

Sugarbeet Disease Management

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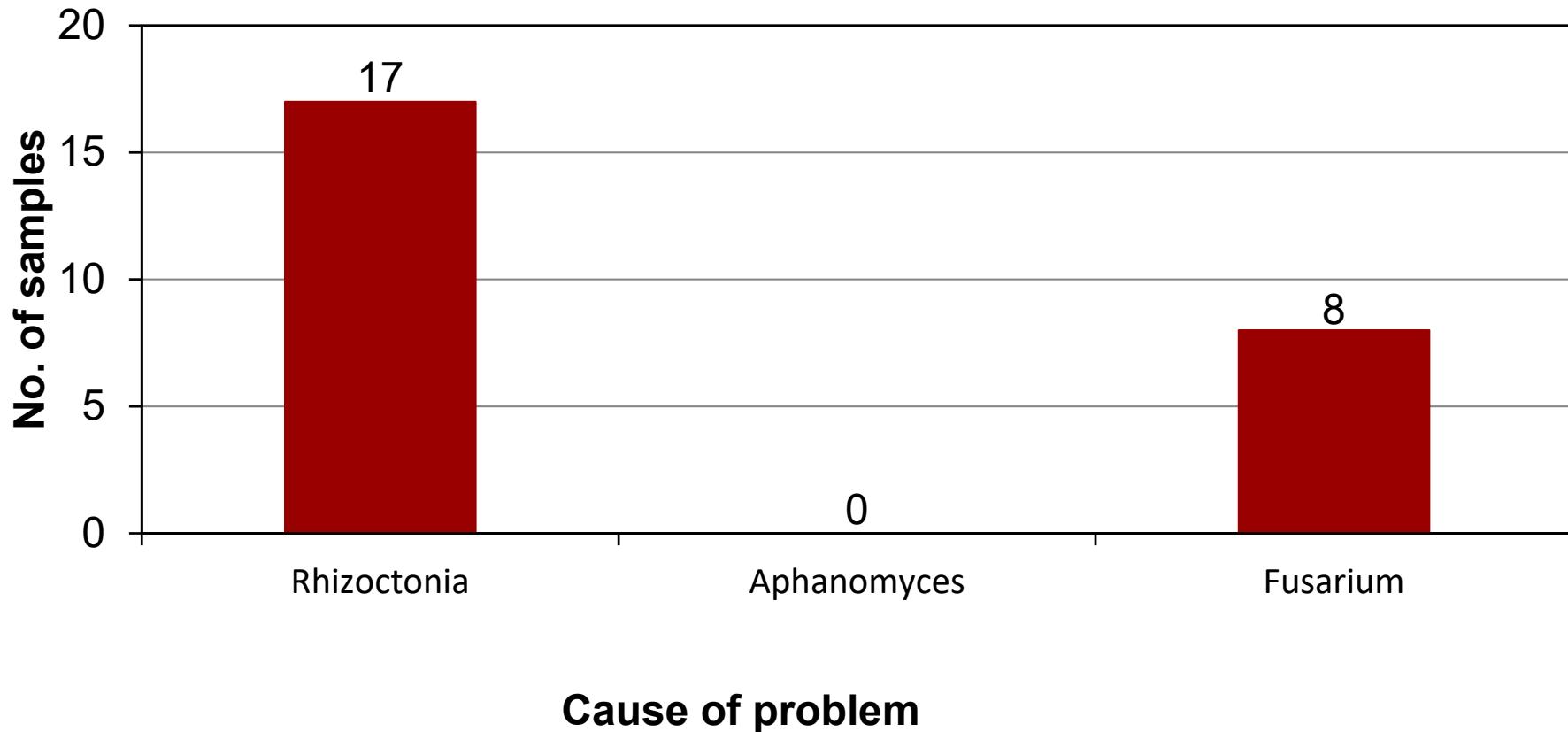
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 @BeetPath

2024 ACSC Grower Seminar

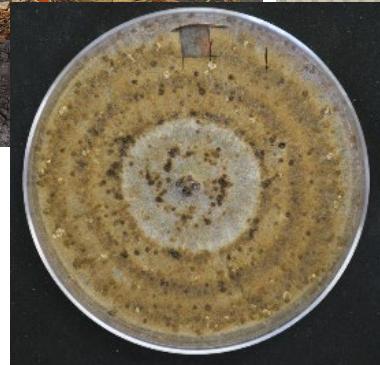
Summary of 2023 Disease Samples



Rhizoctonia Damping-off



Crown and Root Rot



Jun 20, 2023



4.5 Weeks

4.5 variety

Jun 23, 2023



7 Weeks

3.9 variety

Jul 10, 2023



7 Weeks

3.9 variety

Jul 12, 2023



9 Weeks

4.0 variety



Key points about Rhizoctonia

- Can survive in soil 2-3 years as dormant resting structures (sclerotia)
- *Rhizoctonia solani*— groups AG 2-2 (IIIB & IV) and AG 4
- Full-season pathogen
- Disease develops in patches, present in top 4-6 inches
- Field cultivation can increase the risk for crown rot as inoculum gets into the crowns
- Wide host range— Sugarbeet, soybean, edible beans, corn, including weeds



Soybeans

Dean Malvick



<https://extension.umn.edu/pest-management/rhizoctonia-root-and-stem-rot-soybean>

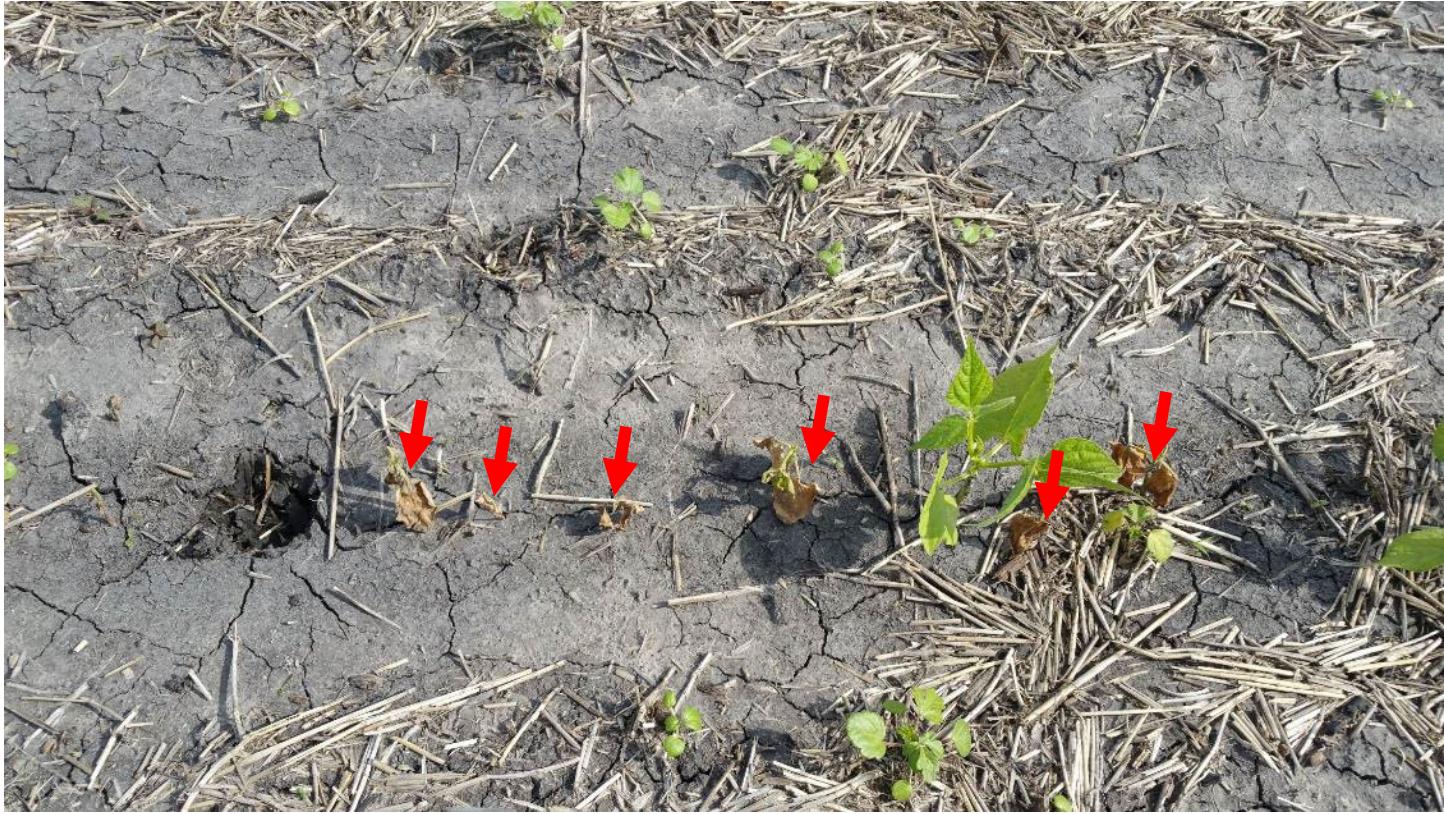


Rhizoctonia root and stem rot

<https://extension.umn.edu/pest-management/rhizoctonia-root-and-stem-rot-soybean>



Navy beans

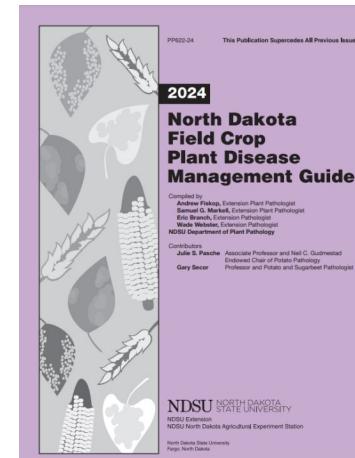


Navy beans

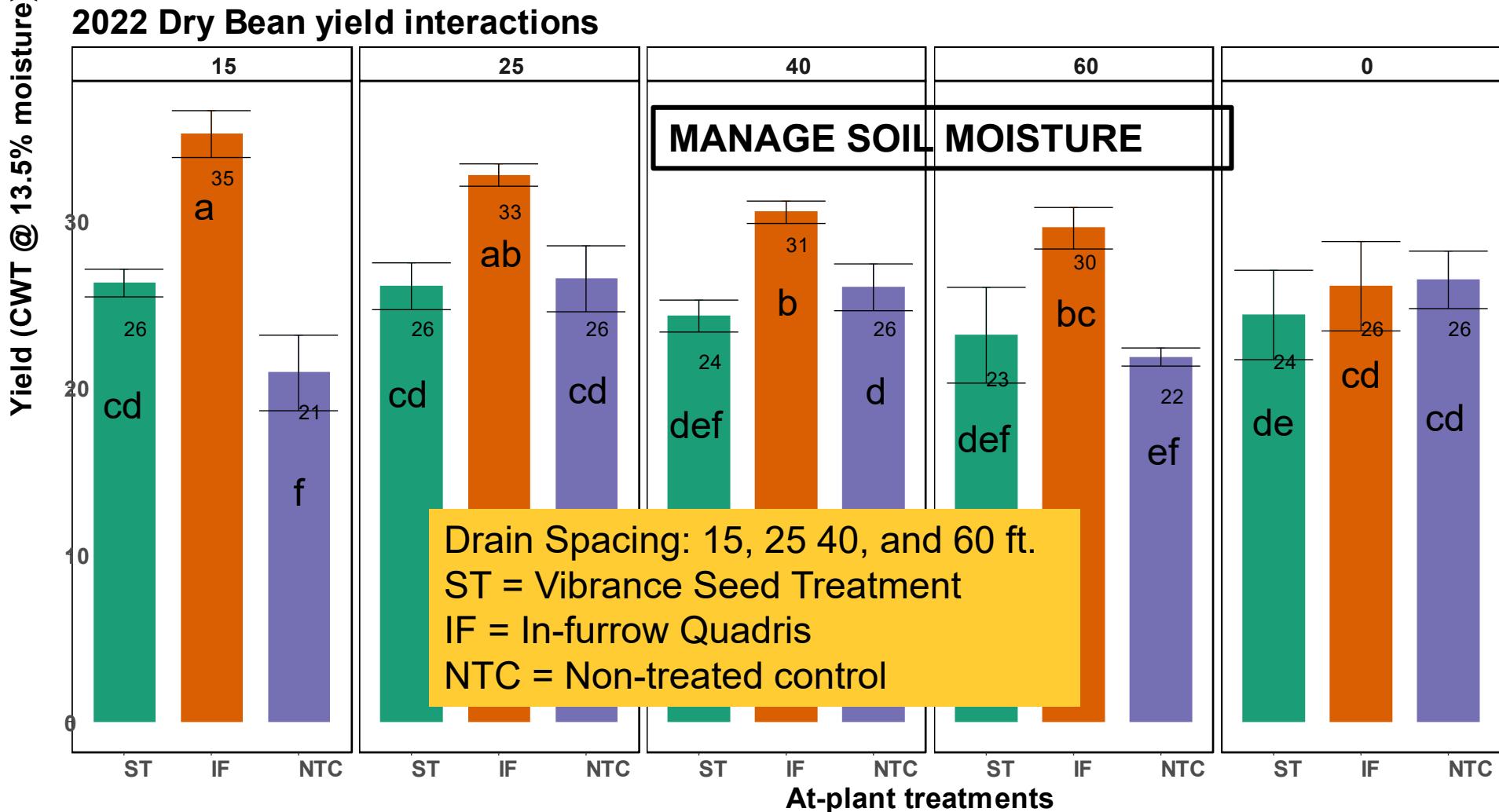


Crop Rotation

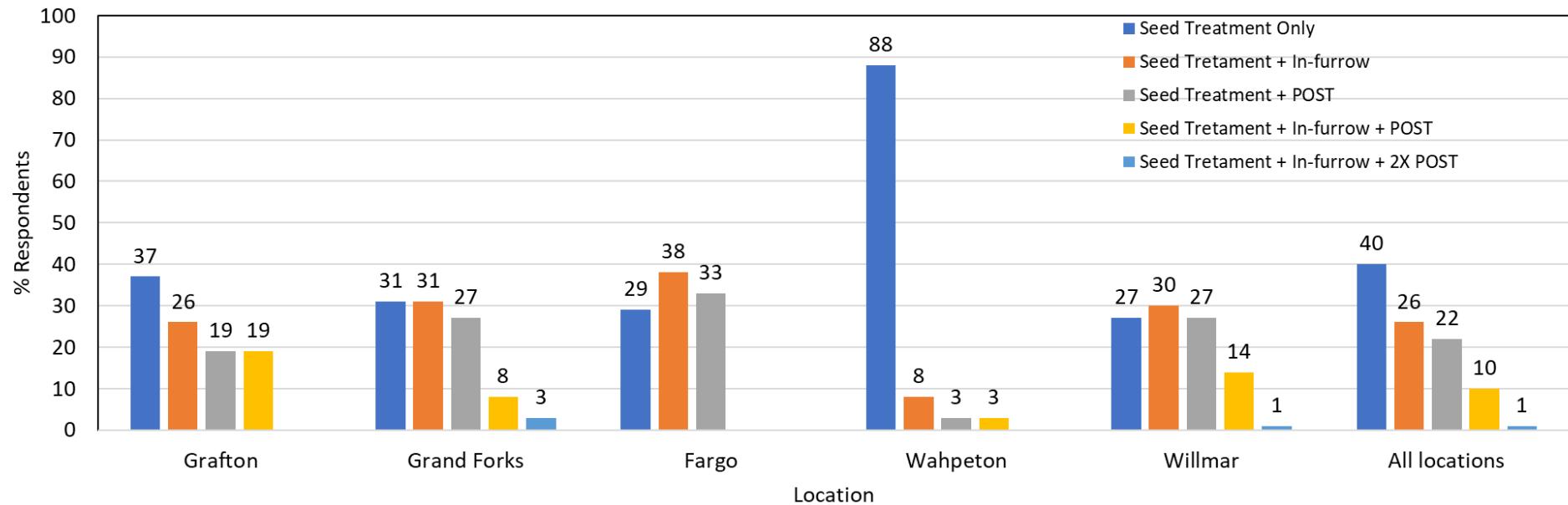
- Small grains prior to sugarbeet is ideal
- Increase the length of rotation
- Managing Rhizoctonia in other crops can reduce the inoculum build up
- Soybean and dry beans
 - Seed treatments
 - Fluxapyroxad (Systiva), Sedaxane (Vibrance)
 - In-furrow/POST application
 - Azoxystrobin (Quadris), Pyraclostrobin (Headline)



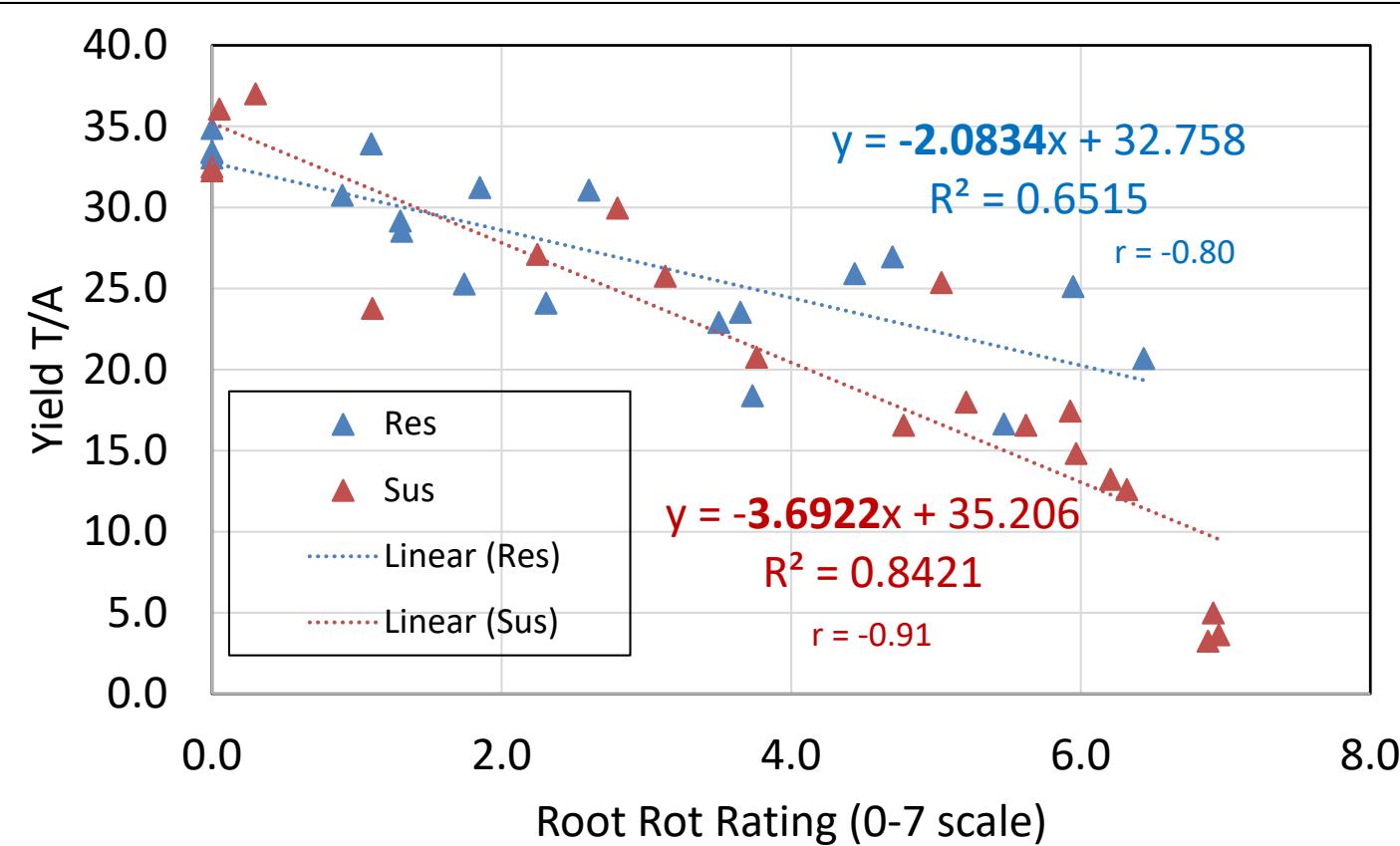
2022 Dry Bean yield interactions



Grower Practices for Rhizoctonia - 2022 Survey



Tolerant variety can lose yield!



Evaluation of At-planting treatments

- Determine the effectiveness of seed treatment, in-furrow fungicides on a moderately susceptible (MS) variety 4.5 rating (Brantner and Moomjian 2023) for:
 - Stand establishment
 - Full-season control of Rhizoctonia diseases
 - NWROC, Crookston
 - May 12 , Rhizoctonia inoculum broadcast prior to planting (50 kg/ha) and incorporated



Seed Treatments

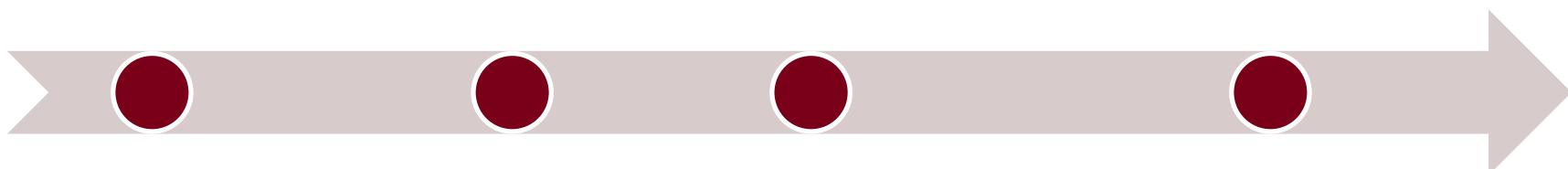
- SDHI class of fungicides (Succinate DeHydrogenase Inhibitor, FRAC group 7)
- Single site of action - Inhibit fungal respiration

Kabina

2014

Systiva

2017



Vibrance

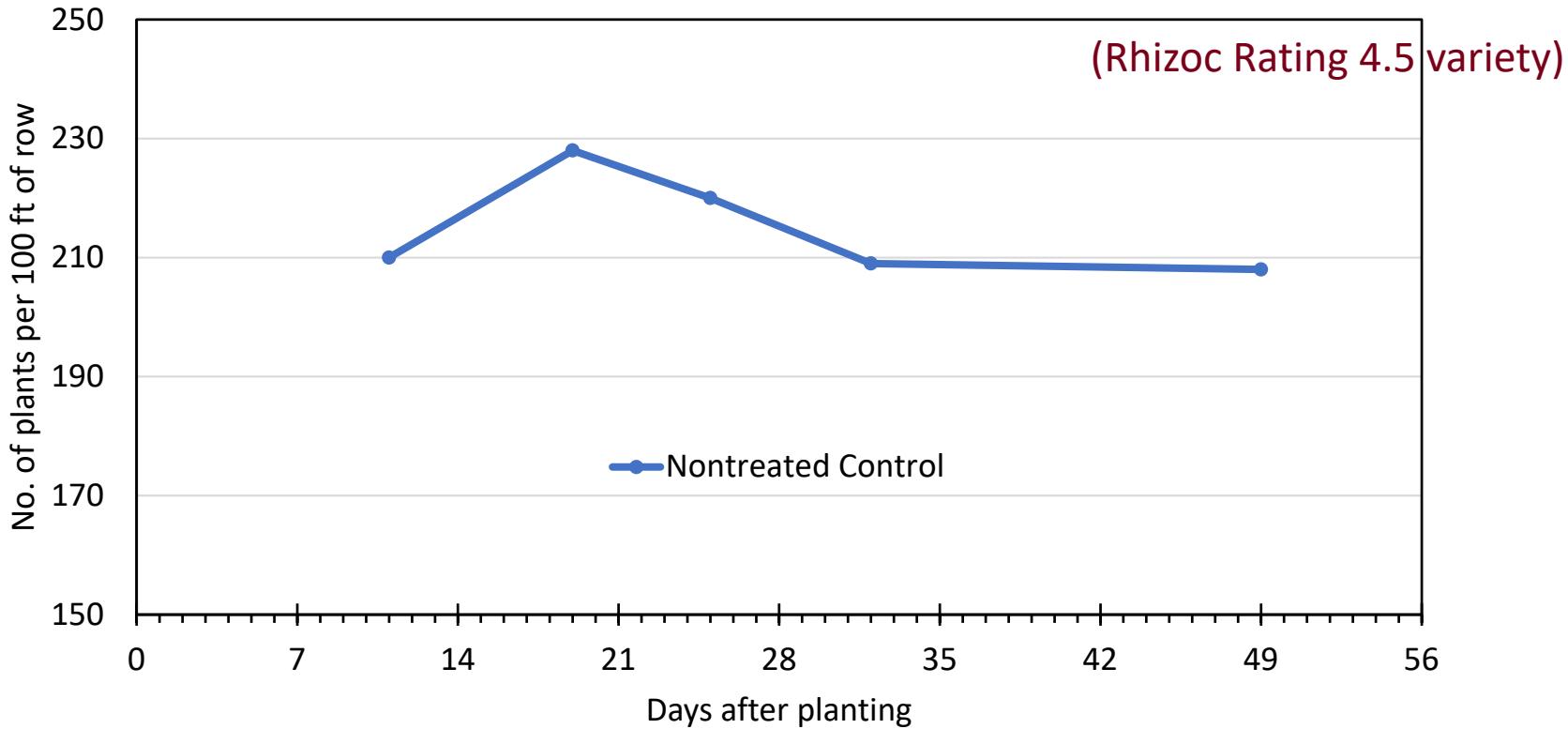
2016

Zeltera

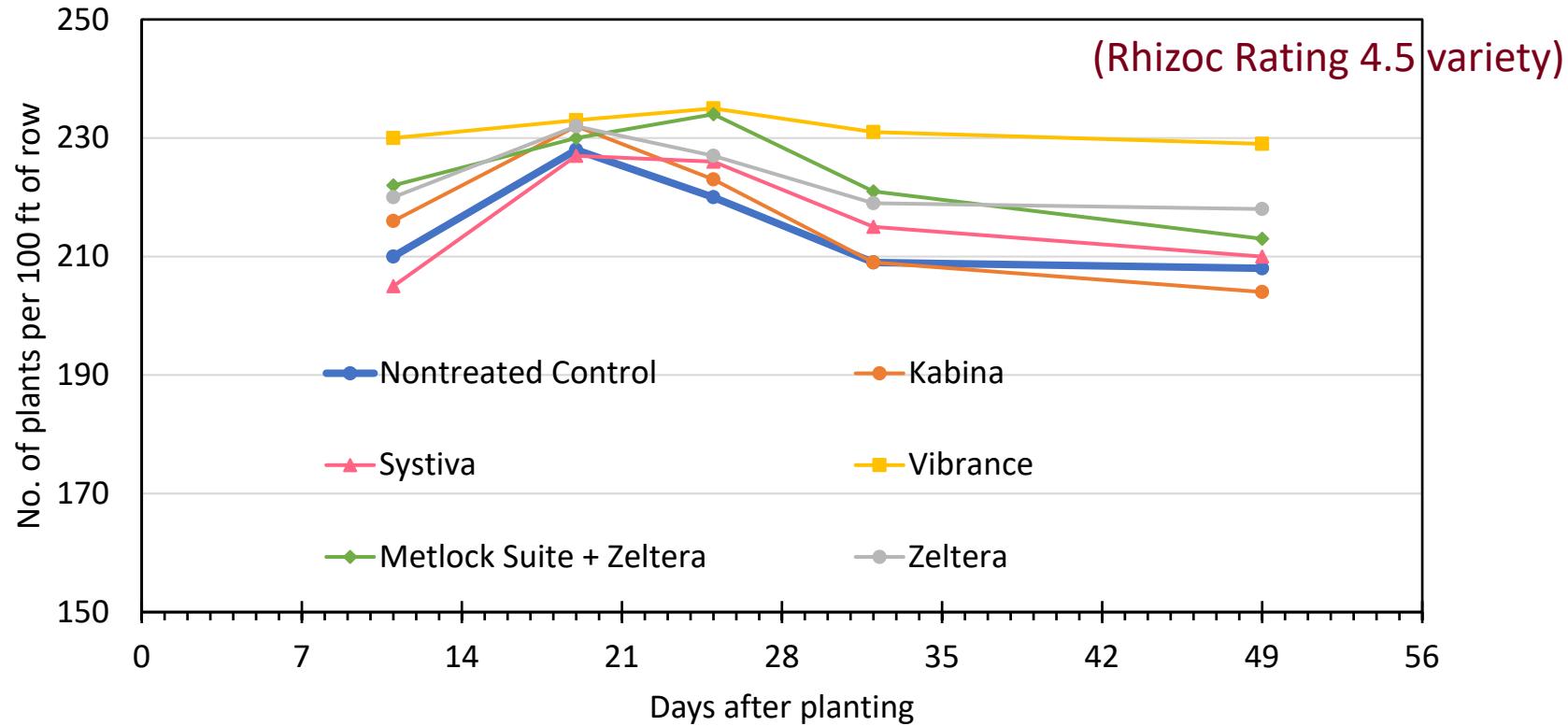
2022



Seed Treatments



Seed Treatments



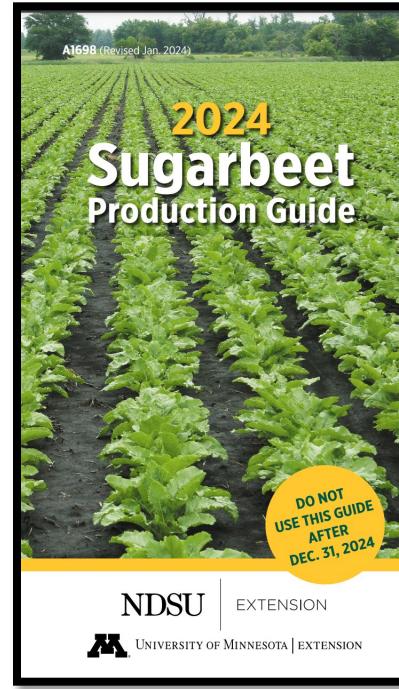
In-furrow Fungicides



- Fungicide in 3 gal. water + 10-34-0 @ 3 gal. applied via drip tube
- Agitation in the tank is important to avoid nozzle clogging
- Do a jar test
- Find compatible fungicides for mixing

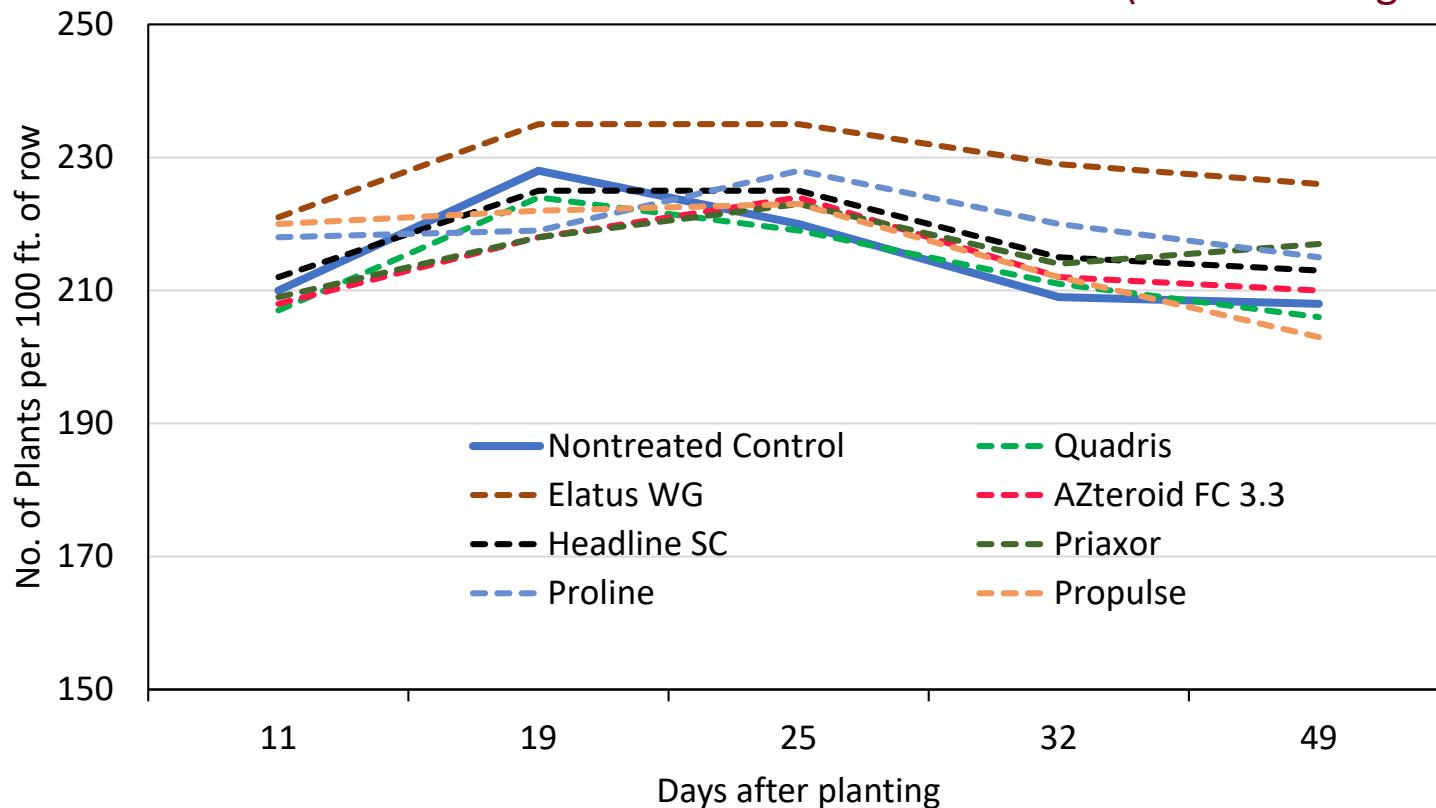
In-furrow Fungicides (rates per acre)

- Quadris 9.5 fl oz (QoI)
- AZteroid 5.7 fl oz (QoI)
- Elatus 7.1 fl oz (QoI + SDHI)
- Headline 9 fl oz (QoI)
- Priaxor 6.7 fl oz (QoI + SDHI)
- Proline 5.7 fl oz (DMI)
- Propulse 13.6 fl oz (DMI + SDHI)

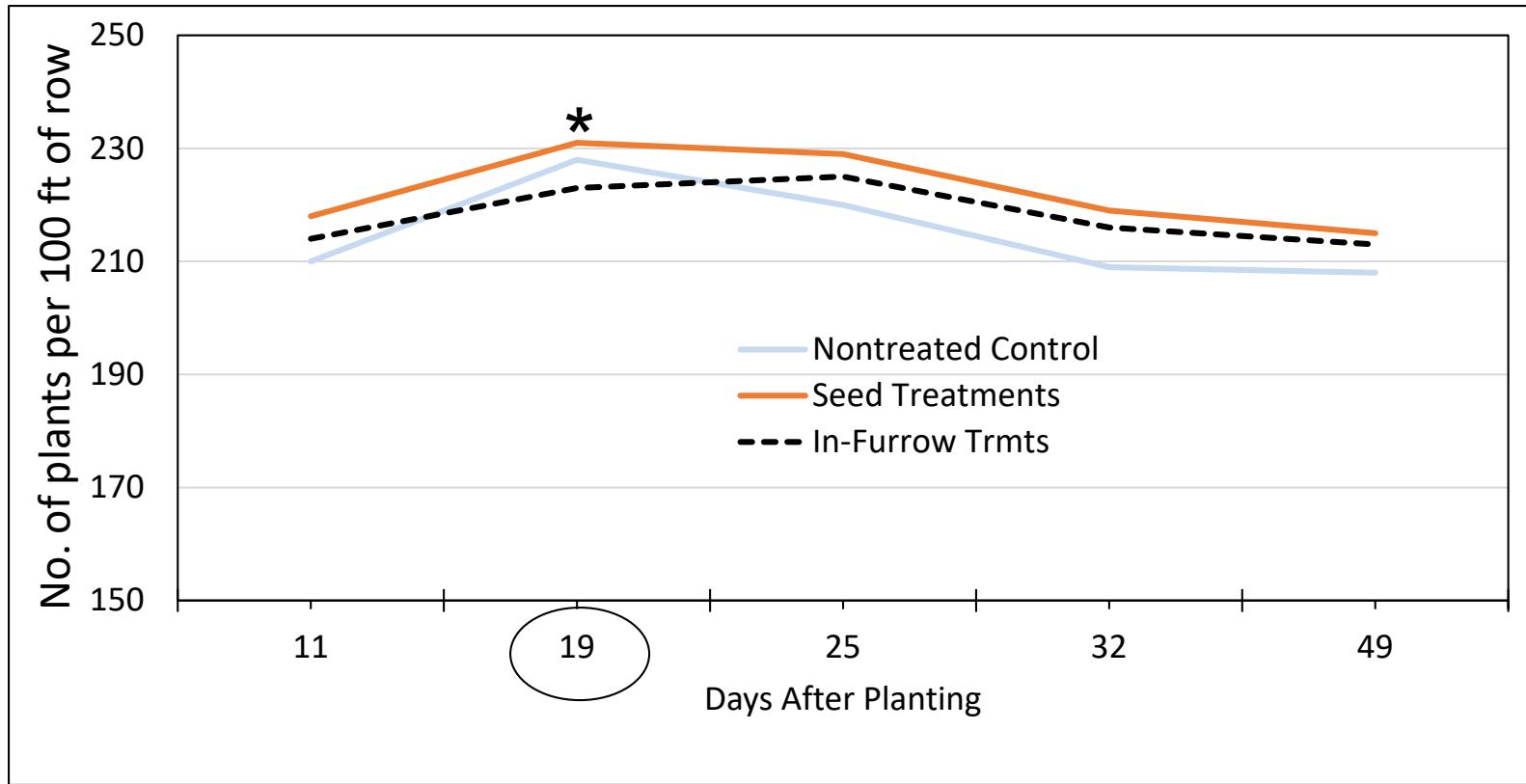


In-furrow Fungicides

(Rhizoc Rating 4.5 variety)



Seed Treatments vs In-furrow Fungicides



Root rot rating scale 0-10



0 1 2 3 4 5 6 7 8 9 10

1 = 1 – 10% rot, 10 = 91 – 100 % rot

Seed treatments vs In-furrow (2023)

Description	# Harvested roots	Root Rot Rating (%)	Root Rot Incidence (%)	Yield (T/A)	RSA (Lbs/A)
Untreated	157	8.6	33.8	26.0	9324
Seed treatments	168	9.9	39	25.0	9312
In-furrow treatments	175	6.3	31	26.9	9916
Seed vs in-furrow contrast (P-value)	0.0033	0.0148	0.0073	0.0338	0.0411



Evaluation of At-planting treatments

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 - Stand establishment
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 - NWROC, Crookston
 - May 12 , Rhizoctonia inoculum broadcast prior to planting (50 kg/ha) and incorporated



Postemergence Fungicides (rates per acre)

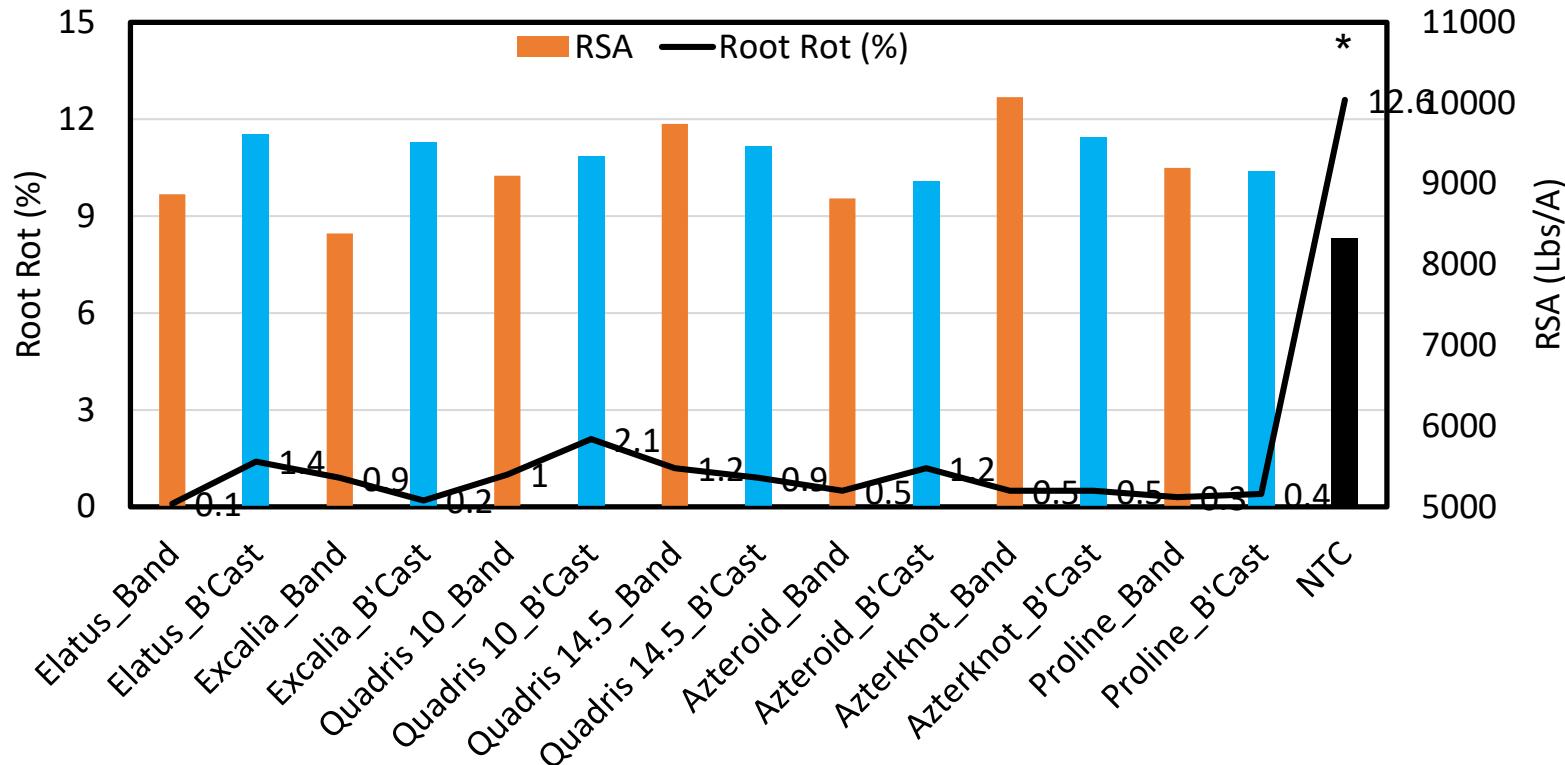
- Quadris 10 & 14.5 fl oz (QoI)
- AZteroid 9.2 fl oz (QoI)
- AZterknot 16.6 fl oz (QoI)
- Elatus 7.1 fl oz (QoI + SDHI)
- Proline 5.7 fl oz. (DMI)
- Excalia 0.64 fl oz (band), 2.0 fl oz (broadcast) (SDHI)

**Recommended
Timing: 4-8 leaf stage**



Postemergence Fungicides (2023)

(Rhizoc Rating 4.5 variety)



Fungicides for Rhizoctonia – Mode of Action (MoA)

- Rhizoctonia is a monocyclic disease cycle so the risk of developing fungicide resistance is relatively low
- Best Practice - Rotate different MoAs

Seed Treatment		In-Furrow		POST	
Kabina		Headline		Quadris	
Systiva		Quadris		Elatus	
Vibrance		Elatus		AZterknot	
Zeltera		AZteroid		Excalia	
		Proline		Topguard EQ	
		Propulse		Proline	
				Propulse	
				Priaxor	

SDHI QoI DMI



Rhizoctonia Management – Take home message

- Best Practices
 - Seed treatment + POST (4- to 8-leaf stage, band or broadcast) – **most fields**
 - Seed treatment + In-furrow (make sure they mix well with the starter fertilizers) + POST – may be needed for **fields with severe history**
- Even resistant varieties can underperform under severe Rhizoctonia pressure
- Thoroughly pressure wash machinery to limit soil movement between fields



Cercospora Leaf Spot (CLS)

- *Cercospora beticola*
- Polycyclic, 10-14 days/cycle



Evaluation of Fungicide Spray Programs

- Determine the effectiveness fungicide mixtures in rotation on a susceptible cultivar (5.0 rating) and CR+ cultivar (2.2)
 - NWROC, Crookston; Planted on May 10
 - Inoculated with dried CLS-infected leaves from 2022 (Jun 27)
 - Fungicides applied at 10-14 days interval
 - Spray 1 (Jun 23, 4 days prior to inoculation), Spray 2 (Jun 30), Spray 3 (Jul 12), Spray 4 (Jul 24), Spray 5 (Aug 07), and Spray 6 (Aug 23)
 - CLS disease severity ratings, 0-10 scale (weekly, Jul 11– Sept 18)
 - Yield and quality parameters

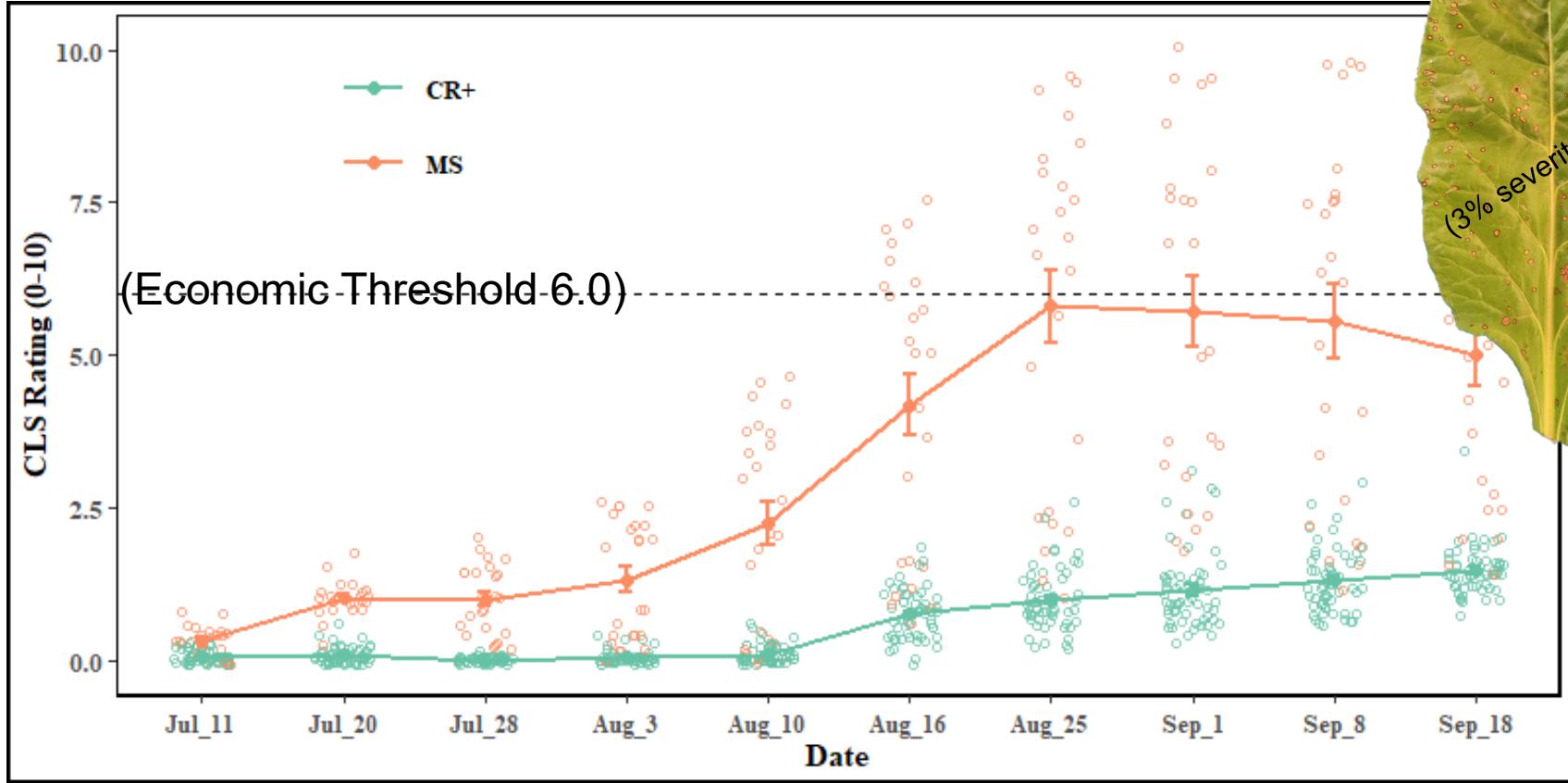


Evaluation of Fungicide Spray Programs - CLS

Treatment	Spray 1 (Jun 23)	Spray 2 (Jun 30)	Spray 3 (Jul 12)	Spray 4 (Jul 24)	Spray 5 (Aug 07)	Spray 6 (Aug 23)
6-Spray program	Provysol + EBDC	EBDC	TPTH + Topsin	Proline + EBDC	EBDC	TPTH + Priaxor
5-Spray program	-	Provysol + EBDC	TPTH + Topsin	Proline + EBDC	EBDC	TPTH + Priaxor
4-Spray program		-	Provysol + EBDC	TPTH + Topsin	Proline + EBDC	TPTH + Priaxor
3-Spray program	-	-	-	Provysol + EBDC	TPTH + Topsin	Proline + Priaxor
3-Spray program	-	-	-	TPTH + Topsin	Proline + EBDC	TPTH + Priaxor
Control	-	-	-	-	-	-



CLS Severity Ratings (2023)



Susceptible Variety
Nontreated control
Sept 11, 2023

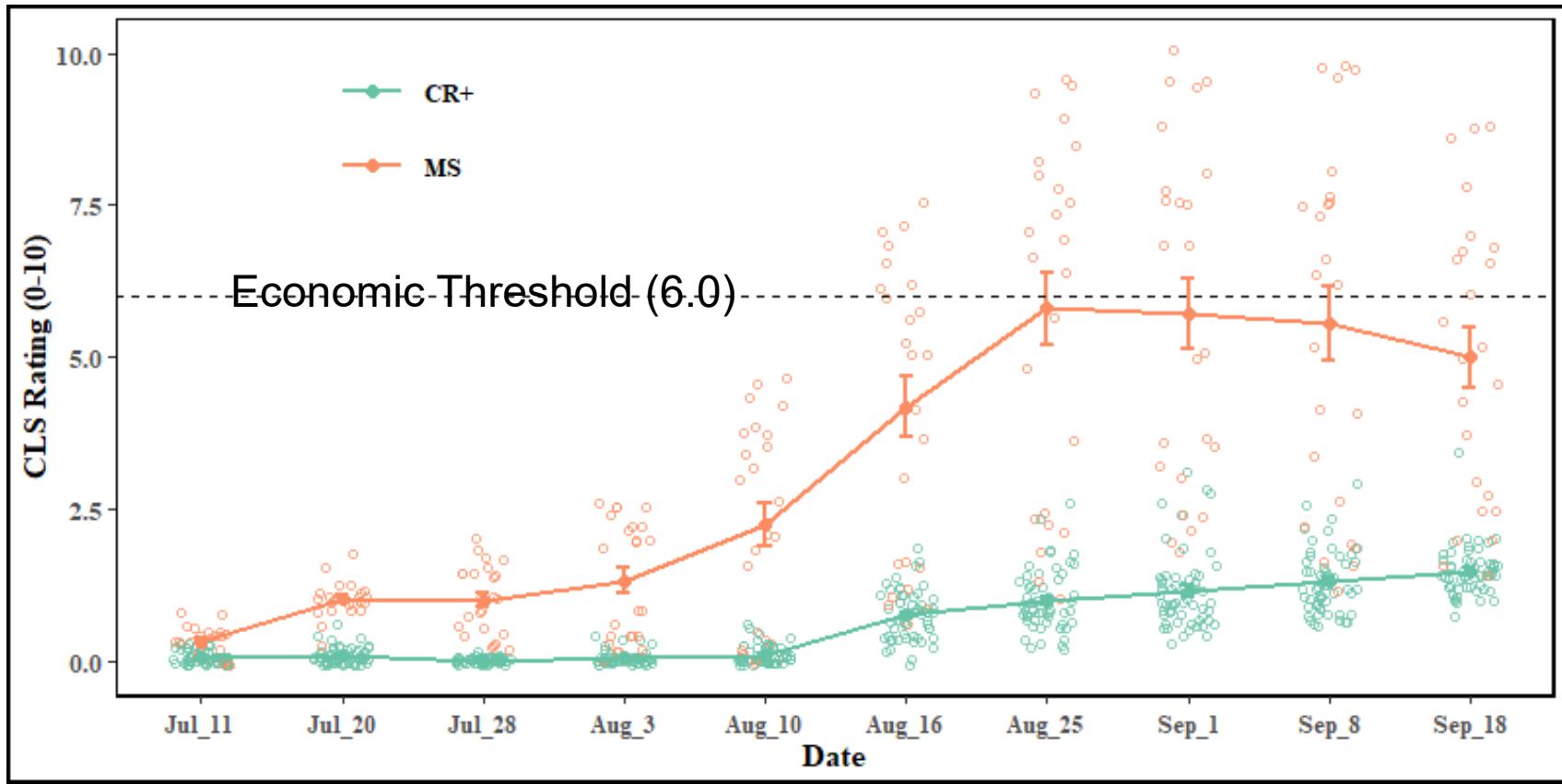


CLS susceptible cultivar (5.0 rating)

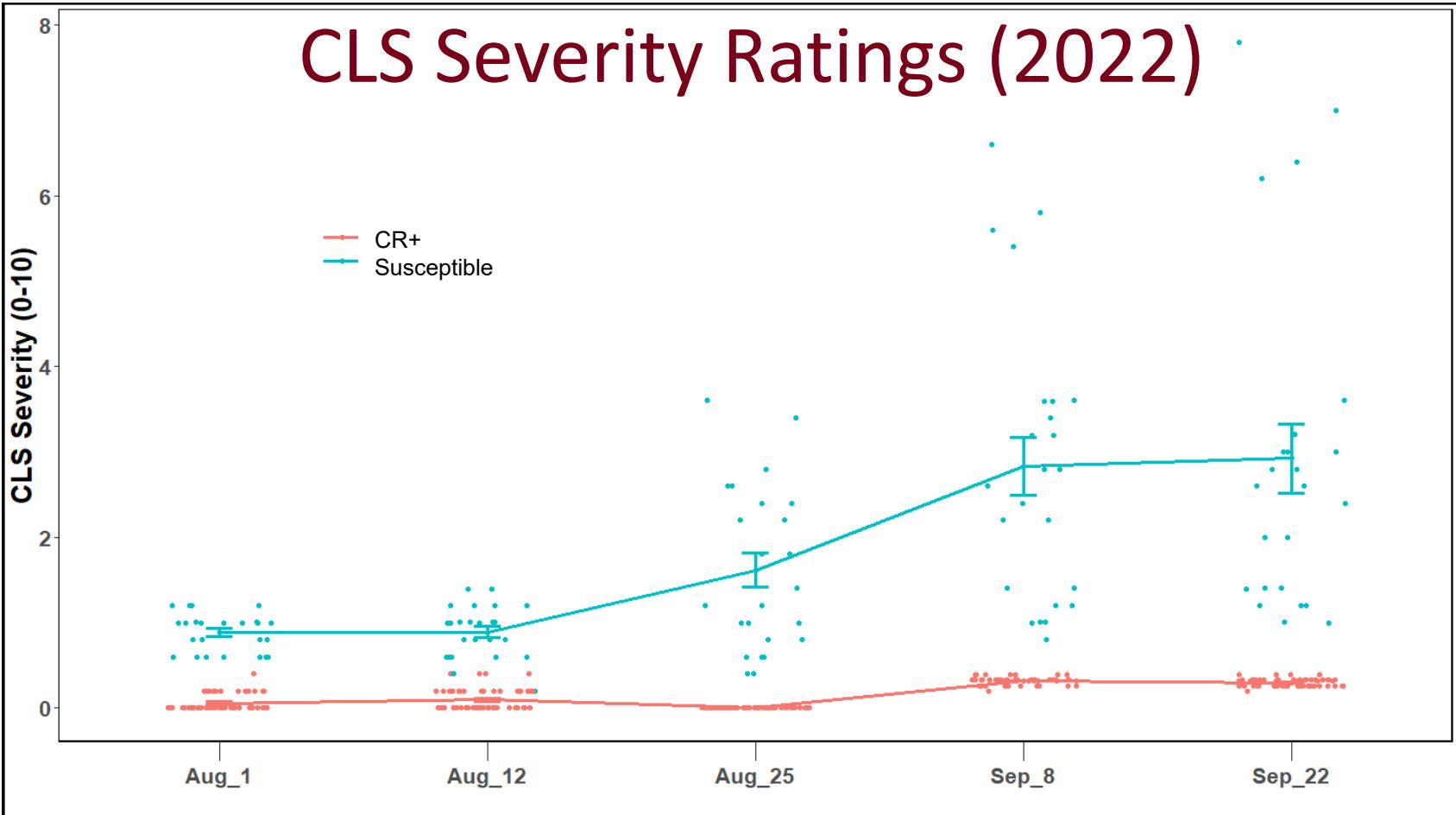
Program	Spray 1 (Jun 23)	Spray 2 (Jun 30)	Spray 3 (Jul 12)	Spray 4 (Jul 24)	Spray 5 (Aug 07)	Spray 6 (Aug 23)	CLS severity (0-10) (Sept 08)	Yield (T/A)	RSA (Lbs/A)	RSA (Lbs gain over Control)
6-Spray program	Provysol + EBDC	EBDC	TPTH + Topsin	Proline + EBDC	EBDC	TPTH + Priaxor	1.6 abcd	30.4	10910	+1829
5-Spray program	-	Provysol + EBDC	TPTH + Topsin	Proline + EBDC	EBDC	TPTH + Priaxor	2.4 d	29.2	10695	+1614
4-Spray program		-	Provysol + EBDC	TPTH + Topsin	Proline + EBDC	TPTH + Priaxor	4.9 e	30.5	10430	+1349
3-Spray program	-	-	-	Provysol + EBDC	TPTH + Topsin	Proline + Priaxor	7.6 f	28.4	10266	+1185
3-Spray program	-	-	-	TPTH + Topsin	Proline + EBDC	TPTH + Priaxor	7.0 f	27.2	9967	+886
Control	-	-	-	-	-	-	9.75 g	25.8	9081	



CLS Severity Ratings (2023)



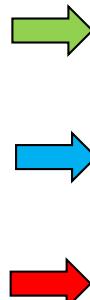
CLS Severity Ratings (2022)



CR+ Variety
Non-treated control
Sept 11, 2023



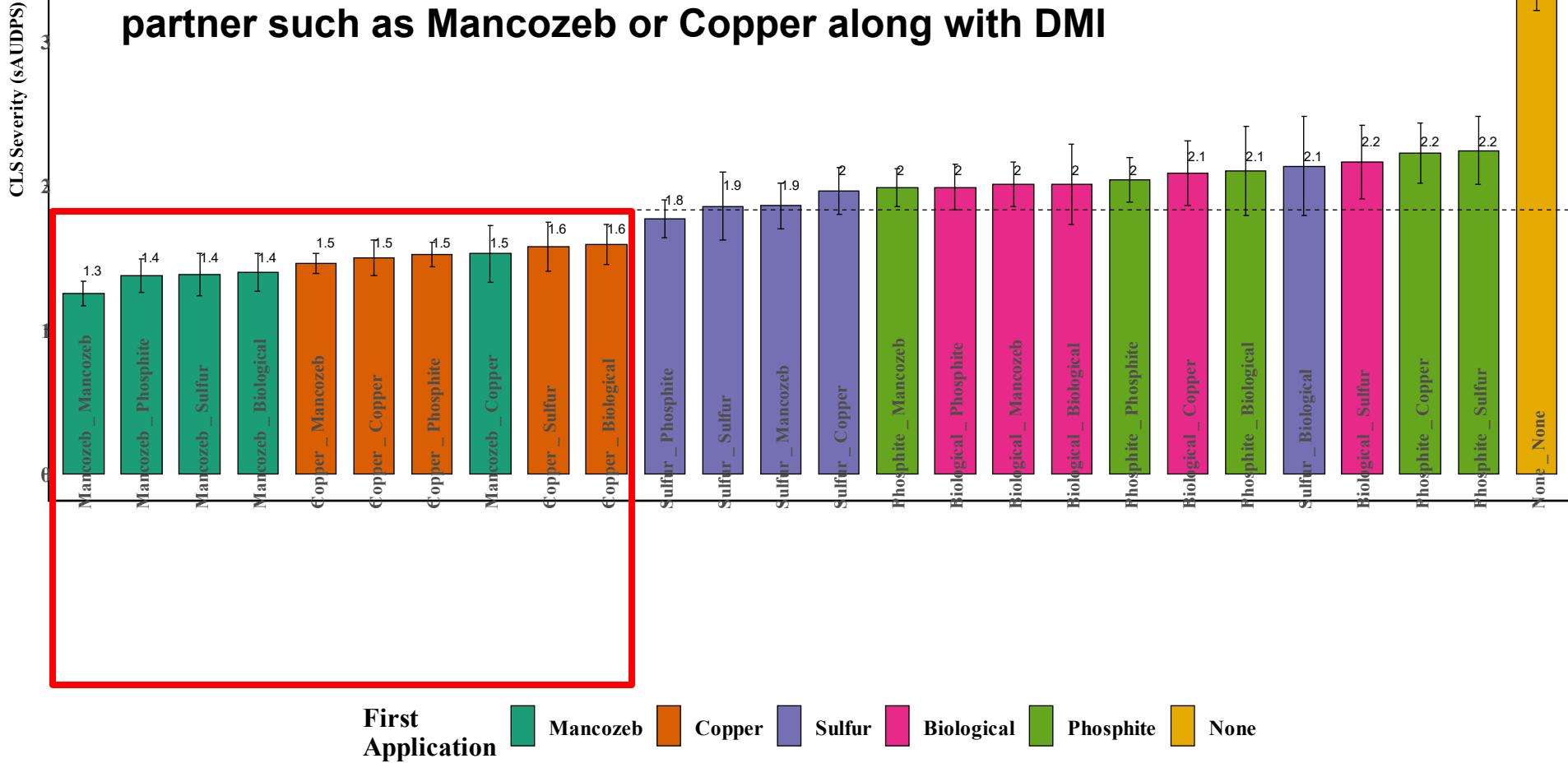
CR+ cultivar (2.2 rating)



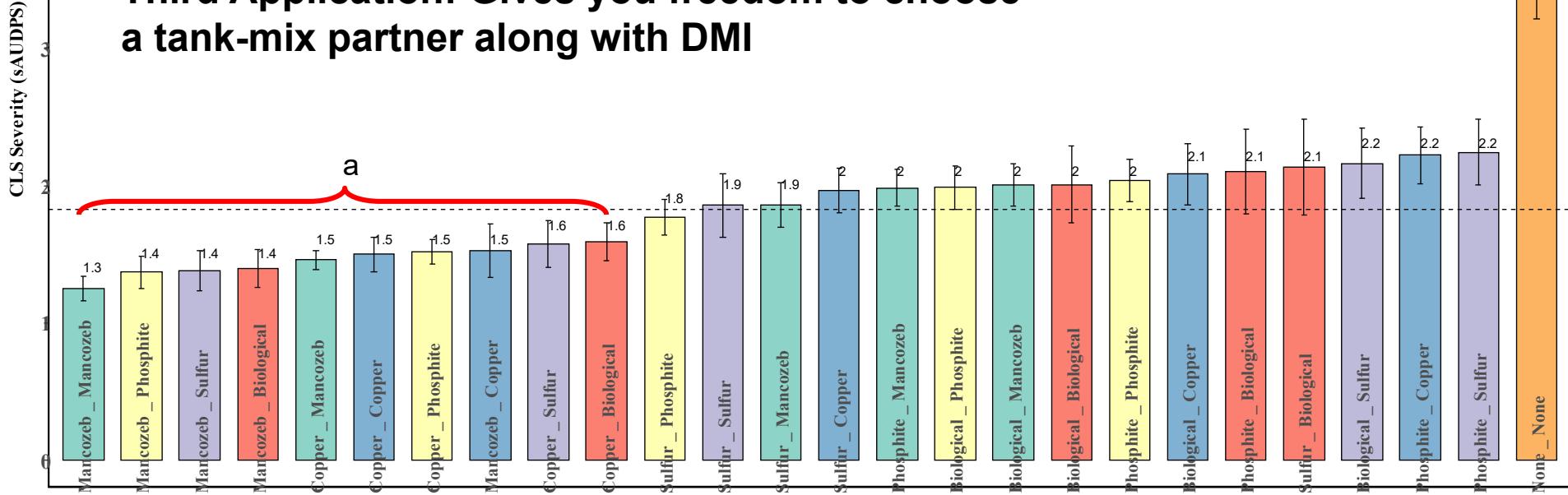
Treatment	Spray 1 (Jun 23)	Spray 2 (Jun 30)	Spray 3 (Jul 12)	Spray 4 (Jul 24)	Spray 5 (Aug 07)	Spray 6 (Aug 23)	CLS severity (0-10) (Sept 08)	Yield (T/A)	RSA (Lbs/A)	RSA (Lbs gain over Control)
Early 3-spray	Provysol + EBDC	-	TPTH + Topsin	-	-	Proline + EBDC	1.45 abc	31.9	11635	+1755
Normal 4-spray		Provysol + EBDC	TPTH + Topsin	-	Proline + EBDC	TPTH + Priaxor	1.40 ab	30.0	10914	+1034
Late 3-spray				Provysol+ EBDC	TPTH + Topsin	Proline + Priaxor	1.3 abc	29.0	10504	+624
Control	-	-	-	-	-	-	2.20 cd	27.1	9880	



First Application: Needs a strong broad-spectrum tank-mix partner such as Mancozeb or Copper along with DMI



Third Application: Gives you freedom to choose a tank-mix partner along with DMI



Mancozeb or Copper

First application

Third Application

Mancozeb Phosphate Sulfur Biological Copper None

Summary – Cercospora Leaf Spot Management

- Cercospora DNA in the leaf tissues and spores are detected very early in the season (yield penalty?)
- Successful CLS management program will utilize
 - Tank-mixing: Mix single site of action fungicides (Proline, Minerva, Inspire etc.) with broad-spectrum fungicides (Tin, EBDC, copper etc.)
 - Fungicide rotation with different modes of action (e.g. do not use triazole fungicides back-to-back). Rotate Proline or Minerva with Inspire XT or Provysol
 - Maintain 10-14 days spray intervals (shorten the interval based on rain events for contact fungicides)
- CR+ varieties are tolerant to Cercospora but not immune
 - Selection pressure is increasing year-to-year
 - Early applications showed benefit compared to late-start
 - 3-spray program with extended interval looked beneficial
 - Will repeat this study in 2024

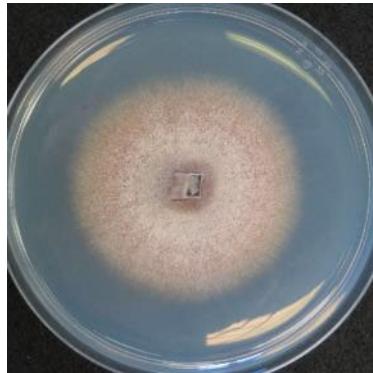


Accurate Diagnosis is critical for Fusarium!

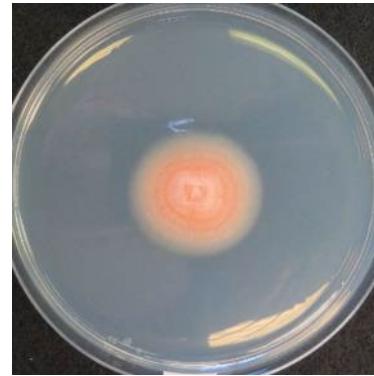


Only tolerant varieties can withstand Fusarium

Fusarium



F. oxysporum



F. secorum



F. equiseti

More than one *Fusarium* spp. can be present in the same field

Fusarium

4 weeks after planting



Fusarium Yellows



Fusarium Yellows



Aug 06, 2019 (4.3 Variety)

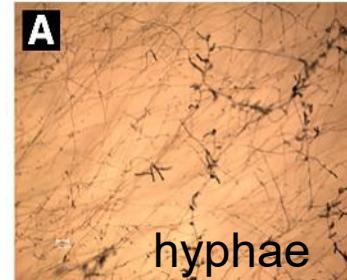


Aug 14, 2019 (2.5 variety)

Alternaria Leaf Spot (ALS)



A. alternata



hyphae

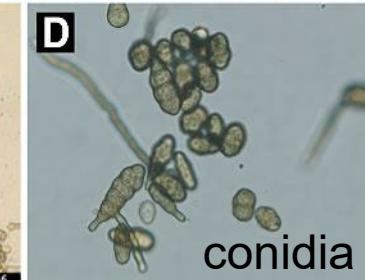


conidia



conidia

A. brassicae



conidia

A. alternata

[Cortes et al. 2022, https://doi.org/10.1094/PHP-03-22-0025-DG](https://doi.org/10.1094/PHP-03-22-0025-DG)

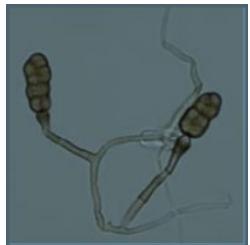
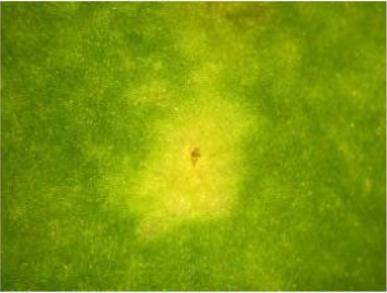


Alternaria Leaf Spot (ALS)

- Varietal susceptibility
 - More CR+ acres – making room for Alternaria?
- Stressed plants are more susceptible
 - Secondary pathogen
- CLS fungicides have good efficacy for ALS
 - DMI, QoI and Tin resistance (Michigan)
- Maintaining a healthy sugarbeet canopy is the best way to manage Alternaria



Stemphylium Leaf Spot (SLS)



Other hosts: Potato,
White Mustard, Red Beet,
Spinach, Lambsquarter



BRAM HANSE¹, ELMA RAAIJMAKERS¹

¹IRS (Institute of Sugar Beet Research), P.O. Box 32, NL-4600 AA Bergen op Zoom

STEMPHYLIUM, A NEW FOLIAR DISEASE IN SUGAR BEET

SLS in USA

- Michigan (Metheny et al. 2019), *S. vesicarium* (mild symptoms compared to *S. beticola*)
- MN and ND
 - Foxhome, MN (Khan et al. 2021), *S. vesicarium*
 - Five samples (2022) – Always present along with Alternaria at a very low frequency - *S. vesicarium*



Dry rot canker

- Binucleate Rhizoctonia



Acknowledgements

- **Sugarbeet Research and Education Board of Minnesota and North Dakota**
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- Seed, chemical and allied industries
- American Crystal Sugar Company quality labs – East Grand Forks and Moorhead
- U of M, NWROC facilities



Sugarbeet Pathology Team

Thank You!



Questions?

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