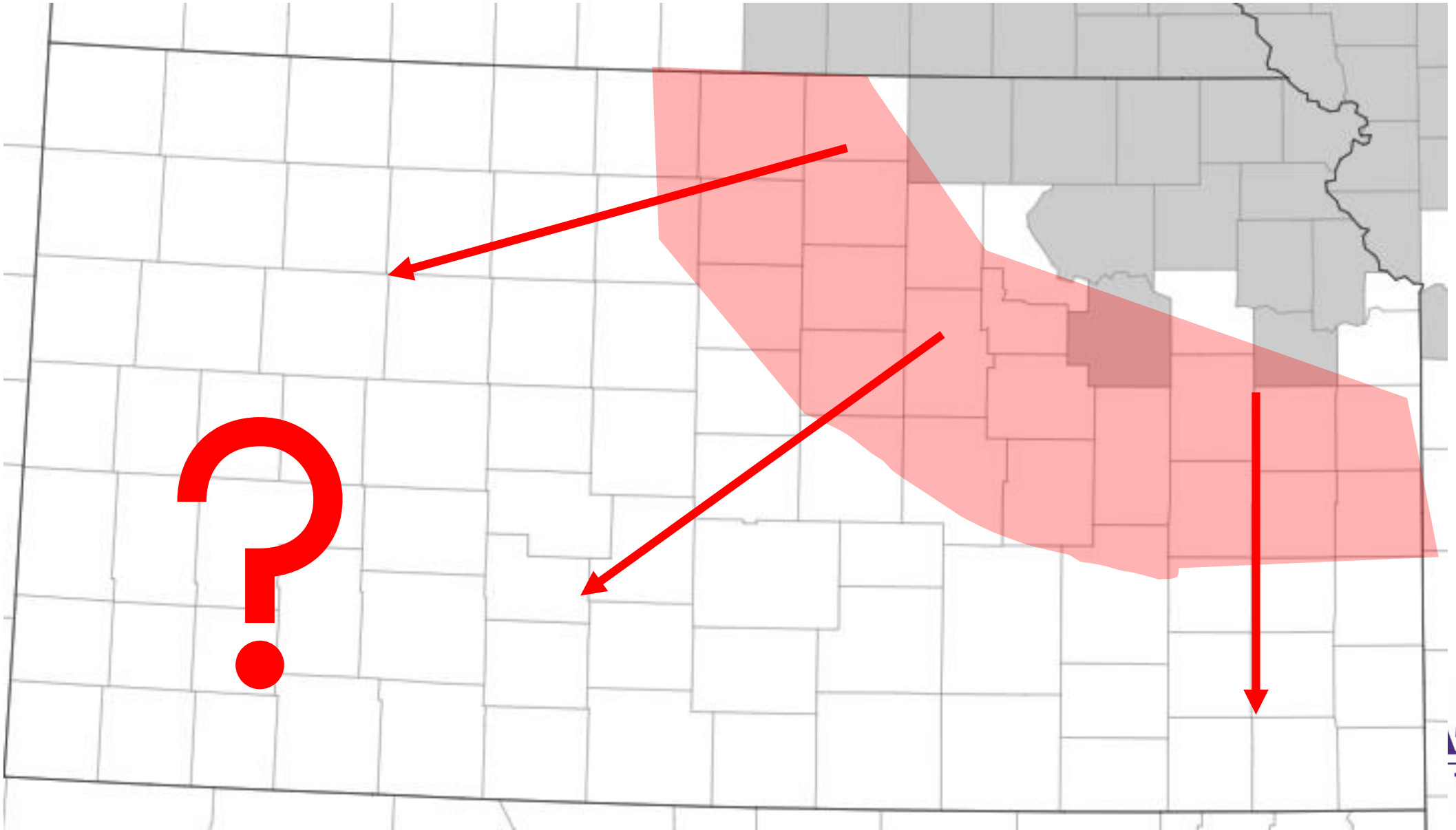
https://corn.ipmpipe.org/tarspot/

1/16/2023

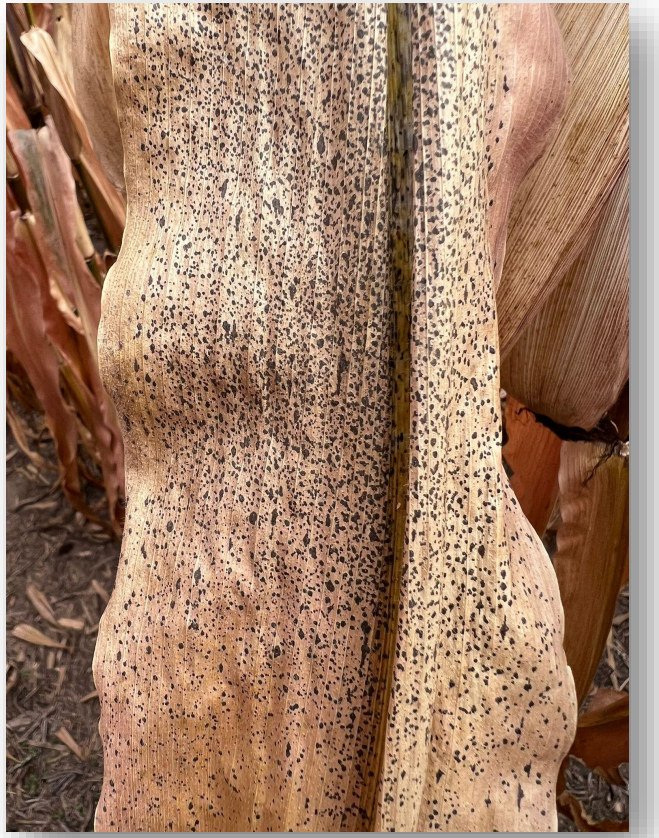



7/27/2023 - Doniphan


8/2/2023 - Nemaha

Severe tar spot outbreaks may reduce yield by more than 30 bushels per acre

- Reduced ear weight, poor kernel fill, loose kernels, and vivipary
- Stalk rot and lodging are increased when tar spot severity is high
- Severe tar spot also reduces forage quality



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Ear leaf severity > 50 %
@R5 on susceptible hybrids

> 30% disease severity
leaves prematurely die

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Rapid development – 13 days difference

FIGURE 1

Rapid development of tar spot in nontreated plots in Indiana in 2019. Image on left taken 21 September and the same plot (right) 13 days later on 4 October. (Photo credit: Darcy Telenko.)

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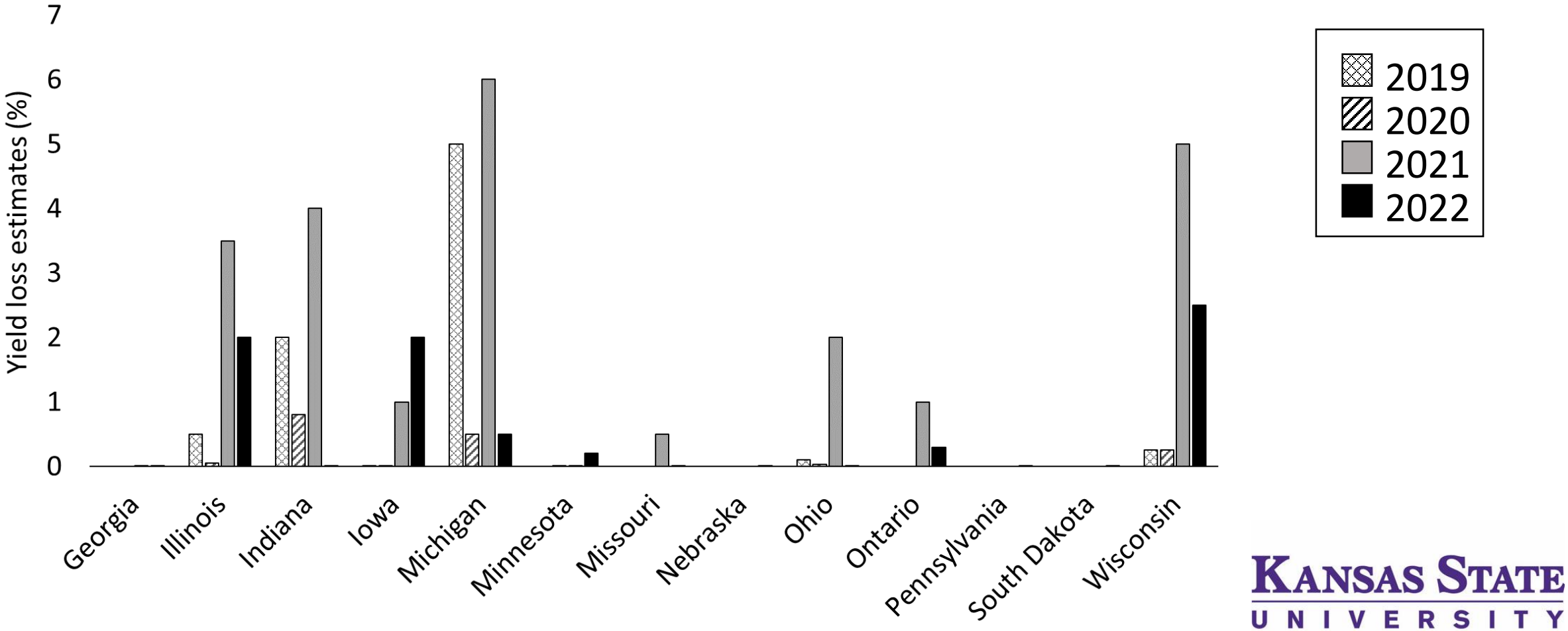
Environment is a strong driver of tar spot disease

Entire field had Headline Amp application at silking (R1)

Dan Heasley - MI 2019

Over the past years **Tar Spot** has been one of the most important diseases some states



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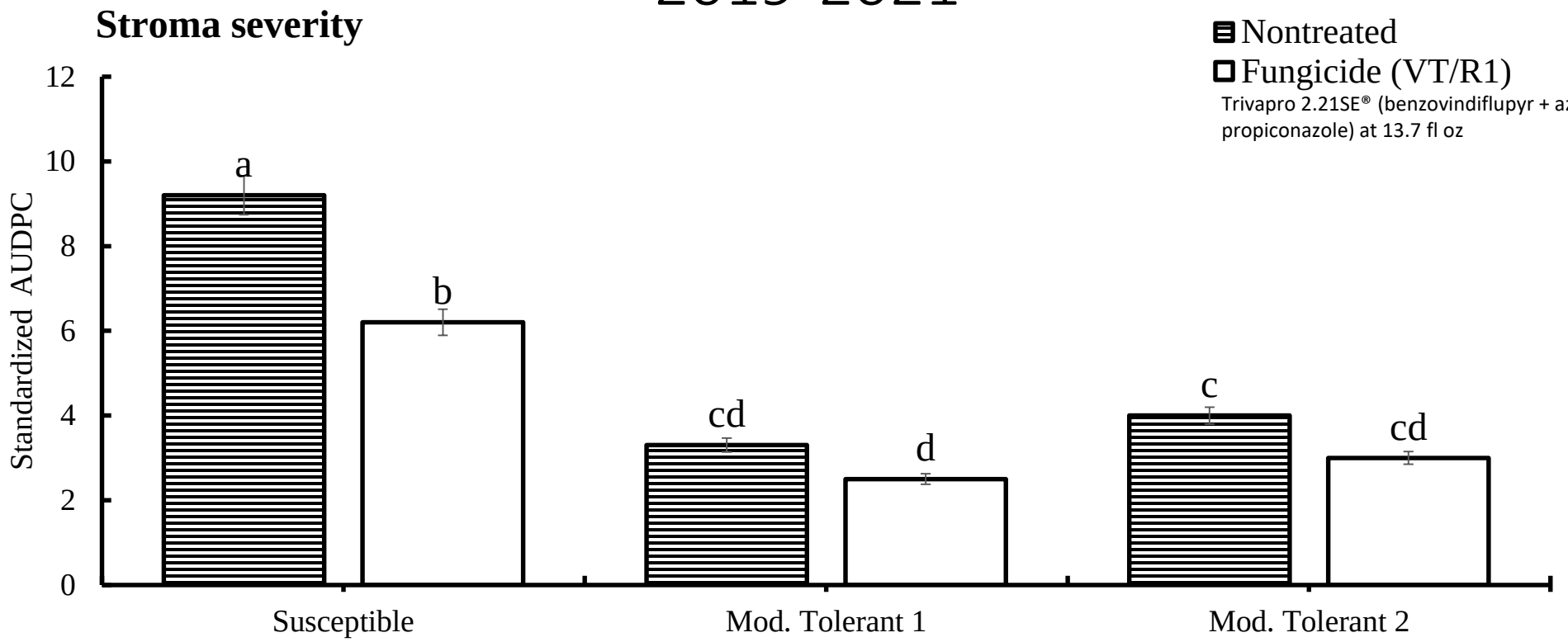
Management

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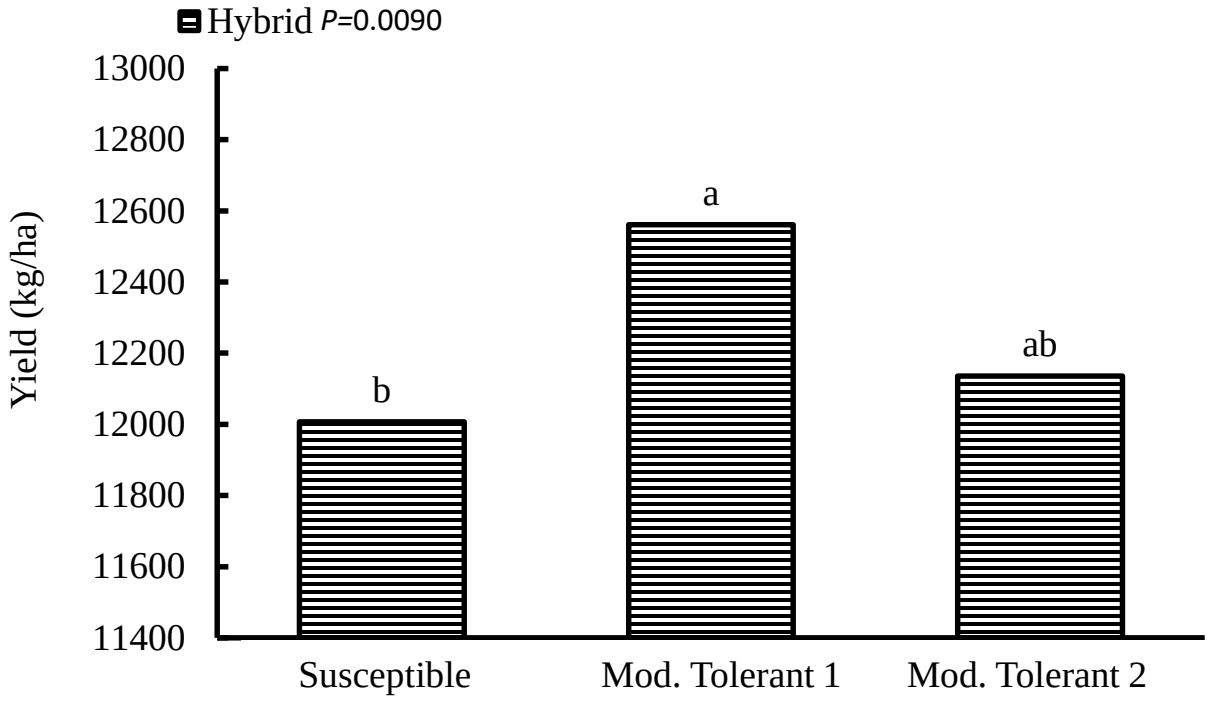
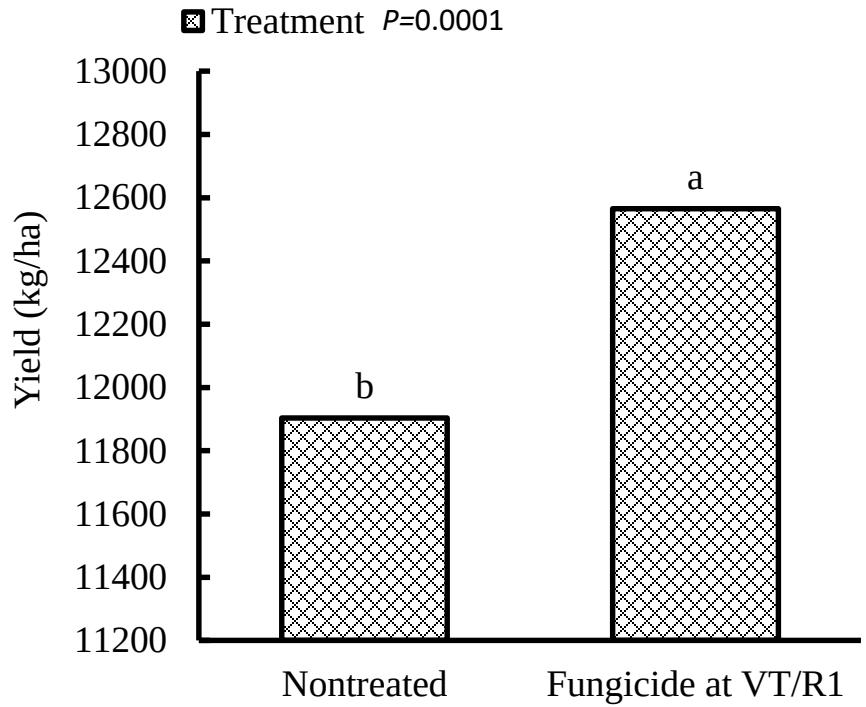
Integration hybrid and fungicide application for control of tar spot 2019-2021





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

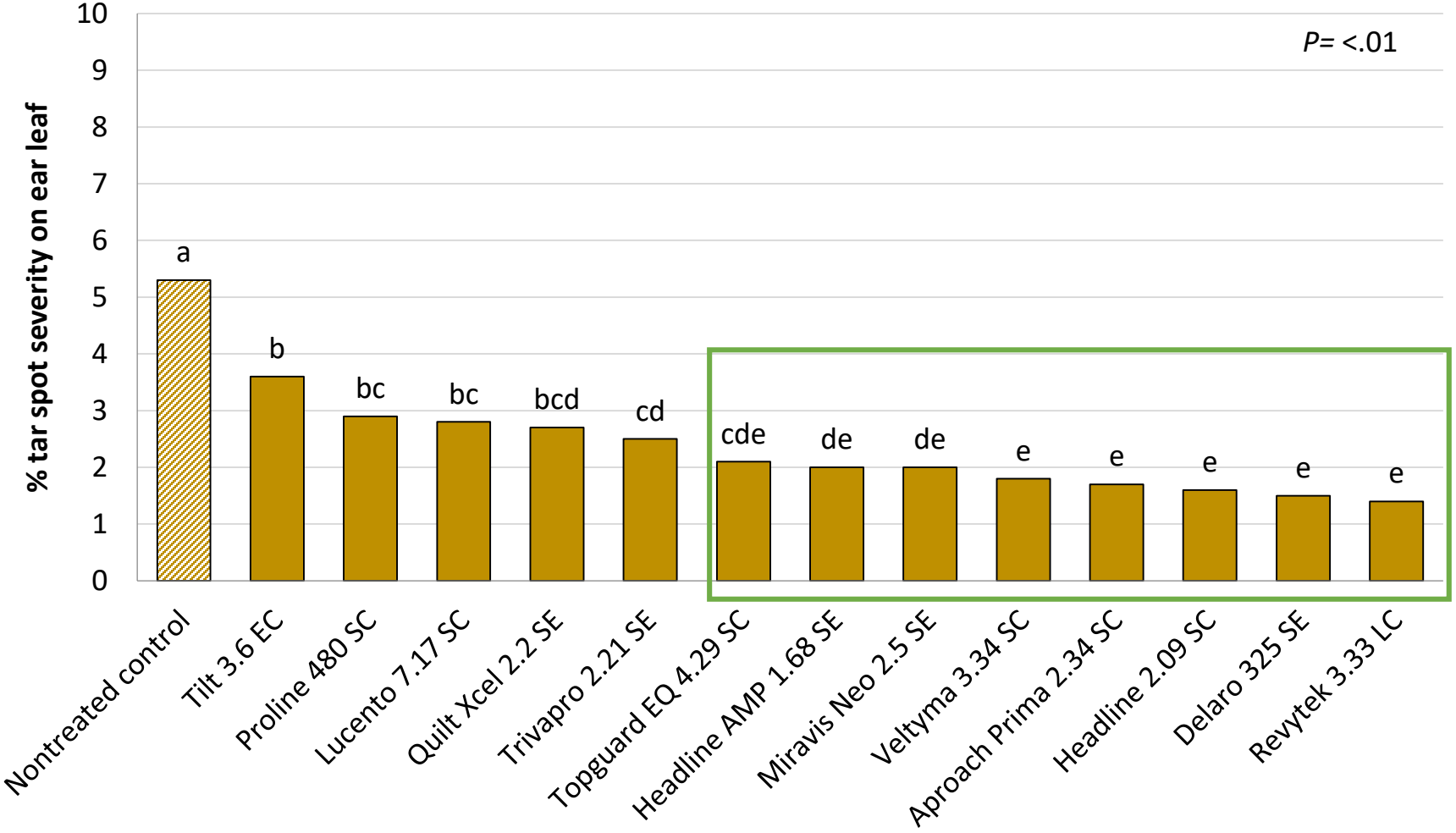
Efficacy categories:
NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good;
E=Excellent; NL=Not Labeled for use against this disease;
U =Unknown efficacy or insufficient data to rank product

Fungicide Efficacy for Control of Corn Diseases Table (04/2022)

	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	G	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[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	NL	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
3 11	Flutriafol 19.3% Fluoxastrobin 14.84%	Fortix 3.22 SC Preemptor 3.22 SC	4.0 -6.0	U	U	U	E	VG	VG	G-VG[3]	R4 (dough)
3 7	Flutriafol 26.47% Bixafen 15.55%	Lucento	3.0-5.5	U	U	U	VG-E	VG	VG	G[3]	R4
3 11	Flutriafol 18.63% Azoxystrobin 25.30%	TopGuard EQ	5.0-7.0	U	F	U	VG	G-VG	G-VG	G-VG[3]	7 days
3 11	Mefentrifluconazole 17.56% Pyraclostrobin 17.56%	Veltyma	7.0-10.0	U	U	U	VG-E	VG-E	VG	VG	21 days
3	Mefentrifluconazole 11.61%										

Indicates product with mixed fungicide classes

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*

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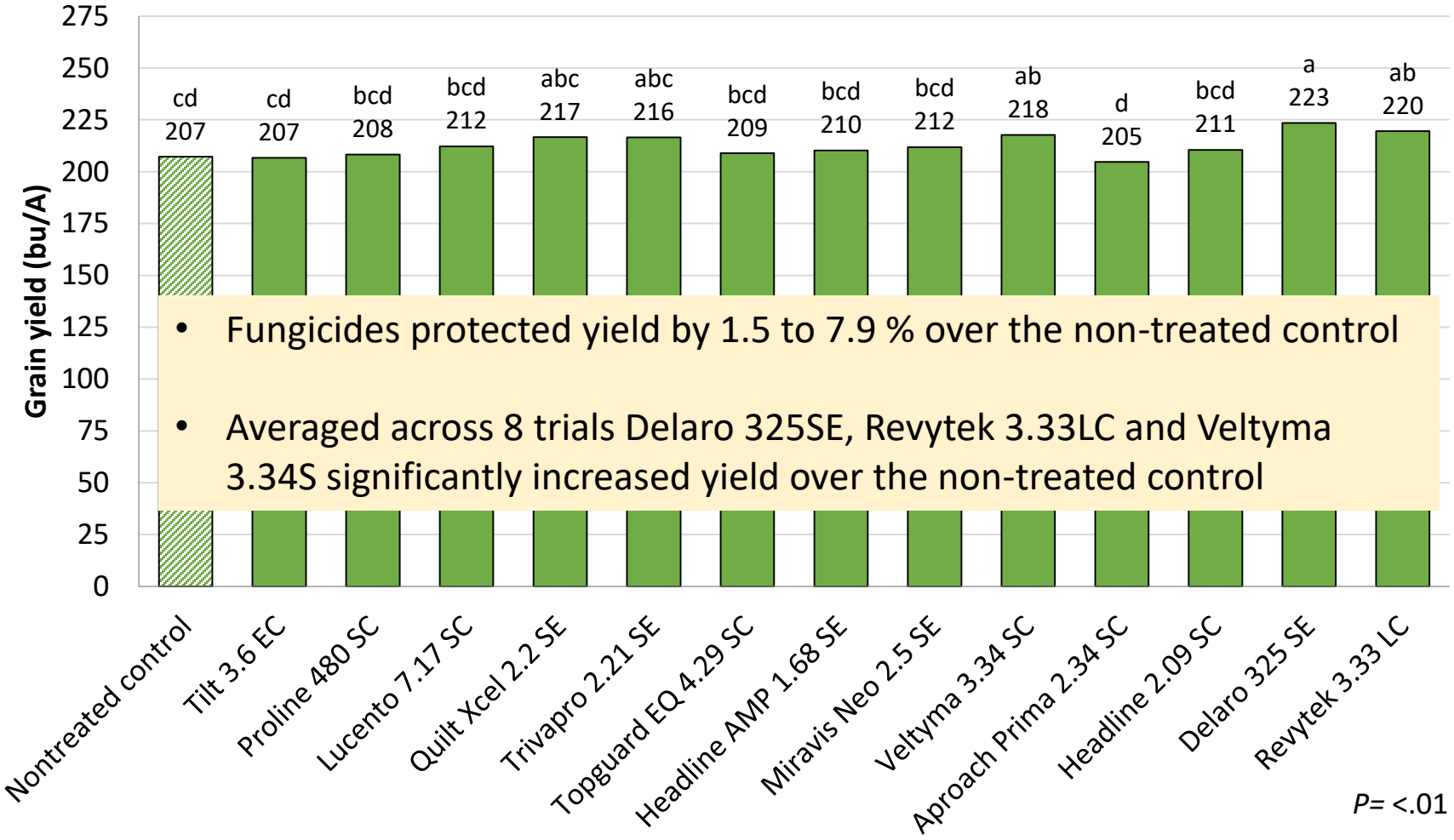
Uniform Fungicide Trial on Tar Spot – Yield 2019 and 2020



- 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*

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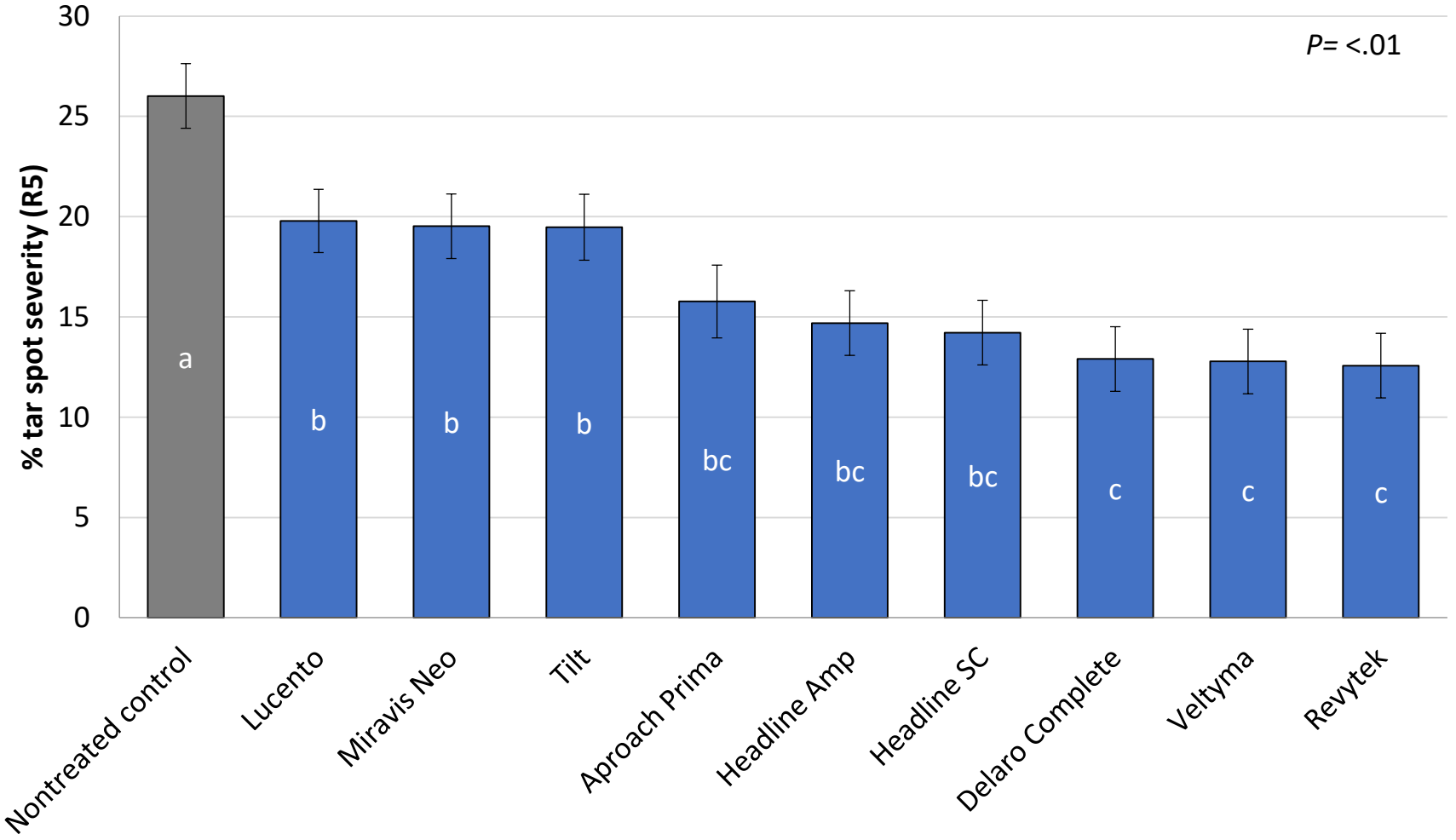
Uniform Fungicide Trial on Tar Spot – Disease Severity 2021



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.

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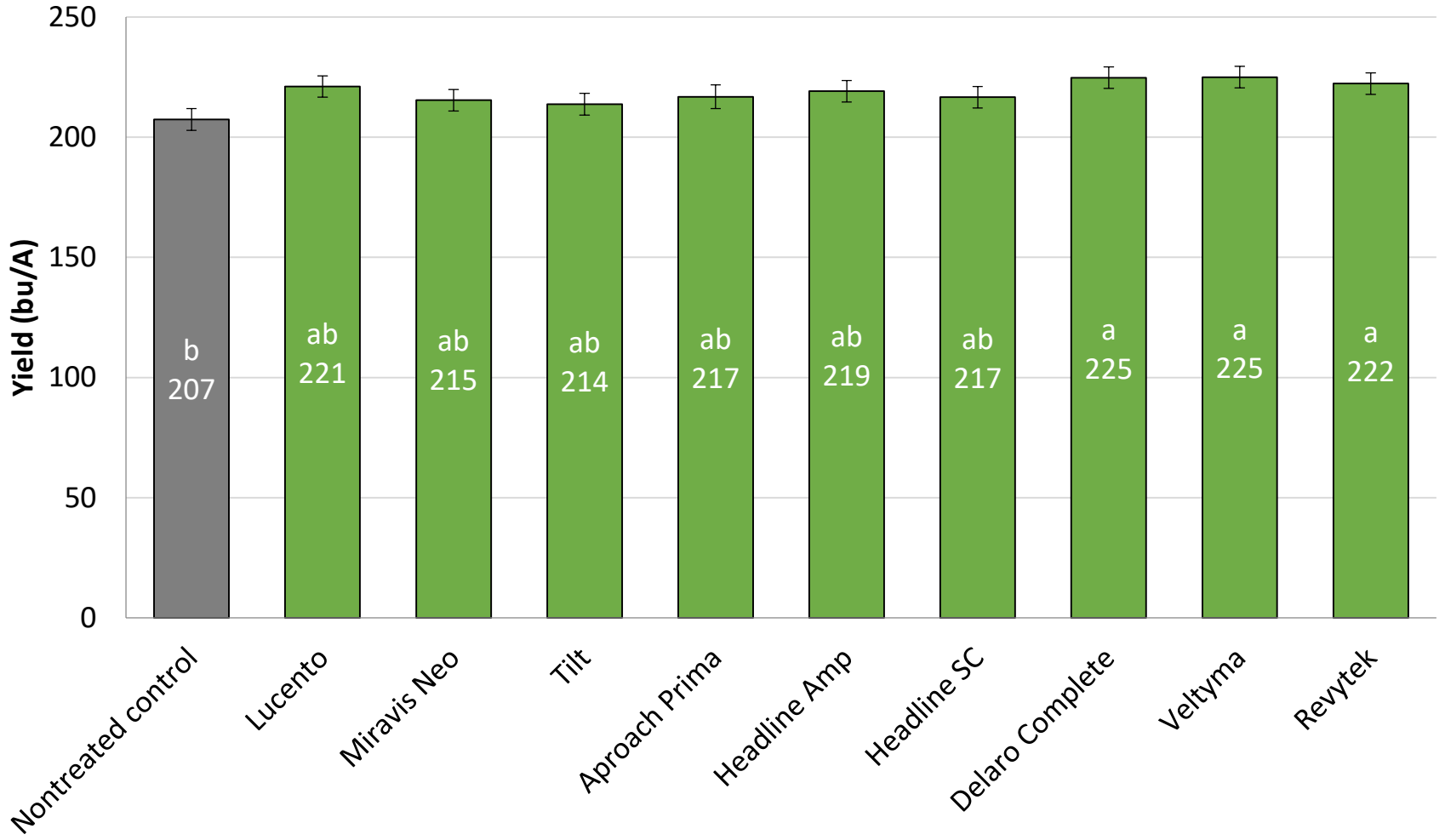
Uniform Fungicide Trial on Tar Spot – Yield 2021



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.

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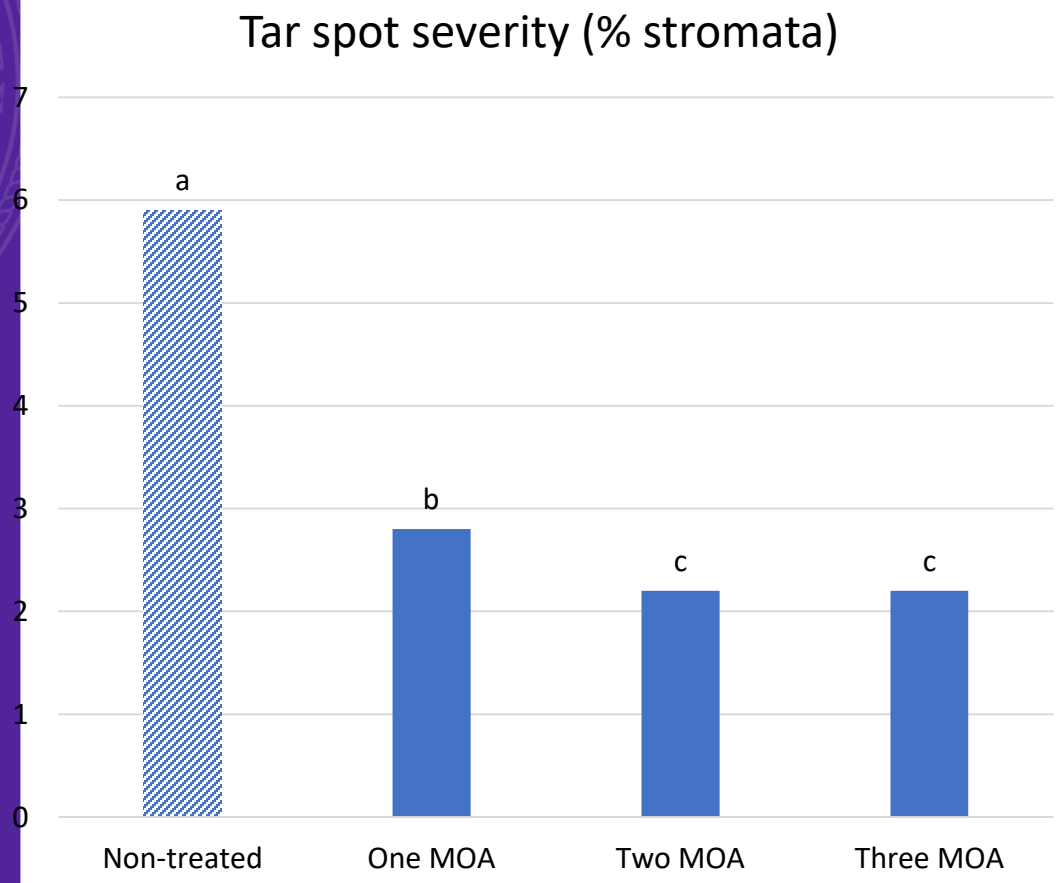
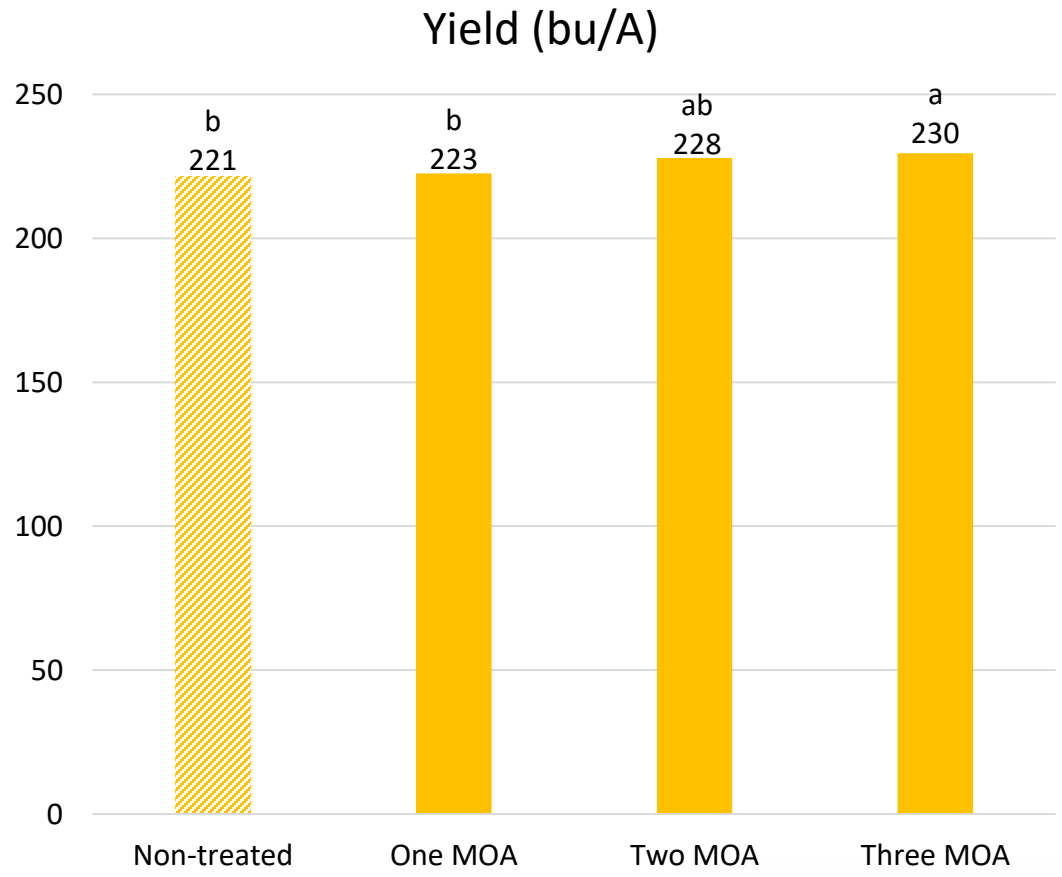
Effect of Mode of Action (MOA) on Tar Spot Severity and Grain Yield





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*

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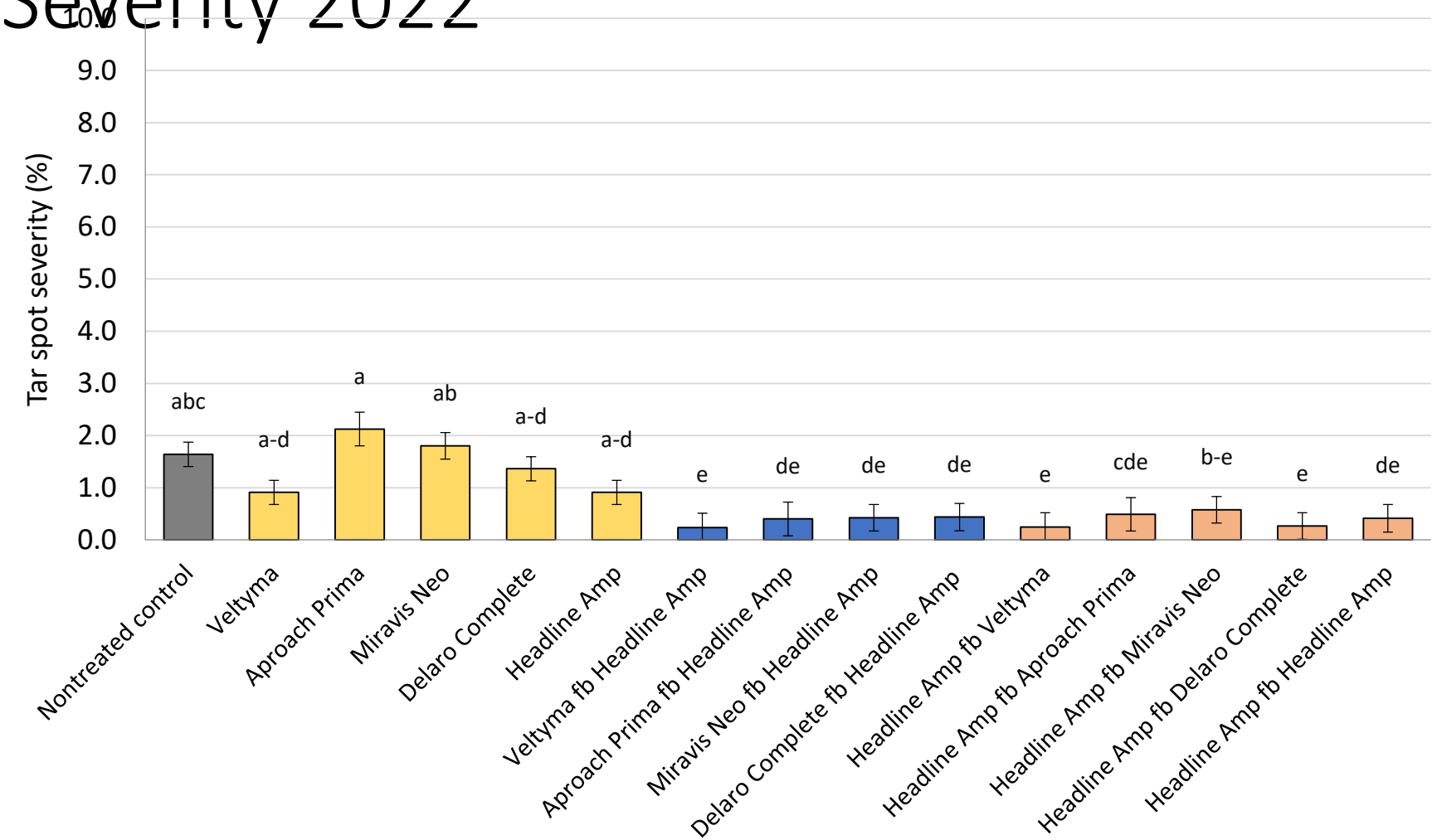
Uniform Fungicide Trials on Tar Spot, 2022

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

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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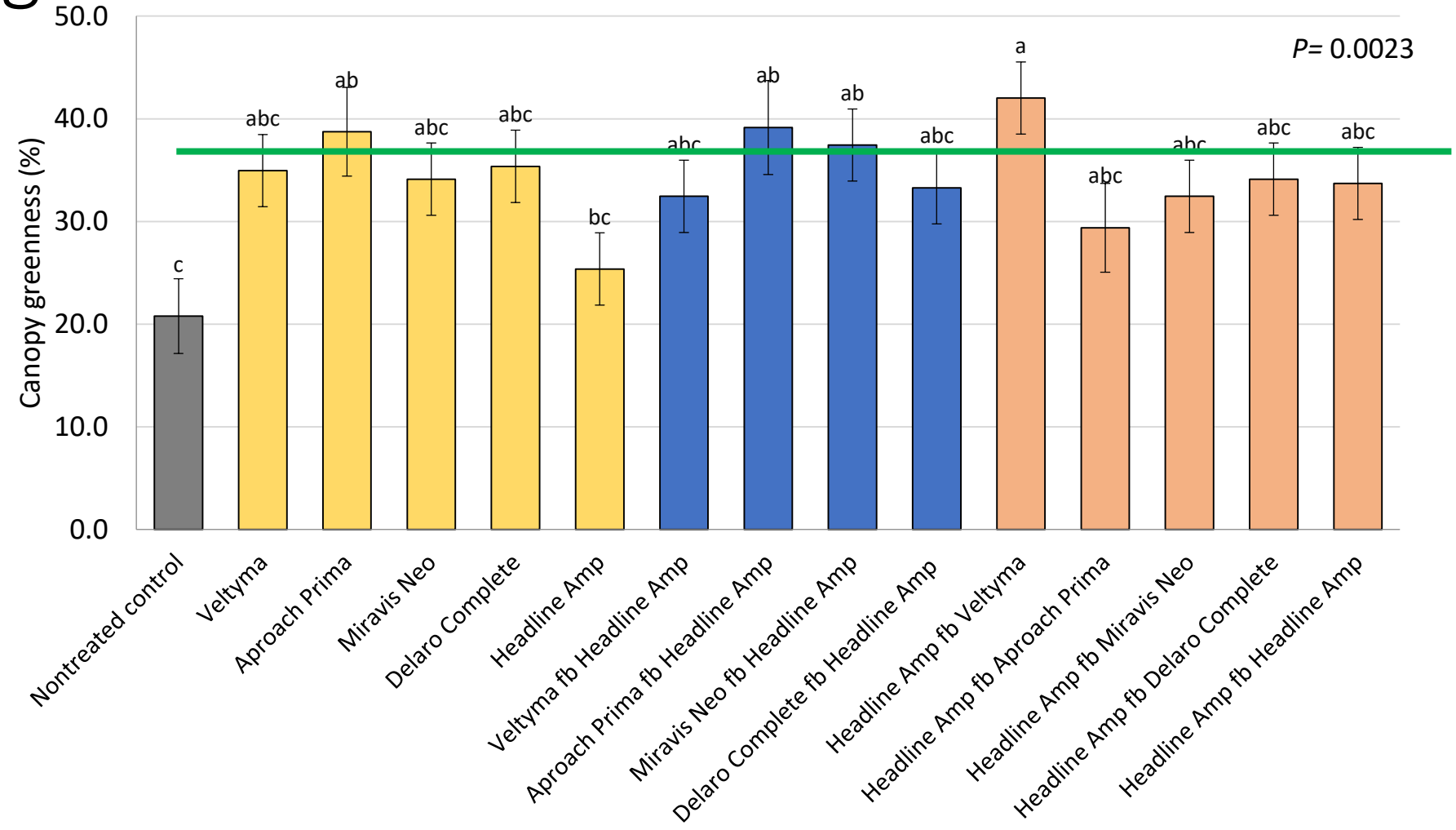
Uniform Fungicide Trial on Tar Spot - Canopy greenness 2022



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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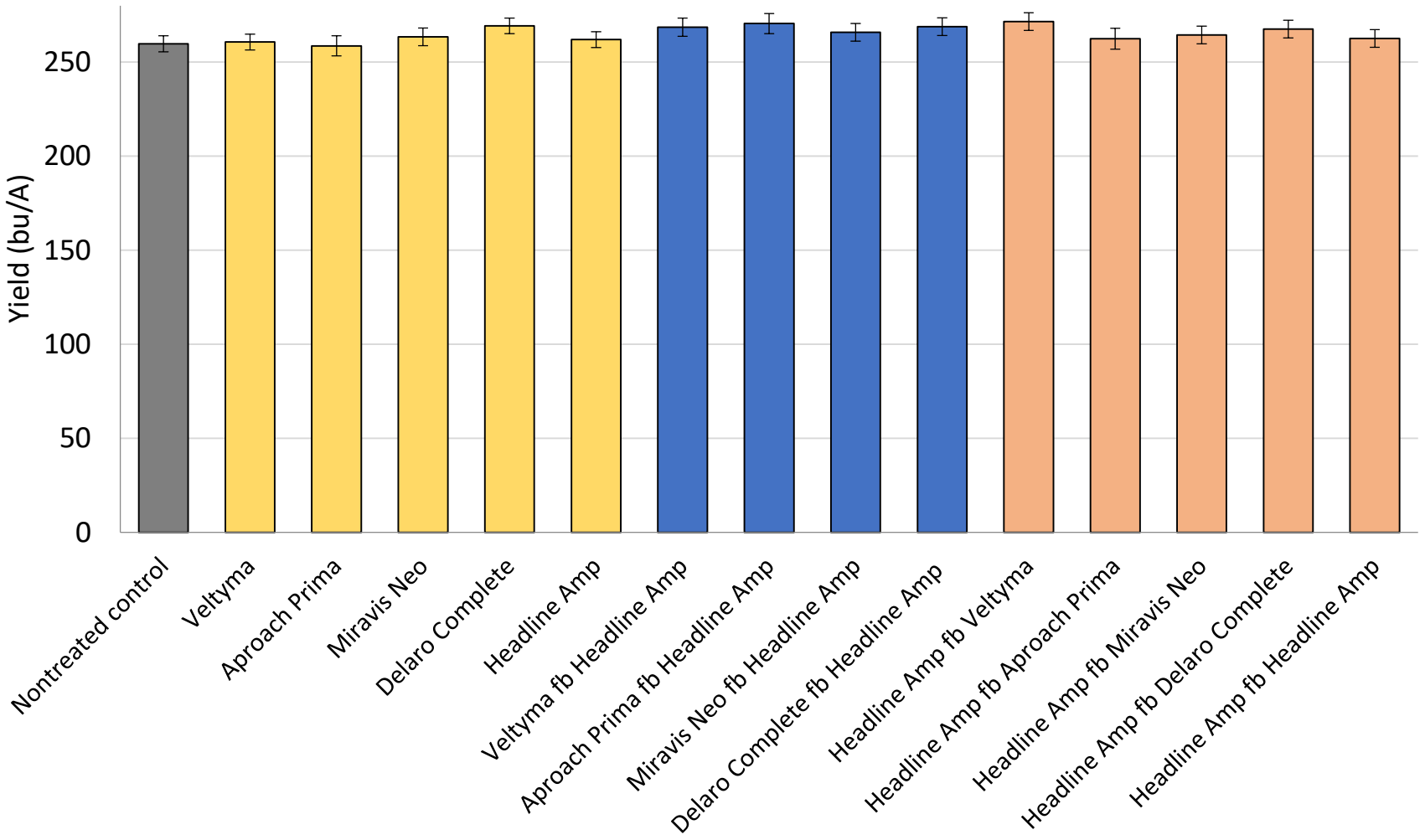
Uniform Fungicide Trial on Tar Spot - Yield 2022

P= 0.6620



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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When should I apply a fungicide for Tar Spot disease control?

- Tasseling (VT) to the silking (R1) growth stage
  - Protection of 14 to 21 days after application.

When should I apply a fungicide for Tar Spot disease control?

- Tasseling (VT) to the silking (R1) growth stage
  - “Protection” of 14 to 21 days after application.

Is there a benefit of a second or a late fungicide application?

- Probably, if disease continue to progress it might be valuable. Here are a few things to consider:
  - Physiological maturity happens at R5; hybrid susceptibility to tar spot (and other diseases); upcoming weather conditions

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Additional links:

- **Tar Spot of Corn**
  - https://cropprotectionnetwork.org/encyclopedia/tar-spot-of-corn
- Tar Spot
  - https://crop-protection-network.s3.amazonaws.com/publications/tar-spot-filename-2019-03-25-120313.pdf
- Tar Spot Distribution Map
  - https://corn.ipmpipe.org/tarspot/

Feel free to contact me!

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