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Fungicides against *Phomopsis* in sunflower

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Outline

- Introduction
- Rationale
- Research Objective
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- Results
- Summary

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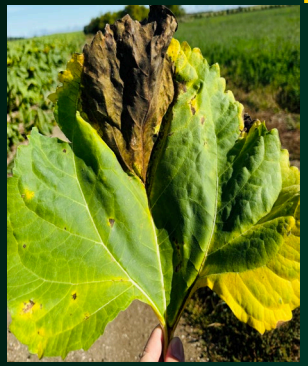
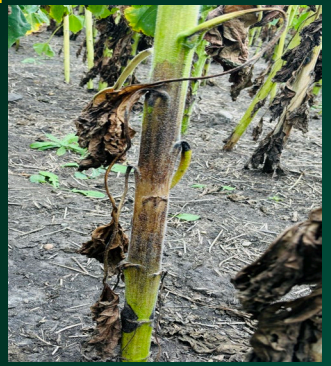
Phomopsis stem canker


Pictures by: Karthika Mohan (Survey 2024)

- Economically important disease of sunflower worldwide (Harveson et al. 2016)
- More than 40% yield loss in 2010 (Mathew et al. 2015)
- Primarily caused by *Phomopsis gulyae* and *P. helianthi* in MN, ND and SD (Mathew et al. 2018)

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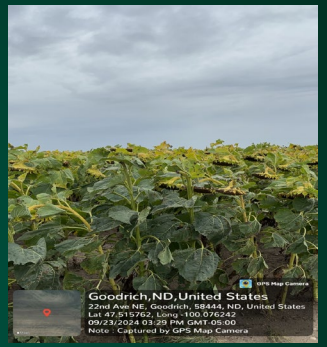
Phomopsis survey 2024

- 50 sunflower fields surveyed
- Four states
  - North Dakota (*n*=31, from 12 counties)
  - South Dakota (*n*= 17, from 5 counties)
  - Minnesota (*n*=1)
  - Nebraska (*n*=1)



Sheridan County, ND

Grant Forks, ND


Sully County, SD

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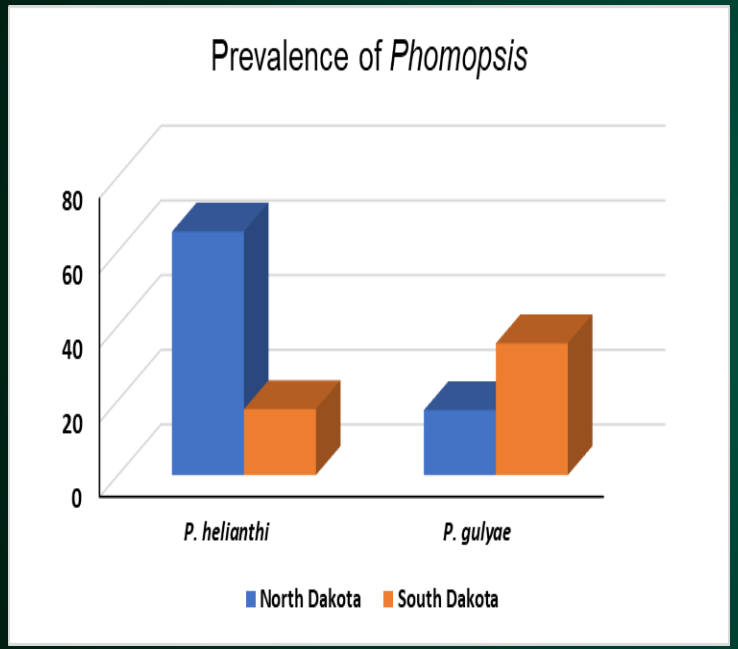
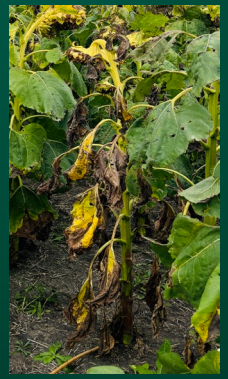
Phomopsis prevalence in fields of North Dakota and South Dakota



- Stem samples from 40 fields were processed
- *Phomopsis* isolated from 29 fields
- Symptoms observed (2024 Survey)



Wilting

Stem lesions of varying size and color

Pith damage

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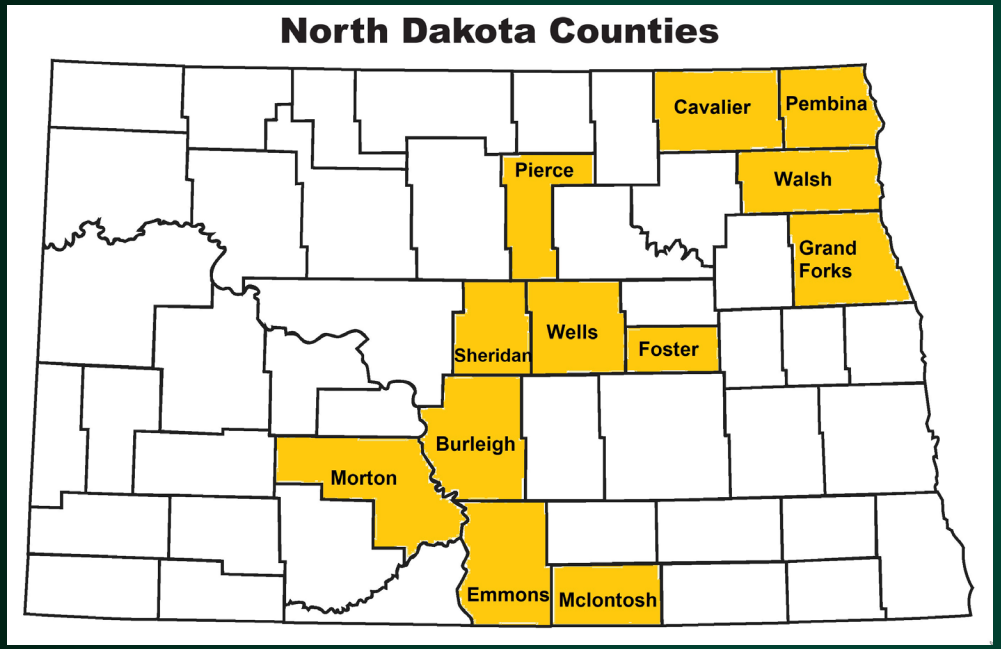
Distribution of *P. gulyae and P. helianthi* in North Dakota



- *P. gulyae*
  - Emmons
  - Morton
  - Pierce
- *P. helianthi*
  - Burleigh
  - Cavalier
  - Emmons
  - Foster
  - Grand Forks
  - Pembina
  - Sheridan
  - Walsh
  - Wells

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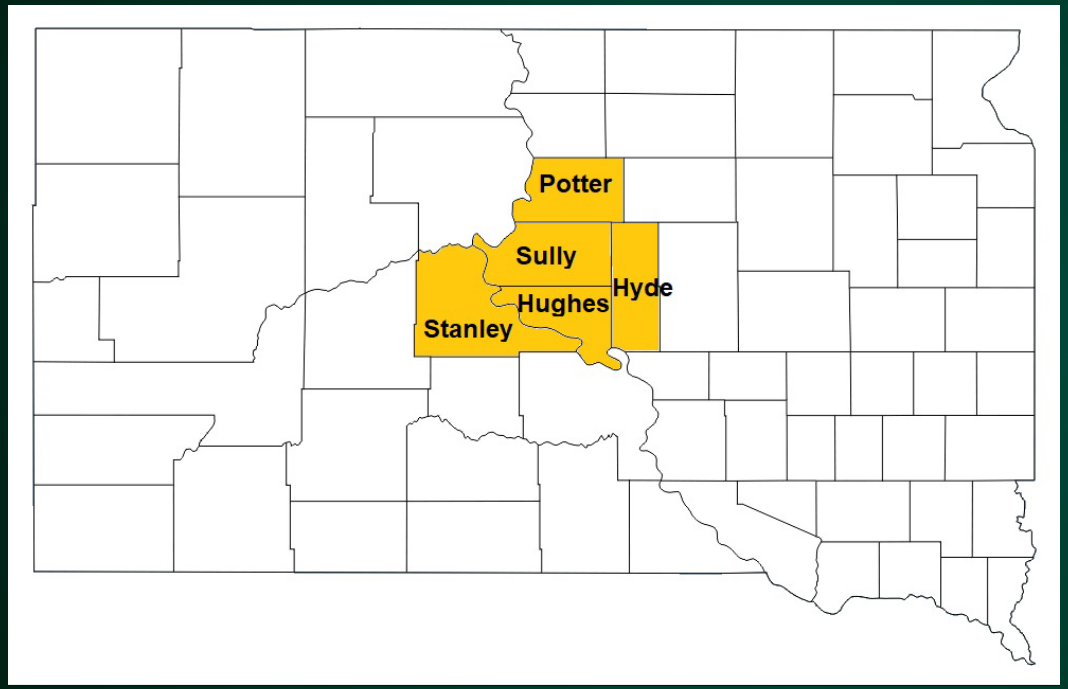
Distribution of *P. gulyae* and *P. helianthi* in South Dakota



- *P. gulyae*
  - Hughes
  - Potter
  - Stanley
  - Sully
- *P. helianthi*
  - Hughes
  - Stanley

Disease prevalence in 2024

	NSA survey in 2023 (Leo et al. 2024)		2024 Survey	
Location	**Average Disease Prevalence in 2023**	**Disease incidence in 2023**	**Average Disease Prevalence in 2024**	**Disease incidence in 2024**
MN	90.9% (n=11)	0 to 45%	-----	-----
ND	25.1% (n=79)	0 to 80%	61.2% (n=31)	0 to 80%
SD	36.5% (n=52)	0 to 100%	52.9% (n=17)	5 to 50%
NE	0% (n=6)	0	-----	------

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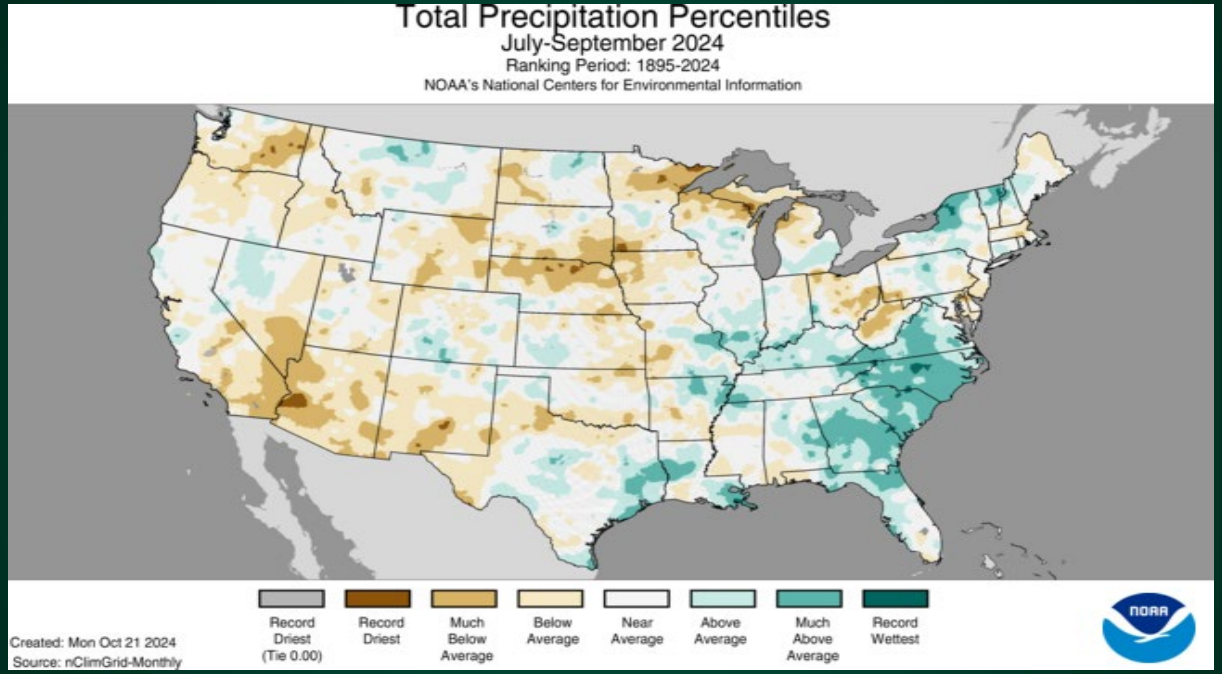
Precipitation trends



Summer precipitation (June, July, and August combined) for the Midwest was slightly above the normal overall

(https://www.ncei.noaa.gov/)

Rationale

QoI fungicide resistance conferred by G143A mutation is confirmed in *P. helianthi* (Mohan et al. 2022)

Fungicide Resistance Management Strategies

Fungicides

Integrated disease management

- Do not use the same product exclusively
- Restrict the number of treatments applied per season
- Maintain manufacturers' recommended dose
- Chemical diversity

- Tillage
- Rotation with non-host crops Eg; corn, wheat
- Managing weeds (Eg; Burdock, Kochia, Lamb's quarters)
- Use of tolerant hybrids

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(https://www.frac.info/fungicide-resistance-management/background#:~:text=Chemical%20diversity,and%20to%20mitigate%20resistance%20problems.)

Why fungicide resistance management?

- Maintain resistant individuals within the fungal population at low frequency
- Extended efficacy and sustainability: Fungicide of interest continue to provide good efficacy under field conditions
- Greater yield
- Improvement on economic returns

Research Objective

Evaluate the effectiveness of fungicides and fungicide application timings for the management of Phomopsis stem canker in sunflower

Materials and Methods

- Field trials
    - Four states (MN, ND, NE, and SD) in 2024
    - Under natural disease pressure
- Using *Phomopsis*-susceptible oilseed hybrid
- Randomized complete block with ten treatments including a non-treated control (NTC)
- Four replicates per treatment

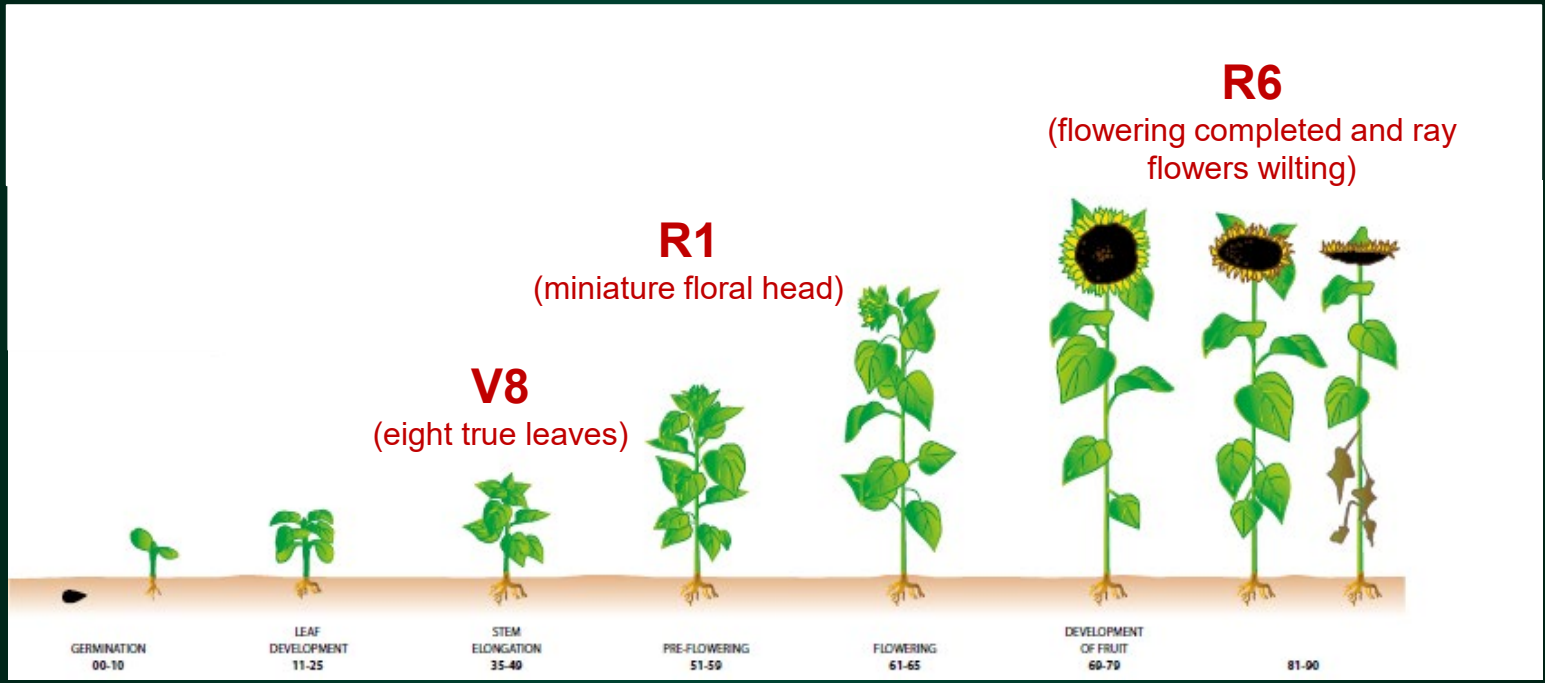
Application of fungicides

- ✓ Foliar fungicides
  - QoI (FRAC 11)
  - Triazole (FRAC 3)
  - SDHI (FRAC 7)
- ✓ Water volume of 15 gal/A
- ✓ MN, NE, ND – Backpack sprayer
- ✓ SD - High-boy sprayer (application speed - 3 km/h and boom height - 1.3 meters above the canopy)
- ✓ Using TeeJet (Spraying Systems Co., Wheaton, IL) flat fan nozzle tips with 40 psi pressure

Backpack sprayer

High-boy sprayer

Growth stages



- Sequential applications - V8 + R1 and R1 + R6

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Fungicide Treatments

Treatment	Active ingredients	Product	Company	Growth stage	Rate (fl oz/ A)
T1	-------	No fungicide control		---	---
T2	Pyraclostrobin (QoI)	Headline		R1	6
T3	Fluopyram (SDHI) + tebuconazole (triazole/DMI)	Luna experience	Bayer	V8	9
T4	Fluopyram + tebuconazole	Luna experience	Bayer	V8	9
	Pyraclostrobin	Headline		R1	6
T5	Pyraclostrobin	Luna experience	Bayer	R1	9
	Fluopyram + tebuconazole	Headline		R6	6
T6	Fluopyram + tebuconazole	Luna experience	Bayer	R1	9
T7	Fluopyram + tebuconazole	Luna experience	Bayer	R6	9
T8	Tebuconazole	Folicur	Bayer	V8	4
T9	Tebuconazole	Folicur	Bayer	R6	4
T10	Fluopyram + tebuconazole	Luna experience	Bayer	R1	9
	Pyraclostrobin	Headline		R6	6

All the fungicide treatments were sprayed with adjuvants [NIS (0.25% V/V, Induce) and Crop oil (0.08% V/V, Interlock)]

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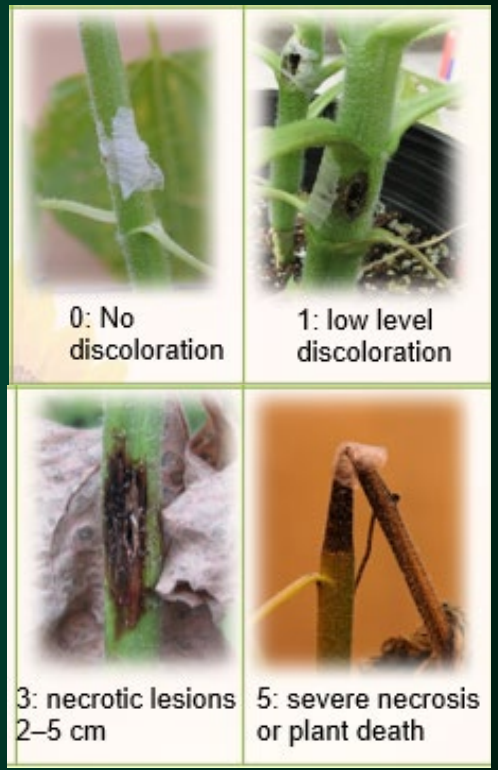
Disease rating and statistical analysis

- After R6 growth stage
- Ten random plants from the two middle rows
- Disease scoring scale of 0 to 5 (Mathew et al. 2015)
- Disease severity index (DSI) was calculated

$$\text{DSI (\%)} = \sum \{[(P \times Q)/(M \times N)] \times 100\}$$

where, P = class frequency, Q = score of rating class,
M = total number of plants and N = maximal disease index (Chiang et al. 2017)

- Yield estimated after adjusting to 10 % moisture
- Data analyzed in R (https://rstudio.com)



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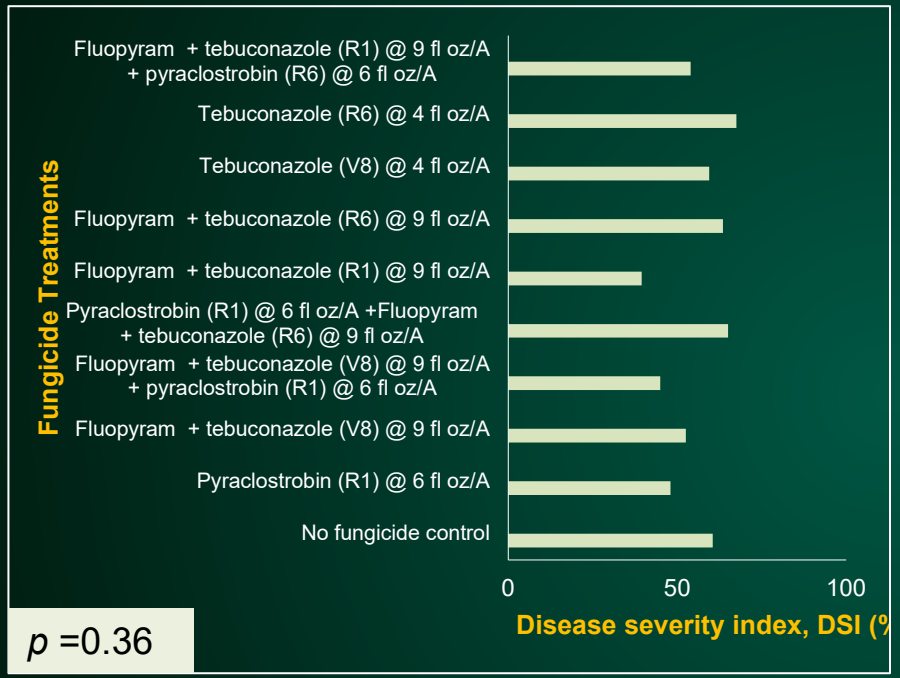
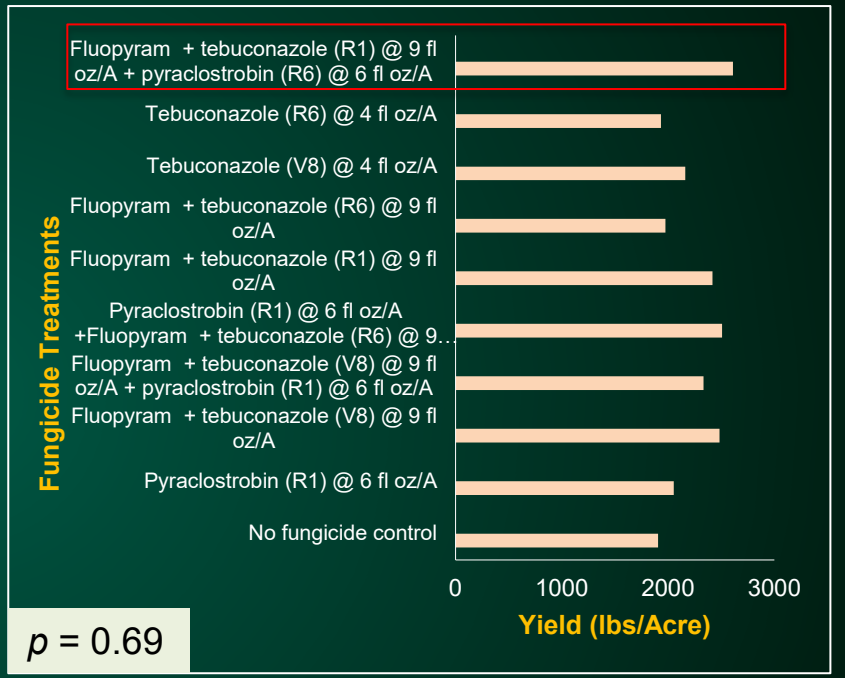
Results

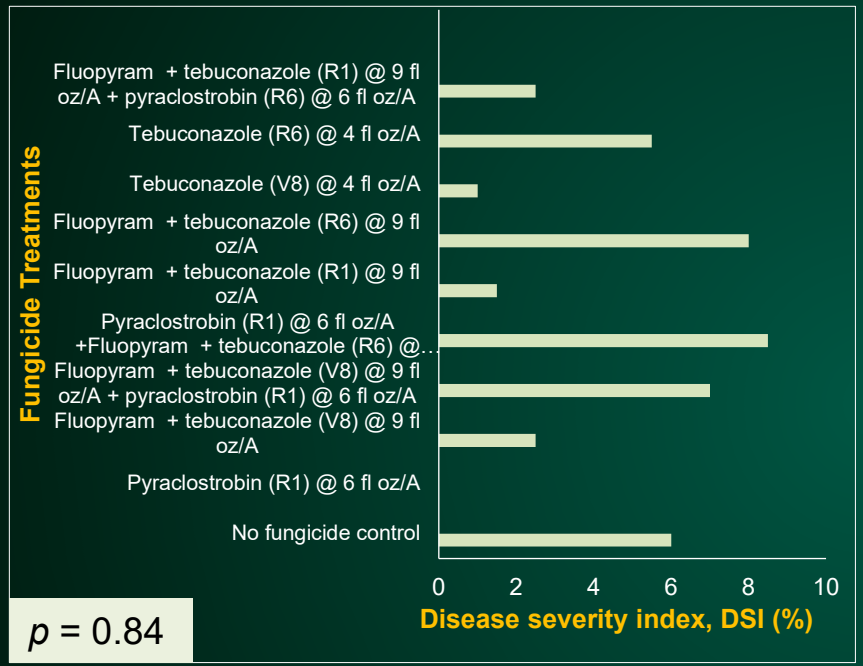
Brookings, SD

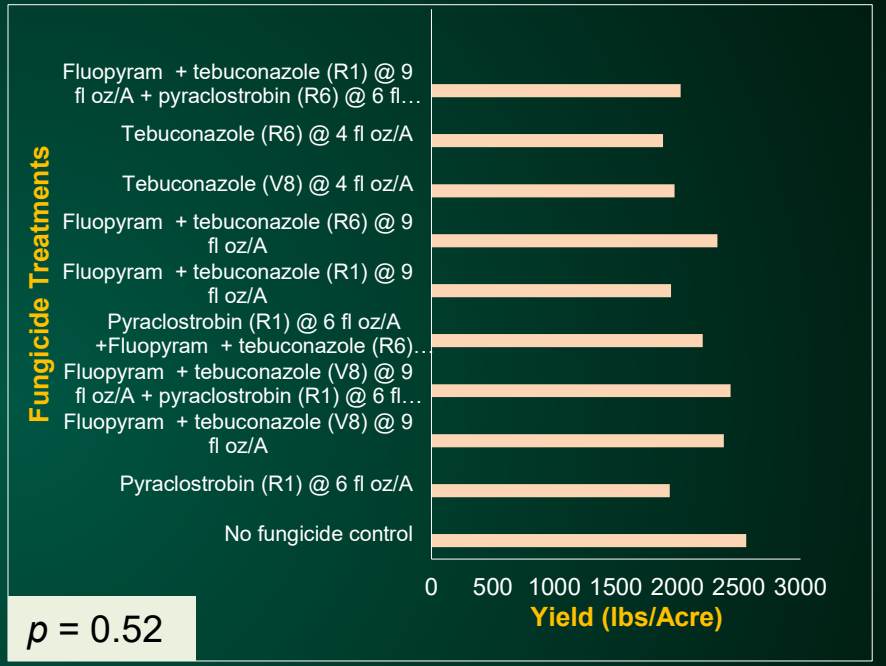




- ✓ No significant differences in disease severity or yield (p>0.05) among the treatments
- ✓ Application of fluopyram + tebuconazole at R1 followed with an application of pyraclostrobin at R6 showed yield increase up to 37%, compared to no fungicide control

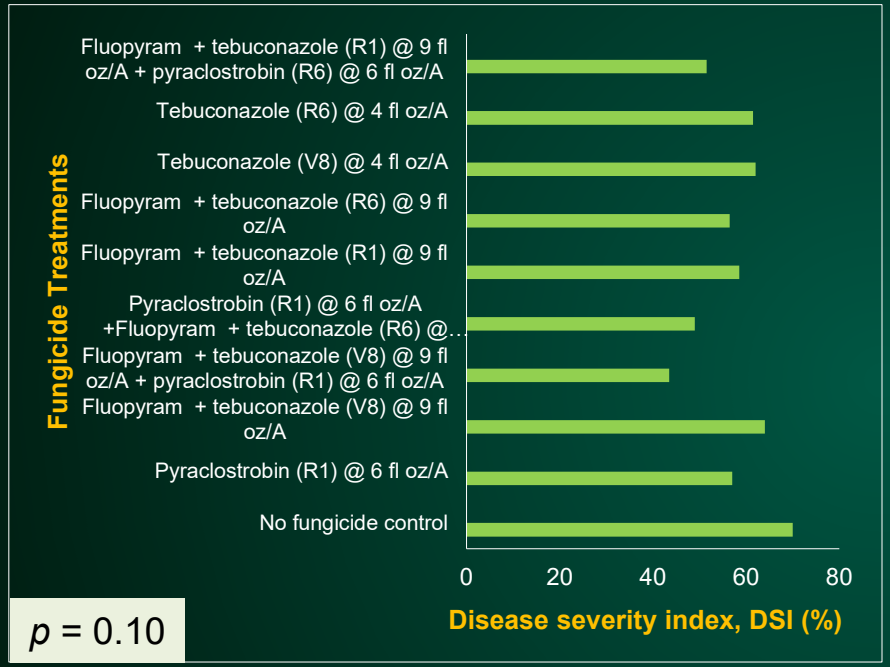
Crookston, MN

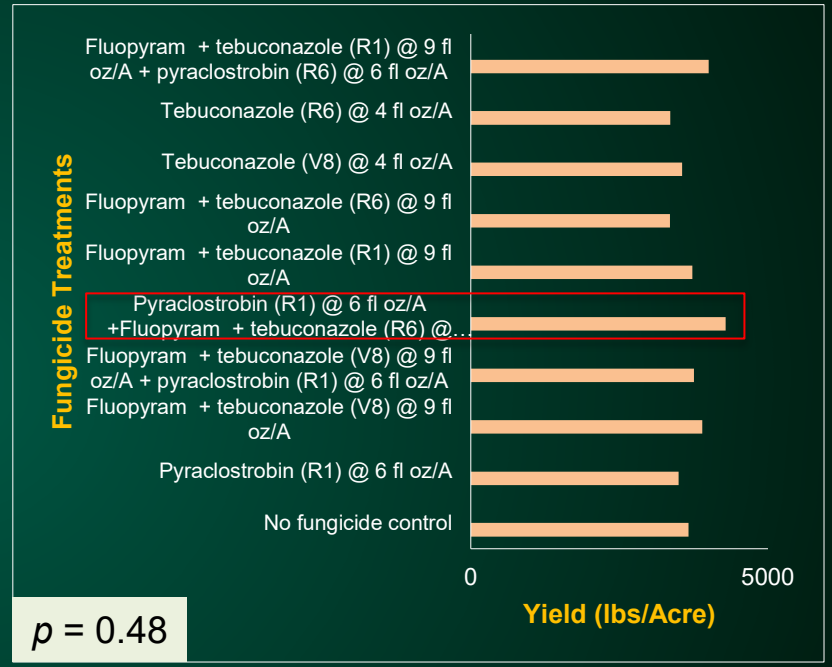




- ✓ No significant differences in disease severity or yield (p>0.05) among treatments
- ✓ Less than 10% disease severity index in all treatments
- ✓ No yield increase was observed when compared to no fungicide control

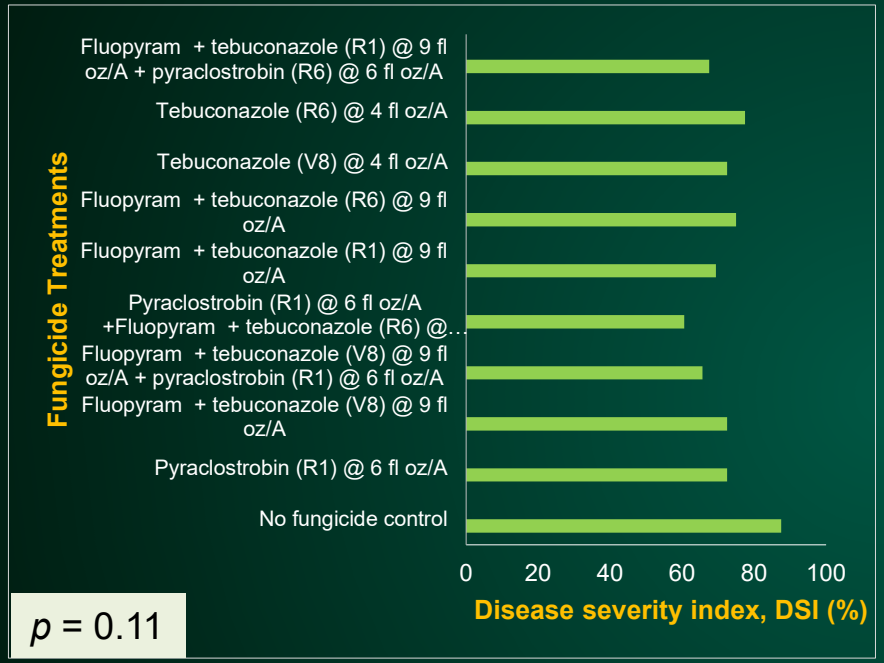
Grandin, ND

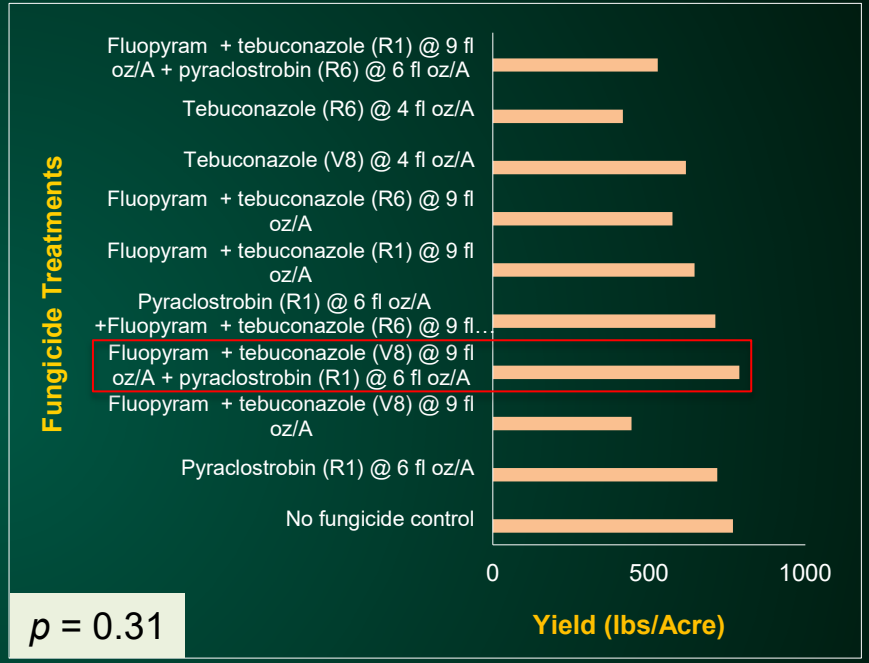




- ✓ No significant differences in disease severity or yield (p>0.05) among the treatments
- ✓ Application of pyraclostrobin at R1 followed with an application of fluopyram + tebuconazole at R6 showed yield increase up to 17%, compared to no fungicide control

Scottsbluff, NE





- ✓ No significant differences in disease severity or yield (p>0.05) among the treatments
- ✓ Three per cent yield increase was observed when fluopyram + tebuconazole was applied at V8 followed by a single application of pyraclostrobin at R1, compared to no fungicide control

Summary

- ✓ Preliminary results indicate that
  - ✓ In 2024, Pyraclostrobin at R1 followed by Fluopyram + tebuconazole at R6 showed yield increase up to 32% when compared to no fungicide control
  - ✓ Support the yield increase observed with the same treatment
    - ✓ In 2022 - 8 to 30%
    - ✓ In 2023, - 3 to 10%
- ✓ However, another year of research is necessary to confirm these findings

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THANK YOU

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