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@BeetPath

Don’t Let the Root Rots Beat your Beets

2019 ASCS Growers’ Seminar

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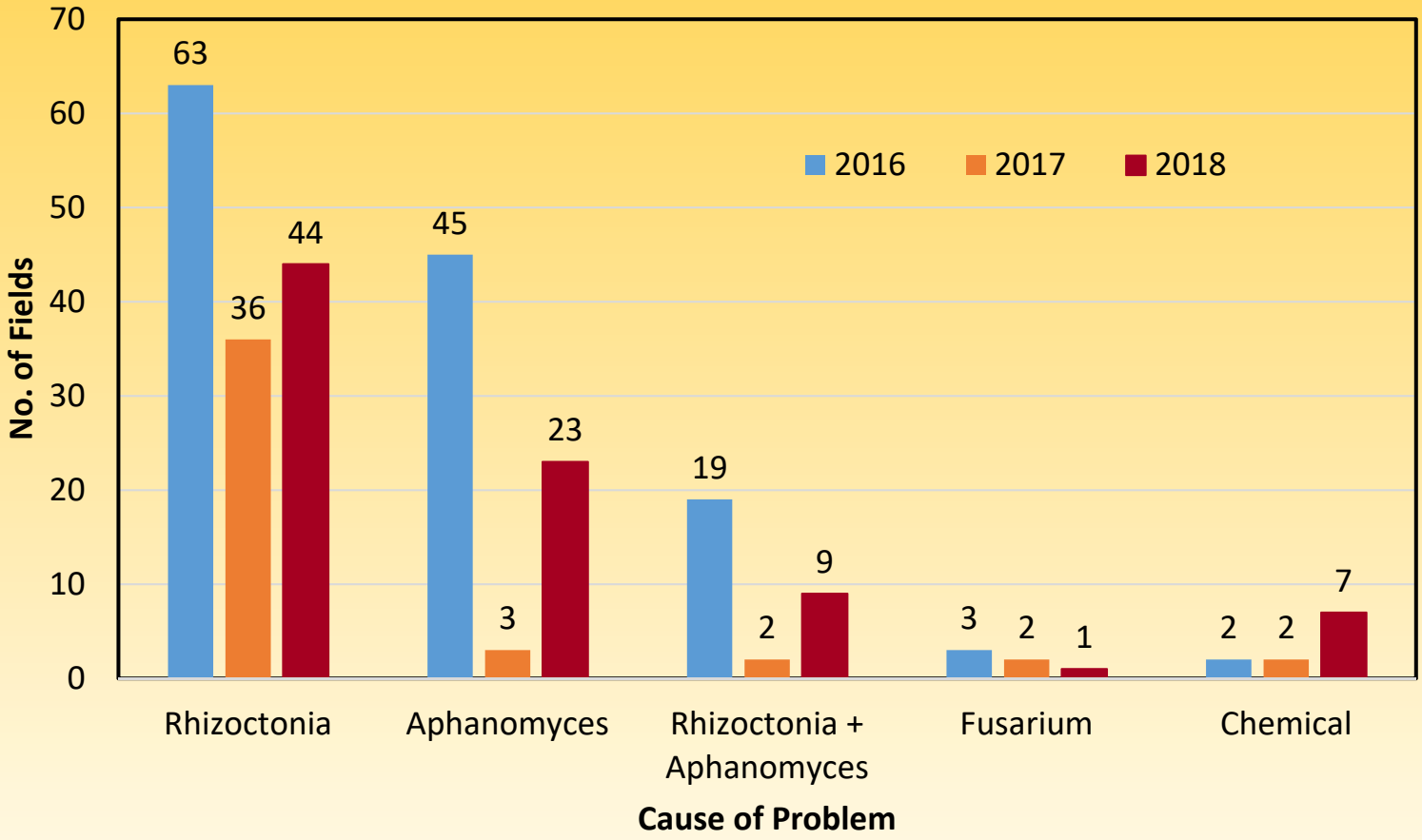
Summary of Field Samples 2016 - 2018



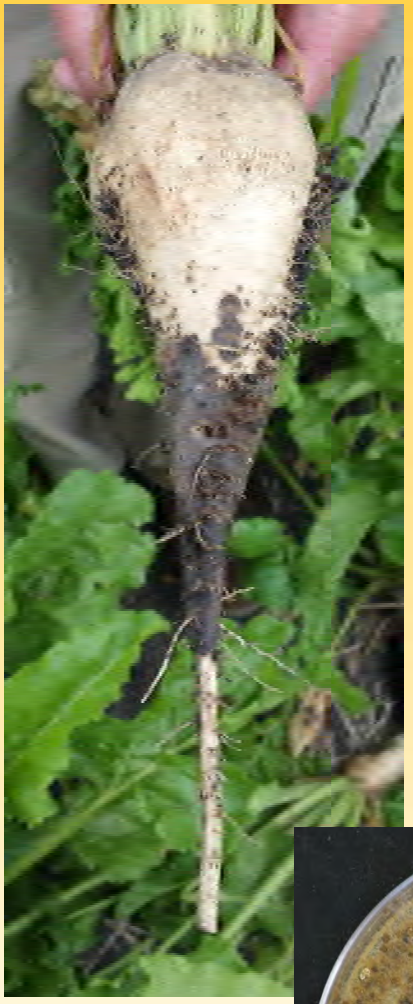
Rhizoctonia + Aphanomyces

Damping-off

Rhizoctonia

Crown and Root Rot

Crown and Root Rot



Management of Rhizoctonia

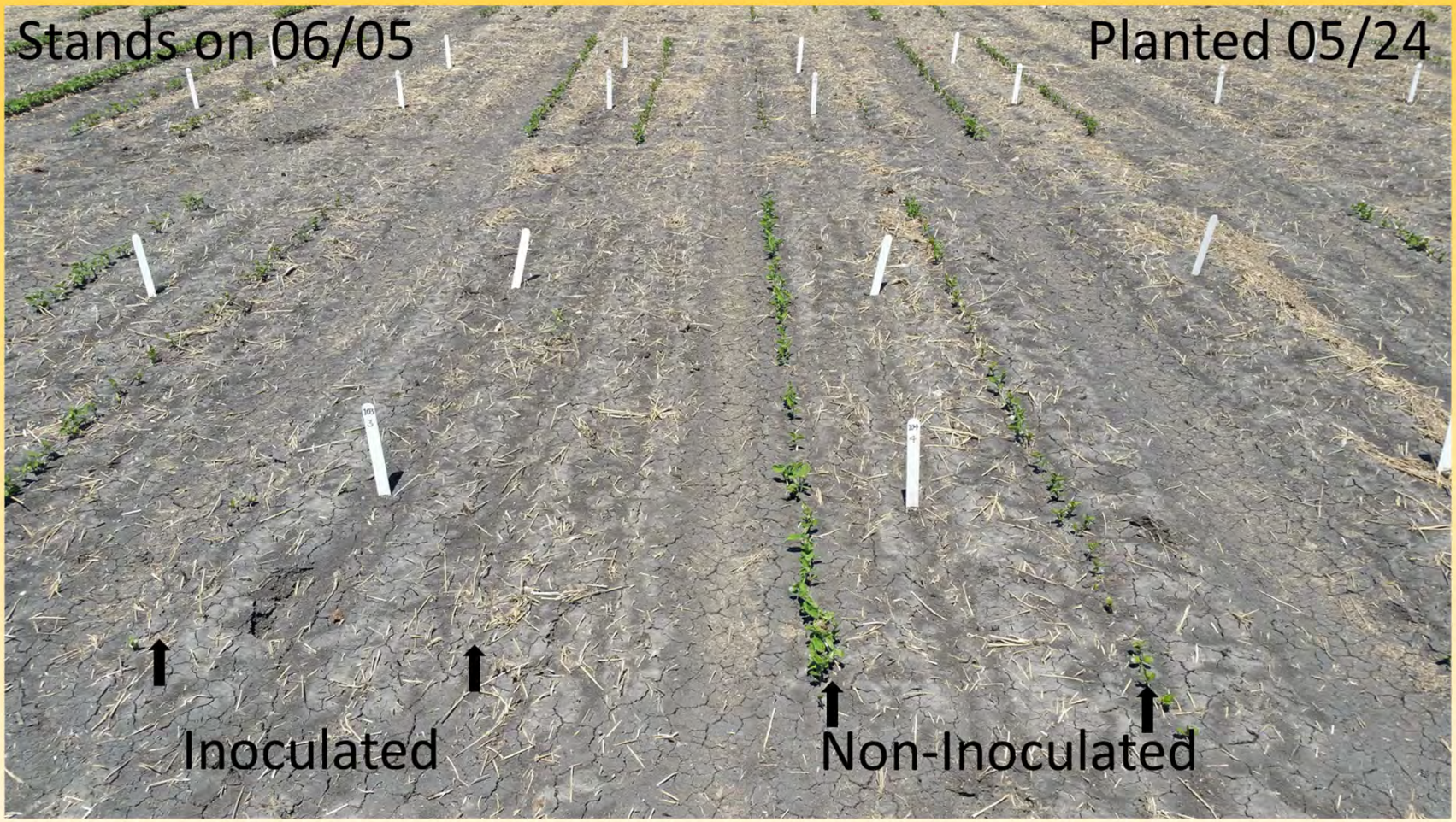
- Early planting

Management of Rhizoctonia

- Early planting
- Crop Rotation
  - Length of rotation
  - Weed control
  - Crop choice

Soybeans

Soybeans



Navy beans

Navy beans

Navy beans

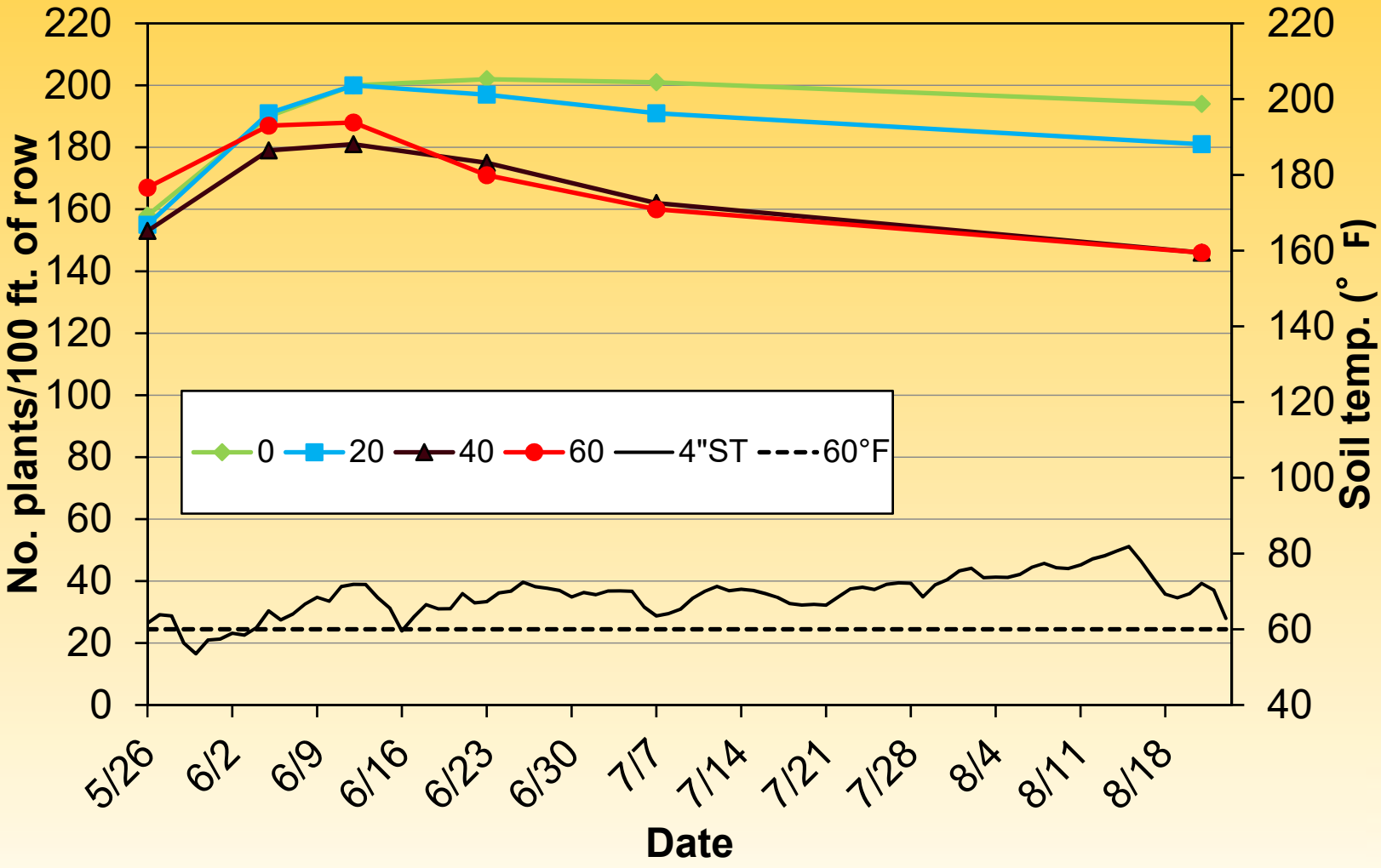
Management of Rhizoctonia

- Early planting
- Crop Rotation
  - Crop choice
  - Length of rotation
  - Weed control
- Resistant varieties

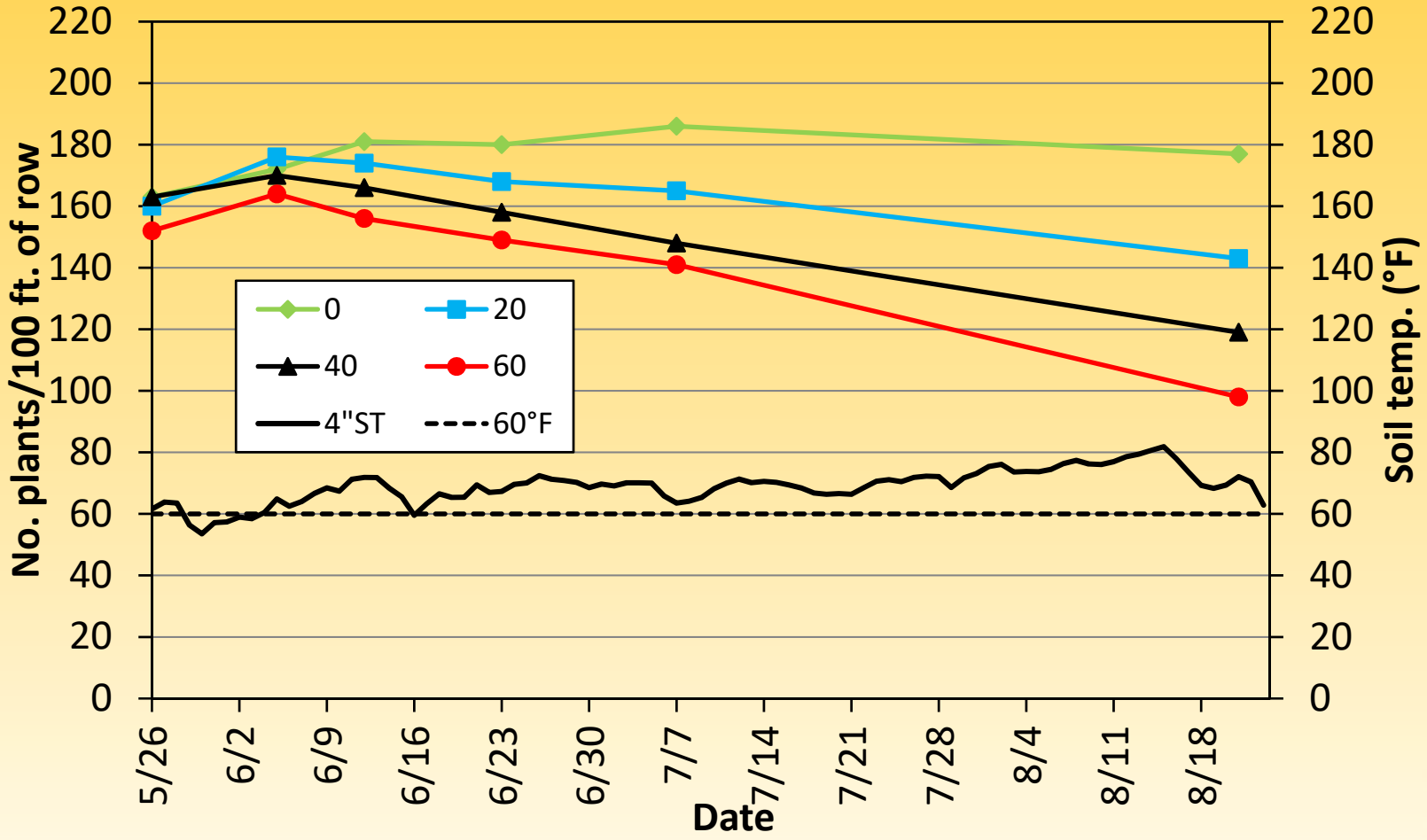
Rhizoctonia rating scale

Reynolds et al.

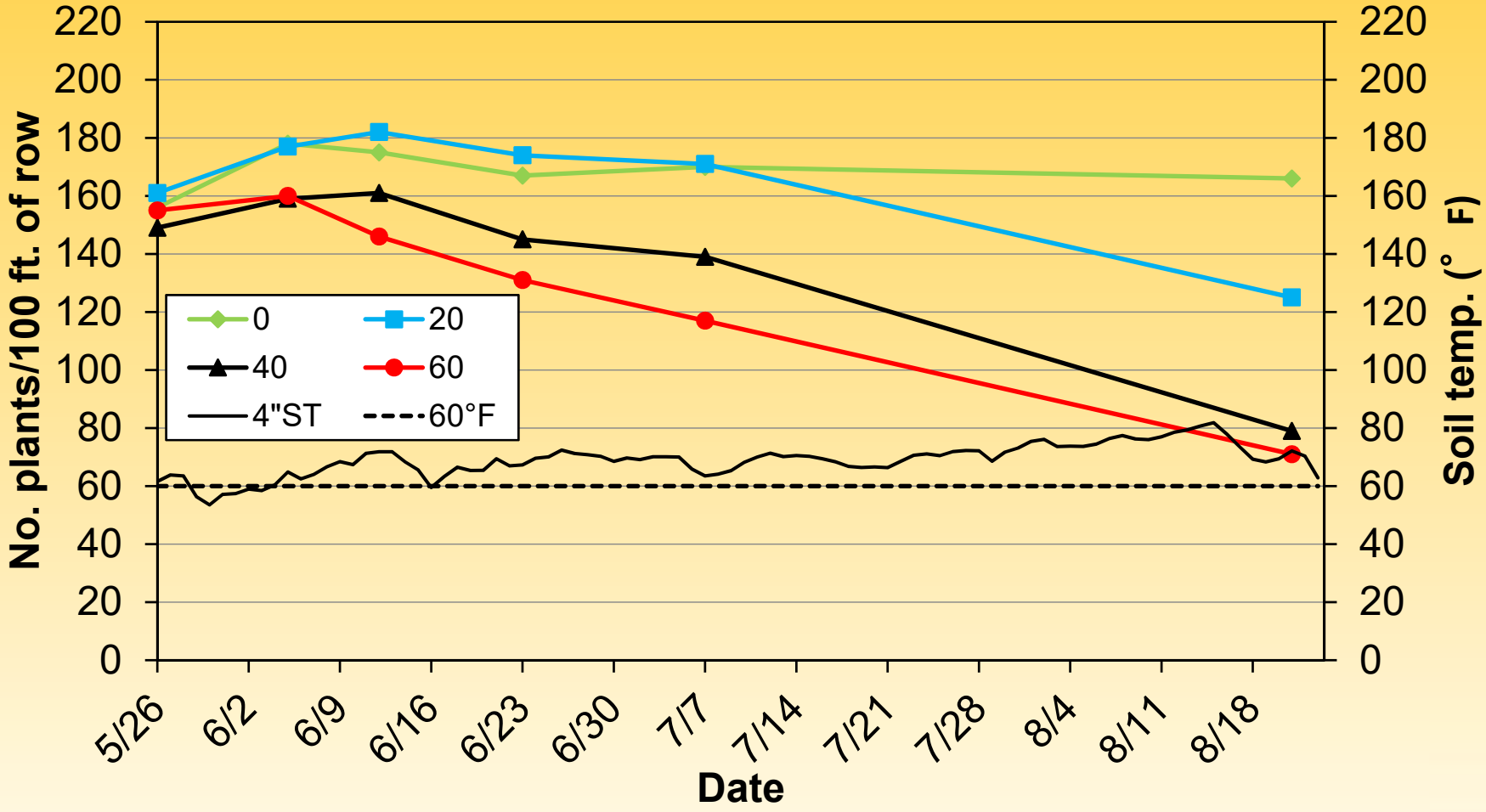
Rhizoctonia & Resistant Variety (~3.4)



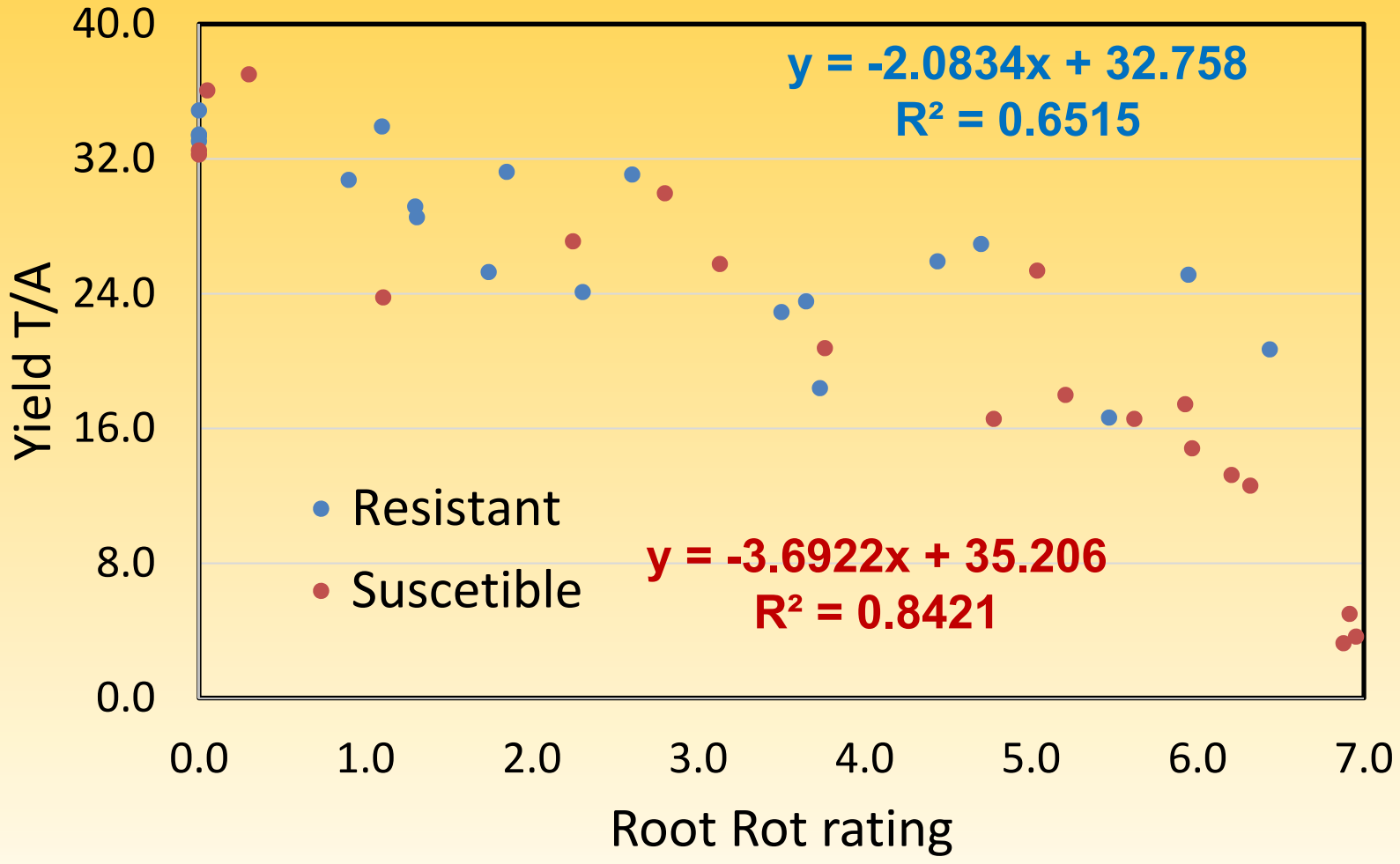
Rhizoctonia & Moderately Resistant Variety (~4.0)



Rhizoctonia & Susceptible Variety (~5.3)



Rhizoctonia affects Yield



Management of Rhizoctonia

- Early planting
- Crop Rotation
  - Crop choice
  - Length of rotation
  - Weed control
- Resistant varieties
- At-planting fungicides
  - Seed treatment

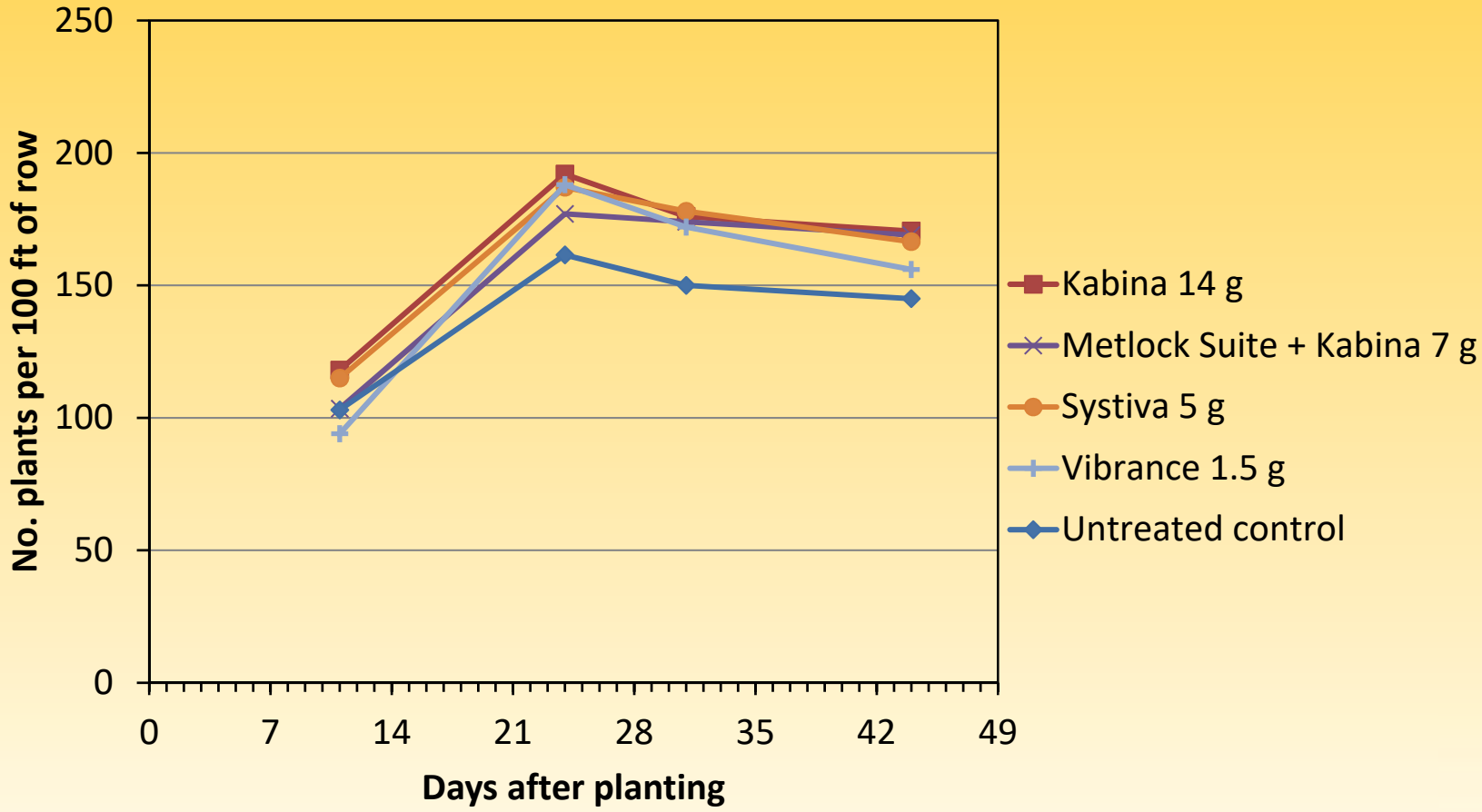
Seed treatments

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

Seed treatments

- Kabina 14 g (Penthiopyrad, 2014)
- Vibrance 1.5 g (Sedaxane, 2016)
- Systiva 5 g (Fluxapyroxad, 2017)
- Metlock Suite [Metconazole + Rizolex) + Kabina 7g (Penthiopyrad), 2014)
- Since 2017, 100% seed is treated for Rhizoctonia and treatment depends on the seed companies' choice

Seed treatments – 2016



Benefits of seed treatments

- Sugarbeet seedlings are very susceptible to Rhizoctonia early on
- Genetic resistance is not expressed until 6-8 leaf stage
- Effective protection of seedling (4-5 weeks)
- Ease of use -It comes with seed
- Safety
- No plugged nozzles

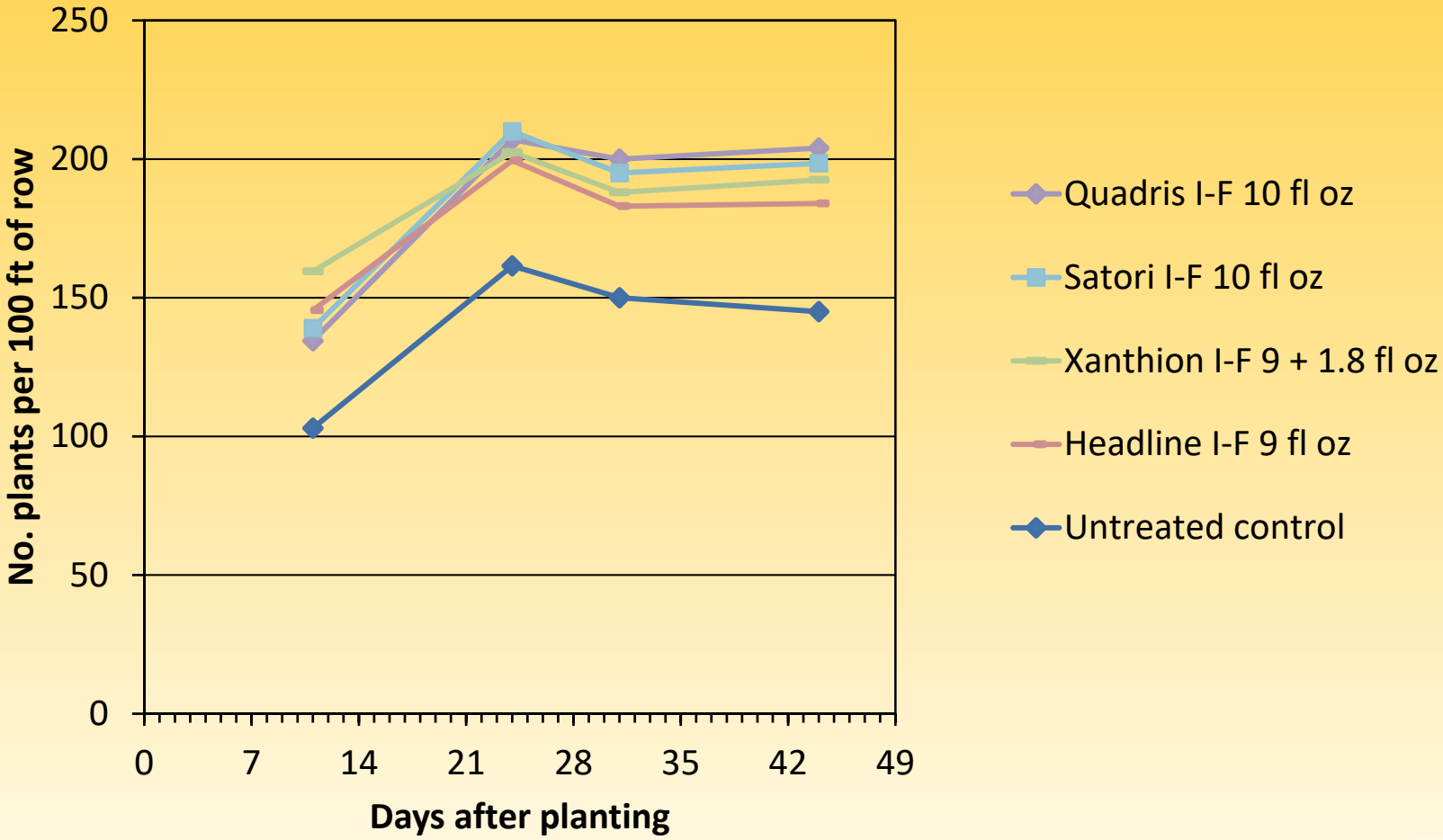
Management of Rhizoctonia

- Early planting
- Crop Rotation
  - Crop choice
  - Length of rotation
  - Weed control
- Resistant varieties
- At-planting fungicides
  - Seed treatment
  - In-furrow application

In-furrow fungicides – 2016

- Via Drip Tube
- Fungicide in 3 gal Water and add to 3 gal. 10-34-0

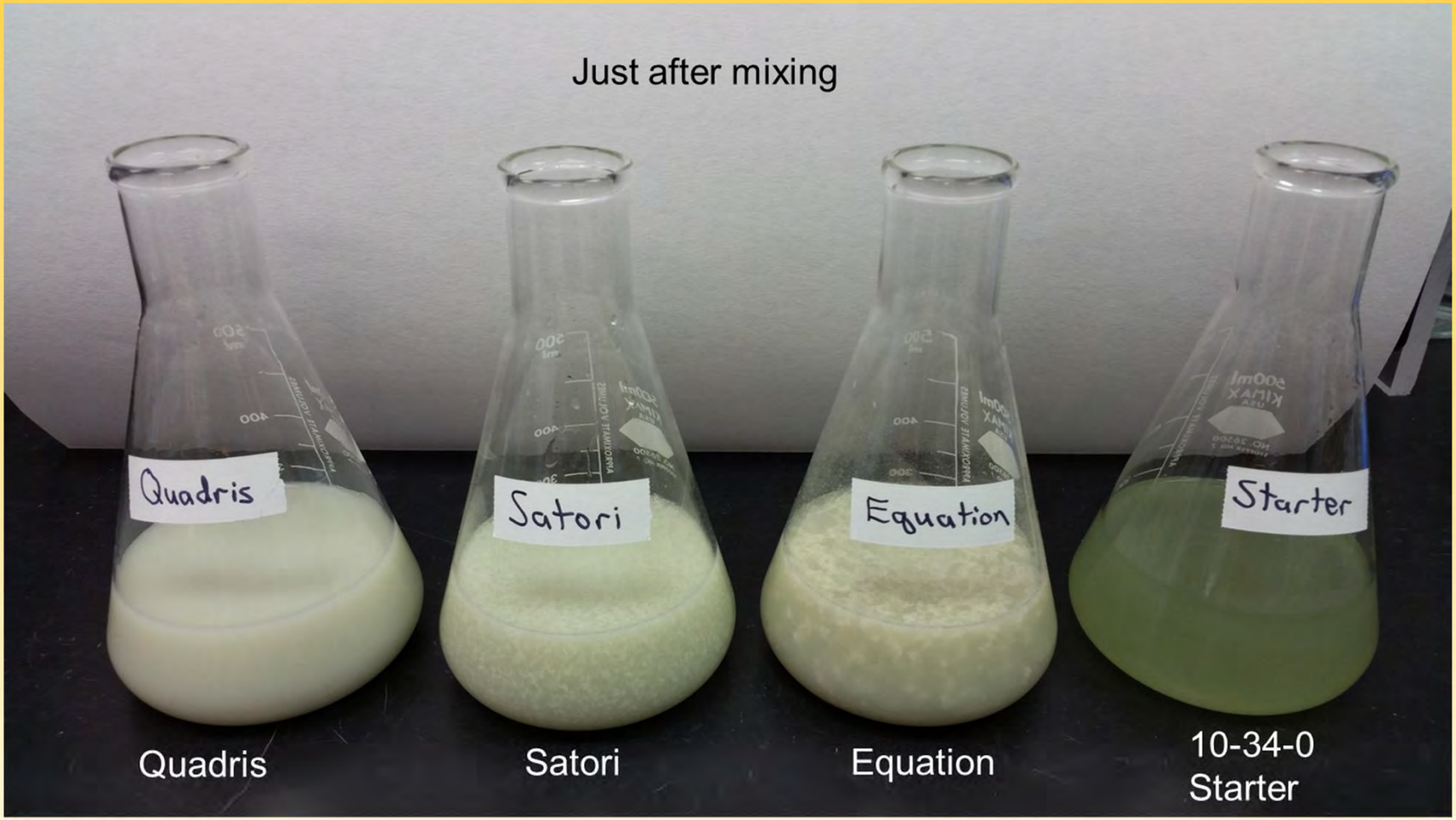
In-furrow fungicides – 2016



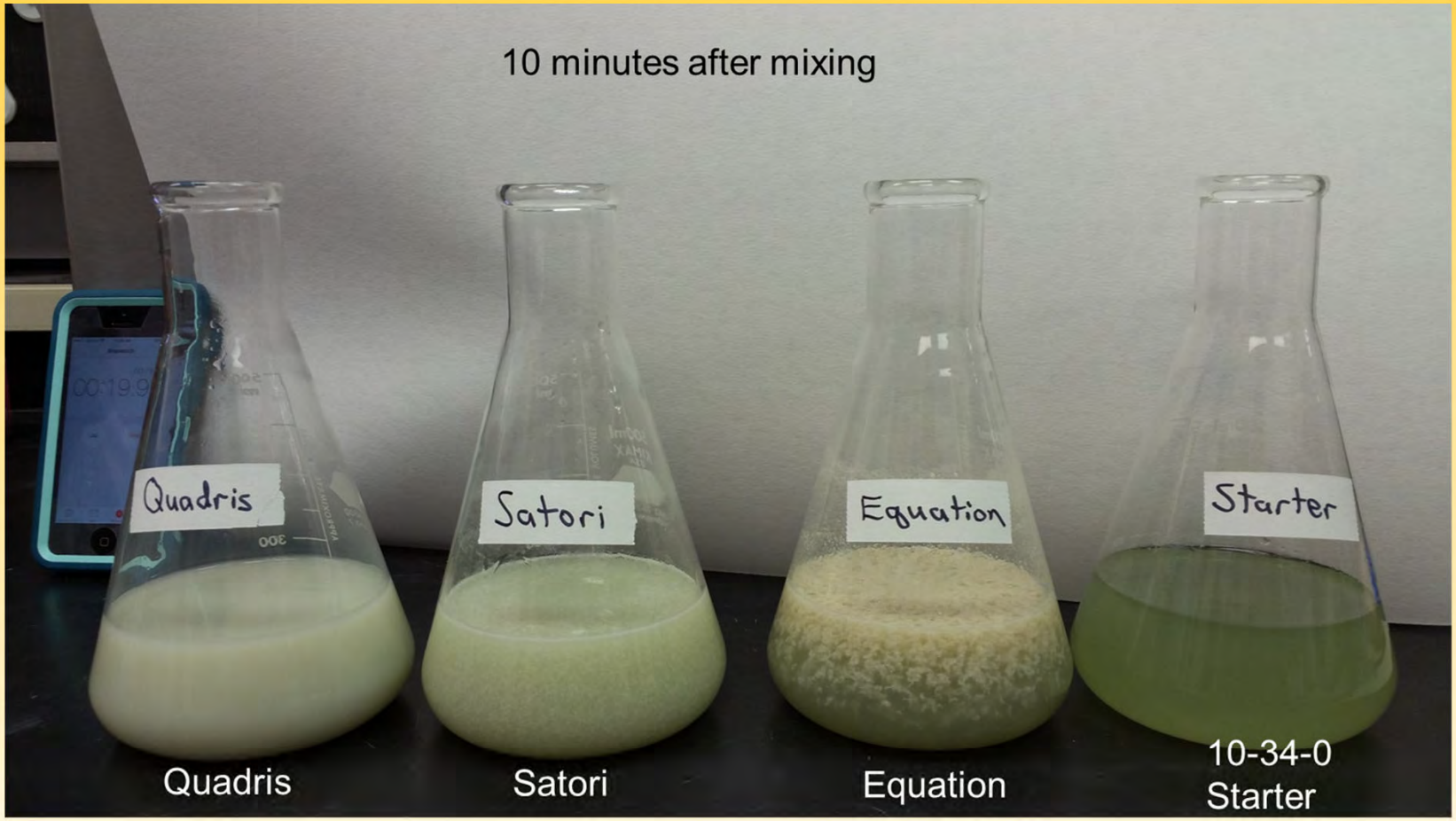
In-furrow fungicides

- Benefits
  - Sanitizing the furrow (seedling + soil)
  - More effective than seed treatments – longevity up to 8-10 weeks (Windels, 2010)
- Risks
  - Phytotoxicity
    - cool weather, dry conditions and light soils
    - Mixing with starter fertilizer and other chemicals
  - Plugged nozzles

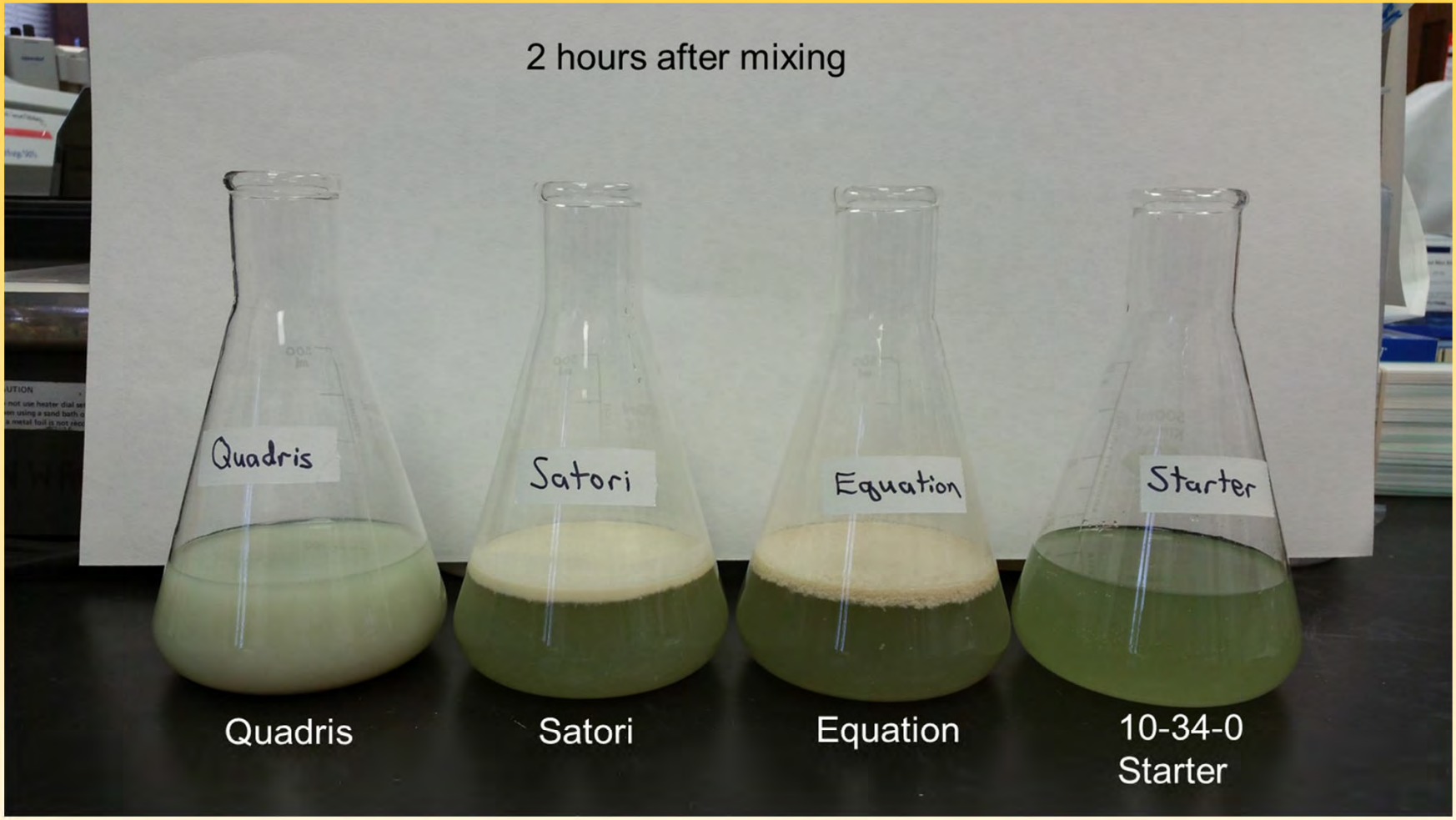
10-34-0 + azoxystrobin



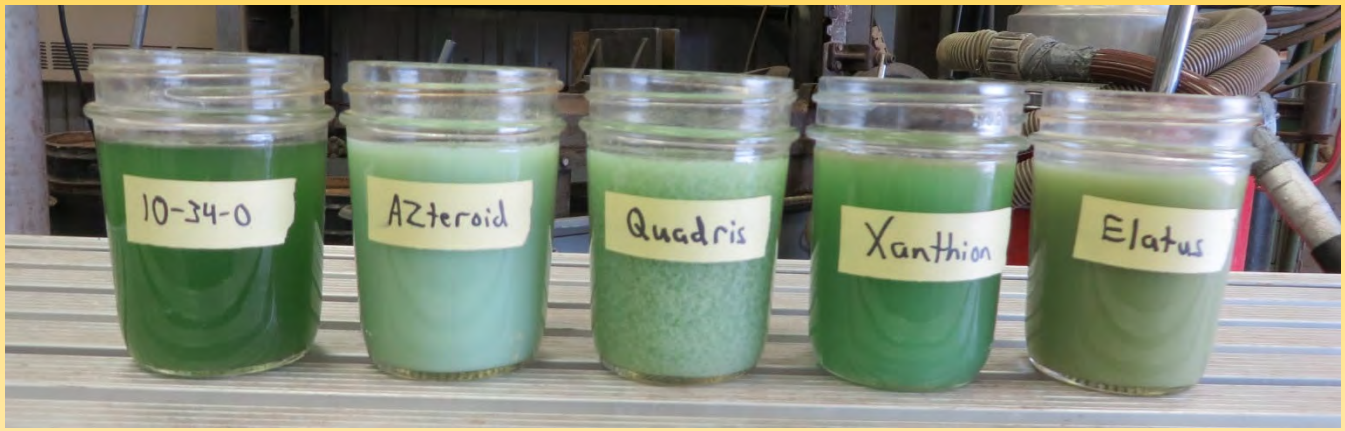
10-34-0 + azoxystrobin

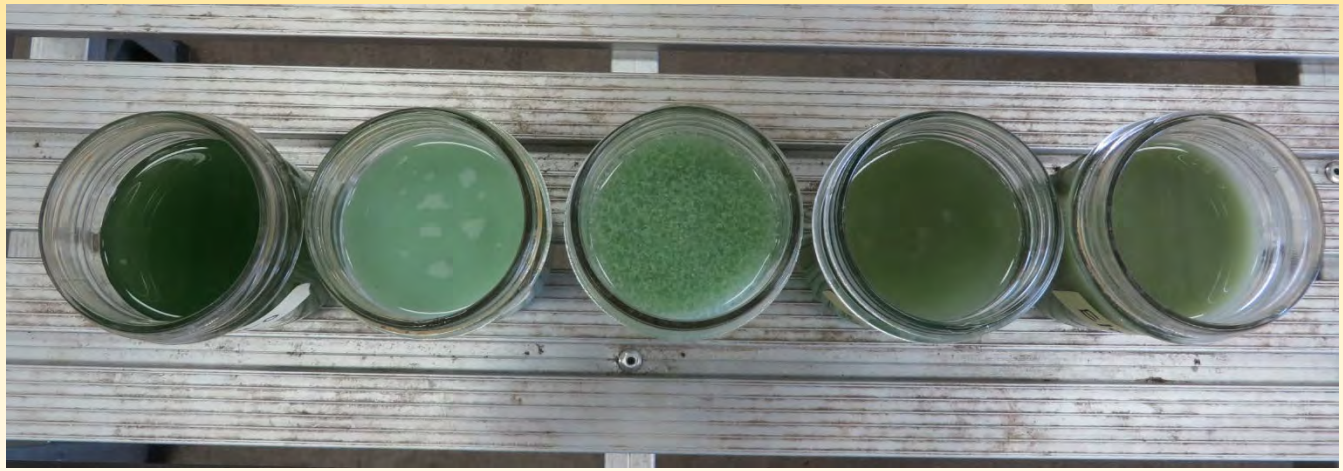


10-34-0 + azoxystrobin



10-34-0 + Fungicides: 0 minutes (shaken and poured in to a jar after sitting for 6 hours after mixing and application in the field)





10-34-0 + Fungicides: 10 minutes

Seed vs In-furrow fungicides - 2015

Treatment	No. harv. Roots/100 ft.	RCRR (0-7)	Yield	RSA
Seed treatments	98	3.9	20.1	6181
In-furrow treatments	**127**	**2.7**	**25.5**	**7772**
Contrast analysis *p*-value	0.001	0.006	0.0032	0.0148

Seed Treatments

14 g Kabina ST

Metlock Suite

Met. Suite + 7 g Kabina

7 g Kabina ST

2 g Vibrance

In-furrow

12 fl oz Headline IF

10 fl oz Quadris IF

10 fl oz Equation IF

10 fl oz Satori IF

NS = not significantly different

Seed vs In-furrow fungicides - 2018

Treatment	No. harv. roots/100 ft	RCRR (0-7)	Yield ton A^{-1}	RSA
Seed treatments	151	0.7	32.8	10440
In-furrow treatments	141	0.4	32.2	10528
Contrast analysis P-value	0.01	0.01	0.5	0.5
			NS	**NS**

Seed Treatments

14 g Kabina ST

Met. Suite + 1 g Vibrance

Met. Suite + 7 g Kabina

5 g Systiva

1.5 g Vibrance

In-furrow

9.5 fl oz Quadris

11.9 fl oz AZteroid

Xanthion (Headline + Integral, 9 + 1.8 fl oz/A)

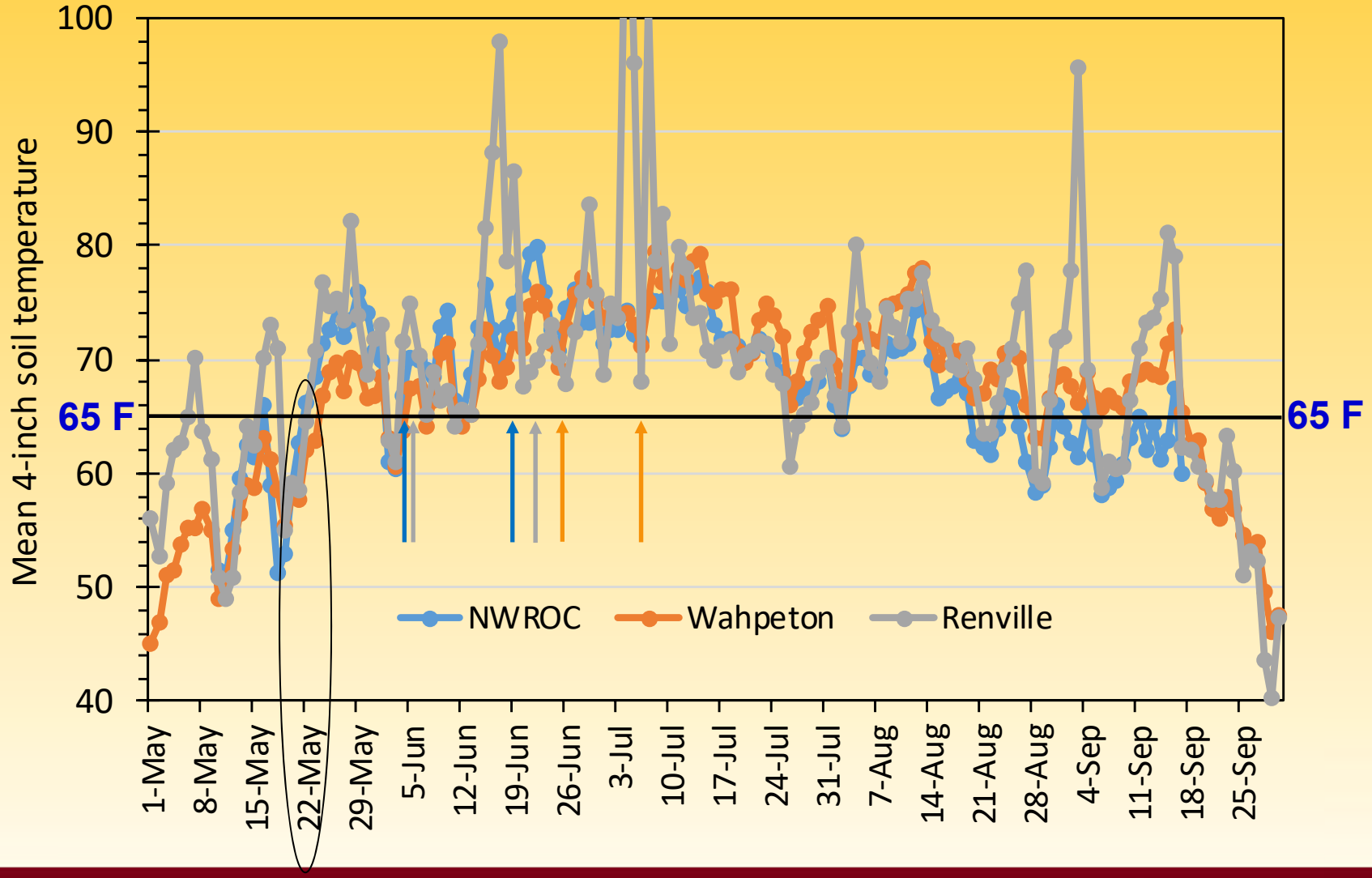
Elatus 9.5 fl oz (* not registered for sugarbeet)

NS = not significantly differer

Management of Rhizoctonia

- Early planting
- Crop Rotation
  - Crop choice
  - Length of rotation
  - Weed control
- Resistant varieties
- At-planting fungicides
  - Seed treatment
  - In-furrow application
- Postemergence fungicides

4-inch soil temp daily means

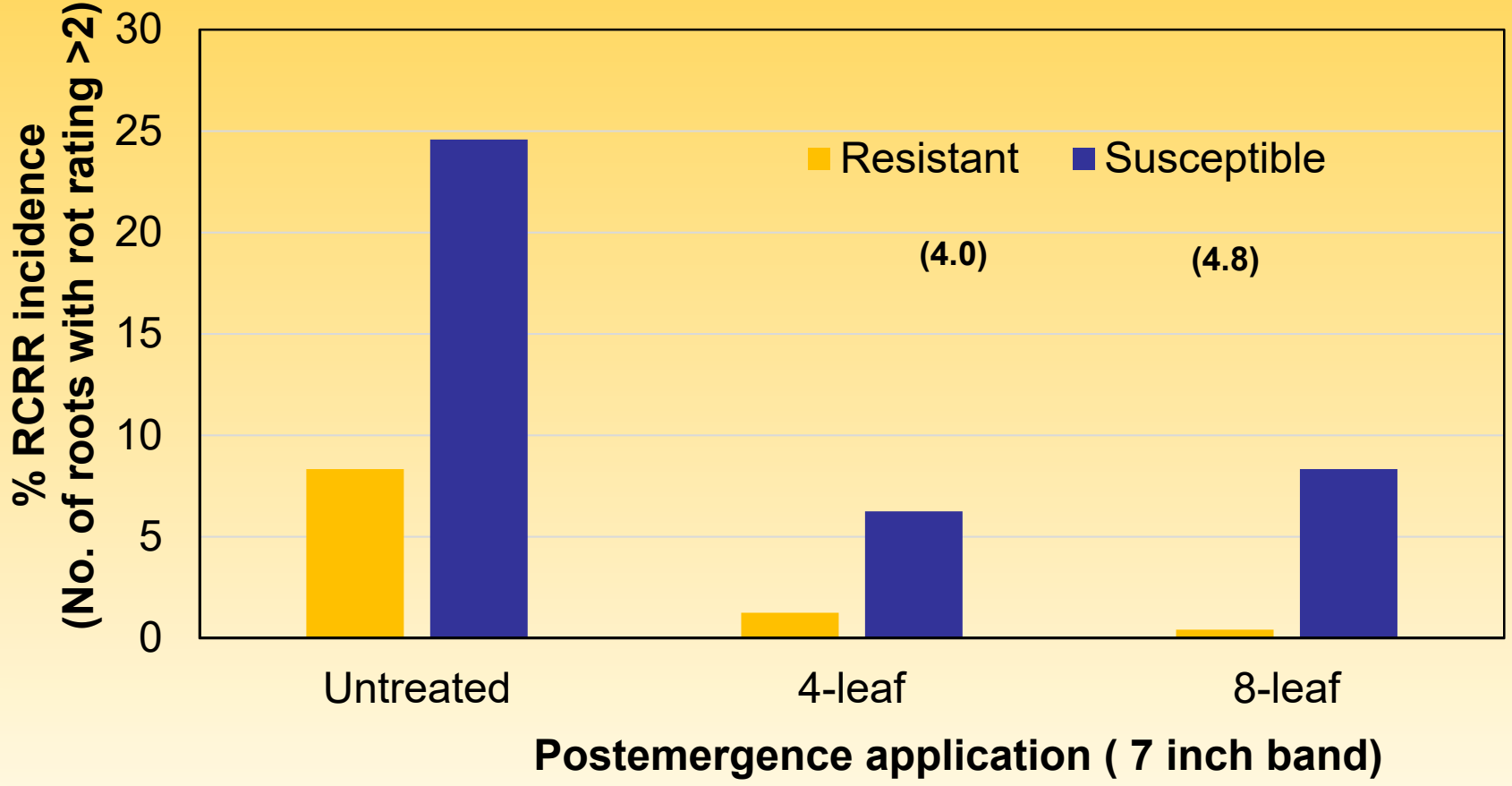


Postemergence Application - 2017

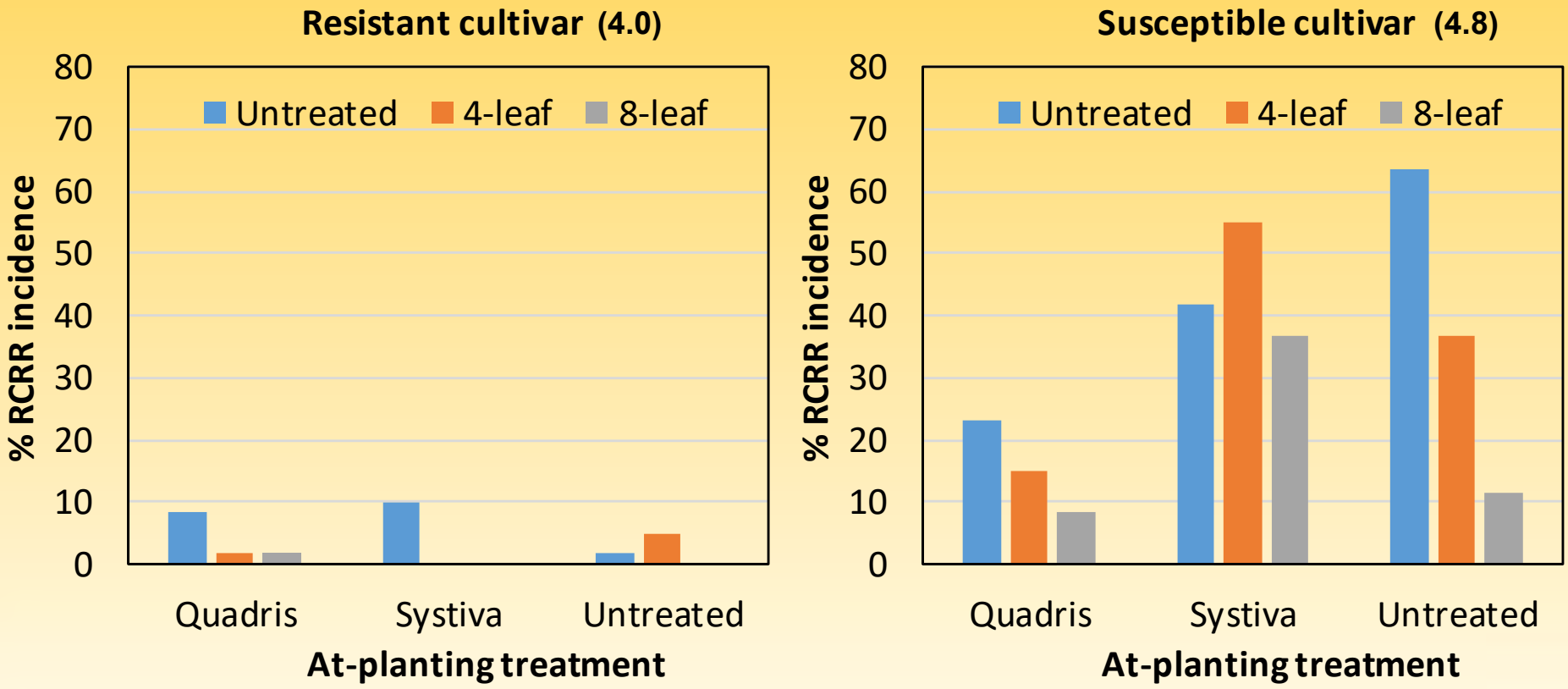
4-leaf stage
June 12

8-leaf stage
June 20

Cultivar x postemergence interaction on disease incidence - NWROC



Cultivar x at-planting x postemergence (7 inch band) interaction on disease incidence - SMBSC



Postemergence fungicides – 2015
Quadris vs Generics

Treatment	RCRR (0-7)	Yield T/A	RSA
Non-inoculated			
No-fungicide control	3.4	24.3	6263
R. solani-inoculated			
Equation @ 14 fl oz/A	1.9 d	31.0 a	8066 a
Quadris @ 14 fl oz/A	2.4 d	29.9 a	7908 a
Satori @ 14 fl oz/A	2.4 d	29.6 a	7790 a
No-fungicide control	**5.5 a**	**14.0 c**	**3411 c**
ANOVA *P*-value	0.0001	0.004	0.002
LSD ($P = 0.05$)[Z]	1.4	8.3	2284

Postemergence fungicides

- Benefits
  - If you are doing a row cultivation--throwing soil onto crowns
  - Late season disease control (rain aug-sept)
  - If sugarbeets are following Rhizoctonia-susceptible crops in a rotation
  - **Band application (preferred)** – severe disease pressure
  - Broadcast application – low disease pressure
- Risks
  - Work better if applied before infection

Rhizoctonia plan for 2019

Past Rhizoctonia pressure (beets/100 ft. row at harvest)	Variety (Your Choice)	Seed treatment	In-furrow treatment	Postemergence treatment
Low (170-200)	Moderate Weak	Yes Yes	No No	No Yes

Specialty < 4.0 Rhizoctonia rating
Moderate 4.0 – 4.4
Weak > 4.4

Rhizoctonia plan for 2019

Past Rhizoctonia pressure (beets/100 ft. row at harvest)	Variety (Your Choice)	Seed treatment	In-furrow treatment	Postemergence treatment
Low (170-200)	Moderate Weak	Yes Yes	No No	No Yes
Moderate (130 – 170)	Specialty Moderate Weak	Yes Yes Yes	No No Yes/No (History)	Yes/No (History) Yes Yes

Rhizoctonia plan for 2019

Past Rhizoctonia pressure (beets/100 ft. row at harvest)	Variety (Your Choice)	Seed treatment	In-furrow treatment	Postemergence treatment
Low (170-200)	Moderate Weak	Yes Yes	No No	No Yes
Moderate (130 – 170)	Specialty Moderate Weak	Yes Yes Yes	No No Yes/No (History)	Yes/No (History) Yes Yes
Severe (less than 130)	Specialty Moderate **Weak?**	Yes Yes Yes	No Yes Yes	Yes Yes Yes

Summary- Rhizoctonia Management

- Seed treatments provide excellent early-season protection
- In-furrow applications
  - Similar to seed treatments under low disease pressure
  - Better than seed treatments under high disease pressure
  - May reduce stands under cool and dry soil conditions
- Seed/in-furrow treatments can broaden the window to apply postemergence application (4 to 8 leaf stage)
- Postemergence application is most beneficial under moderate to heavy disease pressure, especially if beets are following soybeans or edible beans
- Generic formulations of azoxystrobin are effective

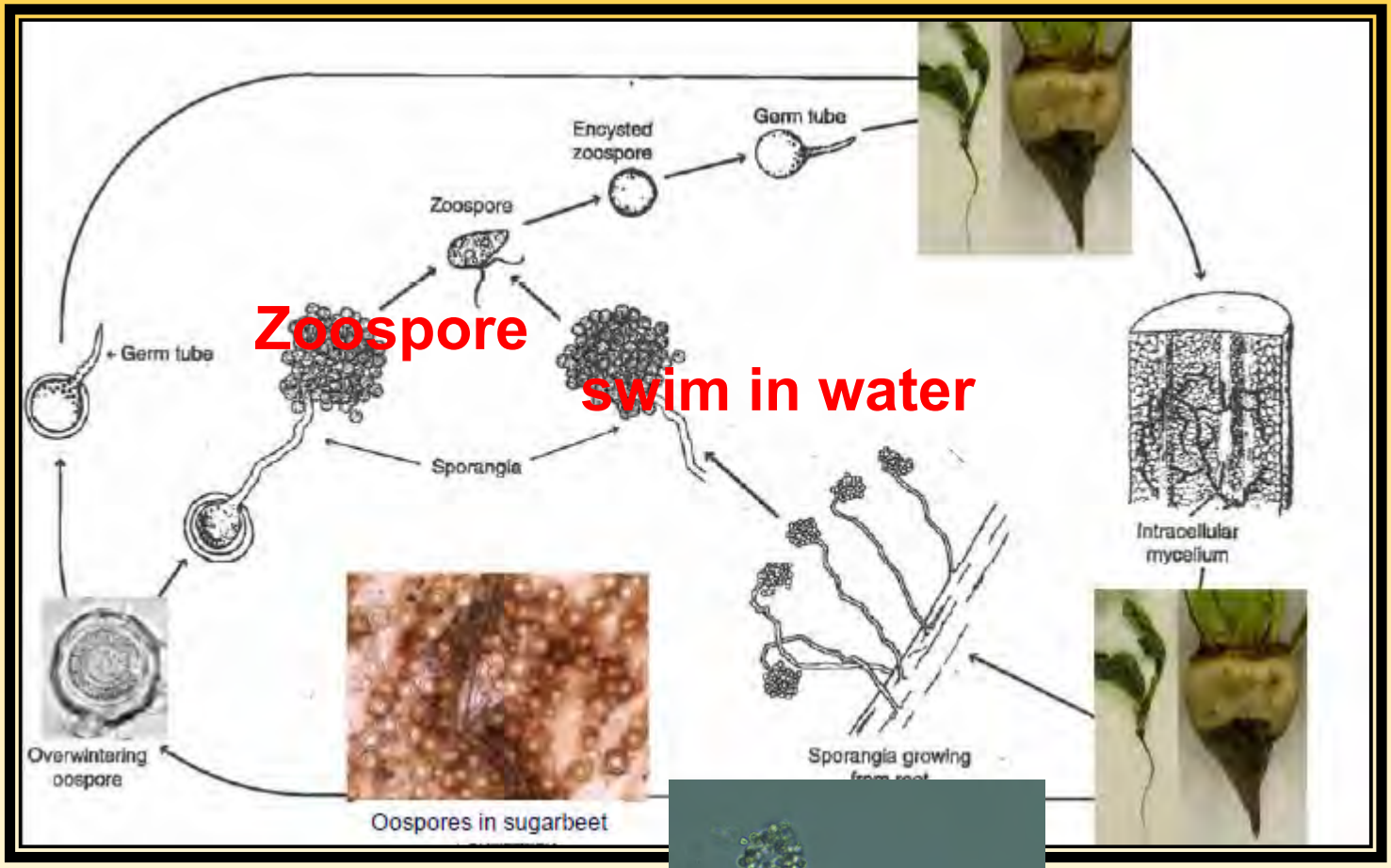
Aphanomyces

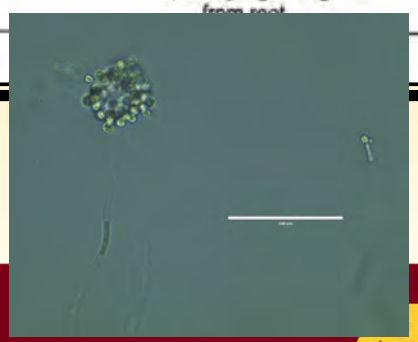
Aphanomyces can be a full-season pathogen

Aphanomyces damping-off

Aphanomyces root rot

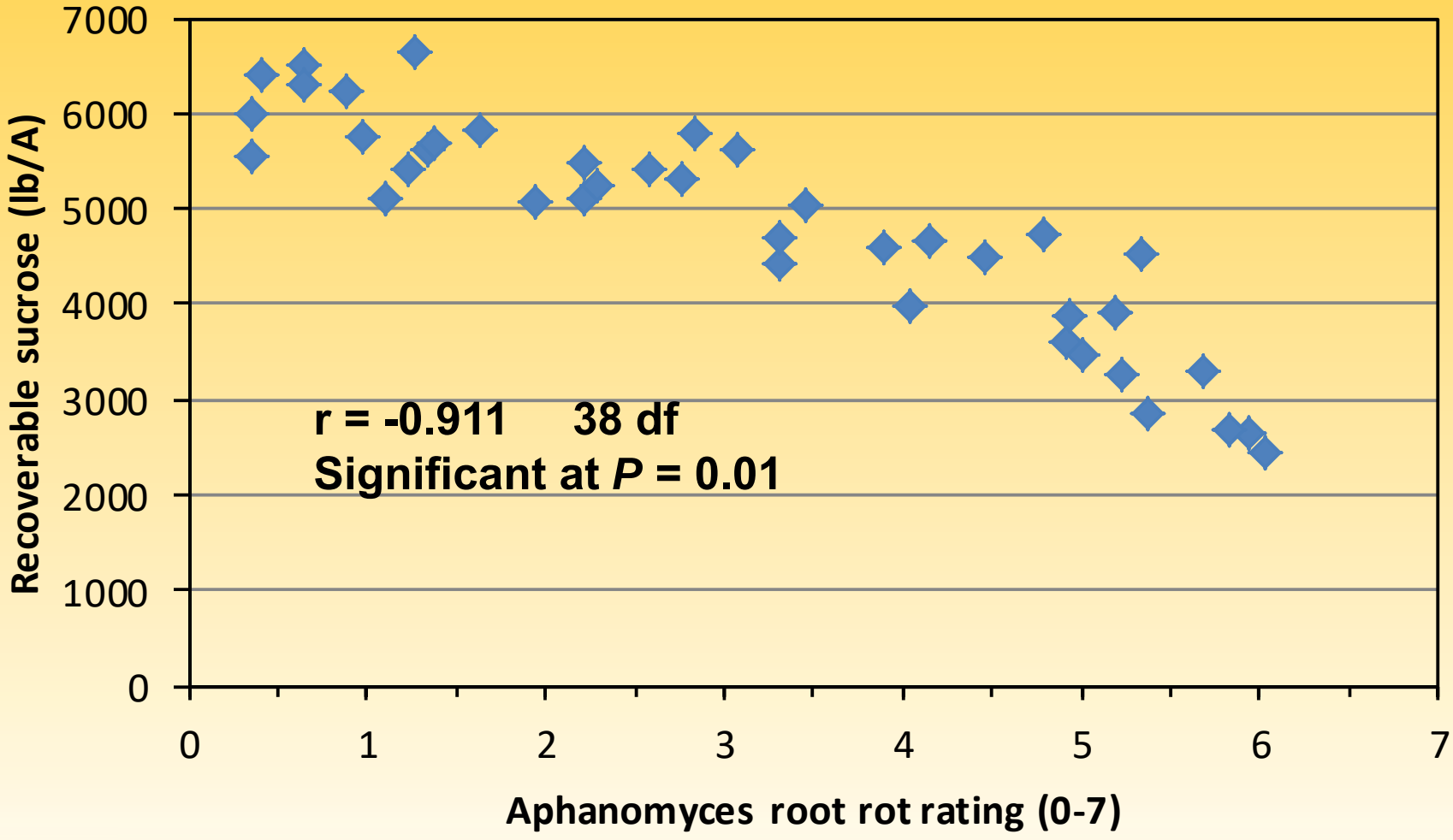
Life Cycle of *Aphanomyces cochlioides*





C. Windels, 2012

Correlation of sugar yield with Aphanomyces root rot

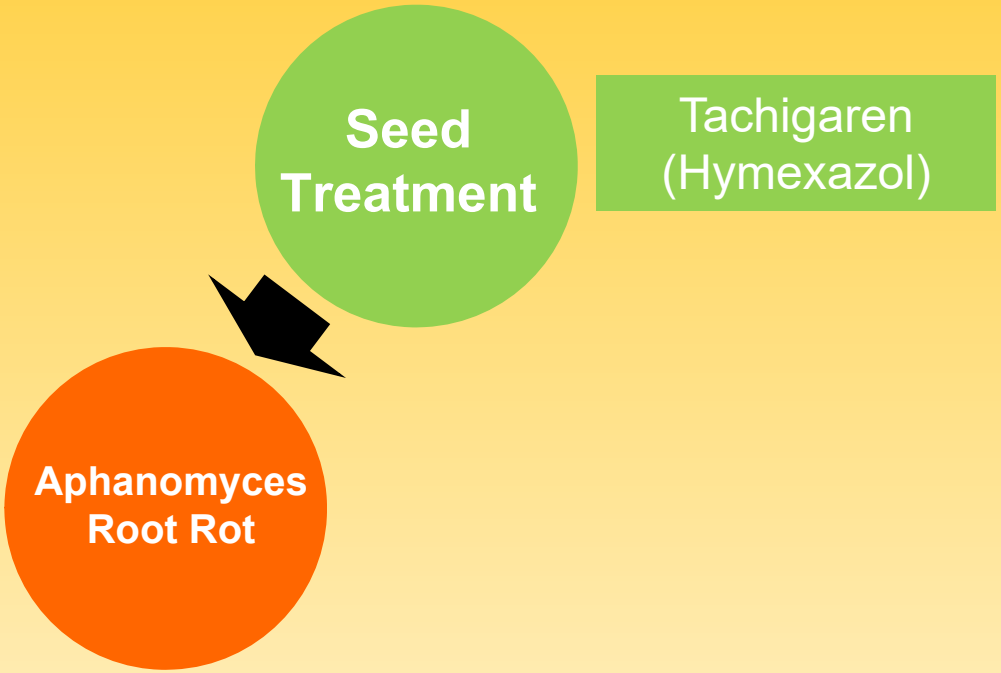


Integrated Management of Aphanomyces

Early planting

Integrated Management of Aphanomyces

Early planting



Integrated Management of Aphanomyces

Resistant variety < 4.4

Varietal Selection

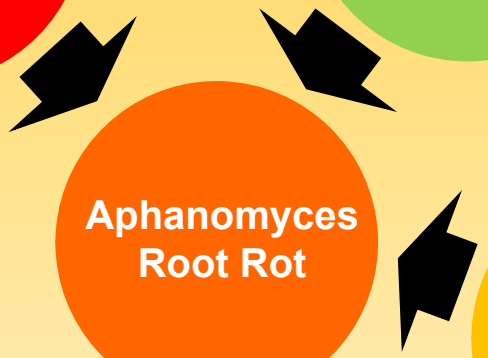
Seed Treatment

Tachigaren (Hymexazol)

Early planting

Aphanomyces Root Rot

Spent Lime



Breckenridge lime trial: 2014

	Aphanomyces rating (0-7)		Recoverable sucrose (lb/A)	
Lime rate	Res. + Tach	Susc. No Tach	Res. + Tach	Susc. No Tach
0	3.6	5.8	5656	4007
5	2.6	5.2	7123	6034
10	2.5	4.6	7211	6473
15	2.2	3.5	8408	8109
20	2.2	3.5	8631	8352
Linear	**	***	***	***
Quadratic	NS	NS	NS	NS

* = significant at P = 0.05
** = significant at P = 0.01
*** = significant at P = 0.001
NS = not significant

Planting: May 22
Harvest: September 22

Breckenridge lime trial: 2012

	Aphanomyces rating (0-7)		Recoverable sucrose (lb/A)	
Lime rate	Res. + Tach	Susc. No Tach	Res. + Tach	Susc. No Tach
0	1.7	4.2	8684	5301
5	1.4	2.8	8857	8806
10	1.6	2.4	9395	9164
15	1.2	1.6	9318	9698
20	1.3	1.7	9367	10506
Linear	**	***	NS	***
Quadratic	NS	*	NS	**

* = significant at P = 0.05
** = significant at P = 0.01
*** = significant at P = 0.001
NS = not significant

Planting: April 26
Harvest: September 28

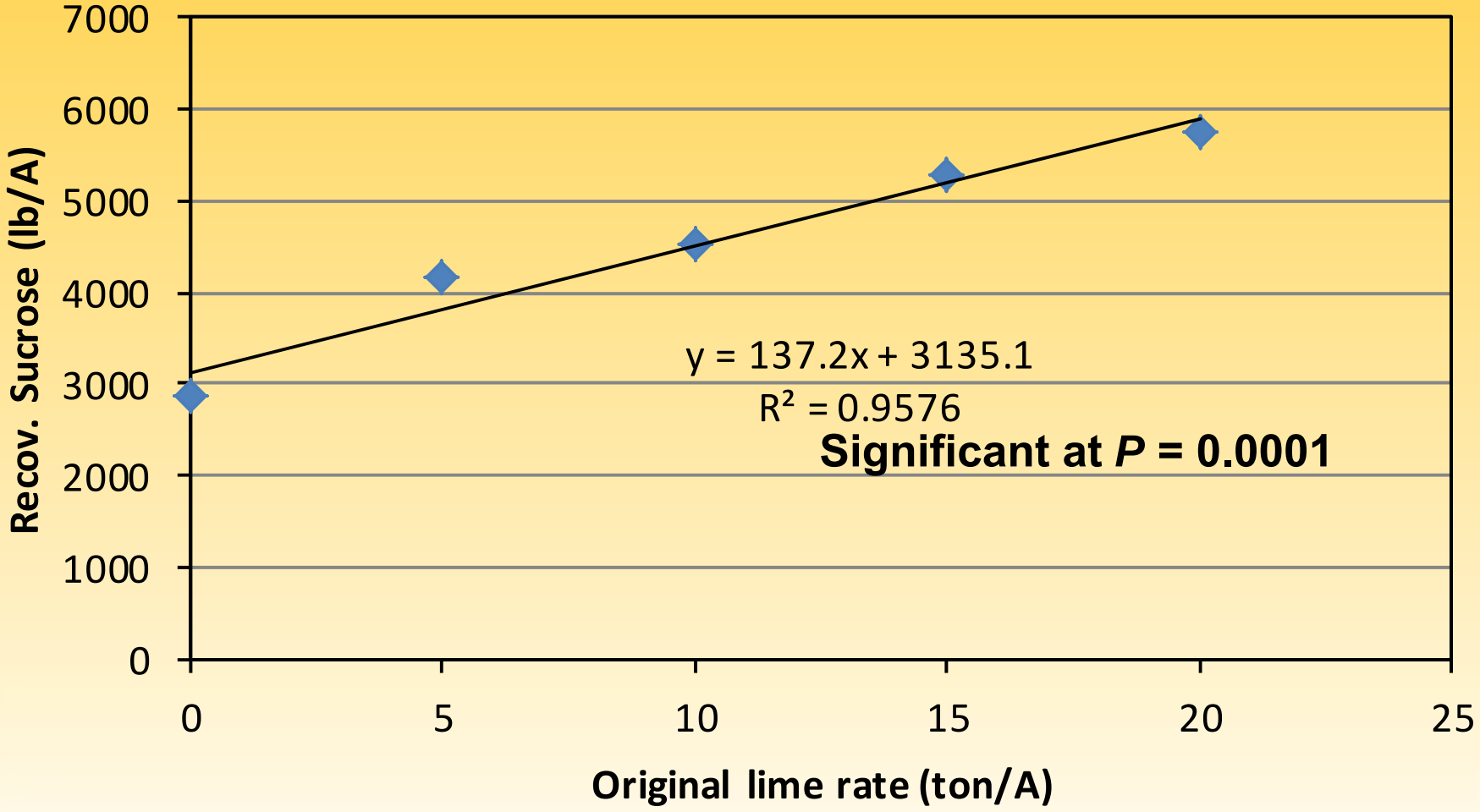
Breckenridge lime trial: 2011

Original Lime rate	Aphanomyces rating (0-7) (Res. + Susc. varieties)	Recoverable sucrose (lb/A) (Res. + Sus. varieties)
0	5.6	738
5	5.1	1966
10	4.8	2380
15	4.2	3258
20	4.3	3404
Linear	***	***
Quadratic	NS	NS

* = significant at P = 0.05
** = significant at P = 0.01
*** = significant at P = 0.001
NS = not significant

Planting: May 06
Harvest: Sept 26

Breckenridge lime trial: 2016



Benefit of additional 5 T/A lime after 2 years

Supplemental lime	Soil Ca (ppm)	Stand at 7 weeks (per 100 ft)	Harvested roots (per 100 ft)	Aph RRR (0-7)	Yield (ton/A)	Sucrose (%)
None	4132	115	101	3.5	20.3	12.6
5 ton/A	4696	133	122	2.6	22.9	12.8
Significance	***	**	**	**	**	NS

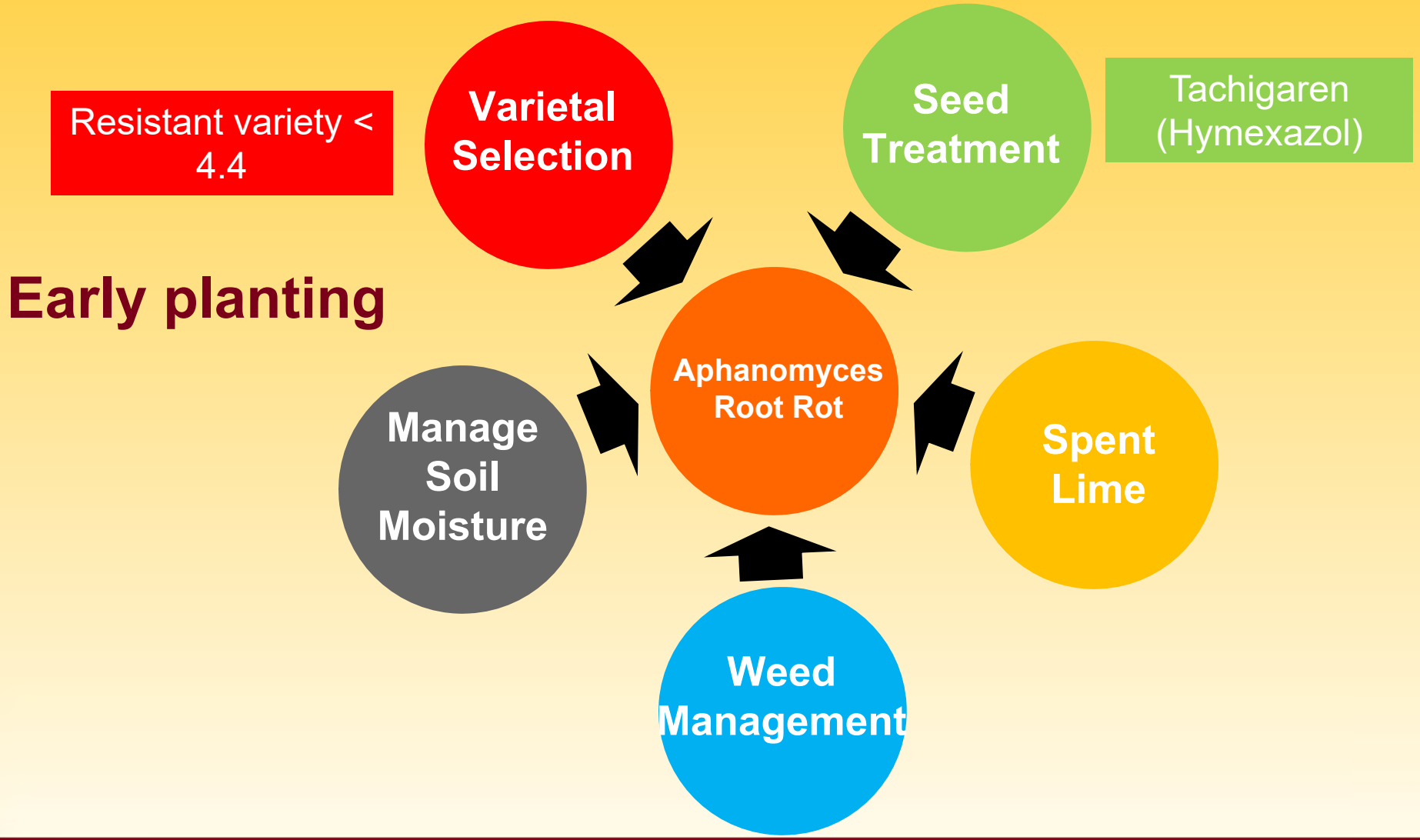
* = Significant at *P* = 0.05
** = Significant at *P* = 0.01
*** = Significant at *P* = 0.001

Aphanomyces Plan for 2019

Current lime rate

- Add 5-10 ton/A spent lime
- Add 5 ton/A spent lime
- Apply based on field history

Integrated Management of Aphanomyces



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- Scott Pahl, Germains Seed Technology
- Seed, chemical, and allied industries
- American Crystal Sugar Company quality lab
- Minn-Dak Farmers Cooperative
- Southern Minnesota Beet Sugar Cooperative

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Thank you!


Jason


Jeff


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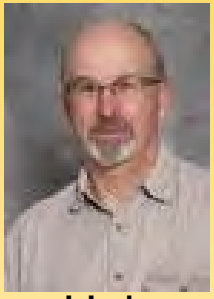
Hal


Alec Claire


Karen


Tim Muira Brandon


Katie


Amanda


Dr. Ian MacRae Tim