UPDATE AND DISCUSSION ON NEW AND EMERGING DISEASES IN CORN AND SOYBEAN

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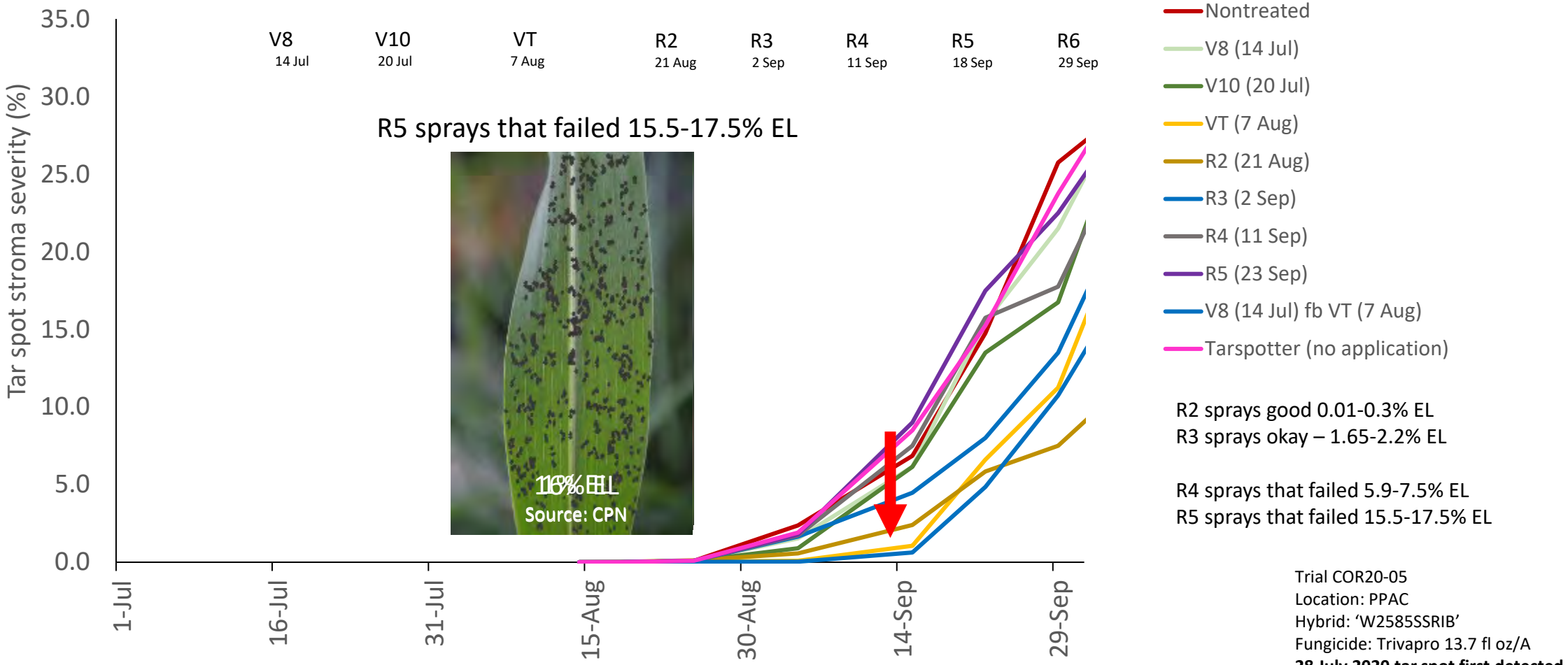
PURDUE UNIVERSITY | Botany and Plant Pathology

Tar spot of corn


Corn
ipmPIPE
Tar Spot Yearly Distribution
2015 to 2023
Legend
No Data
Subject reported
Date : 1-1-2015
1 / 10

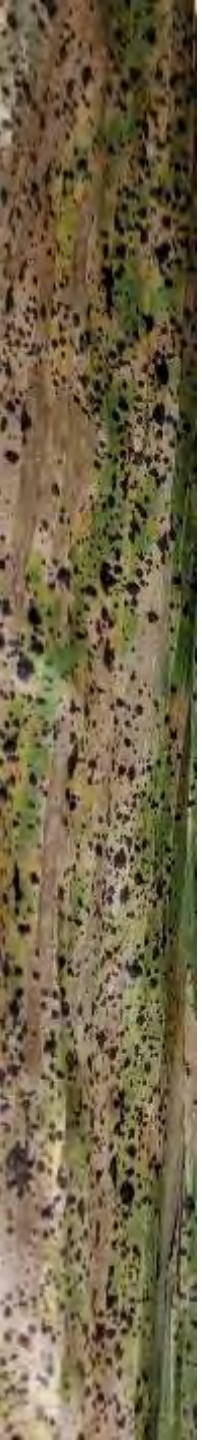
Fungicide Timing and Model Validation for Tar Spot in Corn – Disease Progress, Indiana 2020

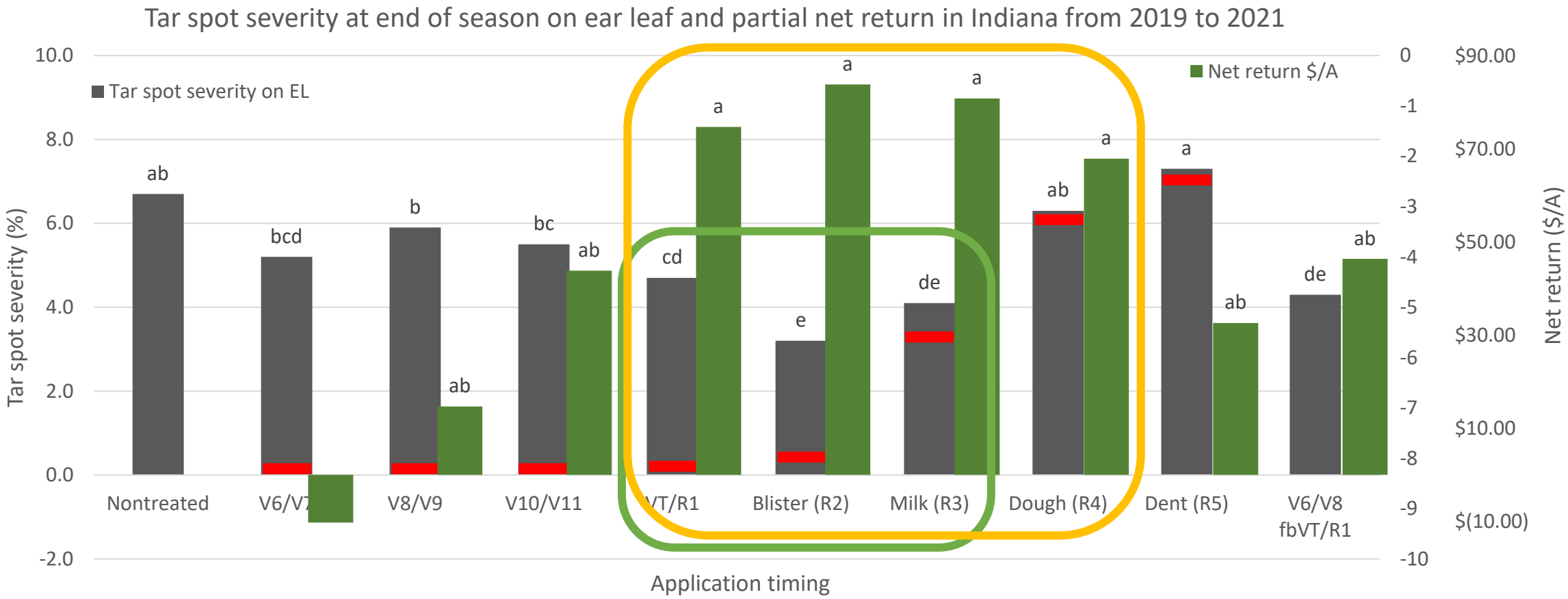


R2 sprays good 0.01-0.3% EL
R3 sprays okay – 1.65-2.2% EL

R4 sprays that failed 5.9-7.5% EL
R5 sprays that failed 15.5-17.5% EL

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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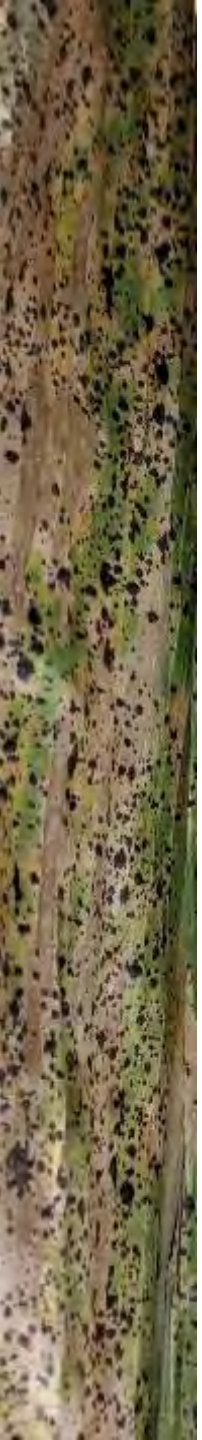
Ross, T. J., Allen, T. W., Shim, S., Thompson, N. M., and Telenko, D. E. P. 2023. Investigations into economic returns resulting from foliar fungicides and application timing on management of tar spot in Indiana hybrid corn. Plant Disease. https://doi.org/10.1094/PDIS-05-23-0932-RE

TELENKO FIELD CROP PATHOLOGY



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	

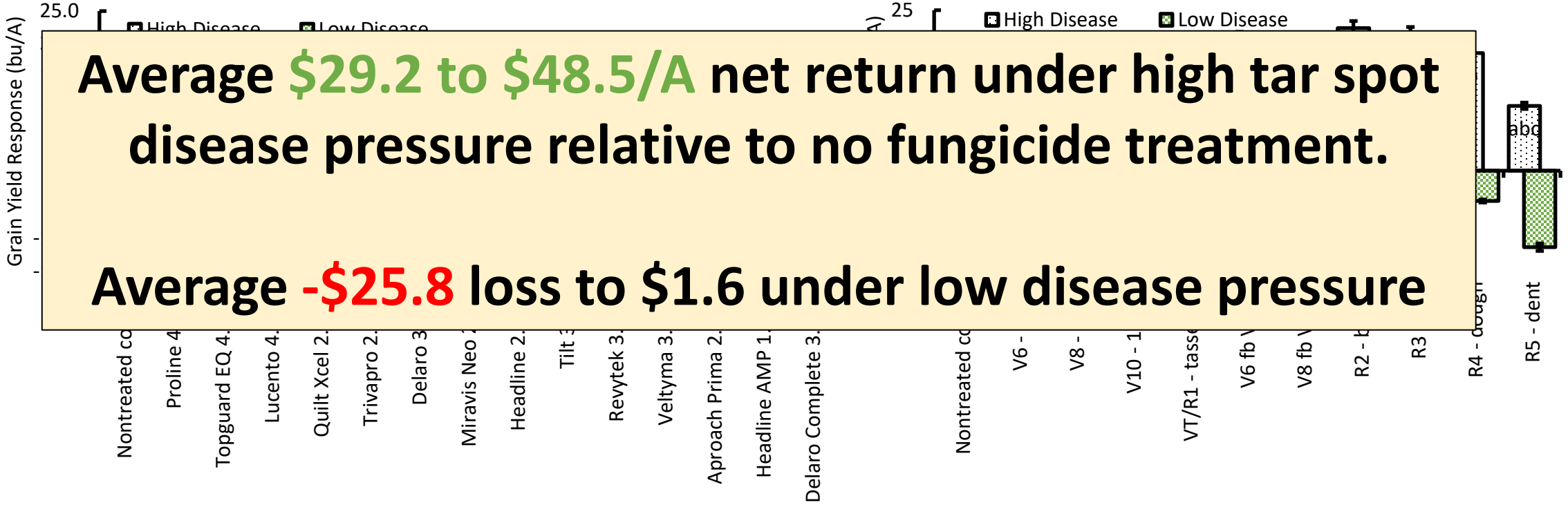
Ross, T. J., Allen, T. W., Shim, S., Thompson, N. M., and Telenko, D. E. P. 2023. Investigations into economic returns resulting from foliar fungicides and application timing on management of tar spot in Indiana hybrid corn. Plant Disease. https://doi.org/10.1094/PDIS-05-23-0932-RE

TELENKO FIELD CROP PATHOLOGY

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)

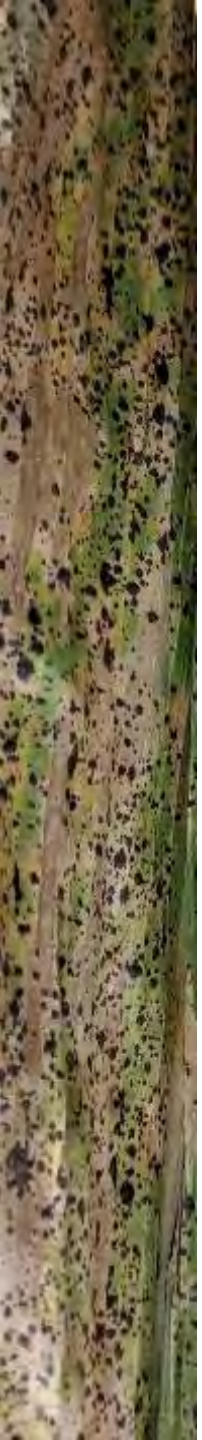


Average $29.2 to $48.5/A net return under high tar spot disease pressure relative to no fungicide treatment.

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

Ross, T. J., Allen, T. W., Shim, S., Thompson, N. M., and Telenko, D. E. P. 2023. Investigations into economic returns resulting from foliar fungicides and application timing on management of tar spot in Indiana hybrid corn. Plant Disease. https://doi.org/10.1094/PDIS-05-23-0932-RE

TELENKO FIELD CROP PATHOLOGY

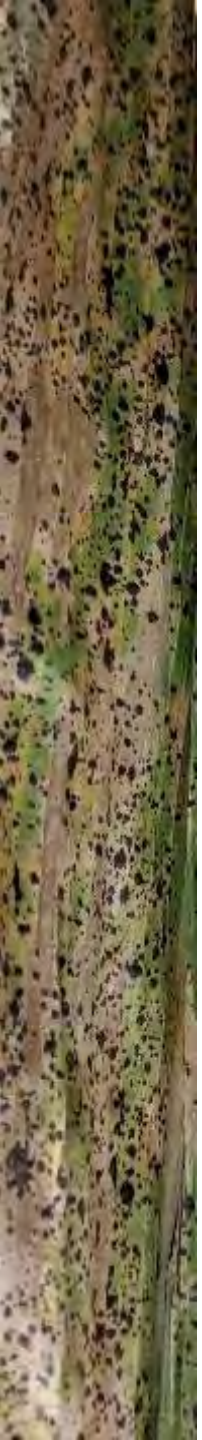


Hybrid by Fungicide Timing Trials on Tar Spot Indiana 2022 and 2023

Hybrids	**Dates 2022**	**Dates 2023**
Tar spot susceptible	planted 20 May	planted 18 May
Tar spot tolerant	planted 20 May	planted 18 May
Fungicide Programs		
Nontreated control		
Delaro Complete 8 fl oz/A at V10	21 Jul	25 Jul
Delaro Complete 8 fl oz/A at VT/R1	2 Aug	3 Aug
Delaro Complete 8 fl oz/A at R2	12 Aug	22 Aug
Delaro Complete 8 fl oz/A at R4	23 Aug	29 Aug
Delaro Complete 8 fl oz/A based on Tarspotter	V8 14 Jul fb VT/R1 2 Aug	R2 17 Aug fb R4 29 Aug
	Tar spot first detection	1 Sep	31 Jul

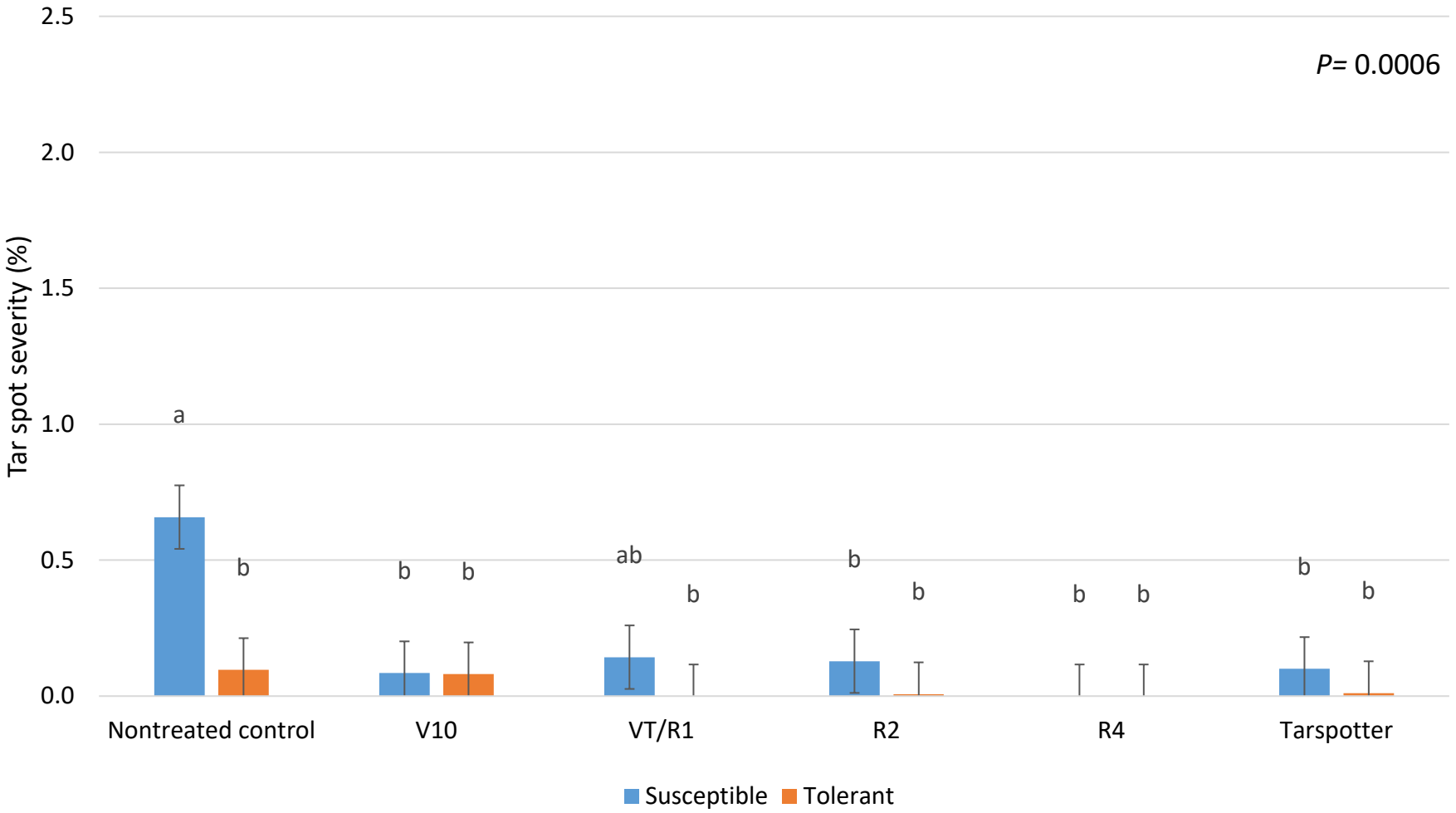
USDA NIFA
Grant no. 2022-68008-36510

TELENKO FIELD CROP PATHOLOGY



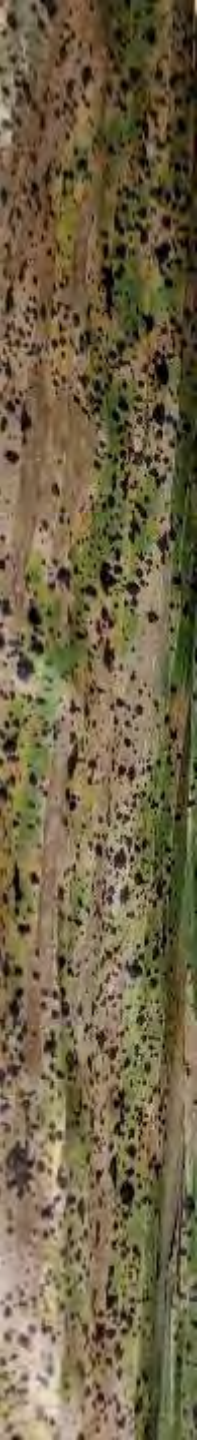
Hybrid by Fungicide – **LOW** Disease Severity at R6 in 2022

Grant no. 2022-68008-36510



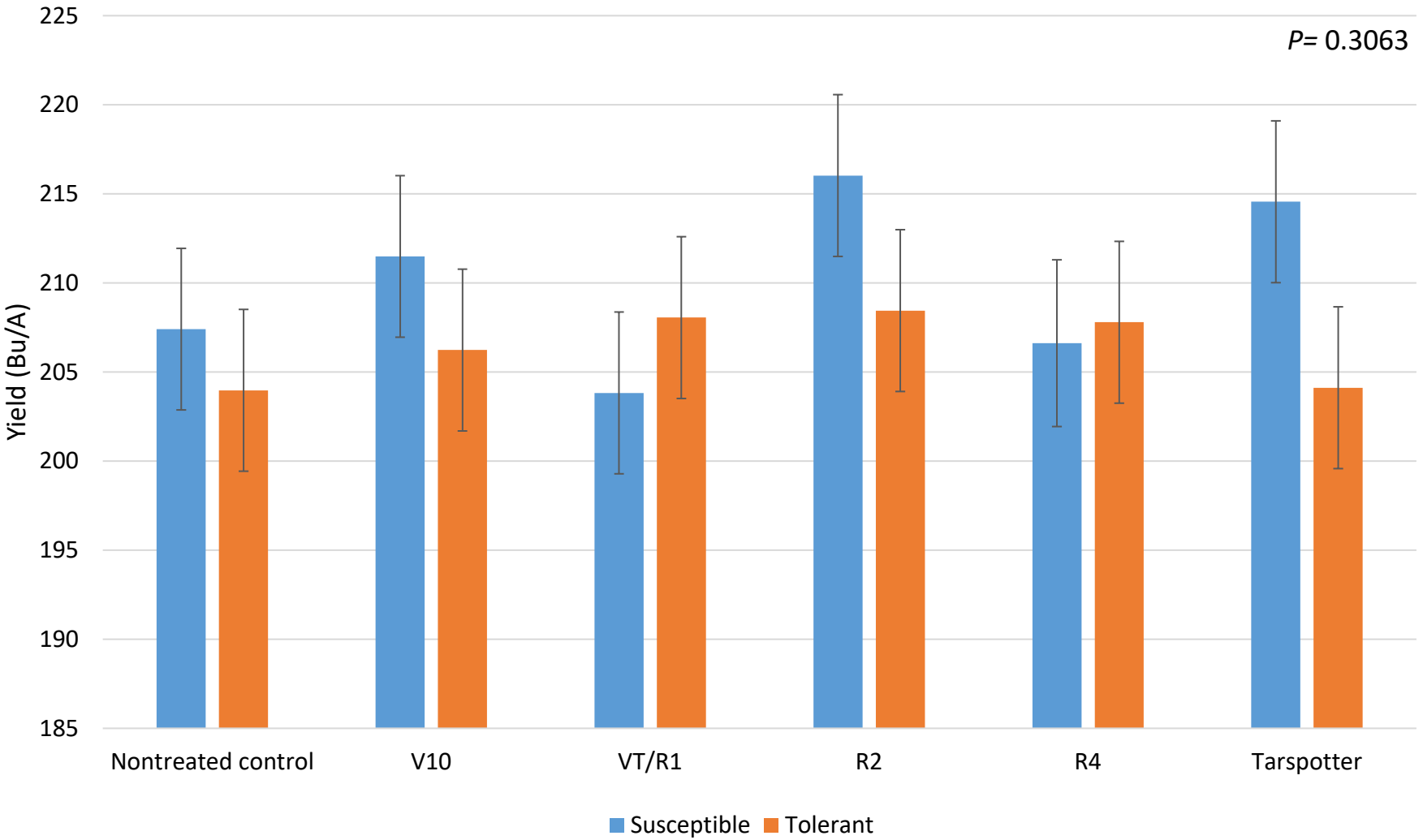
2022 trials conducted in Indiana, Michigan, Wisconsin, and Ontario, CA
(4 environments)

[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).



Hybrid by Fungicide – Yield 2022

Grant no. 2022-68008-36510



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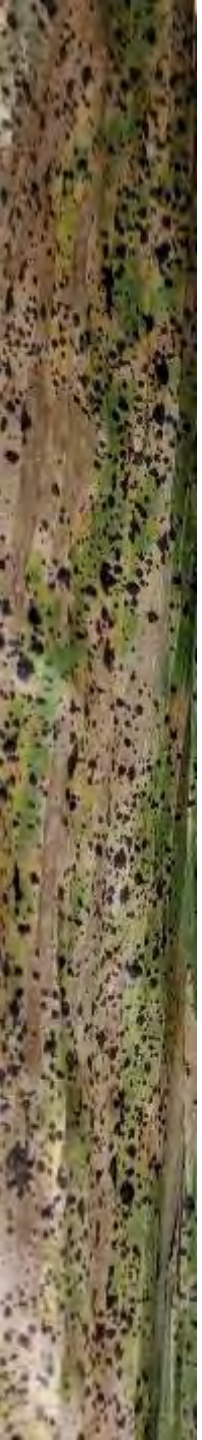

Indiana 2023

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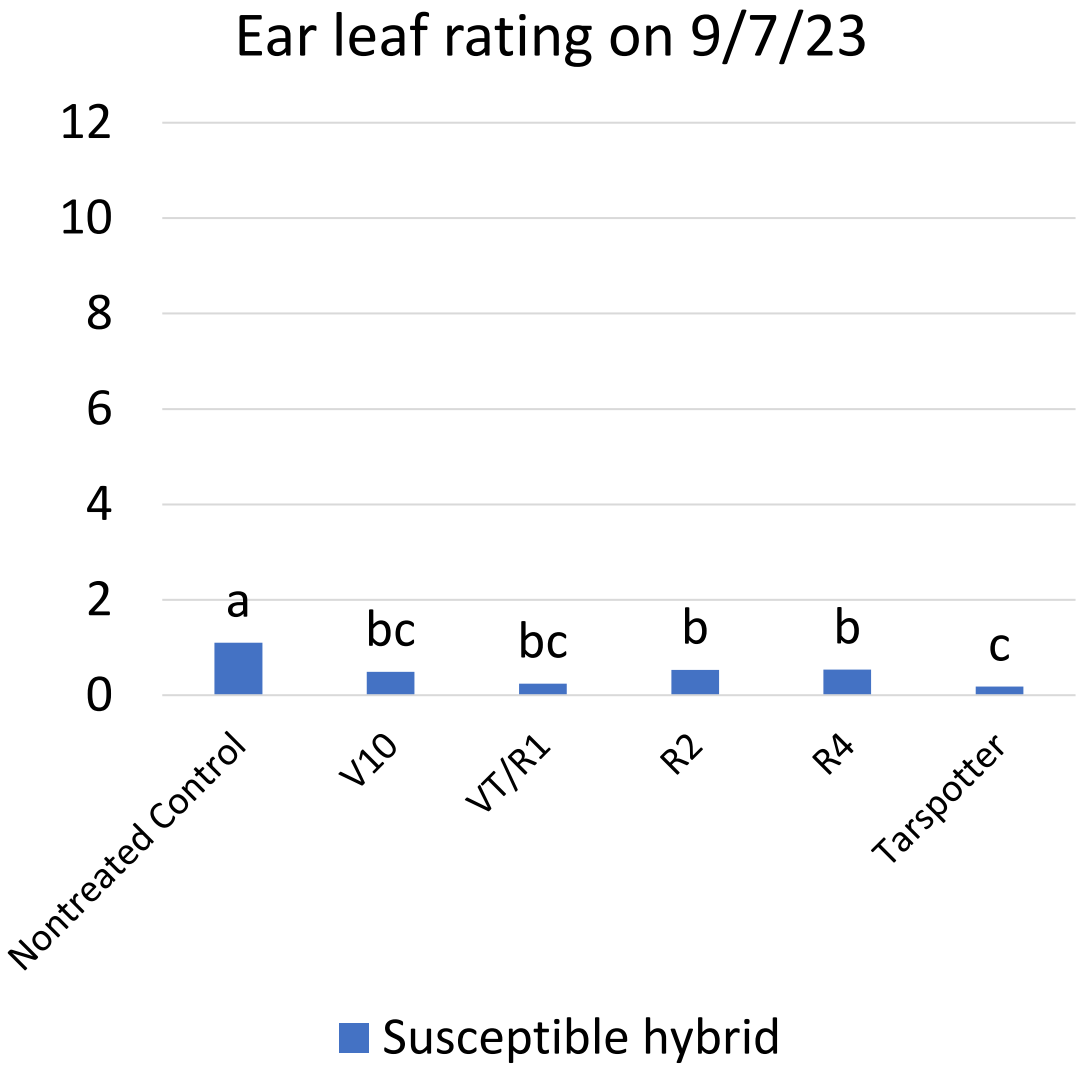
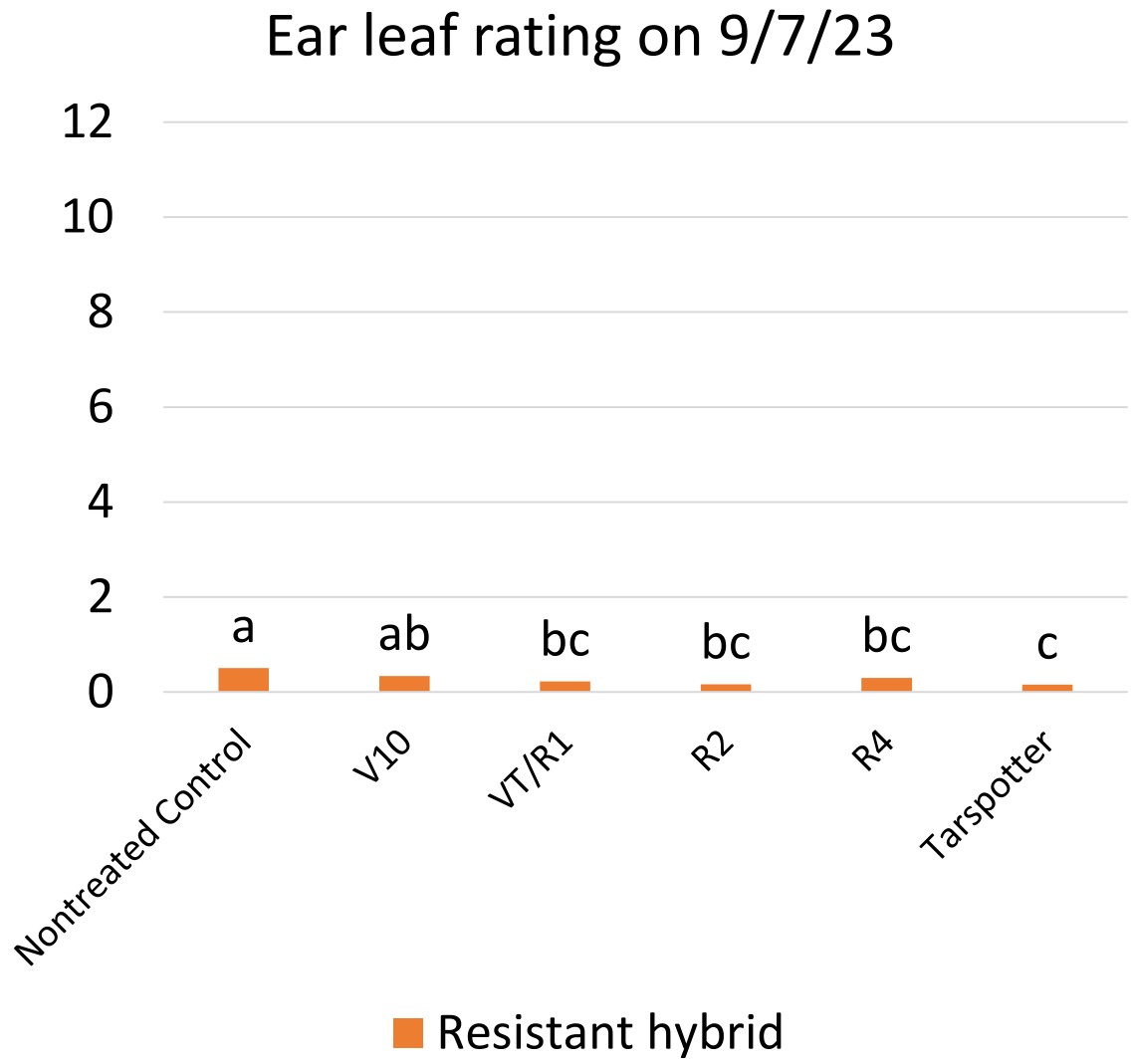
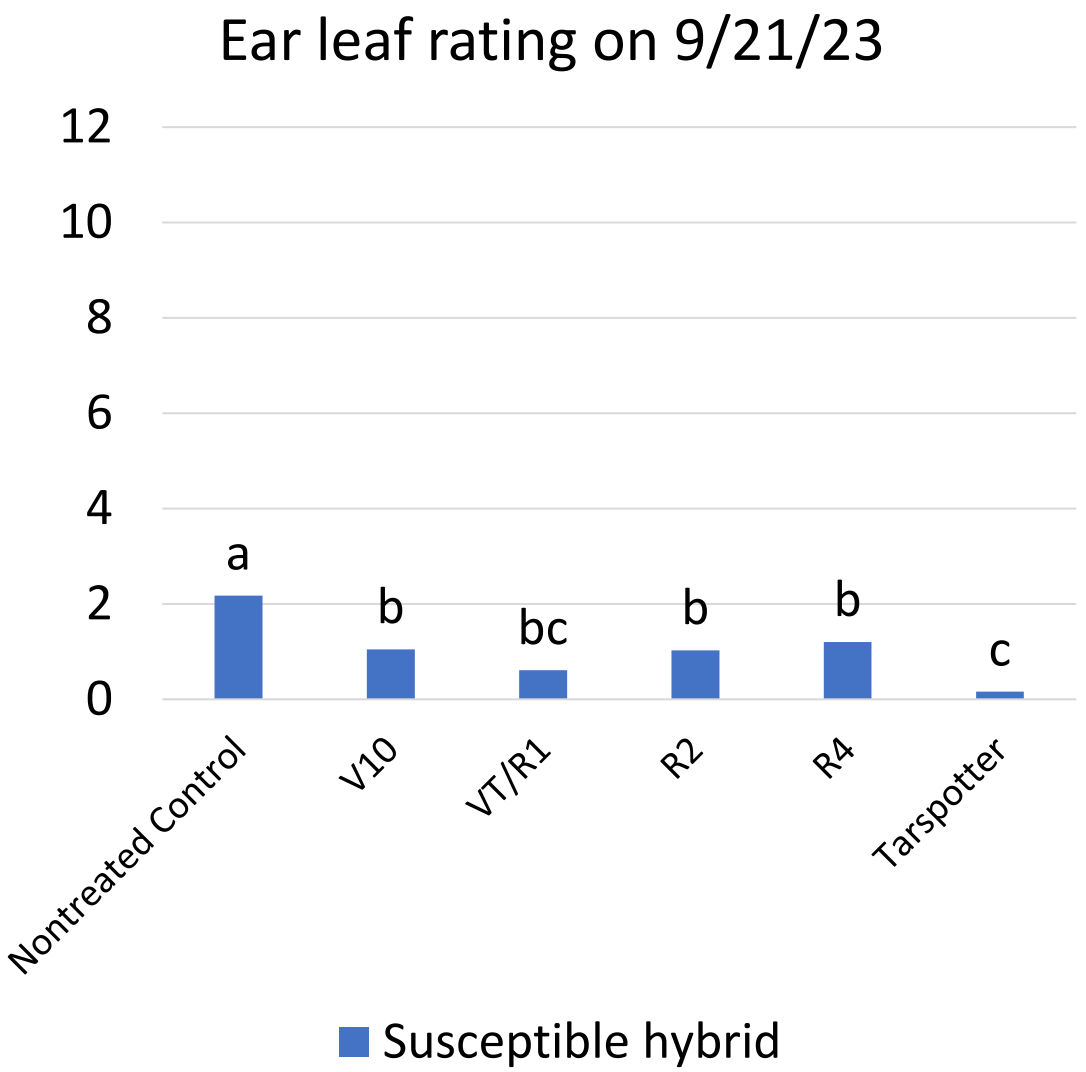
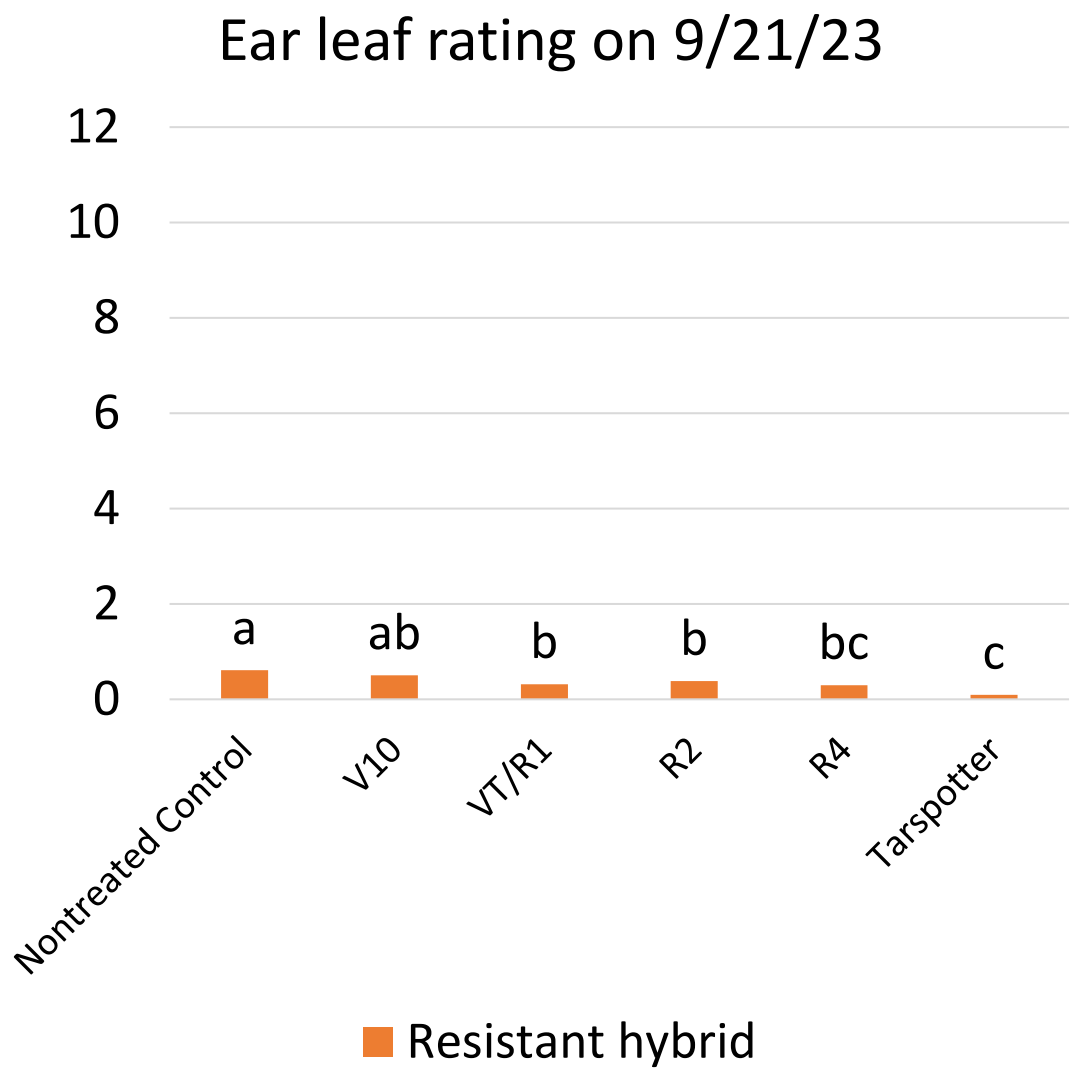




Indiana 2023

Grant no. 2022-68008-36510





Indiana 2023

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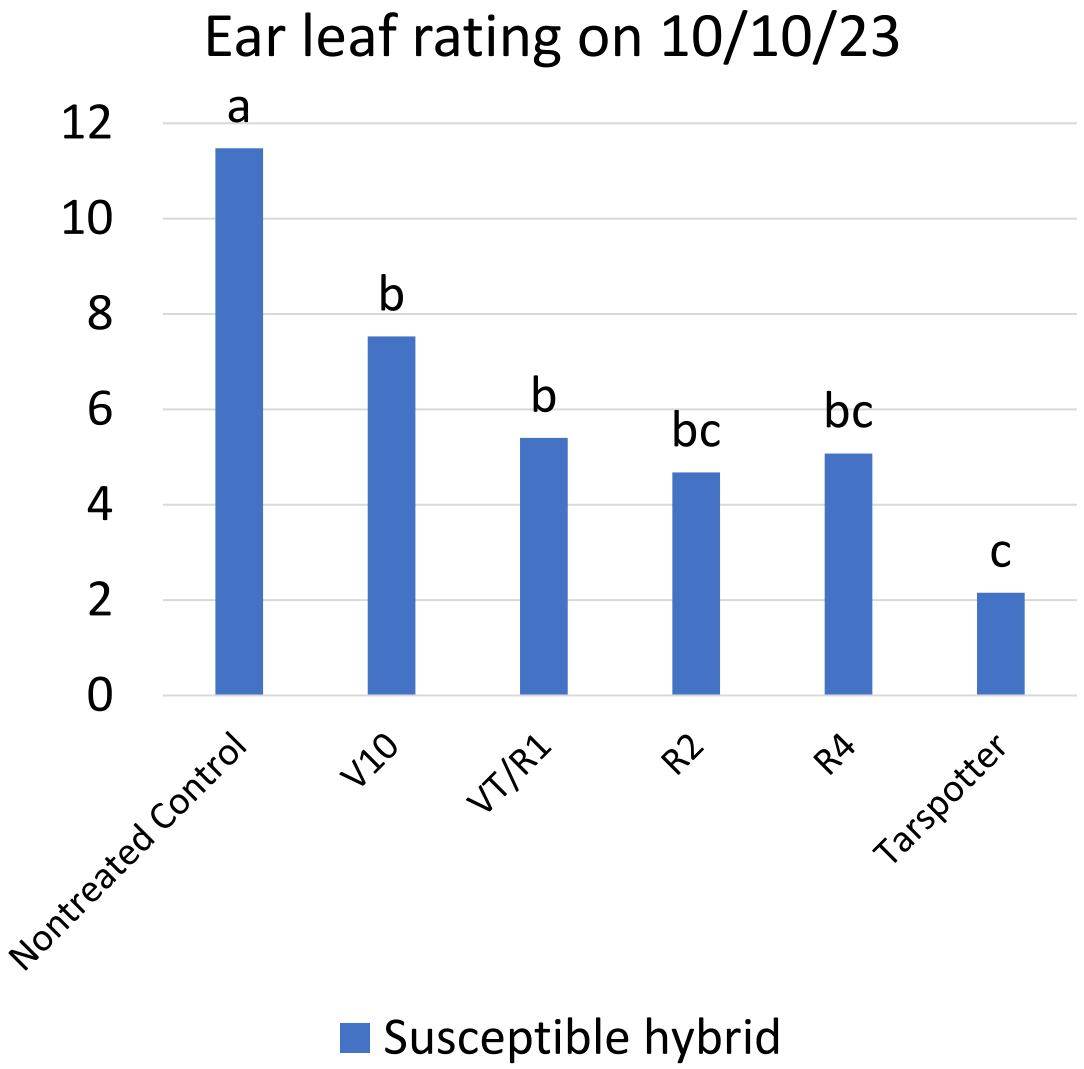

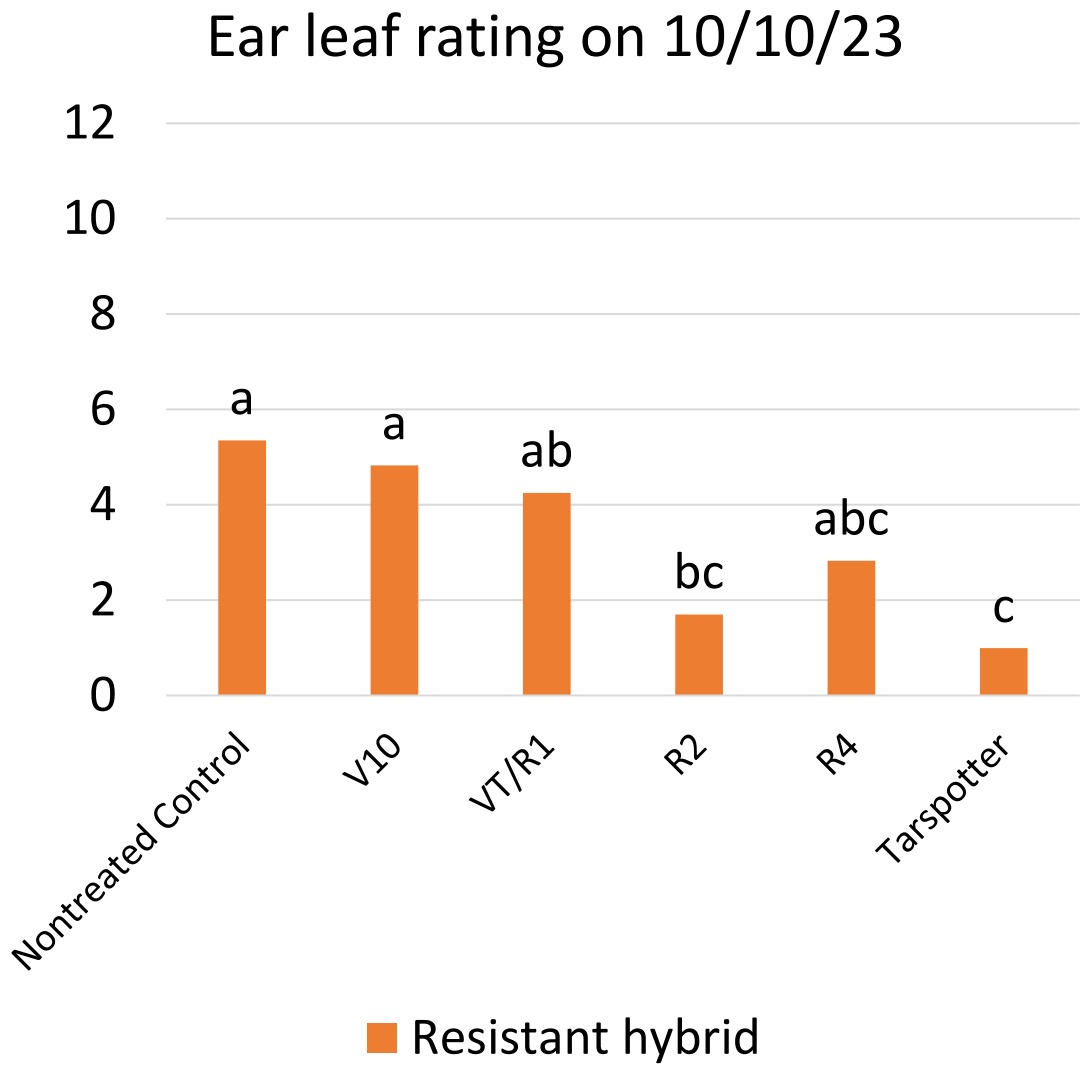

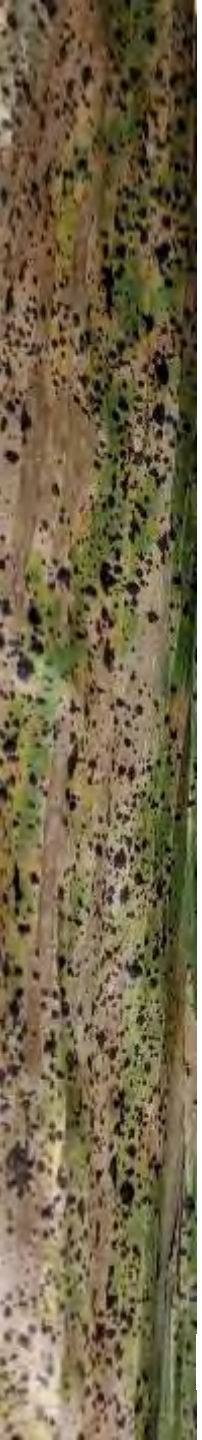

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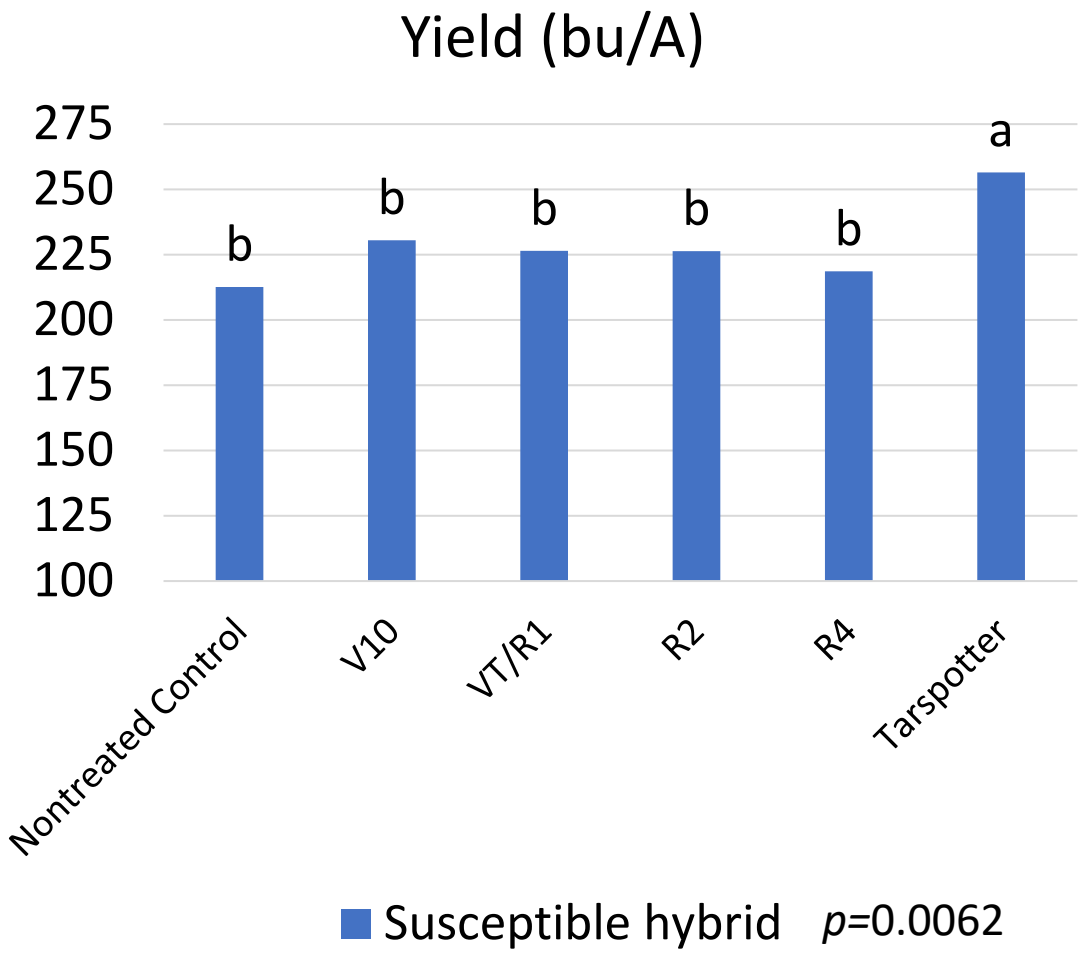

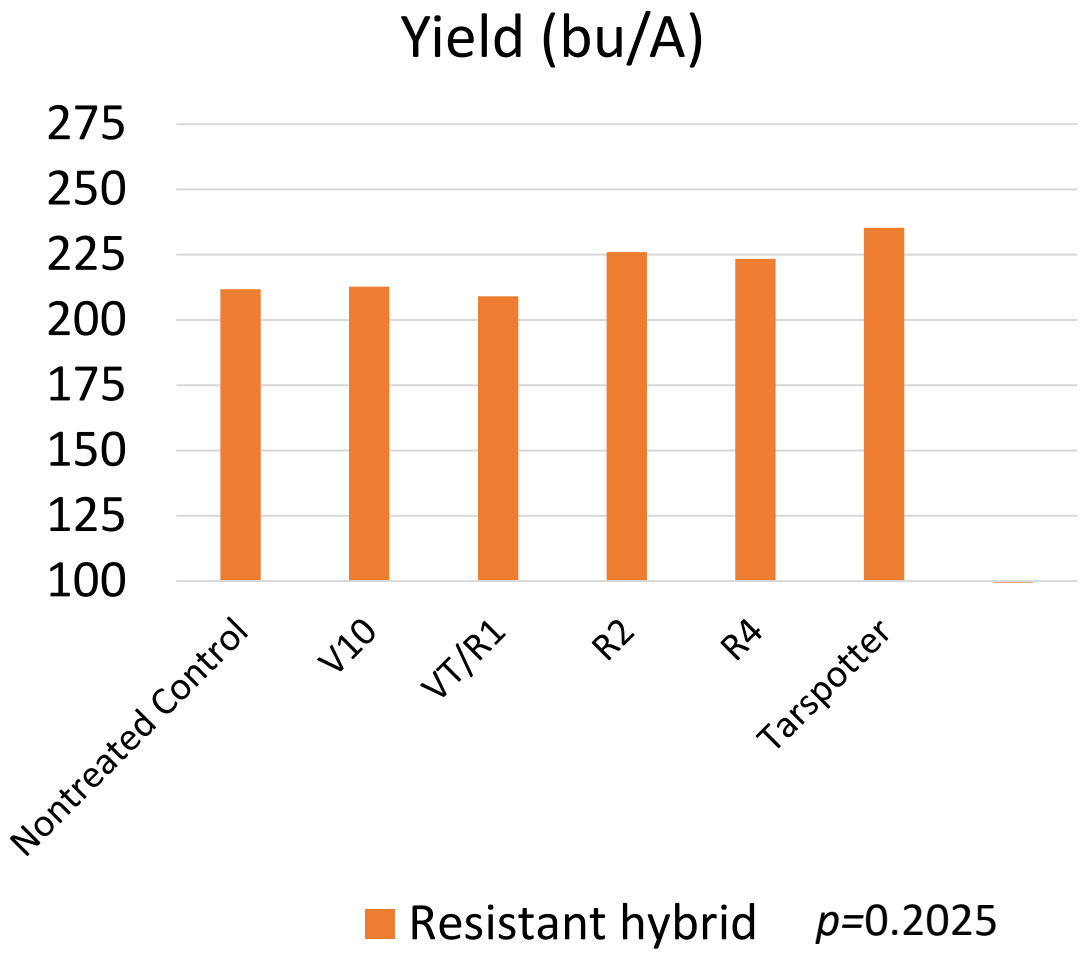



Diseases to Watch Out For!

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Curvularia Leaf Spot in Corn
Curvularia lunata

Identification
- First reported in US in 2017, in multiple states.
- Symptoms – small, tan-colored lesions with brown margins that may be surrounded by yellowish halo
- Lesions may be scattered or in dense groups and generally found in mid to upper canopy
- Similar symptoms to eyespot

Management
- Differences in hybrid susceptibility have been observed.
- Crop rotation and tillage reduce survival of the fungus.
- At present, foliar fungicides are not labeled for management of Curvularia leaf spot.

Favorable Conditions
- The disease may be more common when corn follows corn, as it survives the winter in corn residue.
- Hot and humid conditions favor disease development.
- Lesions tend to form on corn plants following rain that occurs during reproductive maturity.

Lesions may be surrounded by a yellowish halo.

CROP PROTECTION NETWORK

Photo credits: K. Wise and T. Allen

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Diploida Leaf Streak in Corn
Stenocarpella macrospora

Identification

- Symptoms first appear as small light tan to dark brown lesions on leaves.
- The lesions can elongate, concentric zones are visible
- Leaf margins surrounding lesion may appear chlorotic and have water soaked appearance.
- Overtime, the lesions will coalesce and form large blighted areas on leaf.
- Typically symptoms are see in mid-canopy, but all leaves can be affected.

Management

- Cultural methods are main management strategies
- *S. macrospora* can remain viable for at least one growing season - limiting crop rotation for a single year.
- Tillage or removal of corn residue may reduced initial inoculum
- Currently, no foliar fungicides registered for use on Diplodia in corn in the US
- Hybrid resistance ratings are not reported by seed companies, but anecdotal evidence suggests that hybrids vary in DLS severity and symptom expression.

Published in: Nolan R. Anderson; Carl A. Bradley; Kiersten A. Wise; *Plant Health Progress* 22, 159-163.
 • DOI: 10.1094/PHP-01-21-0002-DG

ptoms of Diplodia
howing small
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Example of different stages of symptoms of Diplodia leaf streak. Initial infection produces small tan to dark brown to tan lesions. As disease progresses, the lesions expand parallel along the leaf, and the chlorotic areas around the lesion become more prominent. Under the right conditions, pycnidia are visible within the lesion.

Symptoms of Diplodia leaf streak showing lesion expansion.

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Spots on Corn
Abiotic or a pathogen

Identification

- Tiny (less than 1 mm) tan to brown spots with a darker brown margin (Figure 1).
- The associated leaf spots can be comprised of just a few spots scattered on a leaf, or can be clustered on the leaf covering large sections of the leaf surface (Figure 2).
- It is common to see the spots concentrated along the mid-rib of leaves. The symptoms can easily be confused with southern rust, insect damage, or Curvularia leaf spot
- Symptoms are generally observed in the mid-to-lower canopy and are more noticeable on field edges.

Work is underway to isolate and identify the pathogen.

Symptoms have appeared after tasseling (VT) and into grain fill (R1-R5), developing during the hottest part of the summer.

Figure 2. Clustered symptoms of an abiotic disorder on corn. *Kiersten Wise*

Published in: Kiersten A. Wise, Bob Kemerait, Trey Price and Tom Allen. **Spots on corn: Disease or something different? CPN -2017 doi.org/10.31274/cpn-20210721-0**

TELENKO FIELD CROP PATHOLOGY

Crown Rot in Corn

Plants affected by crown rot may senesce early, and be surrounded by healthy plants. Photo credit: Tamra Jackson-Ziems,

Crown rot at base of split corn stalk.
Tamra Jackson-Ziems

Symptoms of crown rot.
Alison Robertson

CROP PROTECTION NETWORK
CPN-2020. doi.org/10.31274/cpn-20230307-0

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Samples needed for these new diseases.

Please send to state diagnostic lab or contact us with any questions.

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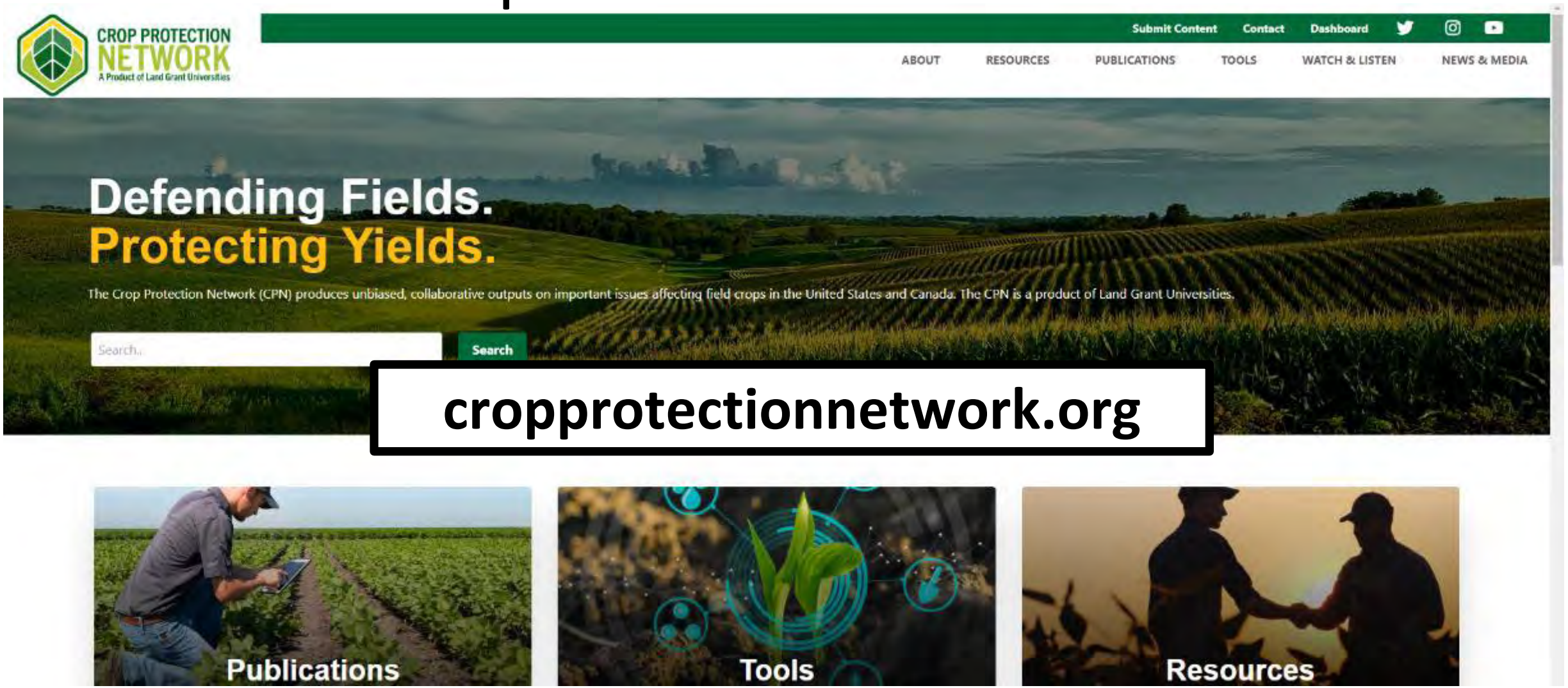
Crop Protection Network



QUESTIONS?

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https://indianafieldcroppathology.com/

EA/EOU

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Red crown rot of soybean

- Caused by a soilborne fungus known as *Calonectria ilicicola*

- Old name of pathogen = *Cylindrocladium parasiticum*

Host range in addition to soybean

Genera:

- *Acacia*
- *Arachis* (peanut)
- *Carica*
- *Crotalarioa*
- *Eucalyptus*
- *Howea*
- *Ilex*
- *Leea*
- *Medicago* (alfalfa)
- *Nerium*
- *Persea*
- *Vaccinium*

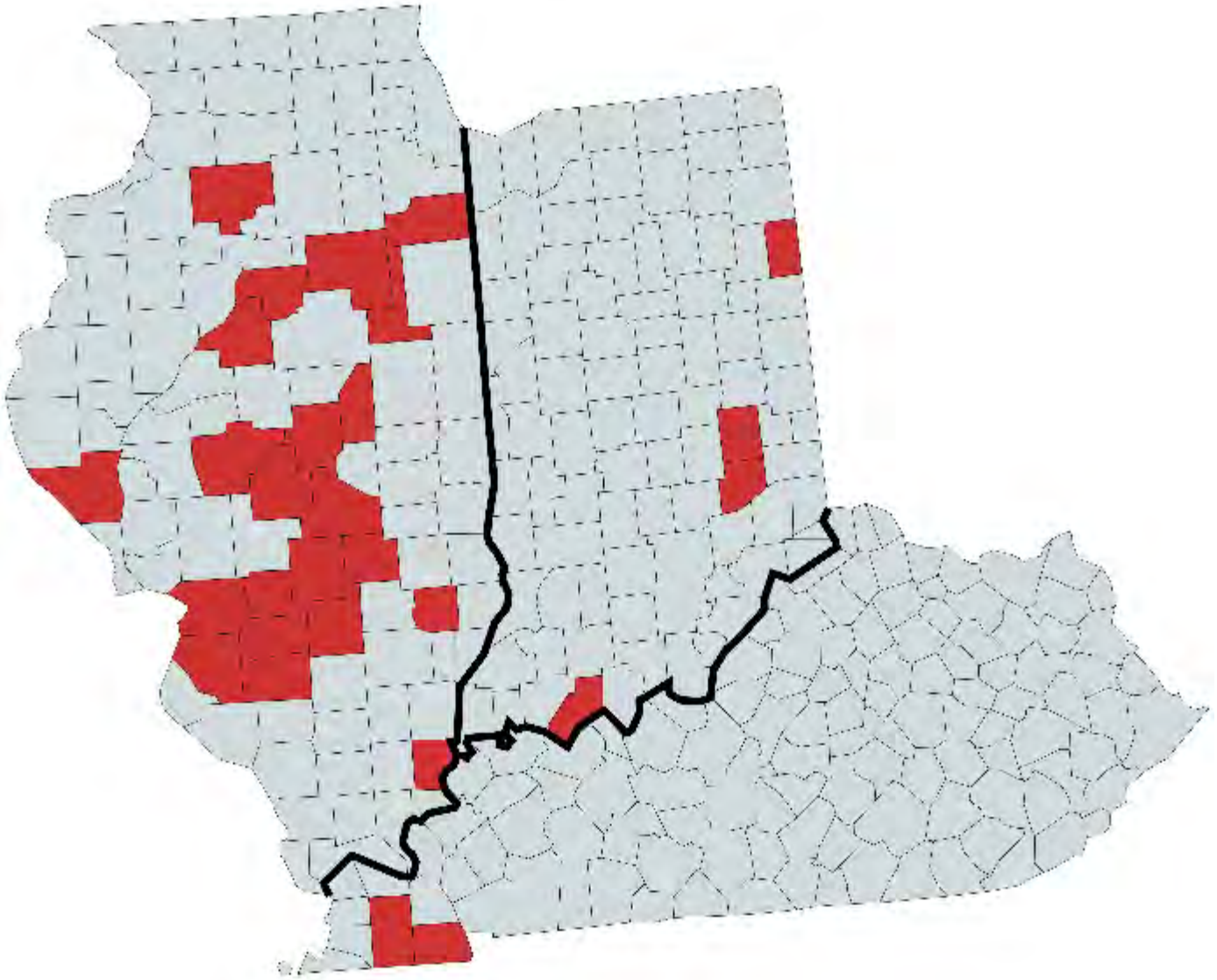
“Historical” geographical footprint of red crown rot in the U.S.

- Map shows approximate distribution of red crown rot in the U.S. around 2014

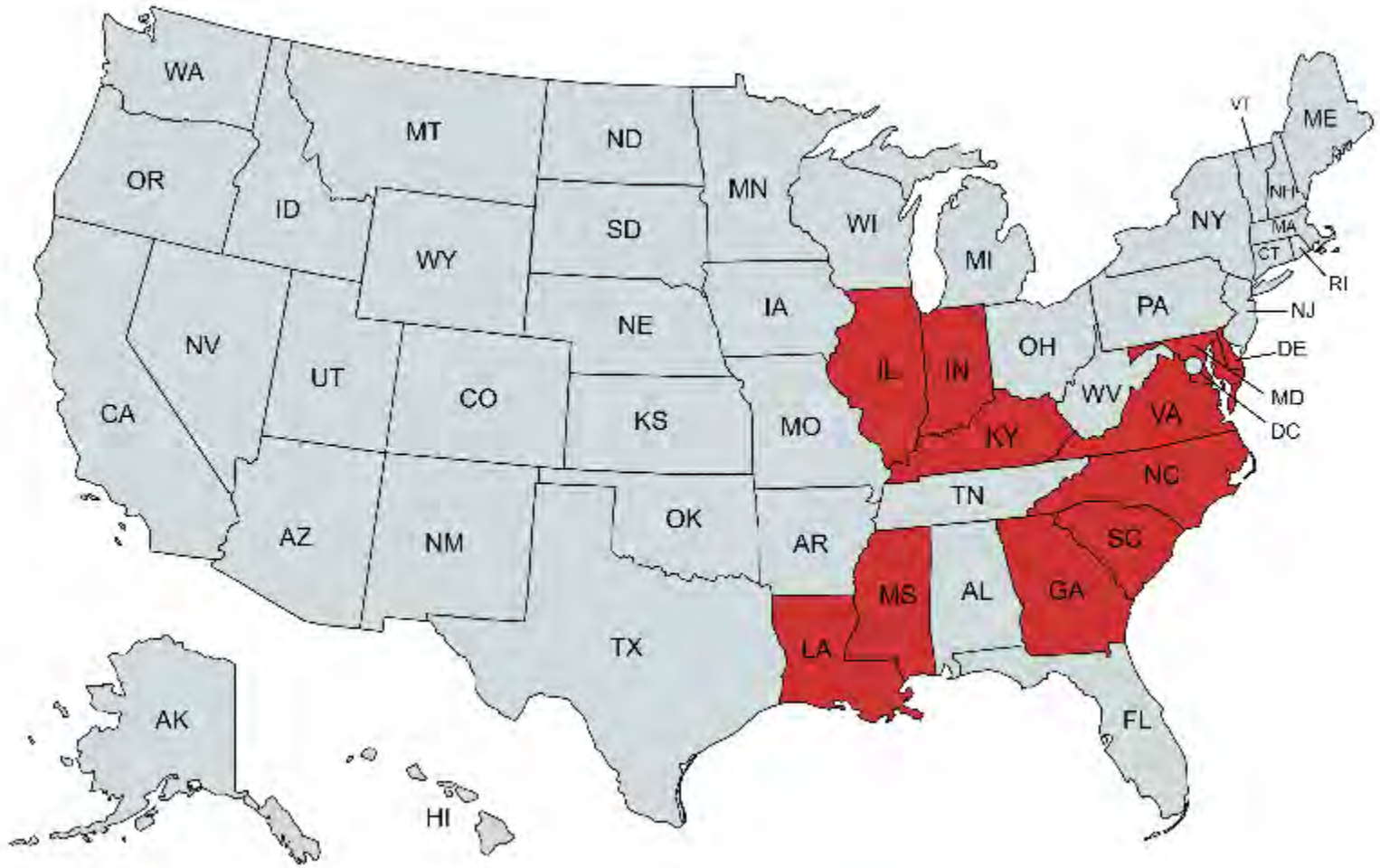
Map image from: *A Farmer’s Guide to Soybean Diseases* (American Phytopathological Society, 2016)

Unofficial updated red crown rot distribution map for the "Midwest"

- Dr. Darcy Telenko (Purdue) provided the information for Indiana
- Dr. Stephen Clough (USDA-ARS, Univ IL) provided the information for Illinois
- Kentucky information came from surveys conducted by Dr. Carl Bradley's lab (Univ KY)



Unofficial map of states with red crown rot of soybean in the U.S.

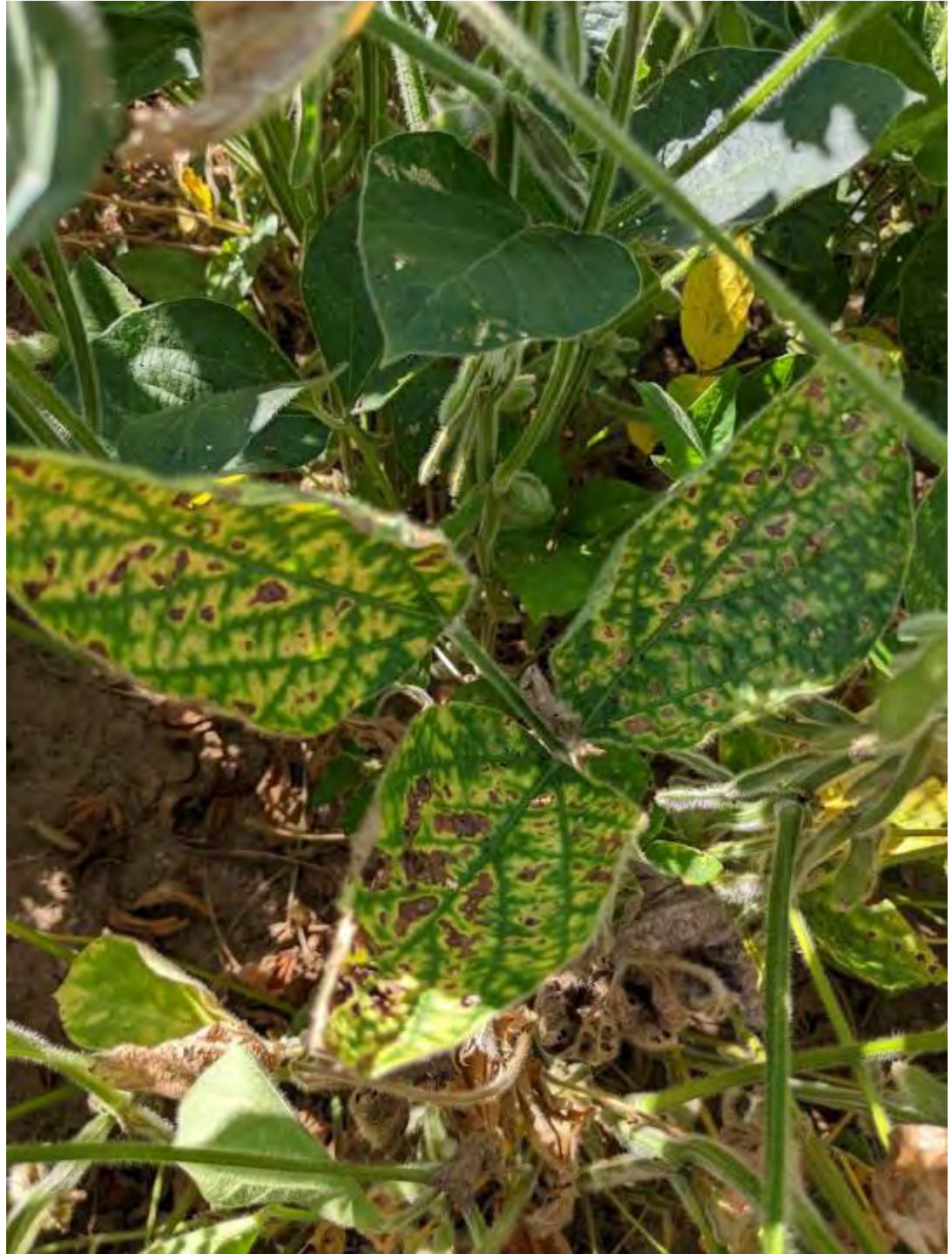


Disease cycle

- Survival structures = microsclerotia in the soil/plant debris
  - Microsclerotia can survive several years
- Microsclerotia germinate and hyphae colonize soybean roots
- Infections can take place during the seedling stage (soon after germination), which generally result into the most severe symptoms
- Maximum root infection occurs when soil temps = 77-86^{o}F

Red crown rot symptoms

- Interveinal chlorosis/necrosis of the leaves



Red crown rot symptoms

- Reddish-colored lower stem/roots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Red crown rot symptoms

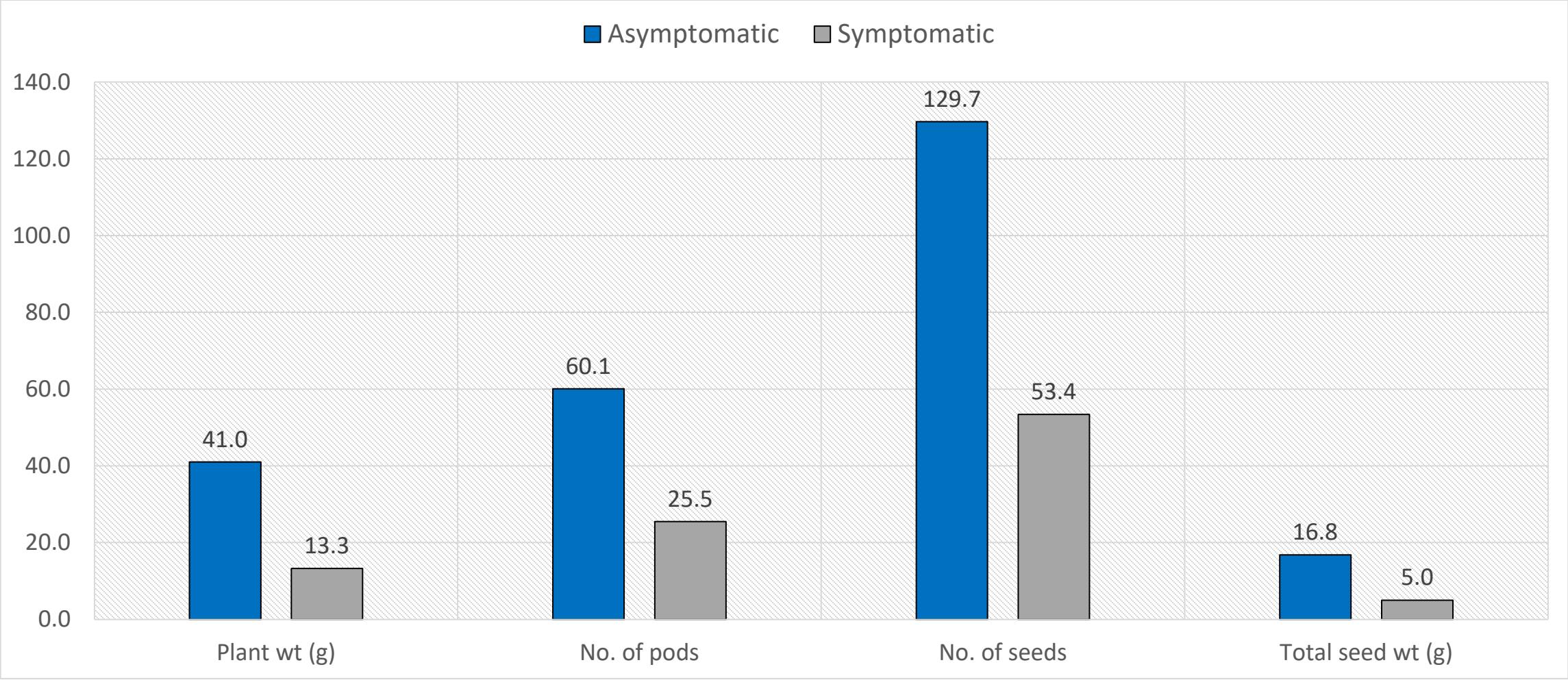
- Reddish-orange, spherical perithecia on the lower stem and root

- Patchy distribution in the field

General observations of red crown rot in Kentucky

- So far (since 2021), double-crop fields have been affected more severely than full-season fields
  - June/July planting dates vs. April/May planting dates
- Red discoloration on lower stem near soil line usually is the first symptom and can be seen during vegetative stages
- Once reproductive stages begin, leaf interveinal chlorosis/necrosis symptoms (SDS “look-alike” symptoms) usually are present in some capacity (maybe not on every affected plant)
  - In a few cases, have found a few plants with both red crown rot and SDS
- Severe infections result in premature death (leaves usually still attached)
- Red- orange perithecia will wash away or disappear and may not always be present

Measured yield components on symptomatic vs. asymptomatic-selected plants (Graves Co., KY – 2021)



Neves et al. 2023. Plant Health Progress 24:303-305.

Management of red crown rot – *Historical recommendations*

- Resistant varieties
  - Probably some differences in susceptibility across varieties, but currently a gap in information for current varieties
- Crop rotation
  - 2-year rotation away from susceptible host will help reduce inoculum in the field (but microsclerotia also survive for several years)
- Manage stresses
  - Manage soybean cyst nematode
- Planting date
  - Research in the 1990s @ LSU – delay planting date
- Prevention
  - Clean soil and debris off equipment between fields

Current Best Red Crown Rot Management Practices

- Determine if you have red crown rot:
  - Submit suspicious samples to your Land Grant University's Plant Diagnostic Lab

- If red crown rot detected:
  - Rotate to a non-host crop in that field next year
  - Consider using a fungicide seed treatment with red crown rot on the label (currently, only Saltro seed treatment has red crown rot on the label)
  - Manage other stresses, pests, and diseases
  - Wash off equipment before traveling to another field (to avoid spread of inoculum from field to field)

Current gaps in information

- How and why is it spreading?

- Effect of planting date on red crown rot (LSU data from 1990s vs. KY observations)
  - LSU research from 1990s: delayed planting reduces risk of red crown rot (planting dates were late-May, mid-June, and early-July with soil temps = 81.9°, 86°, and 88.3°, respectively
  - KY observations that red crown rot worse in double-crop (June/July planted) vs. full-season (April/May planted) soybean

- Soybean varieties: probably some differences in susceptibility, but currently a gap in information

- Effect of other registered fungicide seed treatments

New UK Extension Publication on Red Crown Rot

University of Kentucky College of Agriculture, Food & Environment Extension Plant Pathology

Martin-Gatton
College of Agriculture, Food and Environment
Cooperative Extension Service

Plant Pathology Fact Sheet **PPFS-AG-S-25**

Red Crown Rot of Soybean

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Introduction

Red crown rot is a soybean disease that was first confirmed in Kentucky in 2021 and first confirmed in the neighboring state of Illinois in 2018. Historically, red crown rot had been considered a disease that occurred in states further south than Kentucky (i.e., Louisiana and Mississippi). From measurements conducted within a few Kentucky soybean fields in 2021, small areas affected by red crown rot had grain yields that were approximately 70% less than non-symptomatic areas of these fields. Although the current distribution of red crown rot in Kentucky appears to be limited, the disease has the potential to cause major yield losses.

Symptoms & Signs

Symptoms of red crown rot can occur on leaves, lower stems, and roots of soybean plants.

On **leaves**, symptoms first appear as chlorotic (yellow) flecks that occur between veins (Figure 1). These chlorotic flecks may continue to develop into interveinal chlorosis (yellowing between the leaf veins, while veins remain green) and interveinal necrosis (dead areas between the leaf veins, while veins remain green) (Figure 2). Leaf symptoms are caused by a phytotoxin produced by the causal fungus, which moves through the plant and accumulates in leaves. These leaf symptoms generally are not observed until soybean plants reach the reproductive stages of development (beginning flowering and beyond).

Figure 1. Yellow (chlorotic) flecks occurring on soybean leaflets between the main veins, caused by red crown rot
Figure 2. Interveinal chlorosis (yellowing between the veins) and necrosis (dead tissue between the veins) on soybean leaflets, caused by red crown rot.