# Sugarbeet Disease Management

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2025 ACSC Grower Seminar

# Importance of Correct Diagnosis

Aphanomyces
Rhizoctonia

# Importance of Correct Diagnosis

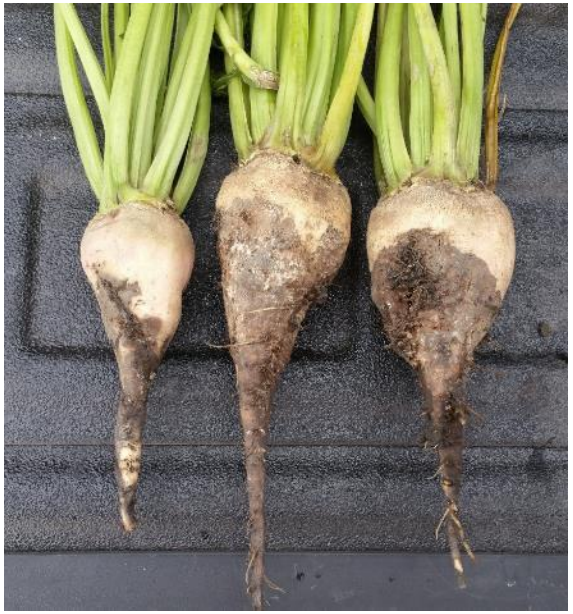


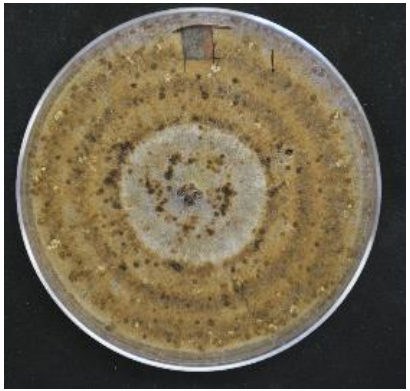
Rhizoctonia + Aphanomyces

# Rhizoctonia Damping-off

# Rhizoctonia Crown Rot

# Rhizoctonia Root Rot





AG 2-2 IIIB

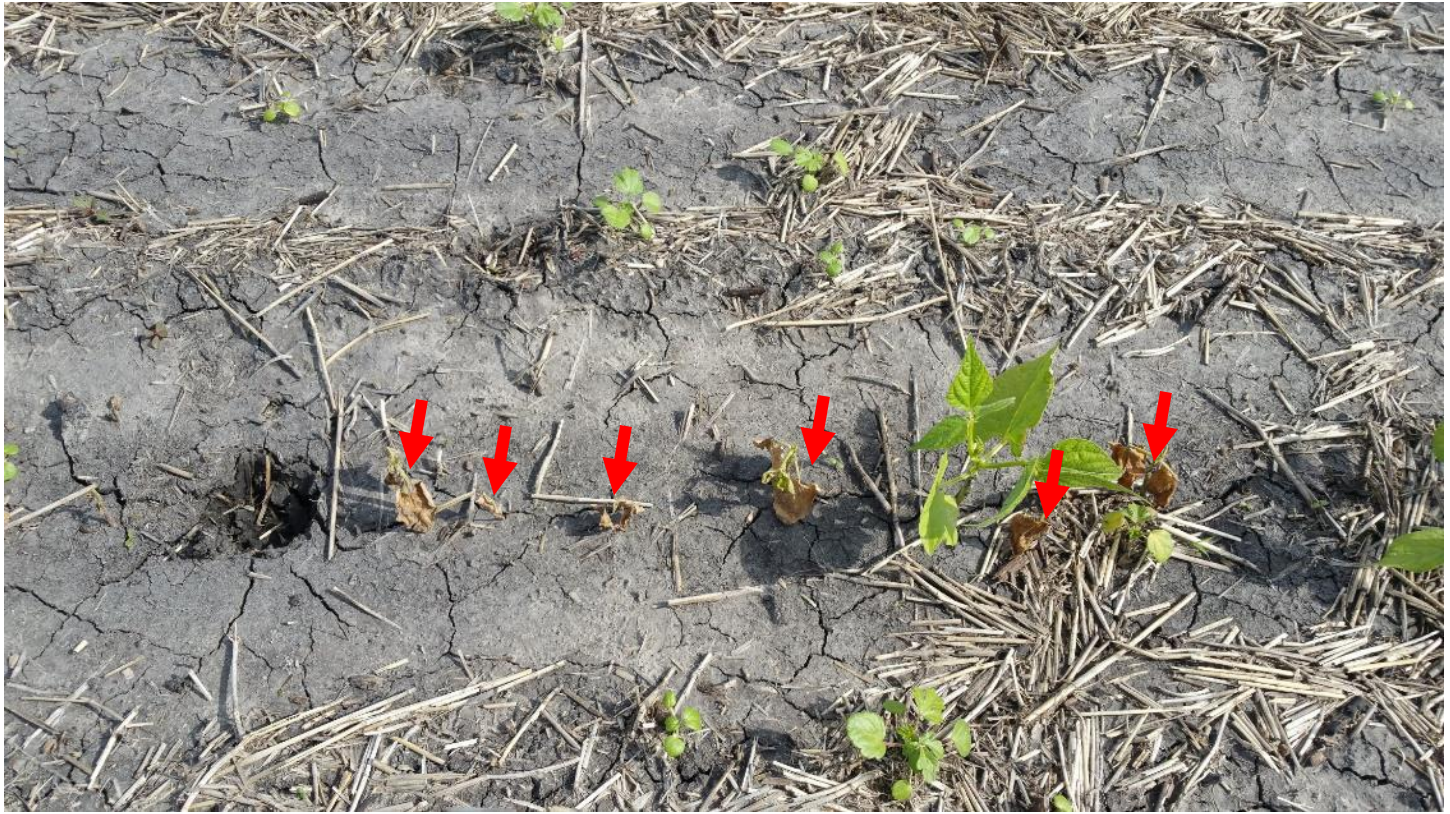
AG 2-2 IV

# Key points about Rhizoctonia

- *Rhizoctonia solani*– AG 2-2 (IIIB & IV), AG 4 groups
- Wide host range- Sugarbeet, soybean, edible beans, corn, including weeds

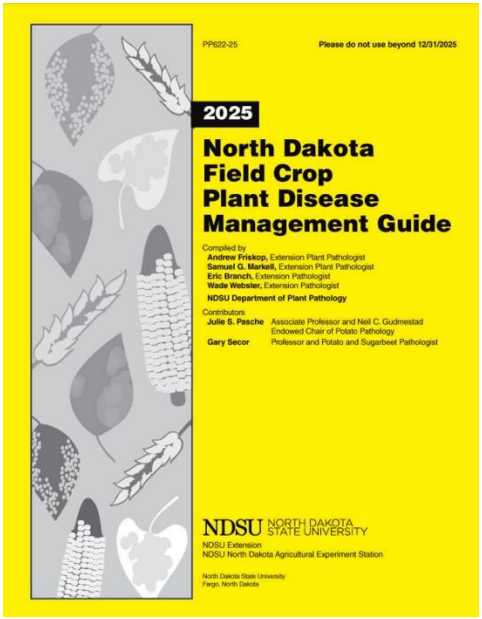
# Soybeans

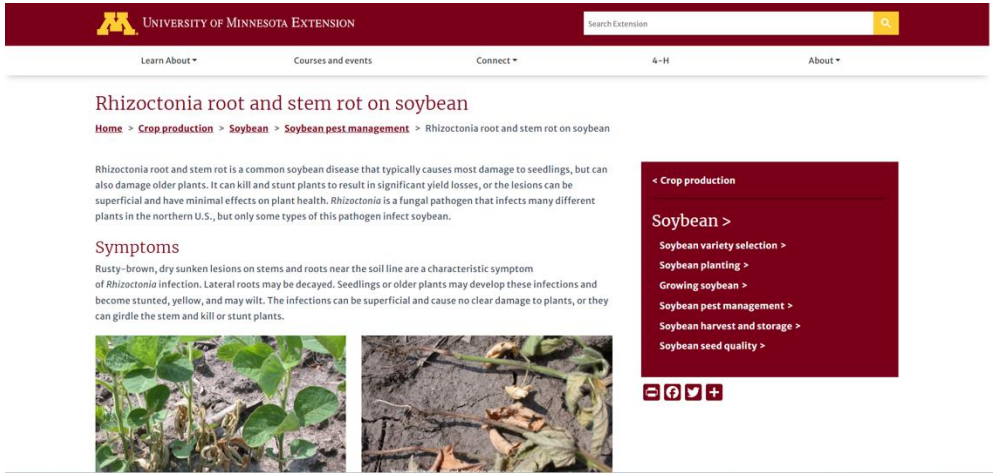
# Navy beans



# How to manage in Rotation Crops?

- Seed treatments
  - Fluxapyroxad, Sedaxane, Rizolex
- In-furrow application
  - Azoxystrobin, Pyraclostrobin
- POST application
  - Azoxystrobin, Pyraclostrobin

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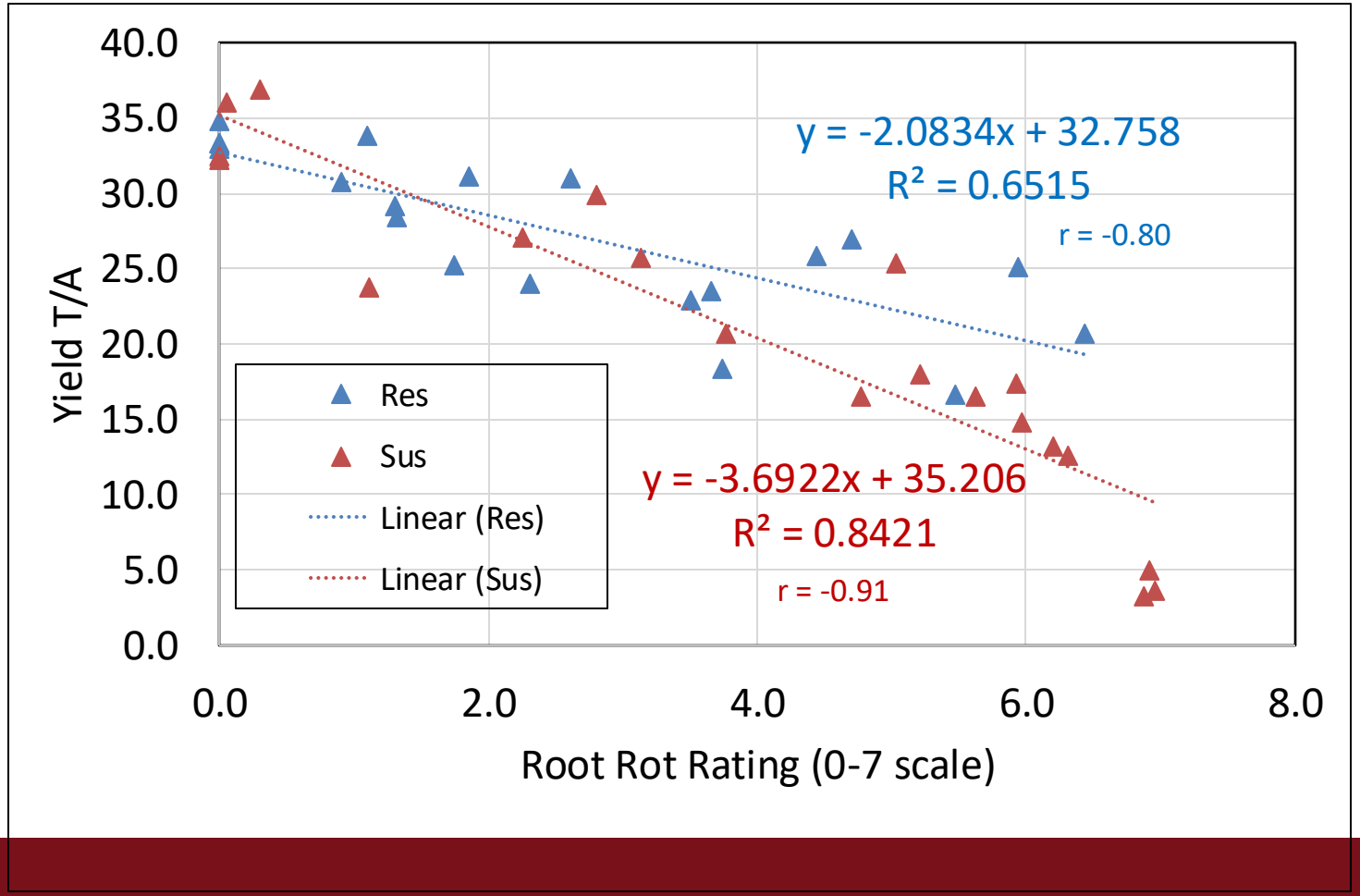
# Key points about Rhizoctonia

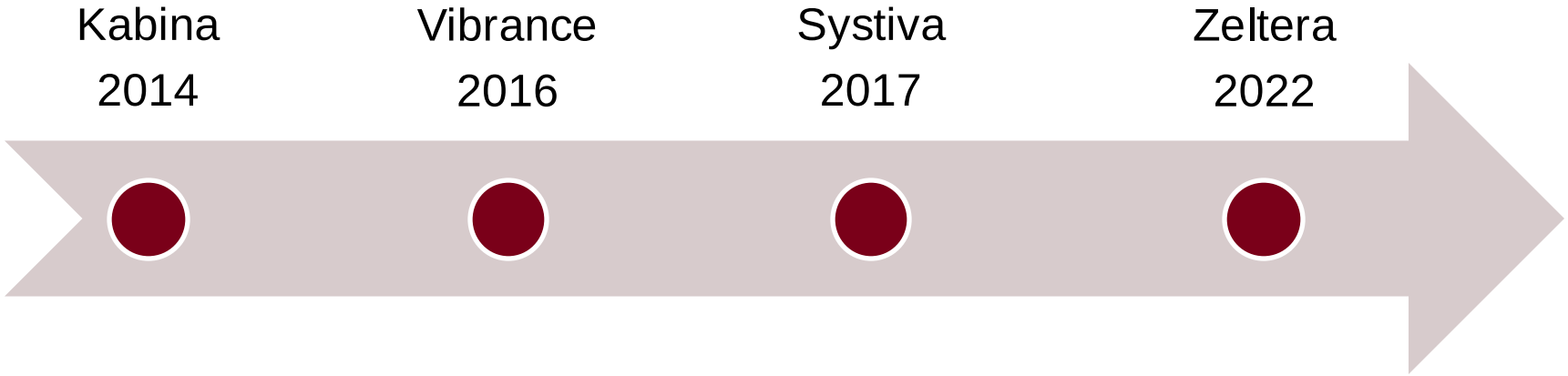
- *Rhizoctonia solani*– AG 2-2 (IIIB & IV), AG 4 groups
- Wide host range- Sugarbeet, soybean, edible beans, corn, including weeds
- Survival: 2-3 years in soil as dormant sclerotia
- How deep in the soil? 4 (common) to 6 inches
- Distribution in a field– entire field vs patchy
- Cultivation → soil in the crown → crown rot
- Overall goal → to reduce the inoculum

# Resistant Variety Matters!



# Seed Treatments

- SDHI class of fungicides (**S**uccinate **D**e**H**ydrogenase **I**nhibitor, FRAC group 7)
- Single site of action - Inhibit fungal respiration



# In-furrow Fungicides

- Do a jar test for compatibility for mixing
- Agitation in the tank is important to avoid nozzle clogging

My Trials:

- Fungicide in 6 gal. water applied via drip tube (2024)
- Fungicide in 3 gal. water + 10-34-0 @ 3 gal. applied via drip tube (past years)

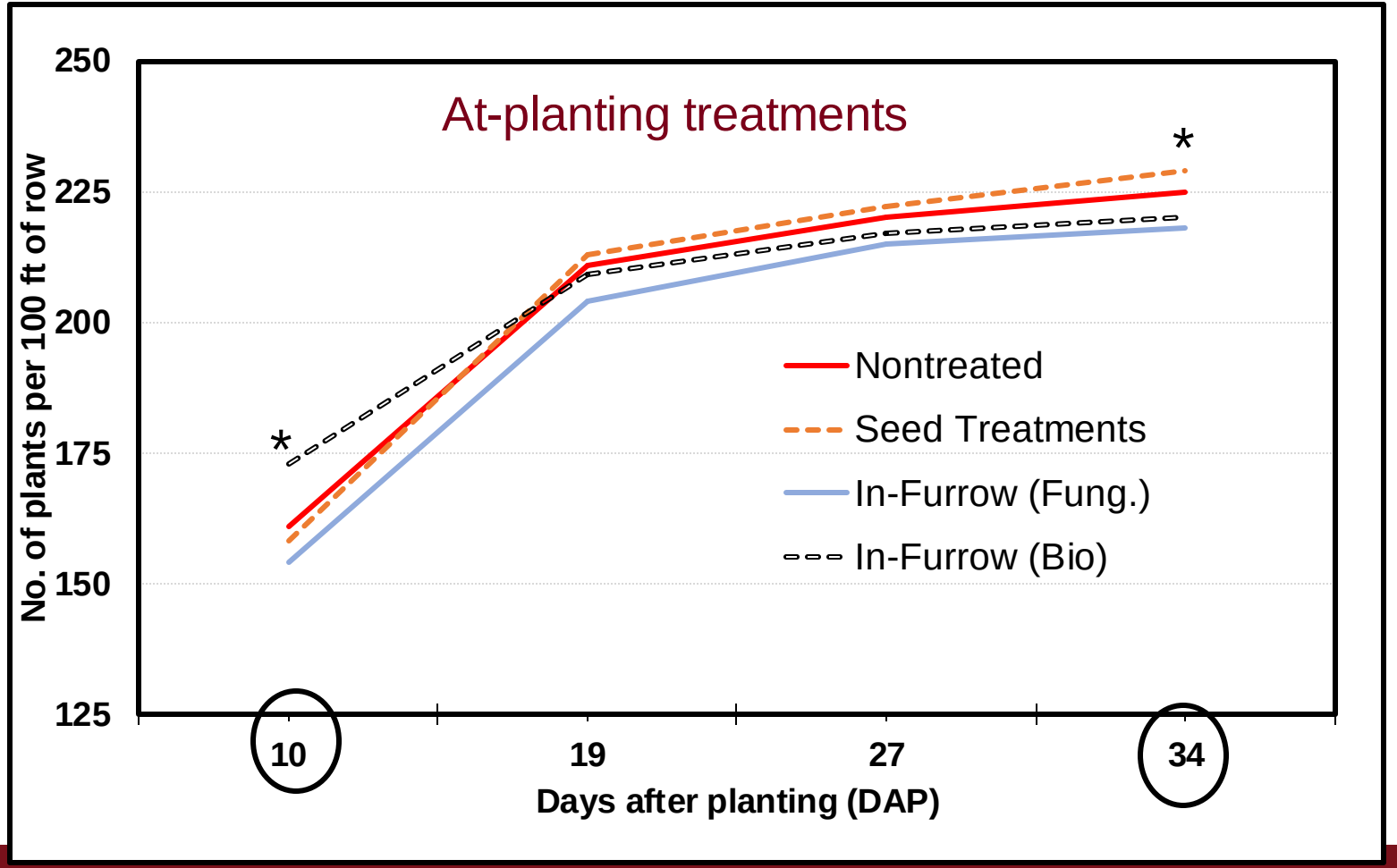
# In-furrow Fungicides (rates per acre)

**Conventional**

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

**Biologicals**

- Zironar: *Bacillus licheniformis* FMCH001 + *B. subtilis* FMCH002
- Bexfond: *B. amyloliquefaciens* subsp. *plantarum* FZB42
- Serenade ASO: *B. subtilis* QST713


At-planting treatments
No. of plants per 100 ft of row
250
225
200
175
150
125
10
19
27
34
Days after planting (DAP)
*
*
Nontreated
Seed Treatments
In-Furrow (Fung.)
In-Furrow (Bio)

# 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

# At-planting treatments

| Application Type | Root Rot Severity (%) | Sucrose (%) | Recoverable sucrose (lbs/ton) | Root yield (tons/A) | Recoverable sucrose yield (lbs/A) |
|---|---|---|---|---|---|
| **Nontreated** | 3.7 ab | 15.0 ab | 300 ab | 33.1 | 9954.5 |
| **Seed treatment** | 2.4 ab | 14.7 a | 294 a | 32.7 | 9610.9 |
| **IF_Fungicides** | **1.7 a** | 15.0 ab | 300 ab | 31.6 | 9472.6 |
| **IF_Biologicals** | 4.2 b | **15.2 b** | **304 b** | 31.1 | 9466.8 |
| *p*-value | **0.0227** | **0.0684** | **0.0684** | 0.2030 | 0.6510 |

# Postemergence Fungicides (rates per acre)

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

- Quadris 10 & 14.5 fl oz (QoI)
- AZteroid 9.2 fl oz  (QoI)
- AZterknot 16.6 fl oz (QoI + Knotweed extract)
- 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)

# Postemergence Fungicides

| Treatment Type | Harvested Roots | Plant Loss (%) | Root Rot Severity (%) | Root Rot Incidence (%) | Sugar (%) | SLM (%) | Root Yield (tons/A) | RSA (lbs/A) |
|---|---|---|---|---|---|---|---|---|
| Nontreated Control | 172 | 24.7 | 16.7 b | 37.5 | 16.13 | 1.88 | 29.6 | 8432 |
| | | | | | | | | |
| **Band vs Broadcast Contrast** | | | | | | | | |
| 7- Band | 202 | 9.6 | 0.2 | 1.6 | 16.55 | 1.80 | 33.1 | 9777 |
| Broadcast | 197 | 11.1 | 1.0 | 3.8 | 16.43 | 1.83 | 32.9 | 9612 |
| *P*- value | 0.3041 | 0.4142 | 0.2704 | **0.0670** | 0.2560 | 0.2237 | 0.8125 | 0.5013 |

**Gain of 1180- 1345 lbs RSA over nontreated control**

**Band: + $350 over nontreated control**

**Broadcast: + $293 nontreated control**

# Fungicides for Rhizoctonia - MoA

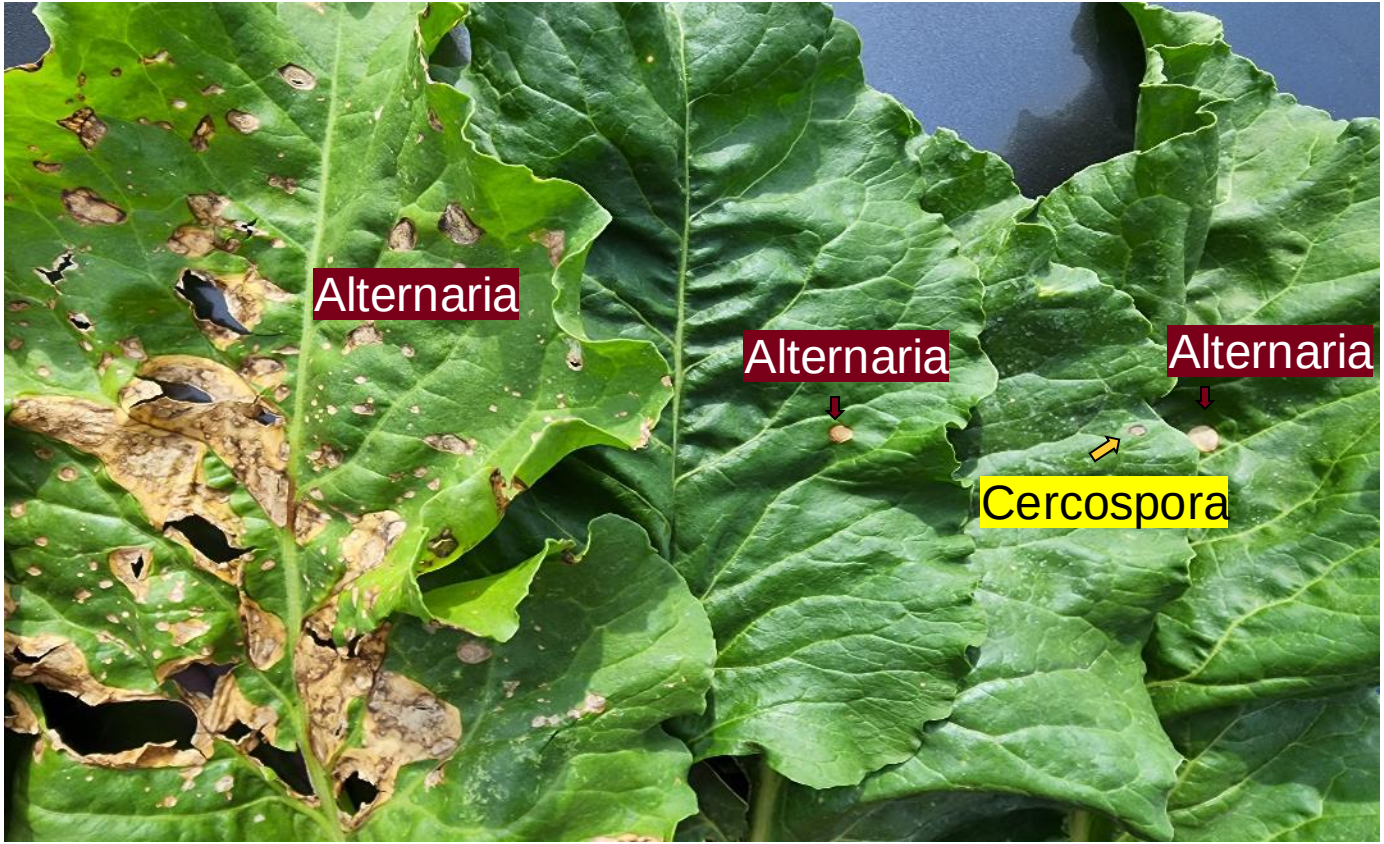
| Seed Treatment | | | In-Furrow | | | POST | | |
|---|---|---|---|---|---|---|---|---|
| Kabina | | | Headline | | | Quadris | | |
| Systiva | | | Quadris | | | Elatus | | |
| Vibrance | | | Elatus | | | AZterknot | | |
| Zeltera | | | AZteroid | | | Excalia | | |
| | | | Proline | | | Topguard EQ |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

Mode of Action | SDHI | QoI | DMI |

# Strategies for full-season Rhizoctonia management

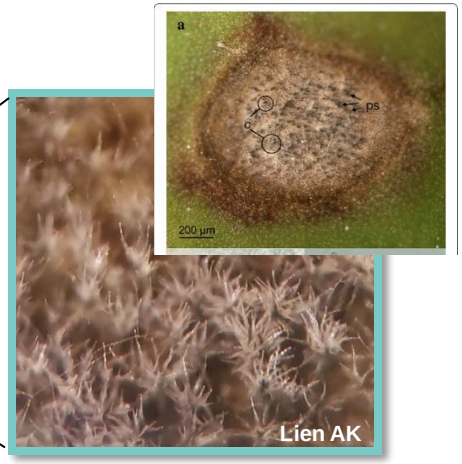
- **Varietal Selection**
  - Resistant variety can make a difference under severe disease pressure
  - Severe disease pressure can overwhelm a susceptible variety
- **Seed treatment**
  - Provide excellent early-season protection (Kabina, Systiva, Vibrance, Zeltera, Metlock suite + Kabina, alone or in combination)
- **In-furrow fungicide application**
  - Early to mid-season protection
  - Some stand loss under dry and/or cool conditions, additional injury with starter fertilizers
- **Postemergence fungicide application**
  - 4- to 8-leaf stage window for application (susceptibility = earlier application)
  - Band and Broadcast applications work well
- **Best Management Practices**
  - Seed treatment + POST – Most fields
  - Seed treatment + in-furrow + POST – For fields with severe disease history

# Leaf spots are getting tricky!



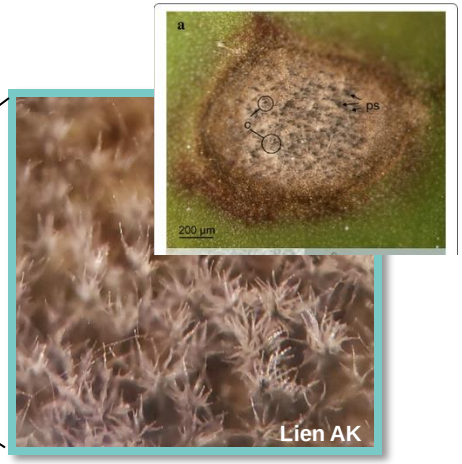
# Cercospora Leaf Spot (CLS)

- *Cercospora beticola*
- Agronomic practices
  - Crop rotation
  - Tillage (residue incorporation)
  - Weed control




# Cercospora Leaf Spot (CLS)

- *Cercospora beticola*
- Agronomic practices
  - Crop rotation
  - Tillage (residue incorporation)
  - Weed control
- Fungicides
  - Timely application
  - Systemic & contact
  - Rotate with different MoA
- Tolerant varieties




# Available fungicides

## Systemic

- DMI or Triazoles
  - InspireXT
  - Provysol
  - Proline
  - Domark, Minerva
  - Topguard

## Systemic

- Benzimidazole
  - Topsin
- Strobilurins
  - Priaxor
  - Headline
  - Veltyma

## Contact

- EBDC
  - Mazate Pro-Stick
- Tin
- Copper
  - Badge
  - Kocide

Listing a few examples, it's not an endorsement of products listed here

# Susceptible Variety (4.9 rating) - Untreated

# Management of CLS – Susceptible Variety (4.9 rating)

| App 1 (3-Jul) | App 2 (15-Jul) | App 3 (29-Jul) | App 4 (12-Aug) | App 5 (25-Aug) | Final CLS Rating (0-10) | RSA (lbs/A) | Gross Revenue/A ($) | |
|---|---|---|---|---|---|---|---|---|
| Inspire XT + Mancozeb | Mancozeb | Tin + Topsin | (Proline + NIS) + Mancozeb | Tin + Priaxor | 6.1 a | 8868 b | $1721.9 | +$783 |
| **Nontreated Control** | | | | | **9.9 d** | **6209 a** | **$938.7** | |
| *P*- value | | | | | **<0.0001** | **<0.0001** | | |

MoAs: DMI EBDC Tin Topsin QoI+SDHI

**Gain of 2659 lbs RSA over nontreated control**

# CR+ Variety (2.1 rating) - Untreated

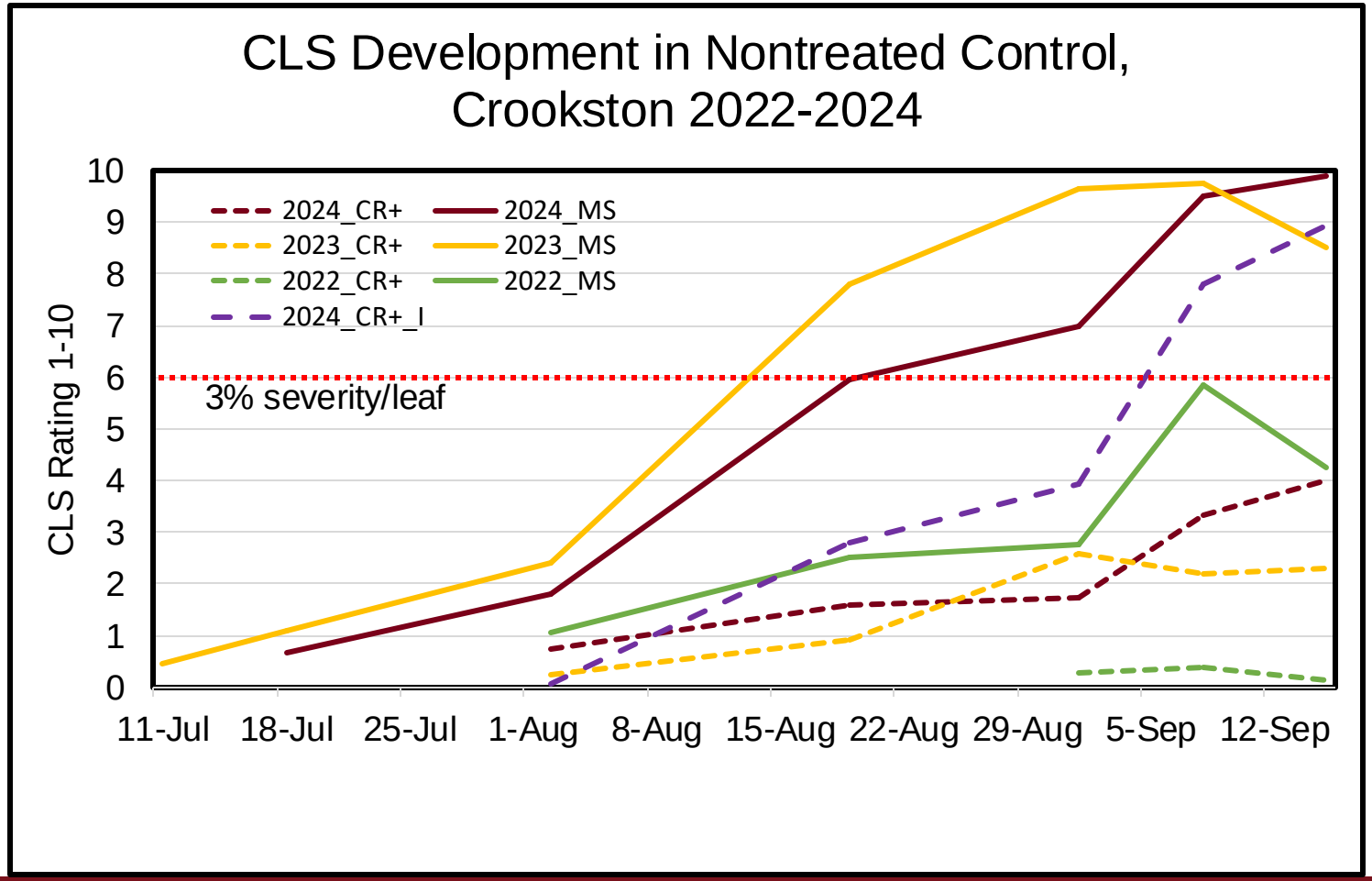
# CR+ Variety (2.1 rating) – 4 spray program

# Management of CLS – CR+ Variety (2.1 rating)

| App 2 (15-Jul) | App 3 (29-Jul) | App 4 (12-Aug) | App 5 (25-Aug) | Final CLS Rating (0-10) | RSA (lbs/A) | Gross Revenue/A ($) | |
|---|---|---|---|---|---|---|---|
| Inspire XT + Mancozeb | Tin + Topsin | (Proline + NIS) + Mancozeb | Tin + Priaxor | 1.4 ab | 8573 | $1780.5 | +$82 |
| Nontreated Control | | | | **4.0 e** | **8022** | **$1698.1** | |
| *P*- value | | | | **<0.0001** | **0.9673** | | |

MoAs: DMI EBDC Tin Topsin QoI+SDHI

**Gain of 551 lbs RSA over nontreated control**


CLS Development in Nontreated Control, Crookston 2022-2024
CLS Rating 1-10
10
9
8
7
6
5
4
3
2
1
0
2024_CR+
2024_MS
2023_CR+
2023_MS
2022_CR+
2022_MS
2024_CR+_I
3% severity/leaf
11-Jul
18-Jul
25-Jul
1-Aug
8-Aug
15-Aug
22-Aug
29-Aug
5-Sep
12-Sep

# CR+ is under increased pressure from Cercospora
# ACSC CLS Nursery, Non-inoculated, Nontreated (2024)

2.6

2.9

4.2

4.8

5.0

# Summary – Cercospora Leaf Spot Management

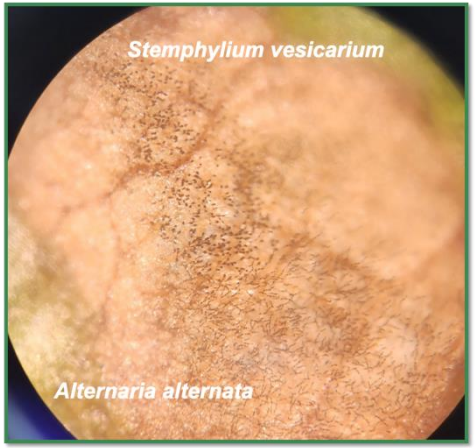
- **Timely fungicide application is key**
  - Maintain 10-14 days spray intervals (shorten the interval based on rain events for contact fungicides)
  - Critical when the DIV's are favorable for CLS development, early is on-time for CLS
- **Rotate Fungicides with different Modes of Action (MoA)**
  - Fungicide resistance is prevalent in most growing regions
  - Tank-mixing of fungicides: Mix single site-of-action fungicides (DMIs, QoIs, 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

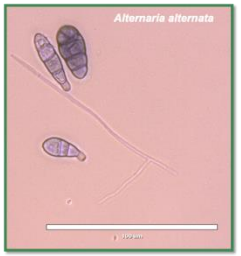
# 2022 Leaf Samples Diagnosis

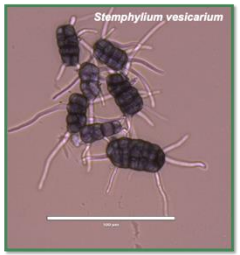
CLS



Positive for Alternaria & Stemphylium




A.K. Lien

# 2022 - 2024 Leaf Samples Diagnosis

| Year | No. of Samples | *Cercospora* | *Alternaria* | *Stemphylium* |
|---|---|---|---|---|
| 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 agriculturist 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 Alternaria Leaf Spot (ALS)

*A. alternata*

# 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

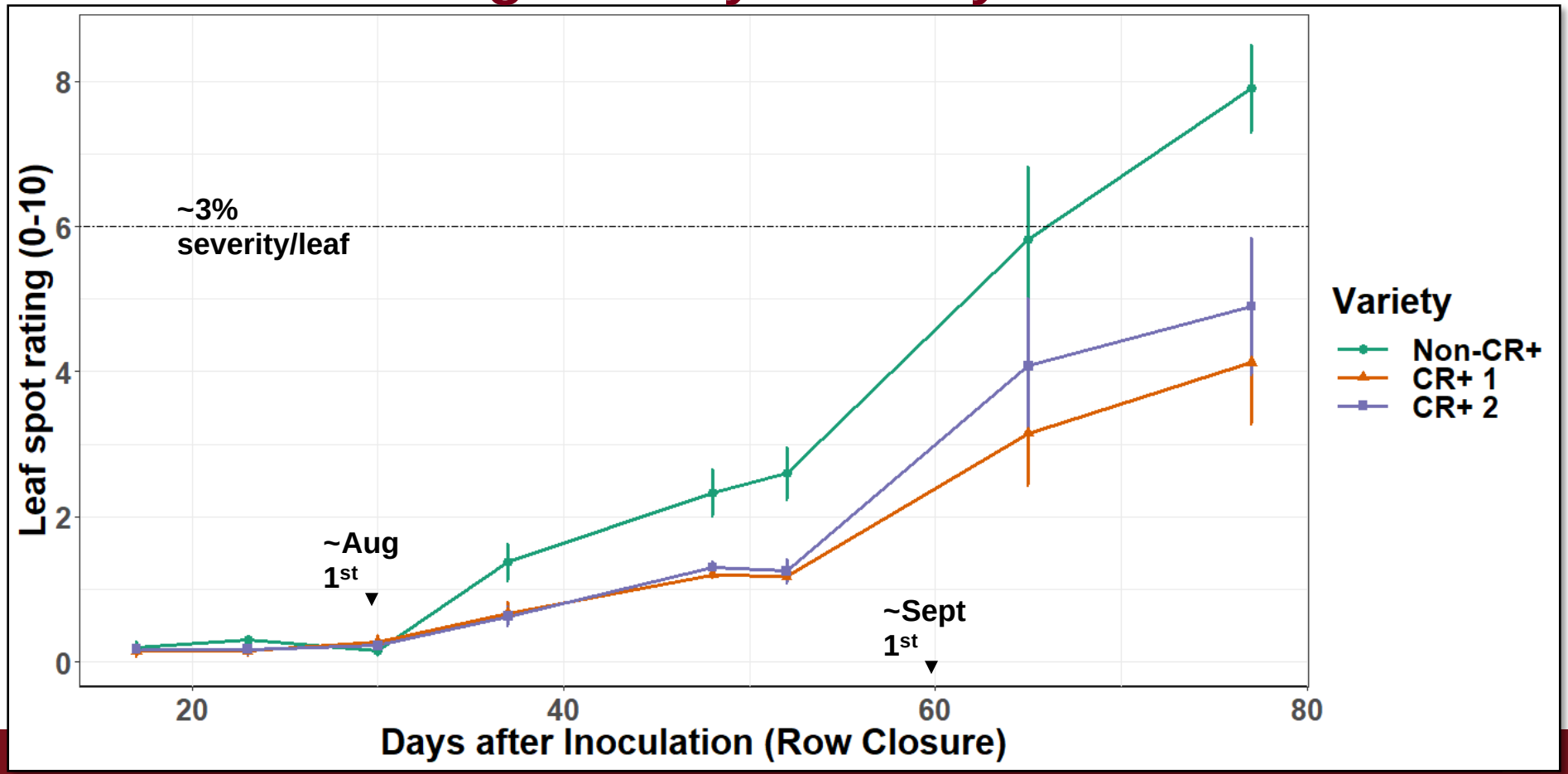
# Stemphylium

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

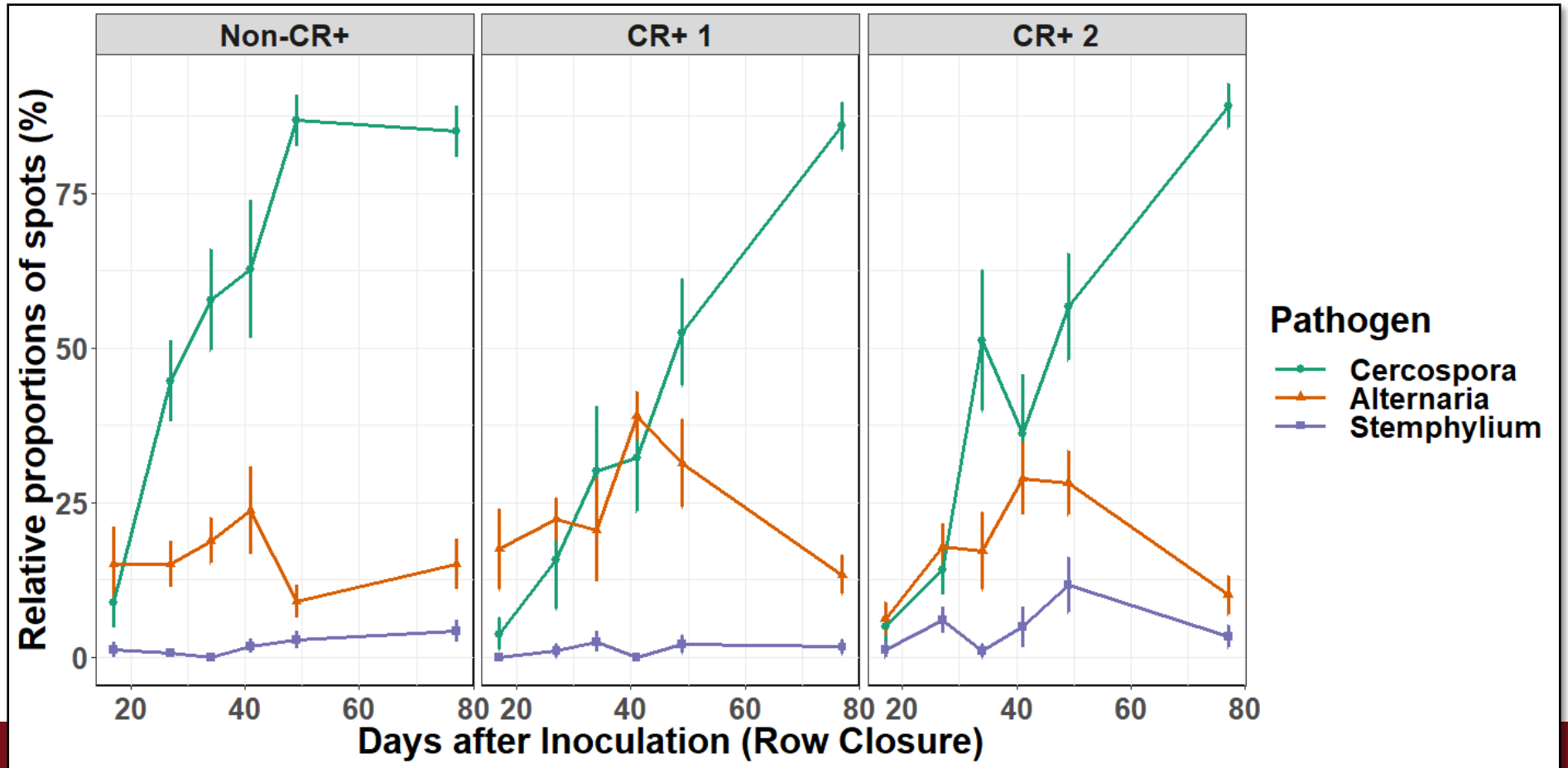
# 2024 Field Trial

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

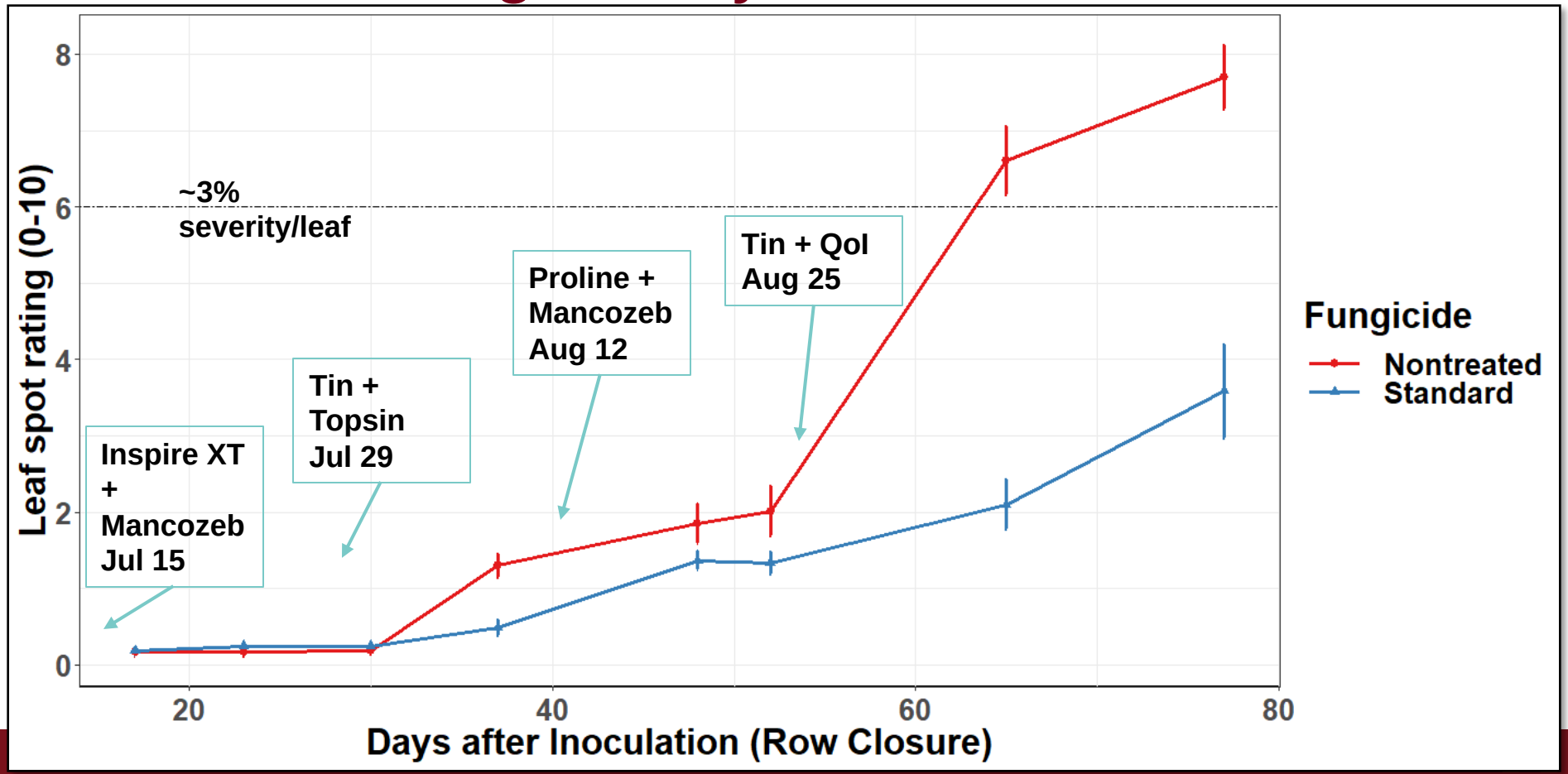
# Disease Progress by Variety



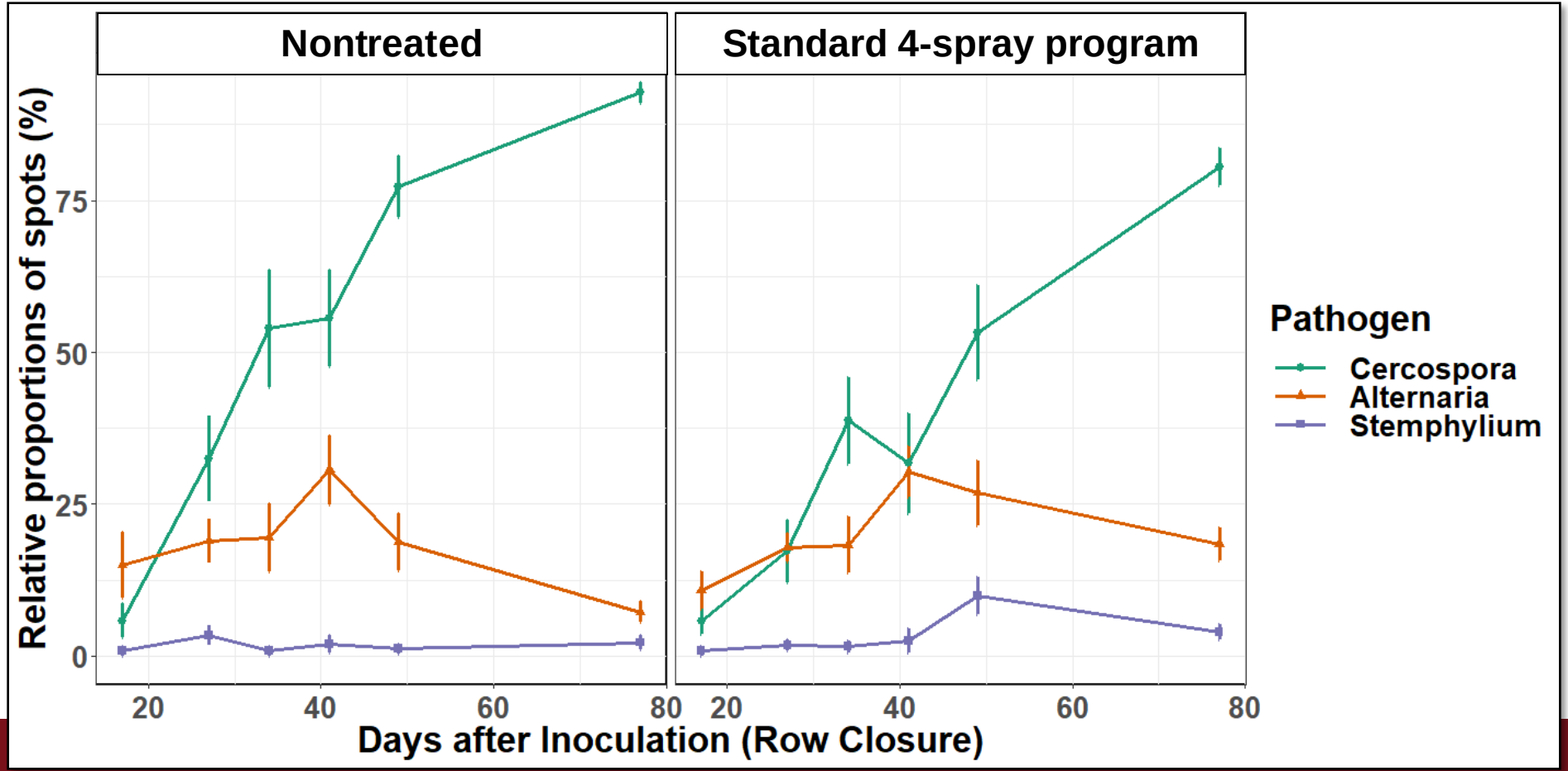
# Proportion of Spots over Time: Varieties



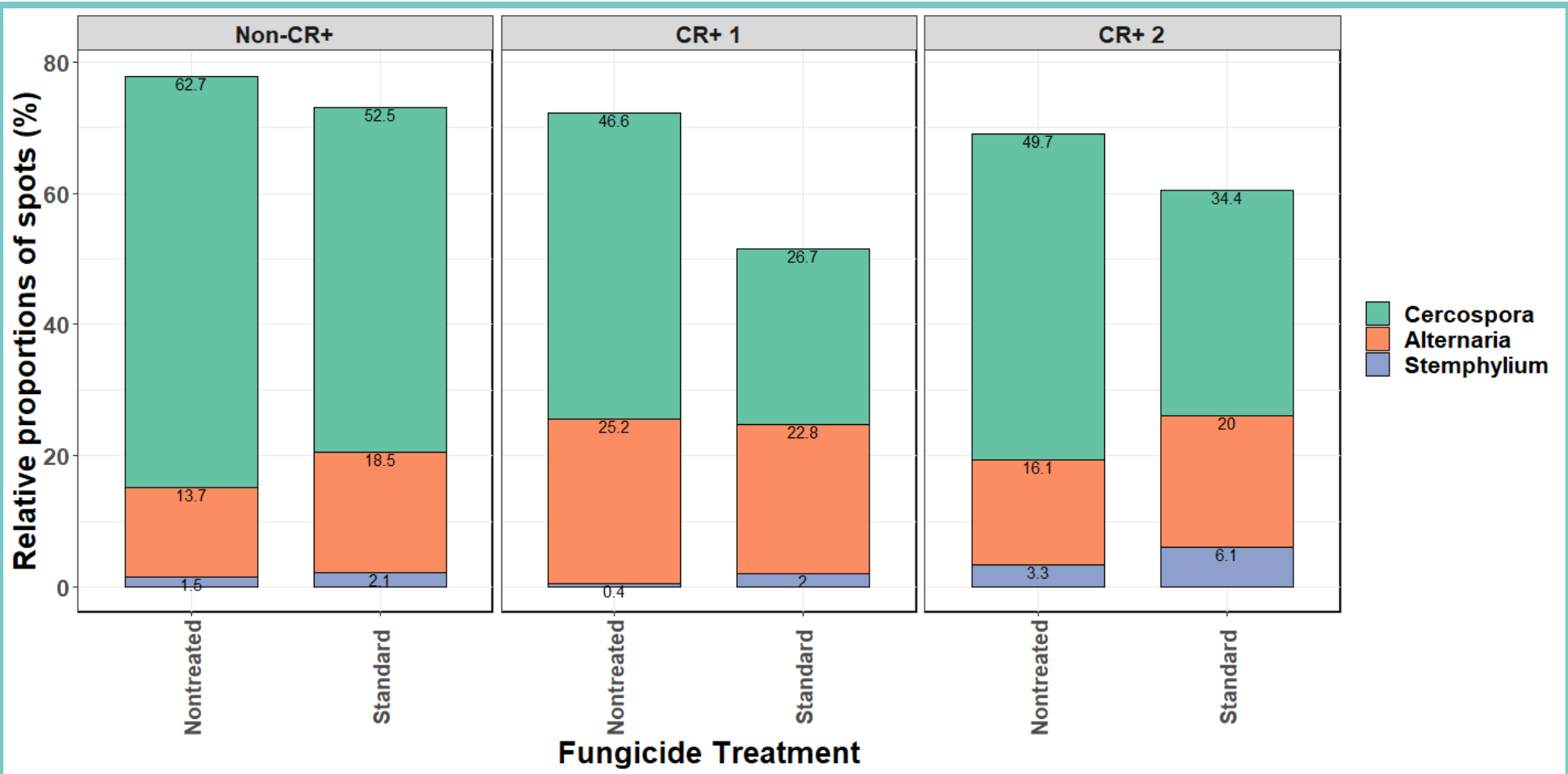
# Disease Progress by Treatment



# 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 leas 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

# Acknowledgements


- **Sugarbeet Research and Education Board of Minnesota and North Dakota**
- USDA-NIFA for partial support of MAES
- American Crystal Sugar Company
- Scott Pahl, Germains Seed Technology
- Seed, chemical, and allied industries
- American Crystal Sugar Company quality labs – East Grand Forks and Moorhead
- U of M, NWROC facilities
- NWROC core research support team

# Thank You!

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# Questions?