

Strategies for successful management of Cercospora Leaf Spot and emerging foliar diseases in Sugar Beet

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 @BeetPath

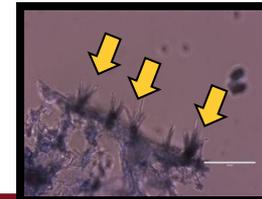


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Cercospora leaf Spot (CLS)

- *Cercospora beticola* Saccardo (1876)
- Multimillion \$\$\$ – loss of root and sucrose yield



Pseudostromata –
up to 22 months

CLS Management

- Agronomic practices
 - Crop rotation
 - Tillage (residue incorporation)
 - Weed control
 - Vegetable gardens
 - Table beets
 - Swiss chards
 - Spinach
 - Disease-free seed
 - Reduce inoculum build-up



Waterhemp, 2024



Table beets, 2023

CLS Management

- Agronomic practices
 - Crop rotation
 - Tillage (residue incorporation)
 - Weed control
- Fungicides
 - Application timing (Initiation and subsequent application)
 - Tank-mixing of systemic & contact fungicides
 - Rotation with different modes of action (MoA)



CLS Management

- Agronomic practices
 - Crop rotation
 - Tillage (residue incorporation)
 - Weed control
- Fungicides
 - Application timing (Initiation and subsequent application)
 - Tank-mixing systemic & contact fungicides
 - Rotate with different modes of action (MoA)
- Tolerant varieties
 - CR+ (since 2021)



Management of CLS

Trial #1: Susceptible Variety (4.9 rating)

Objective: Determine the effectiveness of fungicide mixtures and rotations on CLS

Methods:

- Planting Date: Apr 24, 2024
- RCBD with 4 replications
- Plot Size: 35 ft. long x 11 ft. wide (6 rows)
- Jul 03: Inoculated with dried CLS-diseased leaves collected from nontreated control plots in 2023



Methods:

Treatment	3-Jul App 1	15-Jul App 2	29-Jul App 3	12-Aug App 4	25-Aug App 5
5-Sprays (DMI start)	<u>Difenoconazole + Propiconazole + EBDC</u>	EBDC	TPTH + MBC	Prothioconazole + EBDC	TPTH + Pyraclostrobin + Fluxapyroxad
5-Sprays (EBDC start)	EBDC	<u>Difenoconazole + Propiconazole + EBDC</u>	TPTH + MBC	Prothioconazole + EBDC	TPTH + Pyraclostrobin + Fluxapyroxad
4-Sprays (DMI start)		<u>Difenoconazole + Propiconazole + EBDC</u>	TPTH + MBC	Prothioconazole + EBDC	TPTH + Pyraclostrobin + Fluxapyroxad
4-Sprays (DMI start)		Mefentrifluconazole + EBDC	TPTH + MBC	Prothioconazole + EBDC	TPTH + Pyraclostrobin + Fluxapyroxad
4-Sprays (DMI+QoI start)		Mefentrifluconazole + Pyraclostrobin + EBDC	TPTH + MBC	Prothioconazole + EBDC	TPTH + Pyraclostrobin + Fluxapyroxad
3-Sprays (DMI start)			<u>Difenoconazole + Propiconazole + EBDC</u>	TPTH + MBC	Prothioconazole + Pyraclostrobin + Fluxapyroxad
3-Sprays (Tin+MBC start)			TPTH + MBC	Prothioconazole + EBDC	TPTH + Pyraclostrobin + Fluxapyroxad
Nontreated Control	None	None	None	None	None

Mode-of-Action					
DMI	EBDC	Tin	MBC	QoI	SDHI
Difenoconazole + Propiconazole	EBDC	TPTH	MBC	Pyraclostrobin	Fluxapyroxad
Prothioconazole					
Mefentrifluconazole					



Management of CLS

Trial #1: Susceptible Variety (4.9 rating)

Methods:

- CLS severity, 0-10 scale (Jul 18 – Sept 17)
 - 1=0.1%, 2=0.35%, 3=0.75%, 4=1.5%, 5=2.5%
 - 6=3%, 7=6%, 8=12% 9=25%, 10=50% diseased leaf area
- Standardized Area Under Disease Progress Stairs (sAUDPS)
- Harvest Date: Sept 19, 2024
- Yield (rows 3 and 4) and quality parameters (12 roots/plot), ACSC quality lab



Results:

Treatment	Final CLS Rating (0-10)	CLS Severity (sAUDPS)				
5-Sprays (DMI start)	6.1	2.7 a				
5-Spray (EBDC start)	6.5	3.0 ab				
4-Sprays (DMI (Dif) start)	6.7	3.4 c				
4-Sprays (DMI (Mef) start)	6.3	3.3 bc				
4-Sprays (DMI+QoI start)	7.1	3.5 c				
3-Sprays (DMI start)	7.8	4.4 d				
3-Sprays (Tin+MBC start)	8.2	4.4 d				
Nontreated	9.9	5.4 e				
CV%		26.7				
<i>P-value</i>		<0.0001				



Results:

Treatment	Final CLS Rating (0-10)	CLS Severity (sAUDPS)	Sugar (%)	Root Yield (Tons/A)	Sucrose Yield (Lbs/A)	Gross Revenue over Nontreated
5-Sprays (DMI start)	6.1	2.7 a	15.54 b	31.2 bc	8868 b	\$783
5-Spray (EBDC start)	6.5	3.0 ab	15.19 b	32.7 c	9048 b	\$753
4-Sprays (DMI (Dif) start)	6.7	3.4 c	14.88 ab	30.9 bc	8281 b	\$539
4-Sprays (DMI (Mef) start)	6.3	3.3 bc	15.07 b	31.7 bc	8635 b	\$645
4-Sprays (DMI+Qol start)	7.1	3.5 c	15.06 b	30.6 bc	8378 b	\$604
3-Sprays (DMI start)	7.8	4.4 d	15.24 b	30.0 b	8313 b	\$627
3-Sprays (Tin+MBC start)	8.2	4.4 d	14.88 ab	30.8 bc	8319 b	\$551
Nontreated	9.9	5.4 e	13.82 a	25.4 a	6209 a	
CV%		26.7	5.0	8.9	13.2	
<i>P-value</i>		<0.0001	0.0060	<0.0001	<0.0001	



Trial #2: CR+ Variety (2.1 rating) – Nontreated Control



Trial #2: CR+ Variety (2.1 rating) – 4-Spray program

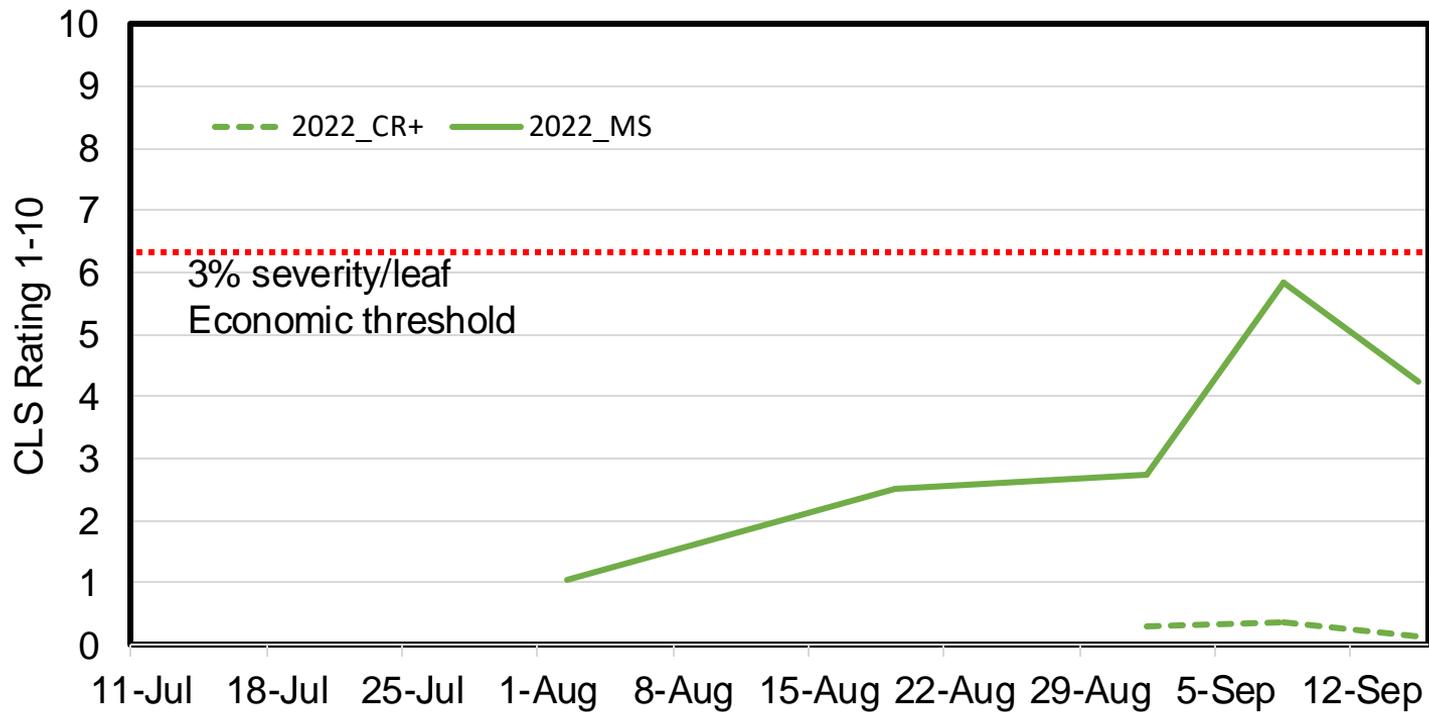


Treatment	App 2 (15-Jul)	App 3 (29-Jul)	App 4 (12-Aug)	App 5 (25-Aug)	Final CLS Rating (0-10)	Sucrose Yield (Lbs/A)
4-Spray (DMI start)	<u>Difenoconazole + Propiconazole + EBDC</u>	TPTH + MBC	Prothioconazole + EBDC	TPTH + Pyraclostrobin + Fluxapyroxad	1.4 ab	8573
Nontreated Control					4.0 e	8022

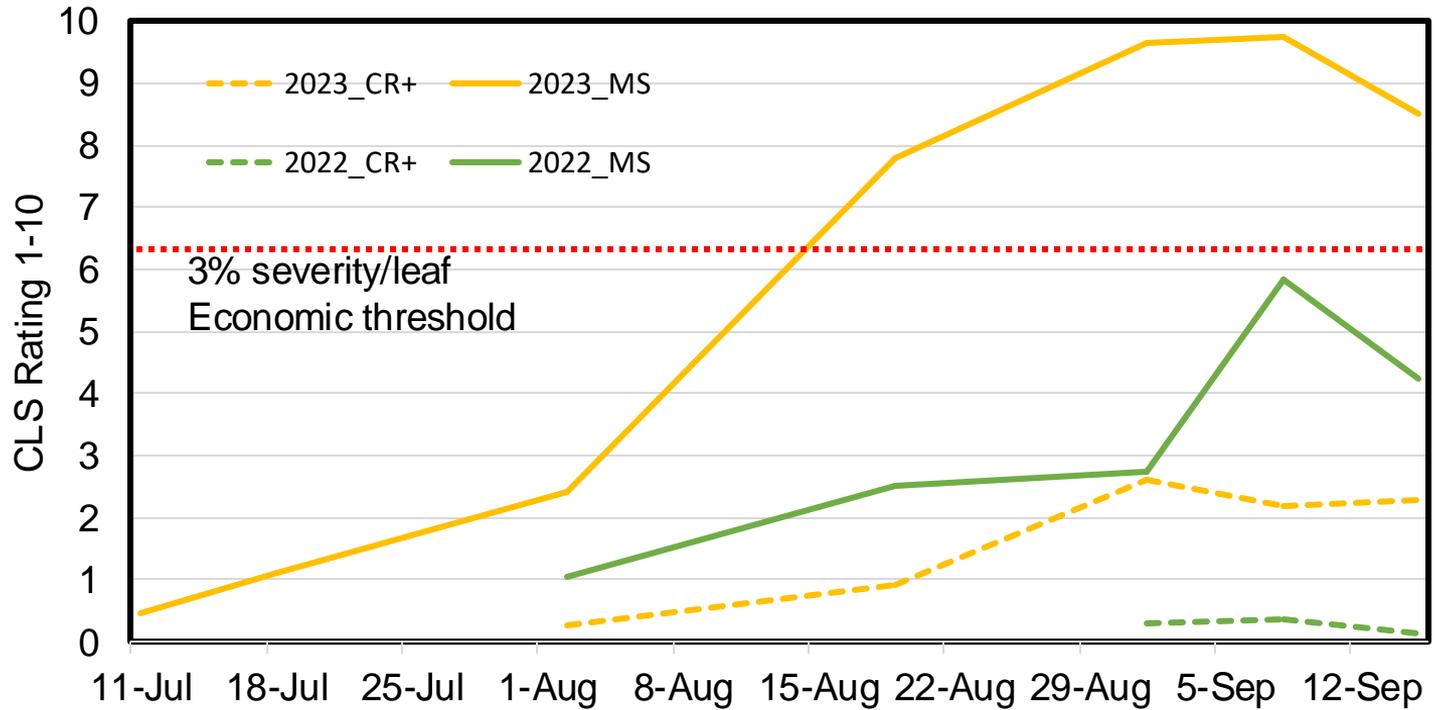
\$82 gain over Nontreated control



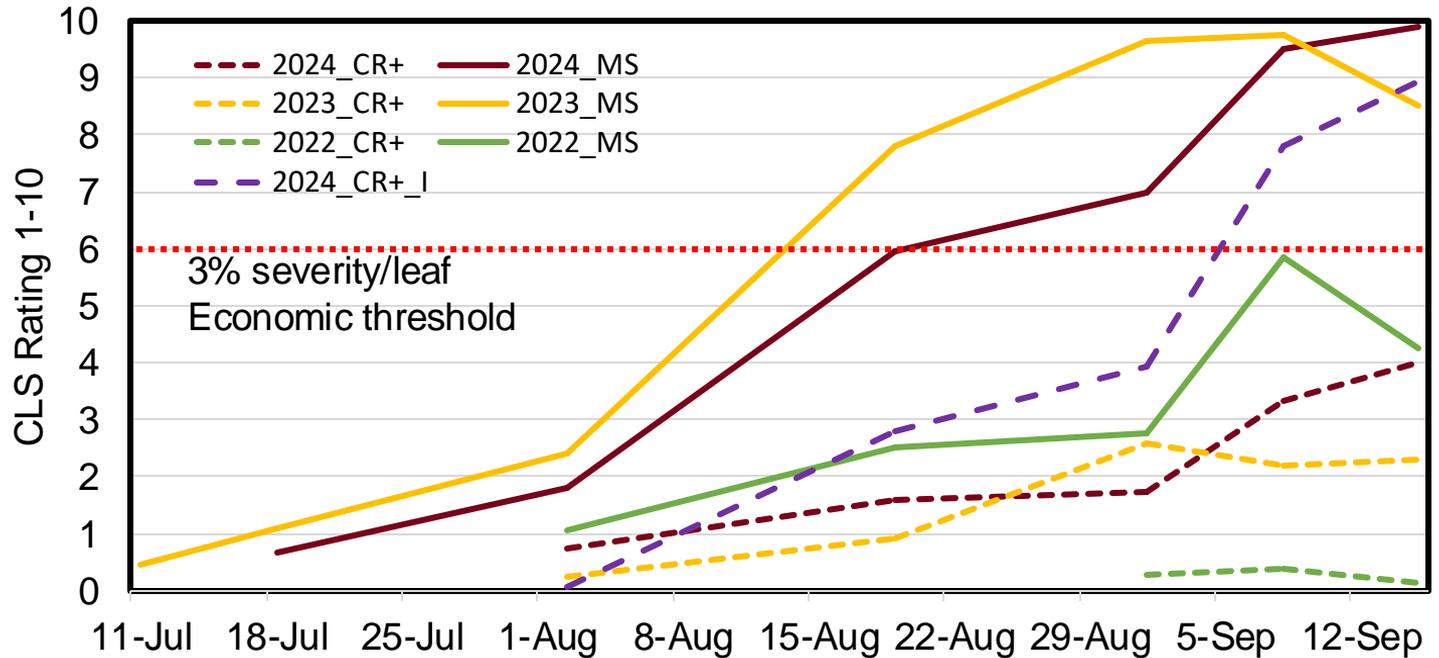
CLS Development in Nontreated Control, Crookston, MN 2022-2024



CLS Development in Nontreated Control, Crookston, MN 2022-2024



CLS Development in Nontreated Control, Crookston, MN 2022-2024



CR+ is under increased pressure from *C. beticola* ACSC CLS Nursery, Non-inoculated, Nontreated (2024)



2.6

2.9



4.2



4.8



5.0

Summary – CLS Management

- **Timely fungicide application is key**
 - Start early (at or just before row closure)
 - Maintain 10-14 days spray intervals (shorten the interval based on rain events for contact fungicides)
 - Critical when the DIV's are favorable for CLS development
- **Tank-mixing and MoA Rotation**
 - Fungicide resistance is prevalent in most growing regions
 - Tank-mixing of fungicides: Mix single site-of-action fungicides (DMIs, Qols, and MBCs etc.) with multi site-of-action fungicides (Tin, EBDC, Copper etc.)
- **CR+ varieties are tolerant to *Cercospora* but not immune**
 - *C. beticola* population is quickly adapting → CLS is showing up earlier in the season
 - CLS severity is increasing every year in the Northern Red River Valley
 - Standard fungicide program with 10-14 days interval maybe the goal



2022 Leaf Samples Diagnosis

Year	No. of Samples	<i>Cercospora</i>	<i>Alternaria</i>	<i>Stemphylium</i>
2022	17	3 (12%)	10 (59%)	6 (35%)

Samples submitted to U of Minnesota SBPP Diagnostic lab. Most agriculturists are comfortable identifying CLS, these numbers are not representative of MN and ND growing regions.

Fields can have multiple pathogens present, and percentages will be greater than 100%



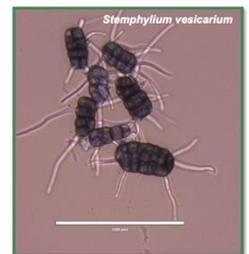
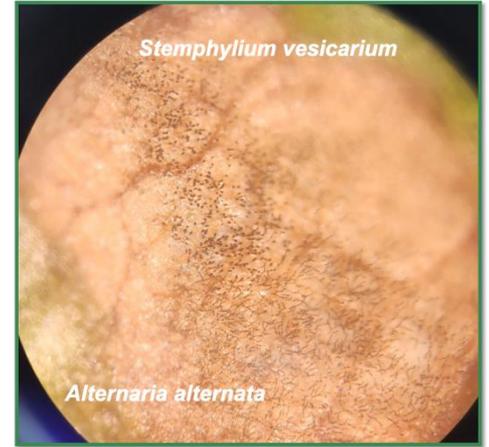
2022 Leaf Samples Diagnosis



CLS



A. alternata
S. vesicarium



A.K. Lien

2022 - 2024 Leaf Samples Diagnosis

Year	No. of Samples	<i>Cercospora</i>	<i>Alternaria</i>	<i>Stemphylium</i>
2022	17	3 (12%)	10 (59%)	6 (35%)
2023	6	6 (100%)	2 (33%)	1 (17%)
2024	61	51 (84%)	46 (75%)	22 (36%)

Samples submitted to SBPP Diagnostic lab. Most agriculturists are comfortable identifying CLS, these numbers are not representative of MN and ND growing regions

Fields can have multiple pathogens present, and percentages will be greater than 100%



2024 Leaf Samples Diagnosis



Alternaria



Alternaria
Stemphylium



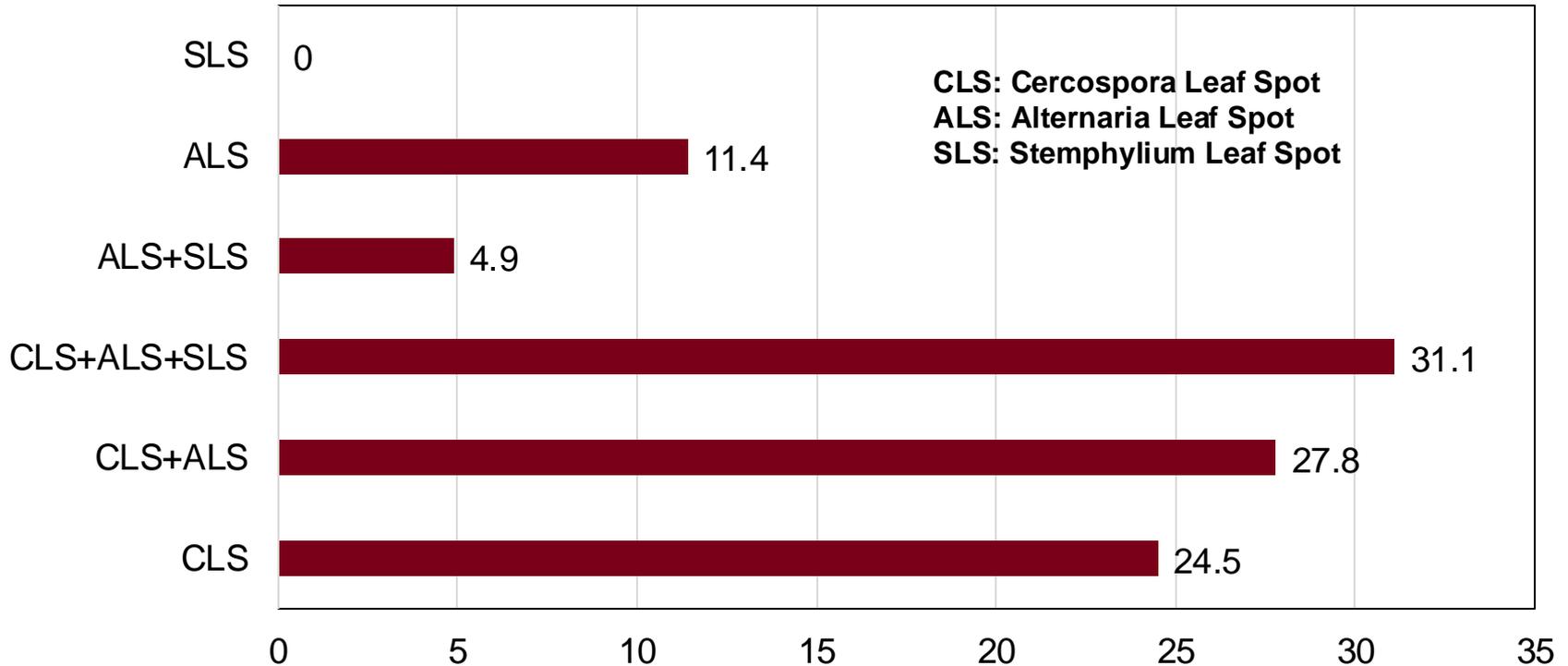
Cercospora
Alternaria



Cercospora
Alternaria
Stemphylium

2024 Leaf Samples Diagnosis

% of Samples



Alternaria

- *Alternaria* spp. became a more serious issue in Michigan since 2015
- Other hosts - **Edible beans, potatoes**
- Strong saprophyte, Drought stress and virus yellowing
- DMI (Tetraconazole) resistance

Stemphylium

- ***S. beticola***, highly virulent – Netherlands, 2007
- ***S. vesicarium*** – mild symptoms - Michigan (2019), MN and ND 2021, 2022, and 2024
- Always present along with *Alternaria* at a very low frequency
- Other hosts- **Potato, Spinach, Table beets**



2024 Field Trial

Objectives:

- Are CR+ varieties more susceptible to ALS and SLS than non-CR+ varieties?
- Does a standard CLS fungicide program control ALS and SLS?

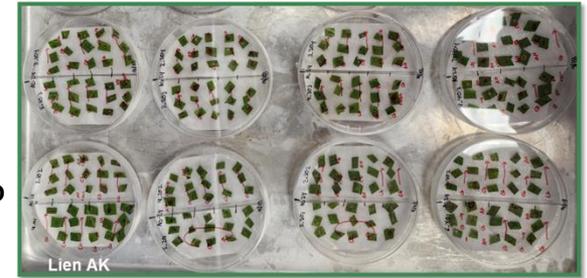


2024 Field Trial

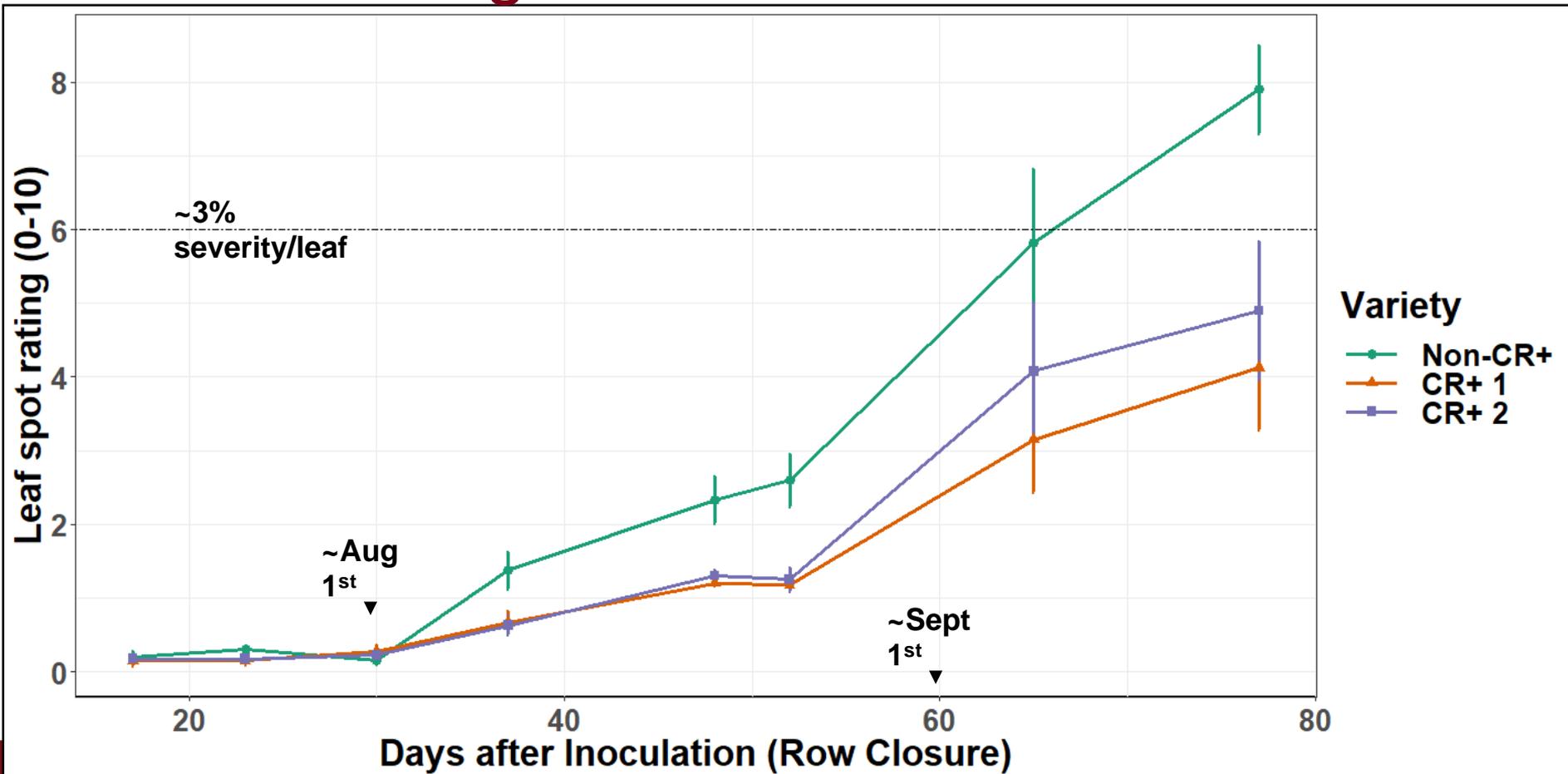


Methods:

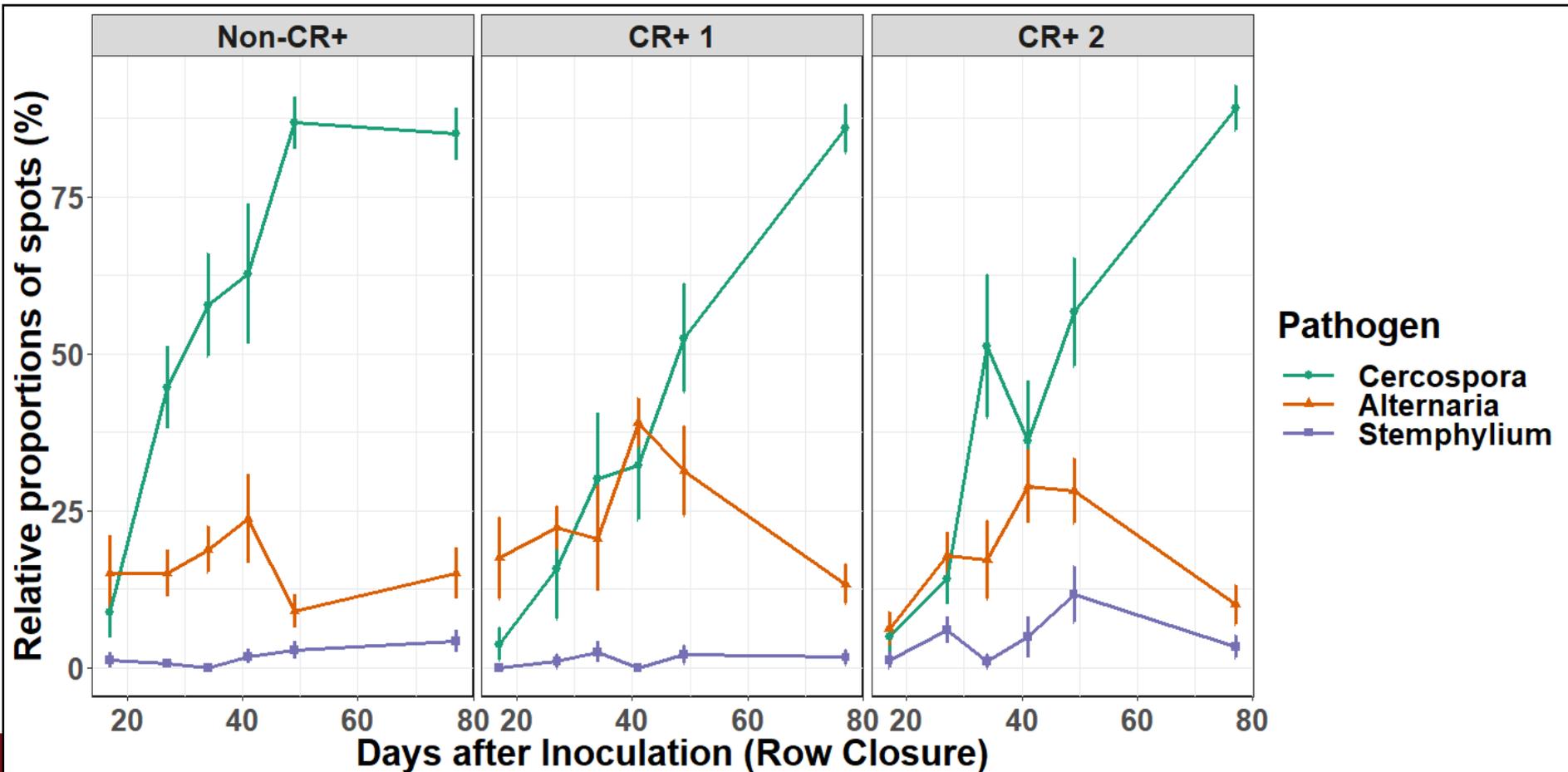
- One CLS Susceptible variety (4.9 rating)
- Two CR+ Varieties (2.1 rating)
- Inoculated with three *A. alternata* + three *S. vesicarium* isolates (Jul 02, infested sorghum, 20 lbs/A)
- Leaf Spot Severity, 0-10 scale
 - 1=0.1%, 2=0.35%, 3=0.75%, 4=1.5%,
 - 5=2.5%, 6=3%, 7=6%, 8=12% 9=25%, 10=50%
- **Proportion of type of leaf spot**



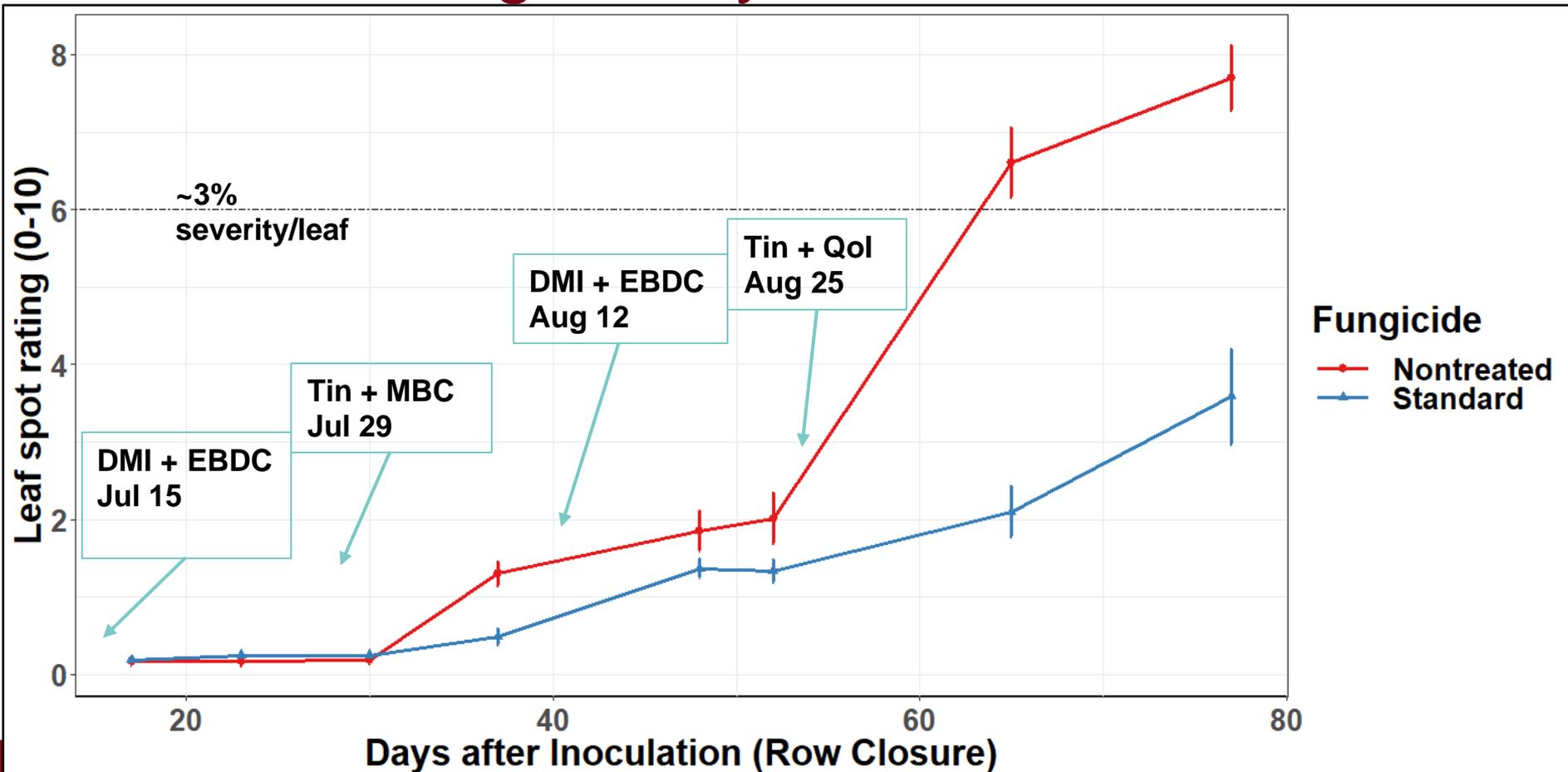
Disease Progress: Varieties



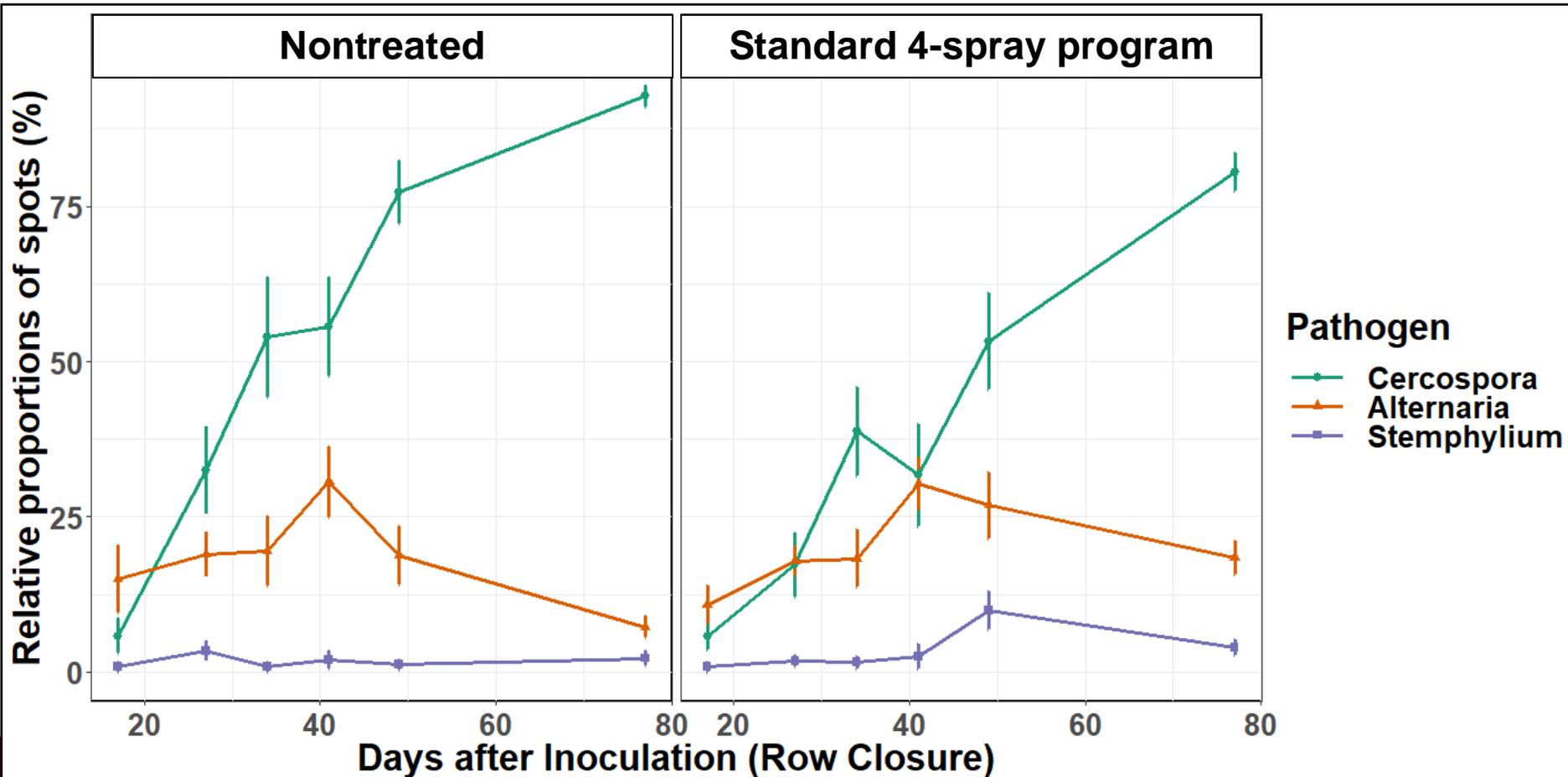
Proportion of Spots over Time: Varieties



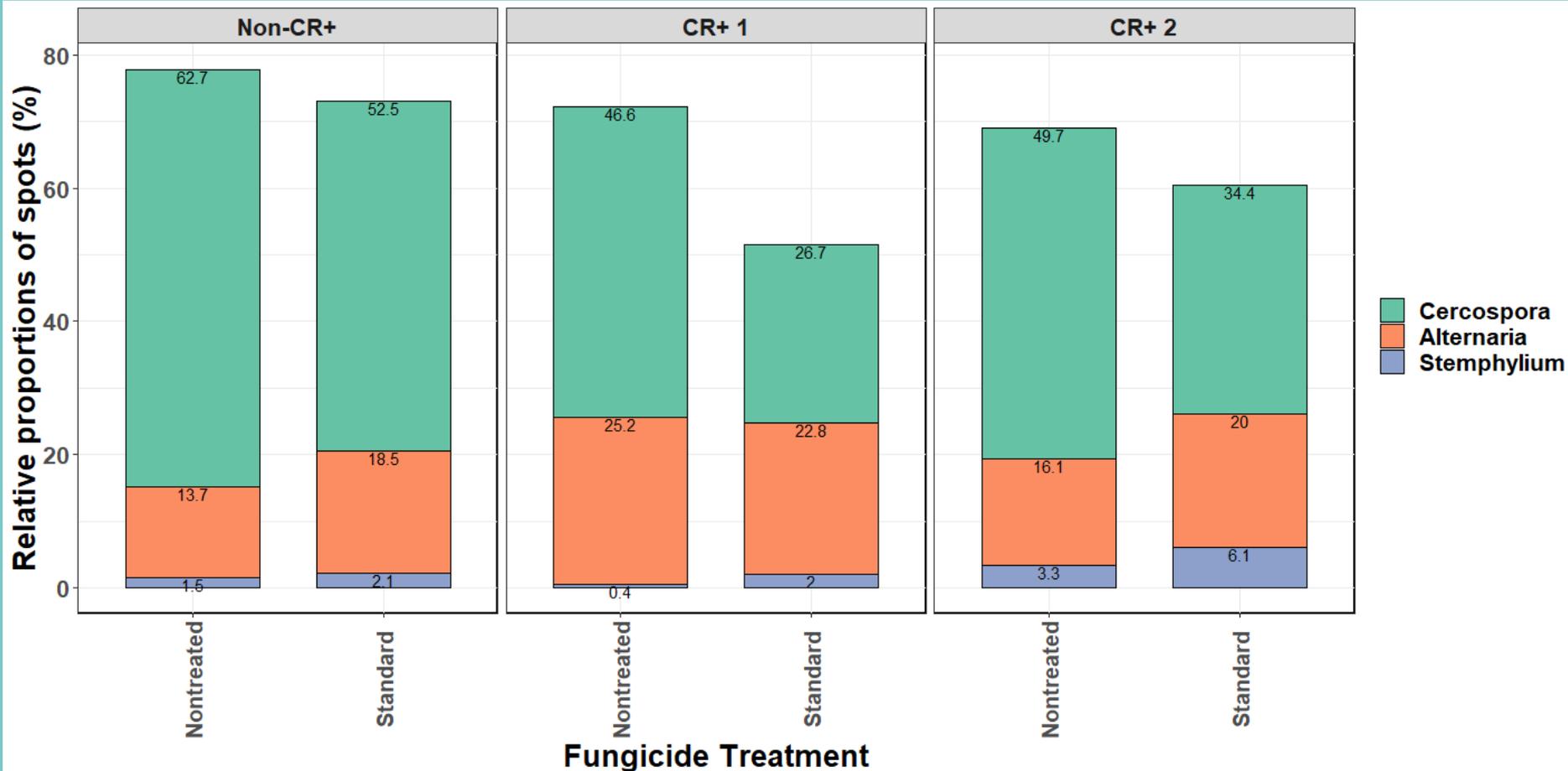
Disease Progress by Treatment



Proportion of Spots over Time: Treatments



Proportion of Spots among Treatments



Summary – Emerging Leaf Diseases

- CR+ varieties had lower leaf spot severity
- Standard CLS fungicide program significantly reduced leaf spot severity in all varieties with CLS dominating by the end of the season.
- Proportion of ALS and SLS were similar in all varieties
- SLS remained low throughout the season
- ALS was moderate and prevalent during mid-season
- Need to screen Alternaria and Stemphylium for fungicide sensitivity
- Need to evaluate efficacy of individual fungicides for ALS and SLS in the field



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- American Crystal Sugar Company quality labs – East Grand Forks and Moorhead
- U of M, NWROC facilities



Sugarbeet Pathology Team



Thank You!

Questions?

My Team
Poster #40
Poster #46



"World's Largest Sugar Beet"

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