Management of Root Diseases in Sugarbeet

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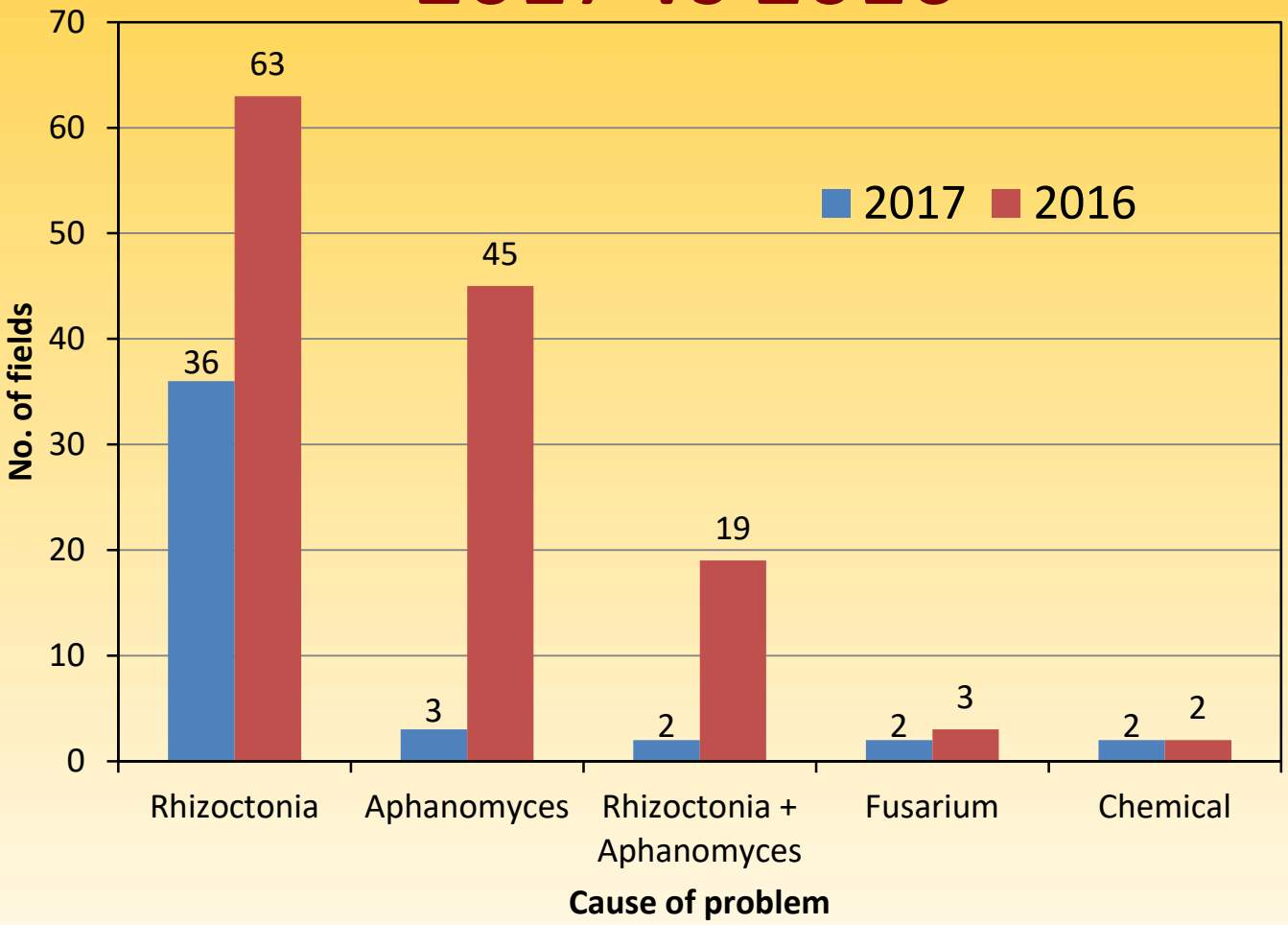
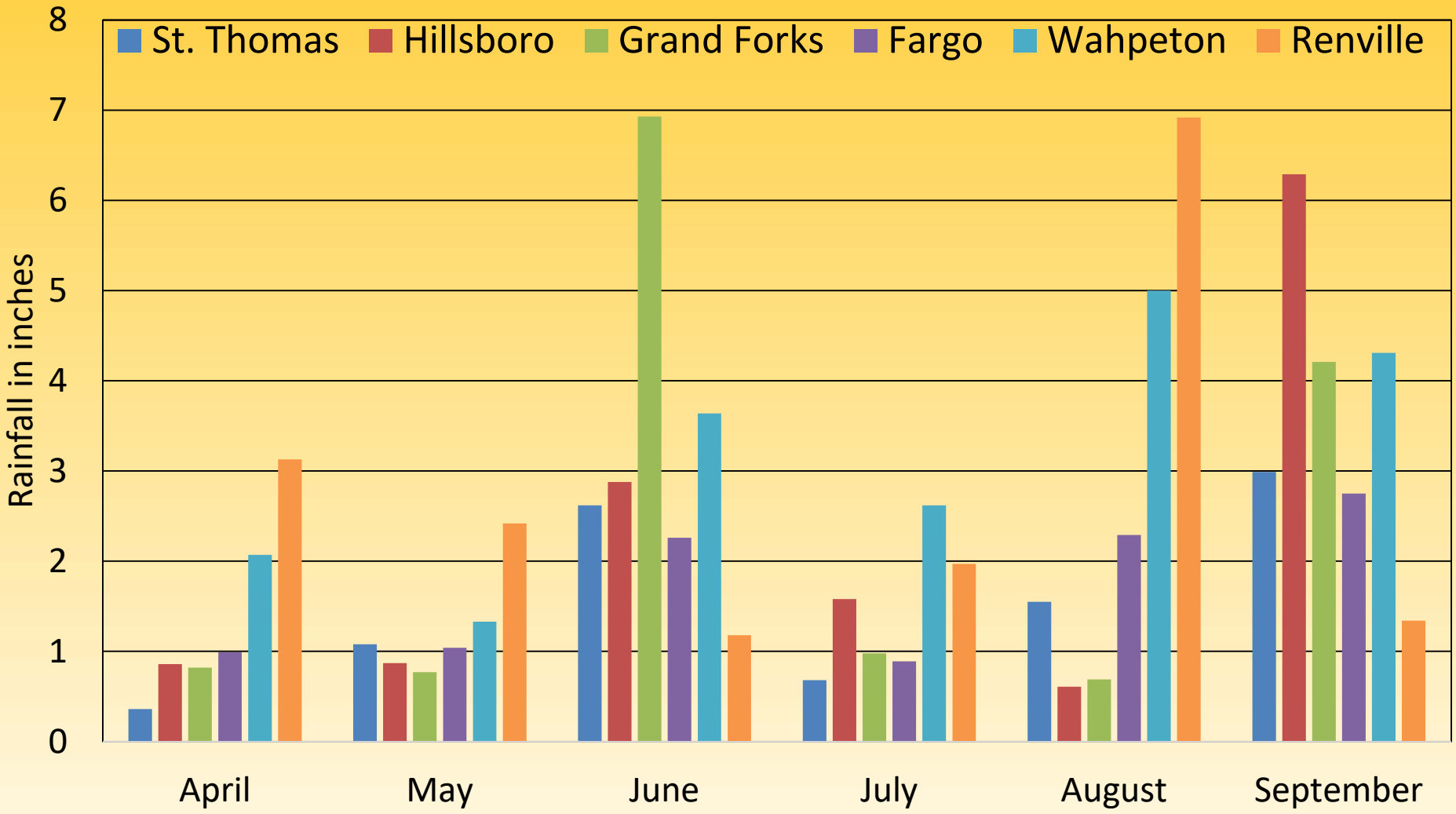
Summary of Field Samples 2017 vs 2016



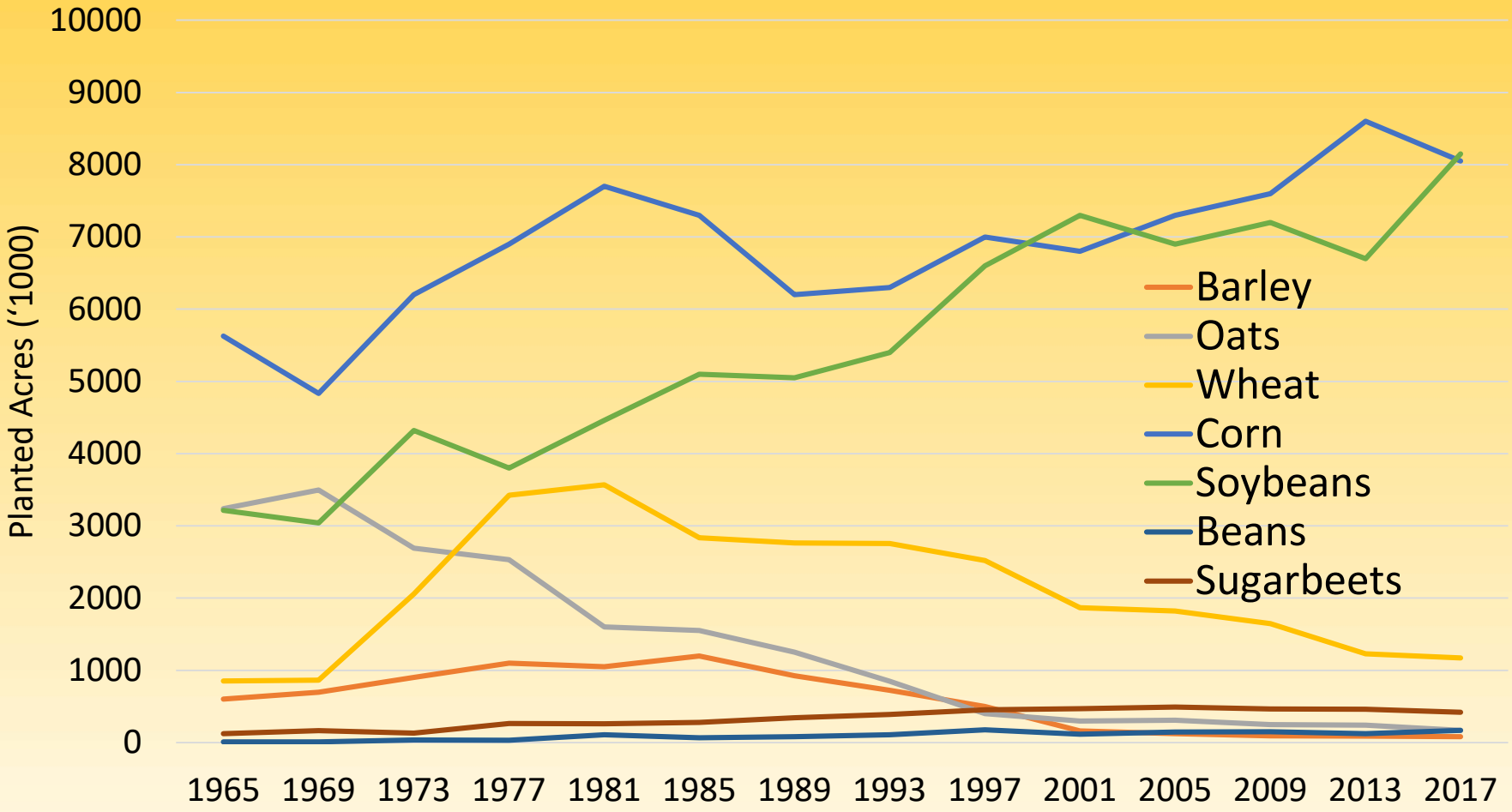
2017 Monthly Rainfall – RRV and So. MN



Source: NDAWN Center, NDSU & SMBSC

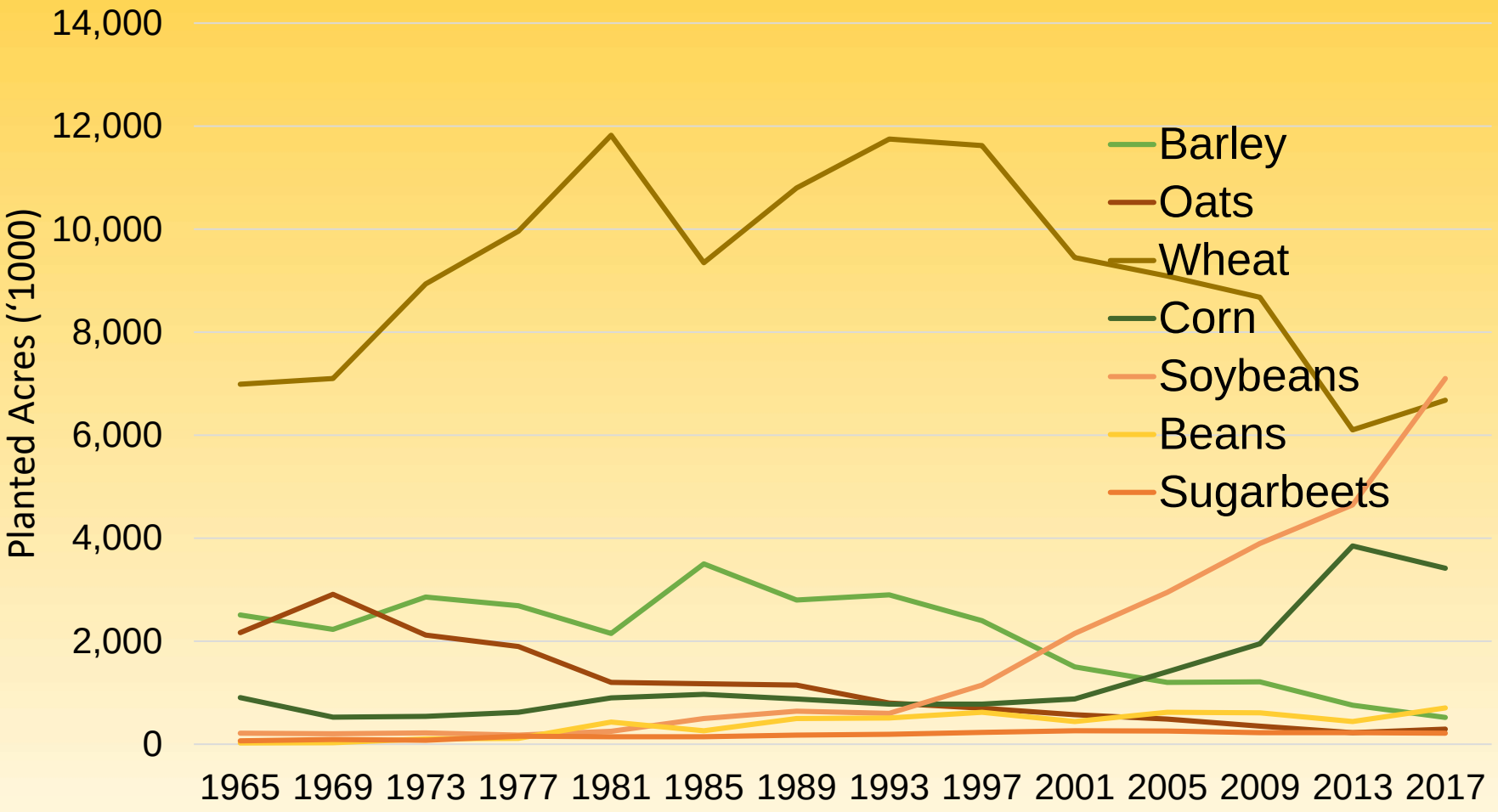
Why Rhizoctonia is becoming an increasing problem?

Acreage for Field Crops in MN



Source: USDA-NASS

Acreage for Field crops in ND

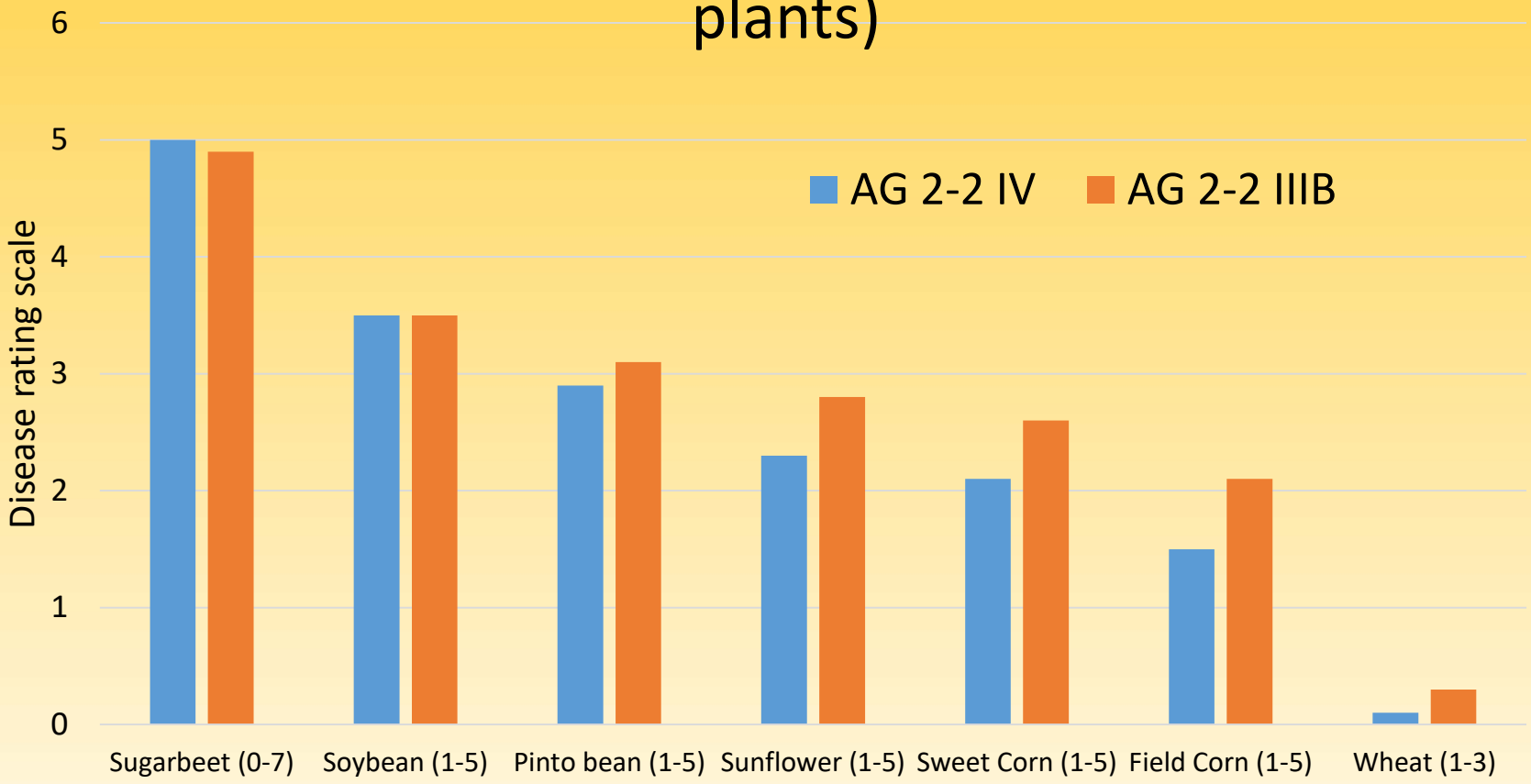


Source: USDA-NASS

Rhizoctonia

- Fungus – *Rhizoctonia solani*
- Anastomosis group AG 2-2
- AG 2-2 has intraspecific groups (ISGs)
  - AG 2-2 IIIB and AG 2-2 IV
- Both ISGs cause same symptoms on sugarbeet
- Both occur in MN/ND (Windels, 2009)
  - RRV (460 cultures): AG 2-2 IV most common (66%)
  - So. MN (504 cultures): AG 2-2 IIIB most common (56%)

Aggressiveness of AG 2-2 IV and 2-2 IIIB on sugarbeet and common rotation crops (adult plants)



(Windels, 2012)

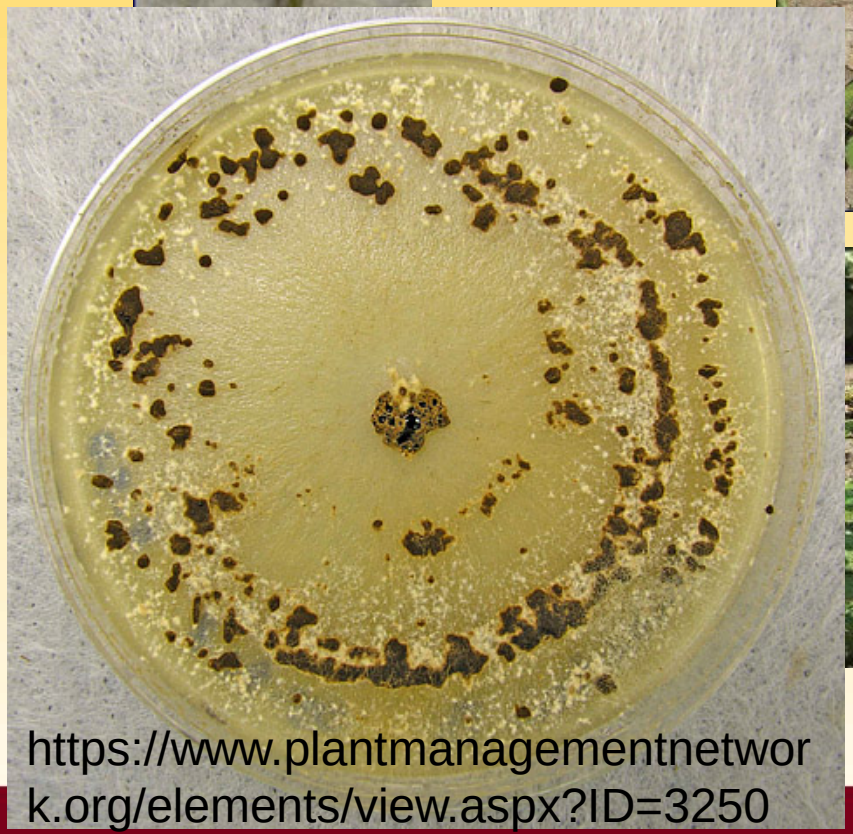
Average disease ratings

Sugarbeet (0-7)	Pinto bean (1-5)	Soybean (1-5)	Wheat (0-3)
~5	~3	~3.5	~0.2

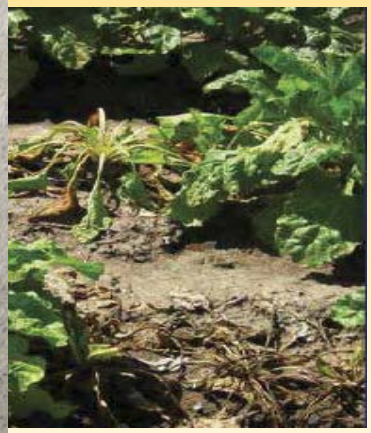
(Windels, 2012)

Damping-off

Crown and Root Rot



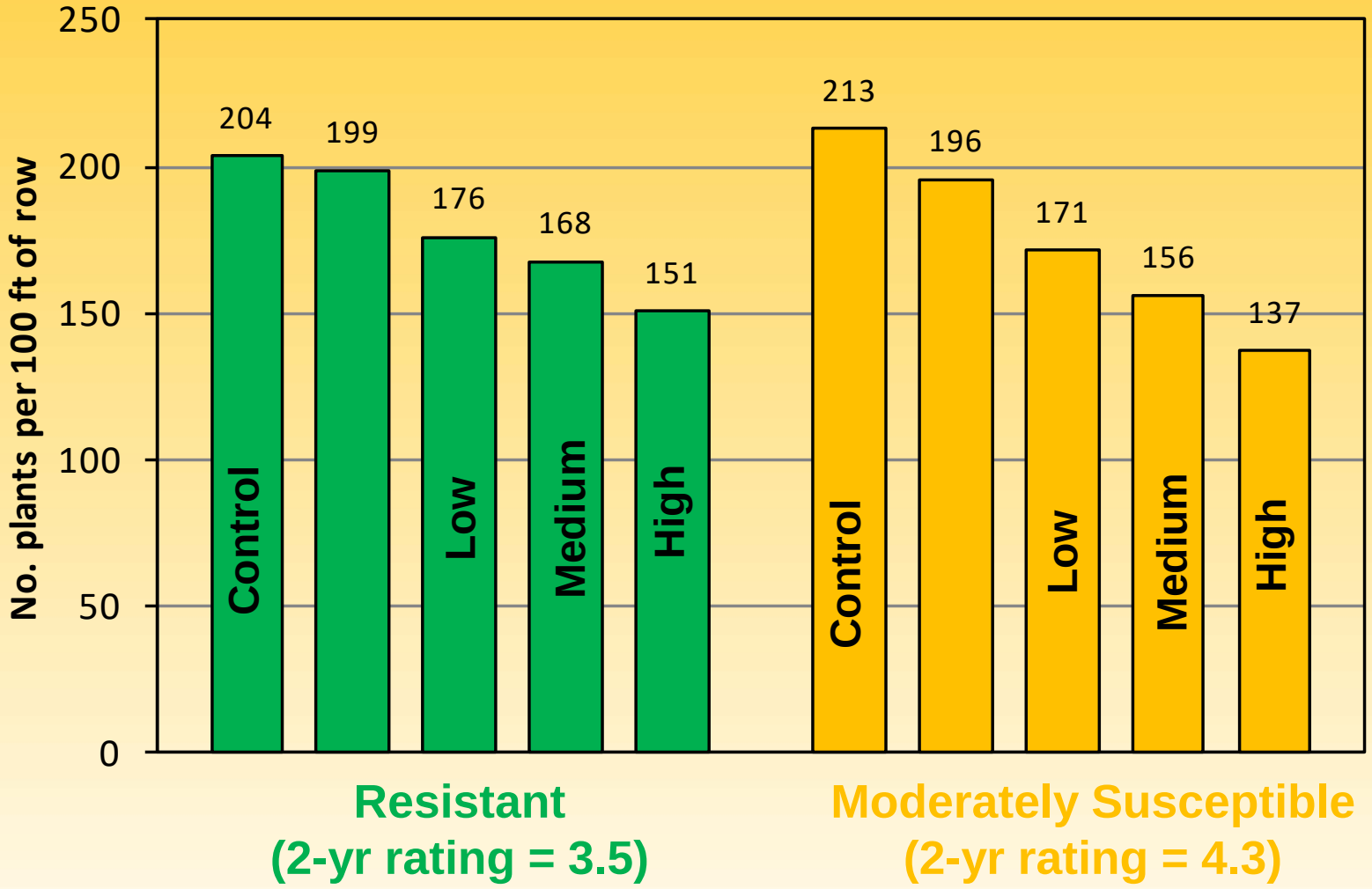
https://www.plantmanagementnetwork.org/elements/view.aspx?ID=3250



Management of Rhizoctonia

- Crop Rotation
  - Length
  - Crop choice & weed control
- Early planting
- Resistant varieties
- At-planting fungicides
  - Seed treatments
  - In-furrow fungicides
- Postemergence fungicides

Rhizoctonia Pressure and Variety Selection



Variety selection for 2018

Roundup Ready ®	Full Market	Aph Spec	Rhc Spec	High Rzm
BTS 80RR52	Yes	Aph		Hi Rzm
BTS 8337	Yes	Aph		Hi Rzm
BTS 8363	Yes			Hi Rzm
BTS 8500	Yes	Aph		Hi Rzm
BTS 8512	Yes	Aph		Hi Rzm
BTS 8524	Yes	Aph		Hi Rzm
BTS 8572	Yes	Aph		Hi Rzm
BTS 8606	New			Hi Rzm
BTS 8629	New			Hi Rzm
Crystal 093RR	Yes	Aph		Hi Rzm
Crystal 101RR	Yes	Aph		Hi Rzm
Crystal 246RR	Yes			Hi Rzm
Crystal 247RR	Yes			Hi Rzm
Crystal 355RR	Yes	Aph	Rhc	Hi Rzm
Crystal 467RR	Yes	Aph		Hi Rzm
Crystal 572RR	Yes			Hi Rzm
Crystal 573RR	Yes	Aph		Hi Rzm
Crystal 574RR	Yes	Aph		Hi Rzm
Crystal 578RR	Yes			Hi Rzm
Crystal 684RR	New	Aph		Hi Rzm
Crystal 986RR	Yes	Aph		Rzm
Hilleshög 4302RR	Yes	Aph+	Rhc	Rzm
Hilleshög 4448RR	Yes			Rzm
Hilleshög 9528RR	Yes	Aph		Hi Rzm
Hilleshög 9707	No	Aph		Hi Rzm
Hilleshög 9708	Yes			Hi Rzm
Hilleshög 9895	No	Aph		Hi Rzm
Maribo 109	Yes	Aph	Rhc	Hi Rzm
Maribo 305	Yes			Rzm
Maribo 502	No	Aph		Hi Rzm
Maribo 504	Yes			Hi Rzm
Maribo 611	No	Aph		Hi Rzm

https://www.crystalsugar.com/media/407966/acscgrowerpkt2017.pdf

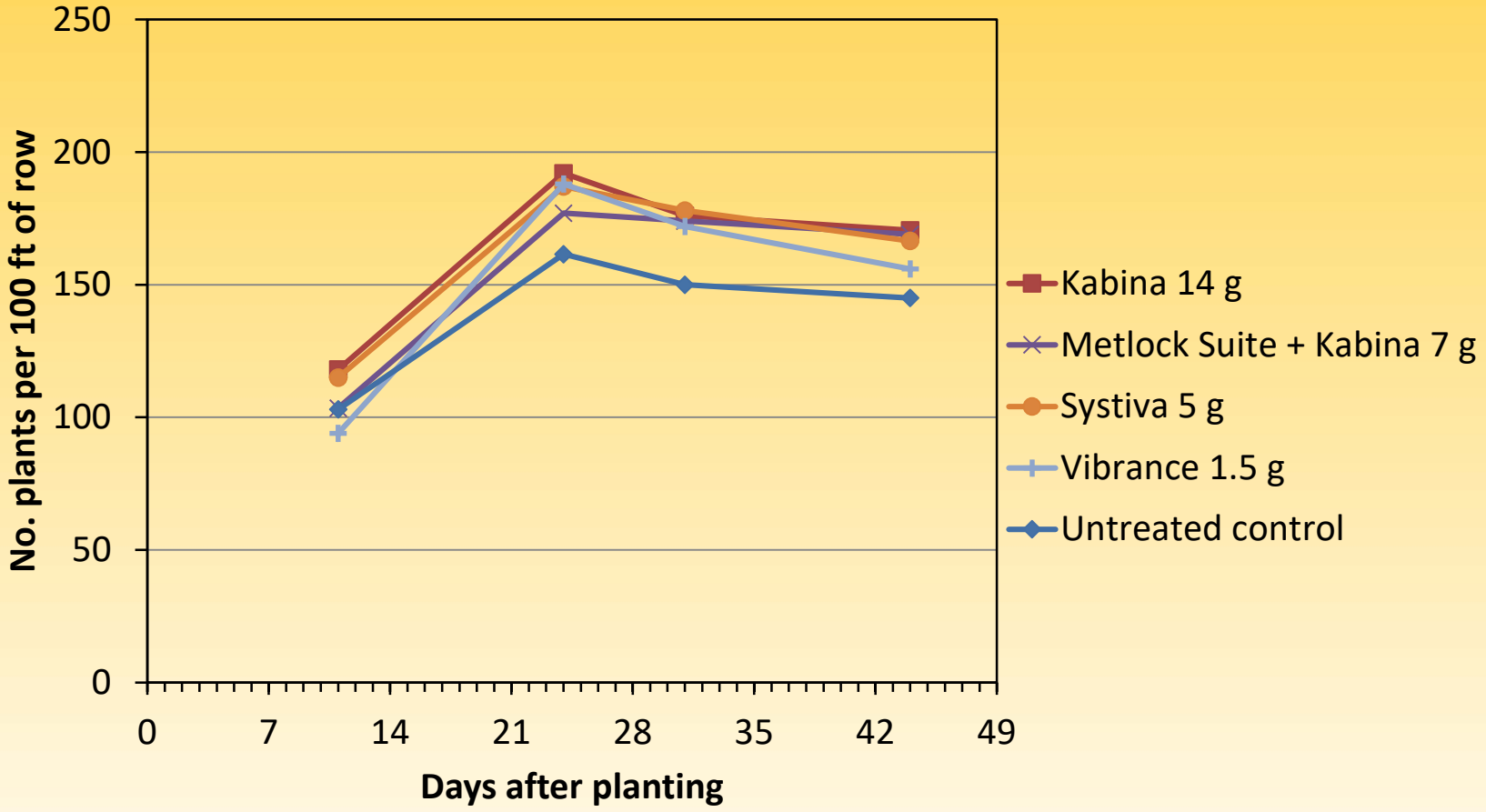
Seed treatments

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

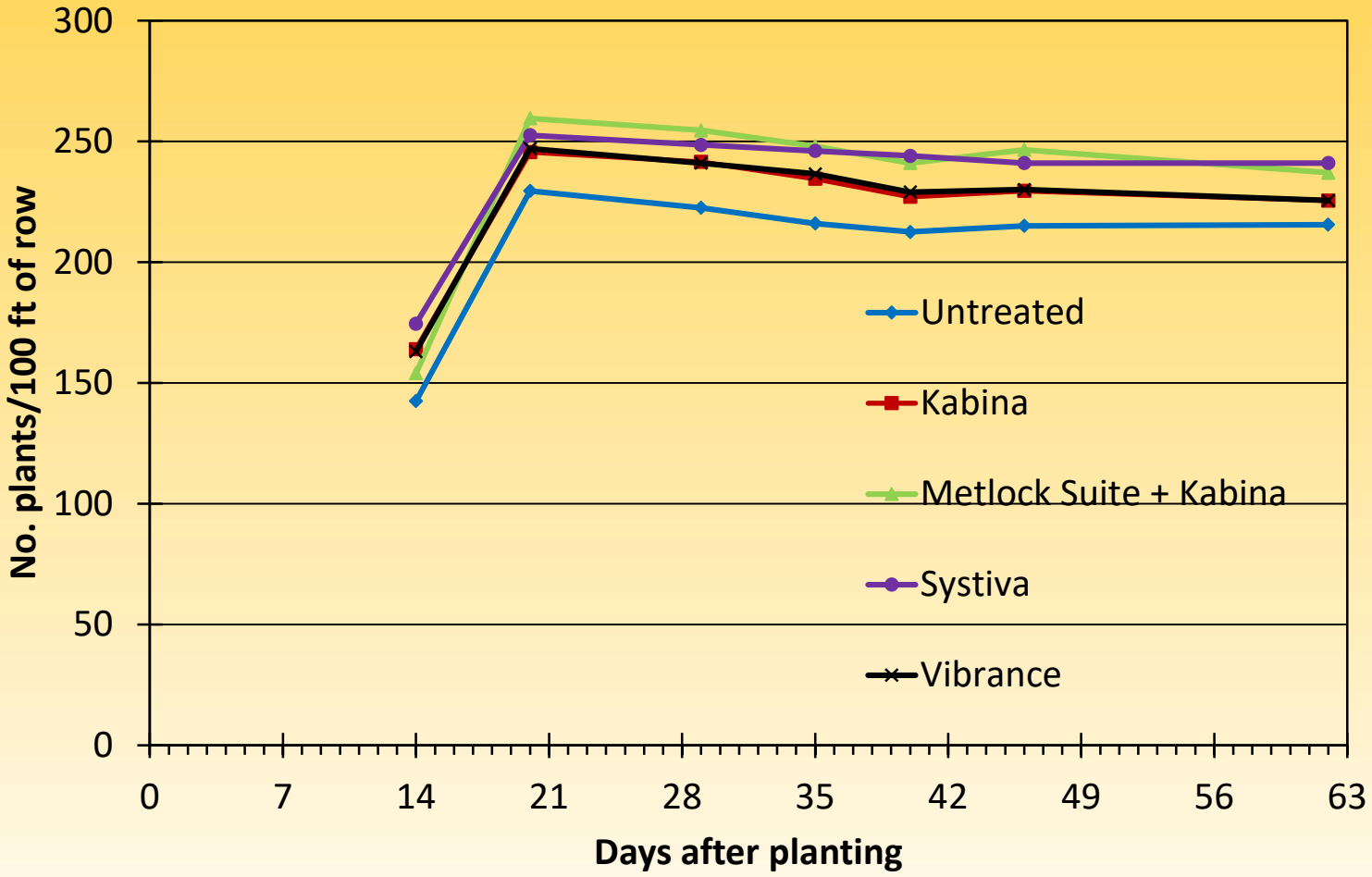
Seed treatments

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

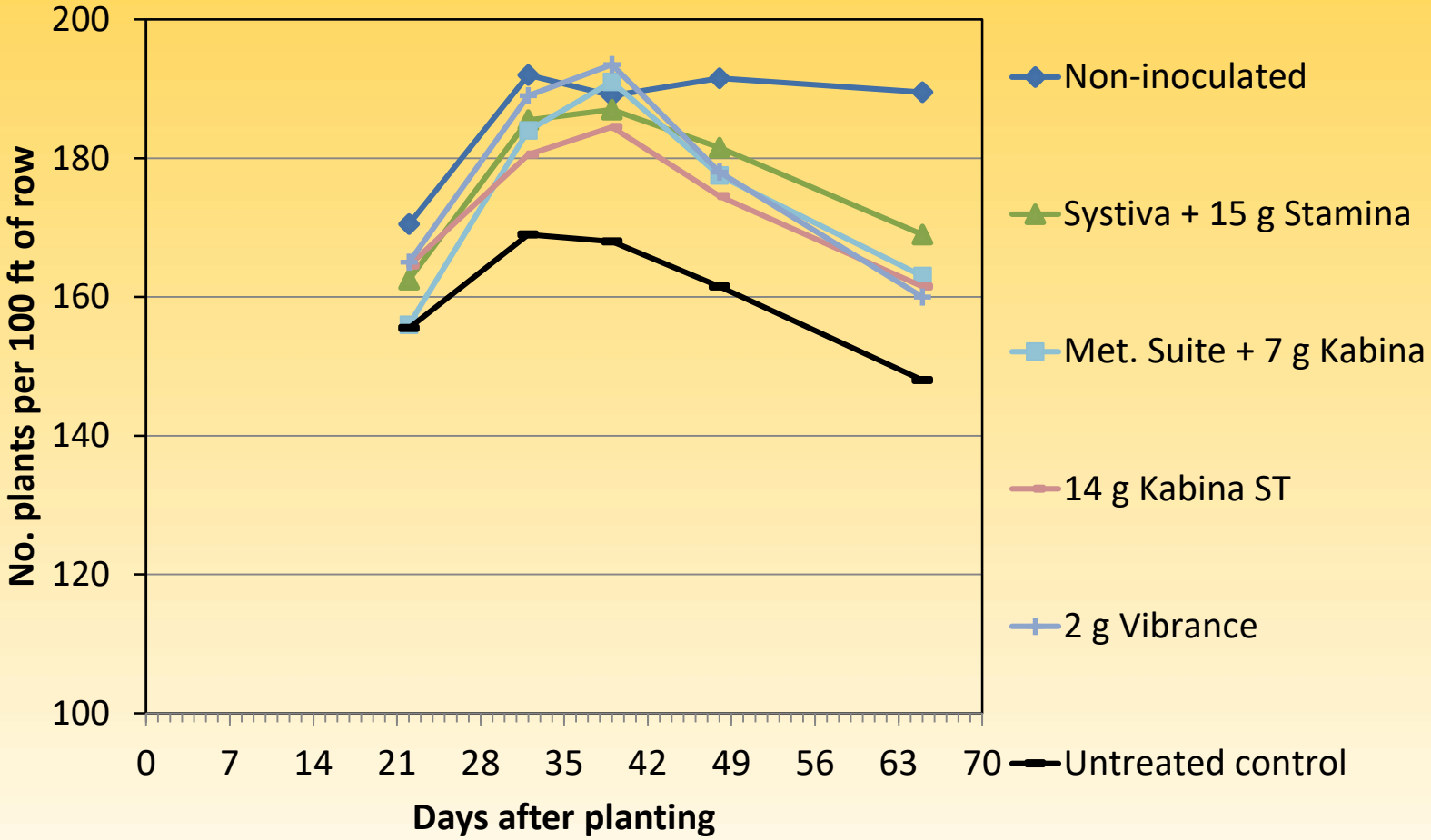
Seed treatments – 2016



Seed treatments – 2017



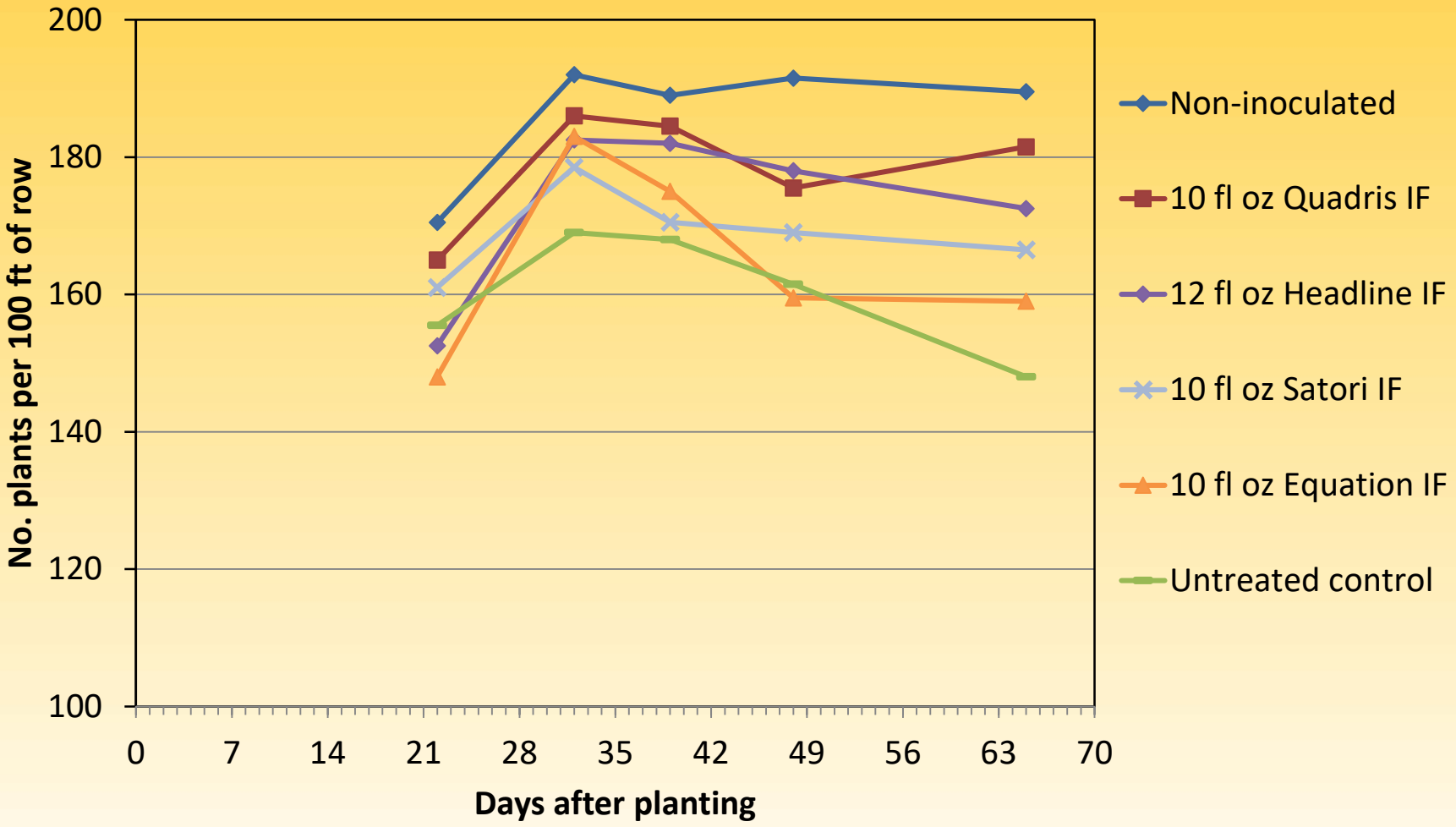
Seed treatments – 2015



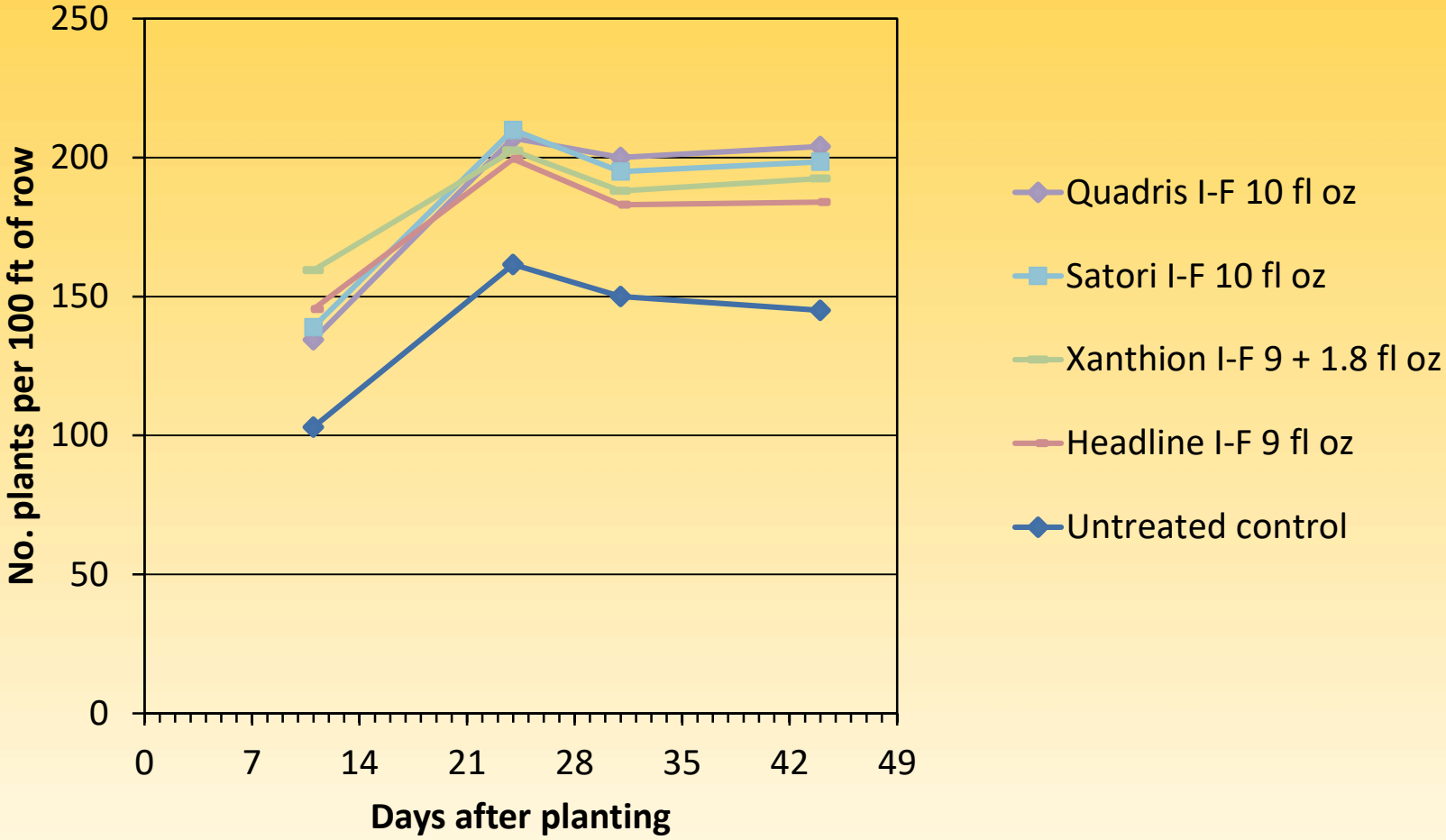
Benefits of seed treatments

- Ease of use -It comes with seed
- Safety
- No plugged nozzles
- 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)

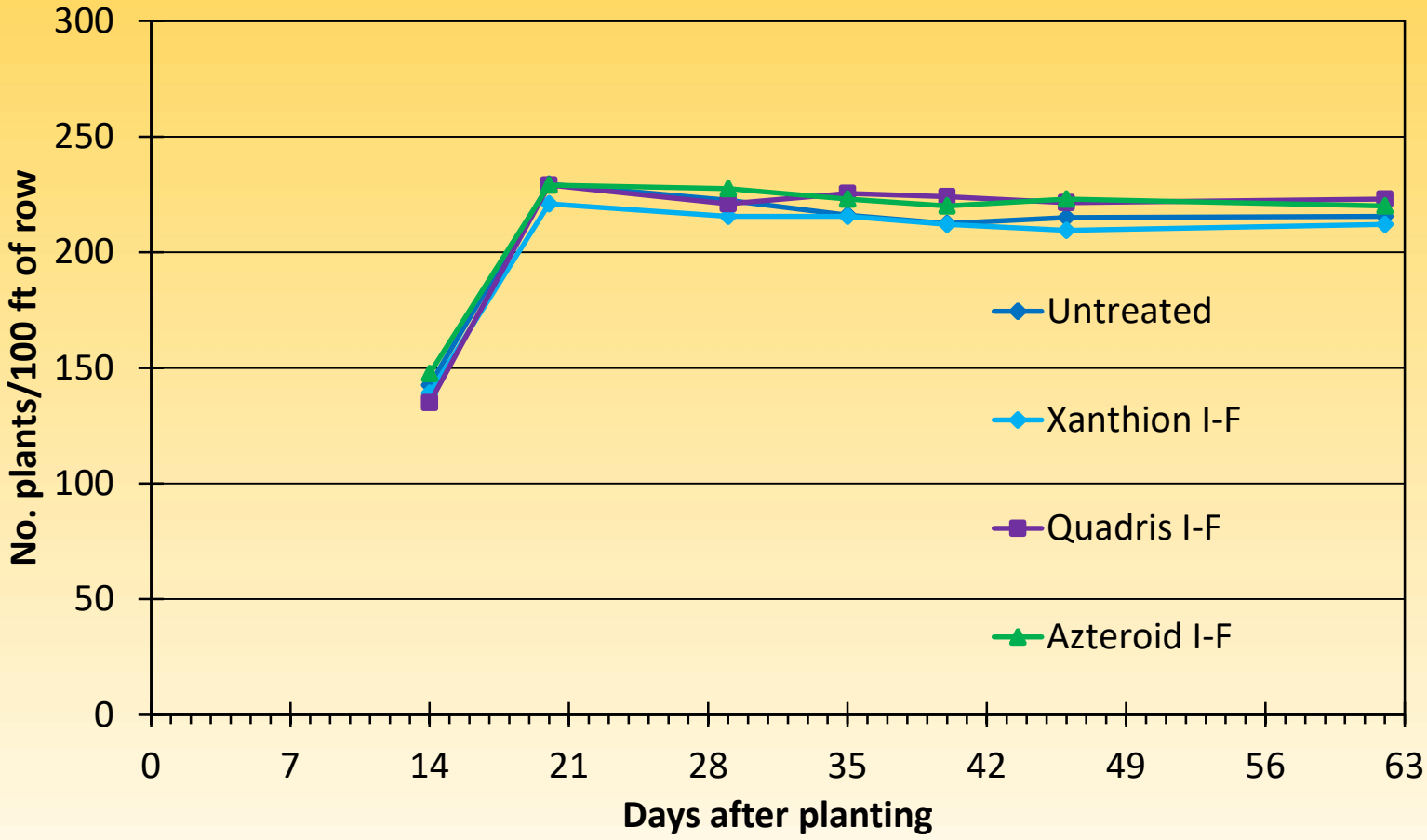
In-furrow treatments – 2015



In-furrow treatments – 2016



In-furrow treatments – 2017



In-furrow treatments

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

Seed vs In-furrow treatments - 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
Seed trts. vs in-furrow trts. Contrast analysis *p*-value	0.001	0.006	0.0032	0.0148

14 g Kabina ST

Metlock Suite

Met. Suite + 7 g Kabina

7 g Kabina ST

2 g Vibrance

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 treatments - 2017

Treatment	No. harv. roots/100 ft	RCRR (0-7)	Yield ton A^{-1}	RSA
Seed treatments	195	1.2	31.6	10708
In-furrow treatments	191	0.8	32.4	11132
Contrast analysis P-value	0.43	0.07	0.36	0.22
	NS	NS	NS	NS

Seed Treatments

14 g Kabina ST

Metlock Suite

Met. Suite + 7 g Kabina

5 g Systiva

1.5 g Vibrance

In-furrow

10 fl oz Quadris

11.9 fl oz AZteroid

Xanthion (Headline +

Integral, 9 + 1.8 fl oz/A)

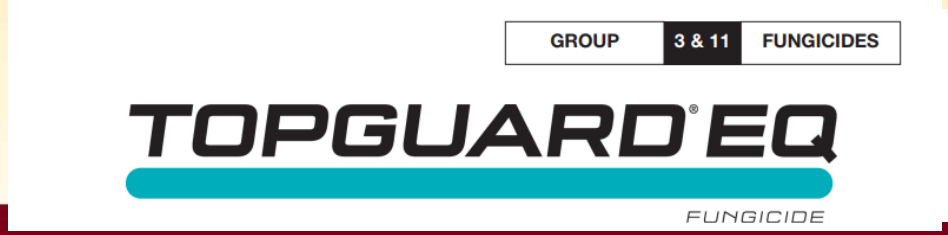
NS = not significantly different

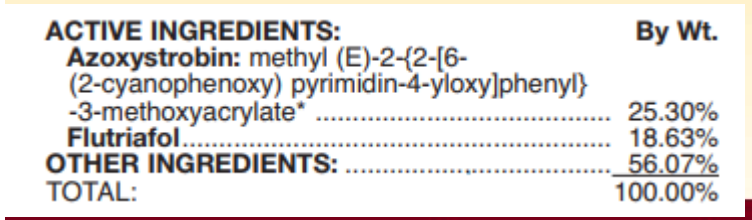
Postmergence treatments - 2017

Treatment (Rates per Acre)	RCRR (0-7)	RCRR % Incidence	Yield T/A	RSA
No fungicide control	**3.7 a**	**75 a**	**23.2 c**	**7324 c**
AZteroid @ 17.6 fl oz, band	0.7 b	15 b	33.6 ab	11084 ab
Quadris @ 10 fl oz, band	0.9 b	16 b	33.5 ab	11272 a
Quadris @ 14 fl oz, band	**1.2 b**	**25 b**	**31.9 ab**	**10659 ab**
Quadris @ 14 fl oz **broadcast**	1.1 b	21 b	33.4 ab	10944 ab
ANOVA *P*-value	<0.0001	<0.0001	<0.0001	0.0001
LSD ($P = 0.05$)[W]	0.92	18.4	3.86	1451

Postmergence treatments - 2017

Treatment (Rates per Acre)	RCRR (0-7)	RCRR % Incidence	Yield T/A	RSA
No fungicide control	**3.7 a**	**75 a**	**23.2 c**	**7324 c**
Topguard EQ @ 7 fl oz	1.1 b	20 b	35.5 a	11715 a
Priaxor @ 6.7 fl oz + NIS (0.25%)	1.5 b	26 b	31.0 b	9809 b
Proline @ 5.7 fl oz + NIS (0.125%)	1.6 b	33 b	32.7 ab	11013 ab
ANOVA *P*-value	<0.0001	<0.0001	<0.0001	0.0001
LSD ($P = 0.05$)[W]	0.92	18.4	3.86	1451





Postmergence treatments - 2016

Treatment (Rates per Acre)	RCRR (0-7)	RCRR % Incidence	Yield T/A	RSA
No fungicide control	**3.8 a**	**61 a**	**18.9 c**	**4240 d**
Satori @ 14 fl oz, band	0.7 d	0 c	21.8 a	5495 ab
Quadris @ 10 fl oz, band	1.0 bcd	0 c	21.3 ab	5416 ab
Quadris @ 14 fl oz, band	**0.9 cd**	**1 c**	**21.9 a**	**5606 ab**
Quadris @ 14 fl oz **broadcast**	1.1 bcd	5 c	22.0 a	5389 abc
ANOVA *P*-value	<0.0001	<0.0001	0.0007	0.0003
LSD ($P = 0.05$)[W]	0.7	9.9	1.47	576

Postmergence treatments - 2016

Treatment (Rates per Acre)	RCRR (0-7)	RCRR % Incidence	Yield T/A	RSA
No fungicide control	**3.8**	**61 a**	**18.9 c**	**4240 d**
Topguard EQ @ 8 fl oz	0.8 d	1 c	22.6 a	5891 a
Priaxor @ 6.7 fl oz	1.6 b	9 bc	21.1 ab	5336 abc
Proline @ 5.7 fl oz + NIS (0.125%)	1.5 bc	9 bc	19.9 bc	4827 c
ANOVA *P*-value	<0.0001	<0.0001	0.0007	0.0003
LSD (*P* = 0.05)	0.7	9.9	1.47	576

Postmergence treatments - 2015

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 treatments

- Benefits
  - If you are doing a row cultivation
  - Later season disease control
  - Beneficial if later part of the season stays wet
  - Low disease now means clean fields in the future
  - If sugarbeets are following Rhizoctonia-susceptible crops in a rotation

Postemergence treatments

- Risks
  - Timing
    - Work better if applied before infection
    - May not be useful if later part of the growing season stays dry
  - **Band application (preferred)** – severe disease pressure
  - Broadcast application – low disease pressure

Take Home Message for 2018

Rhizoctonia pressure (beets/100 ft. row)	Resistant (Specialty) variety	Seed treatment	In-furrow treatment	Postemergence treatment
Low (170-200)	No No	Yes Yes	No No	No Yes (if following Beans)
Moderate (130 – 170)	Yes Yes No	Yes Yes Yes	No No No	No Yes (if following Beans) Yes
Severe (less than 130)	Yes No	Yes Invest	Yes Your $$$$$	Yes Elsewhere!

Take Home Message for 2018

- Seed treatments Kabina, Vibrance, Systiva, or Metlock Suite + Kabina 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

Management of Aphanomyces – Spent Lime Application

Aphanomyces can be a full-season pathogen

Aphanomyces damping-off

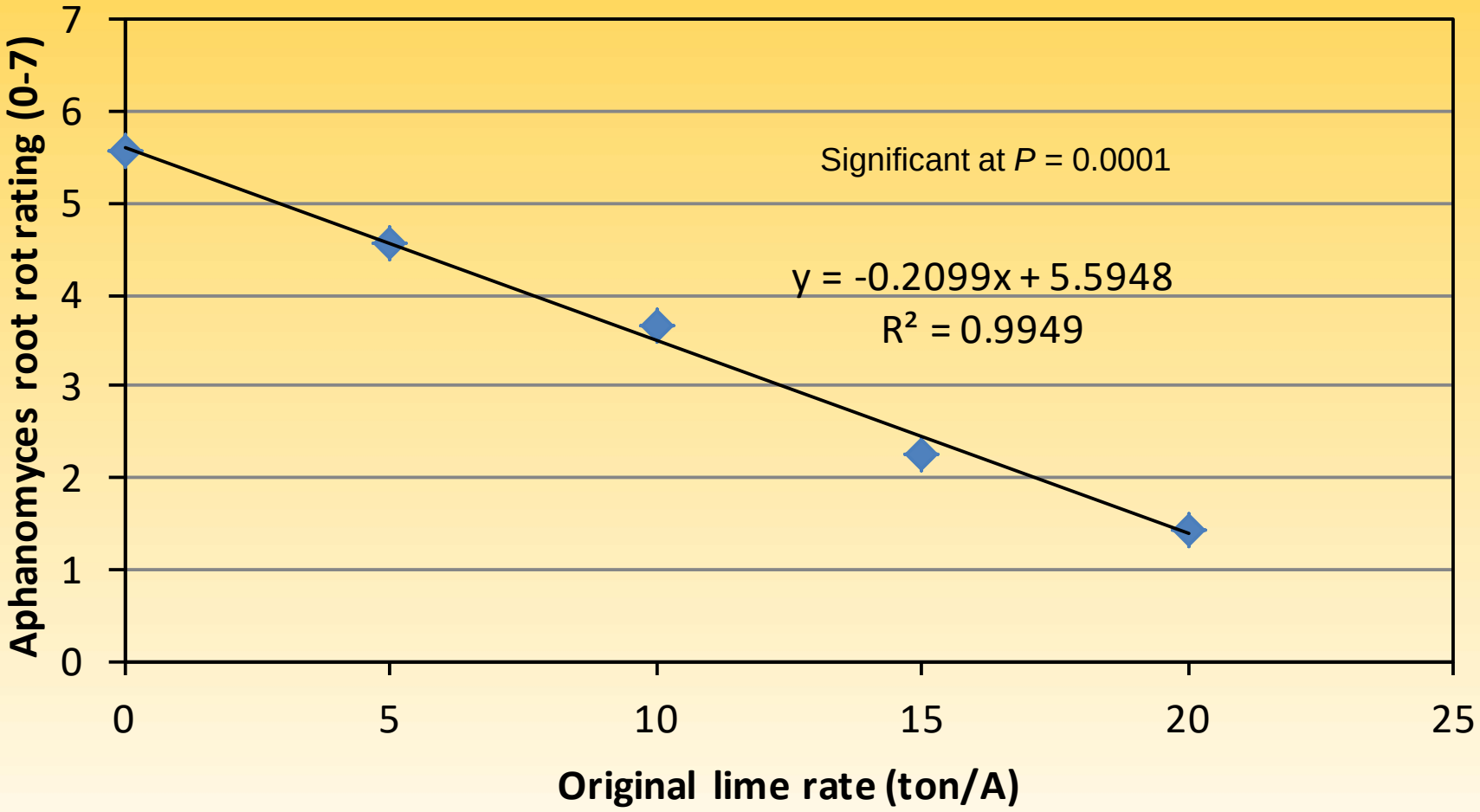
Aphanomyces root rot

2016 - No lime

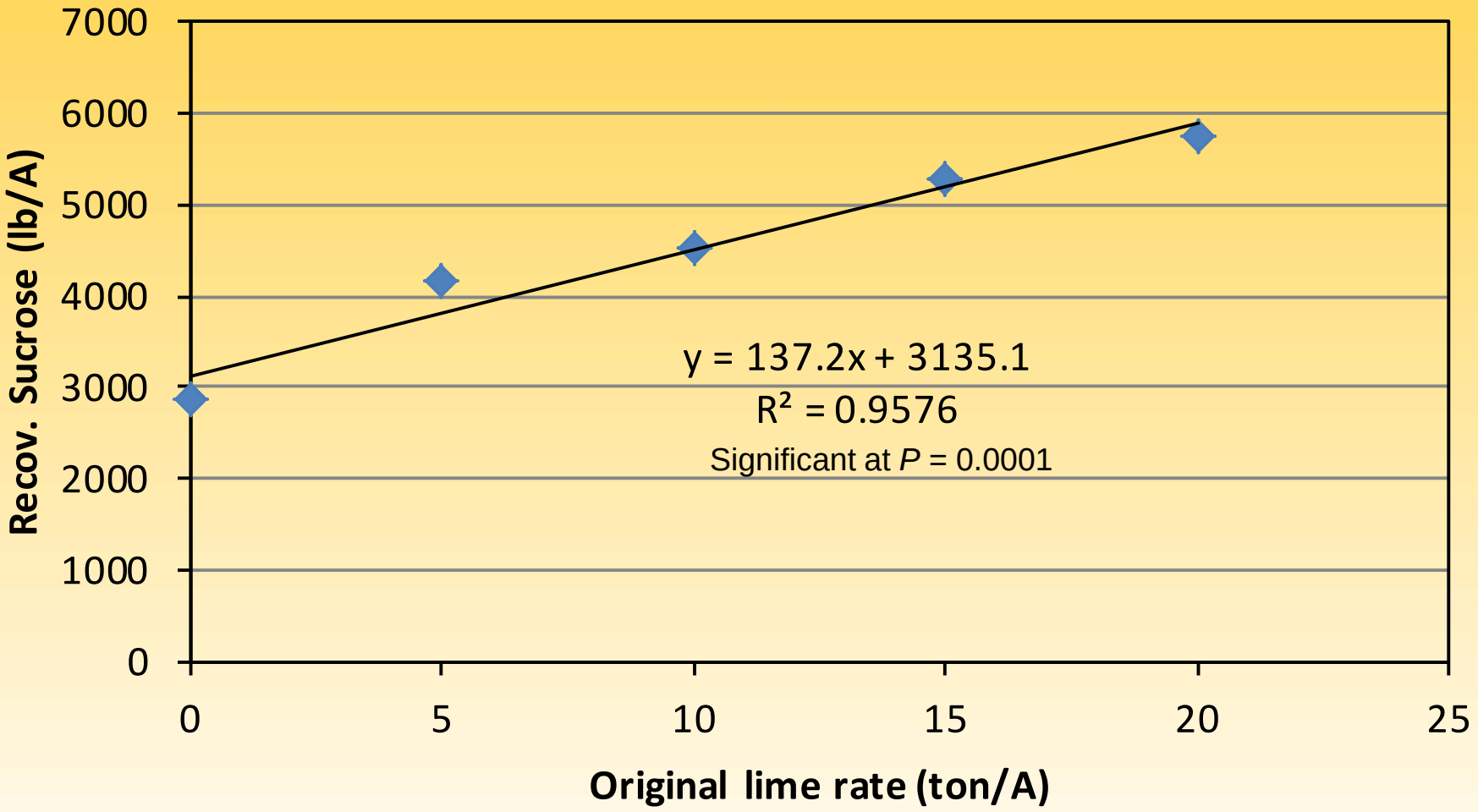

2016 - 10 ton/A lime


2016 - 20 ton/A lime

Original lime still reduced Aphanomyces in sugarbeet after 12 years (2016)



Original lime still improved sugar yield after 12 years

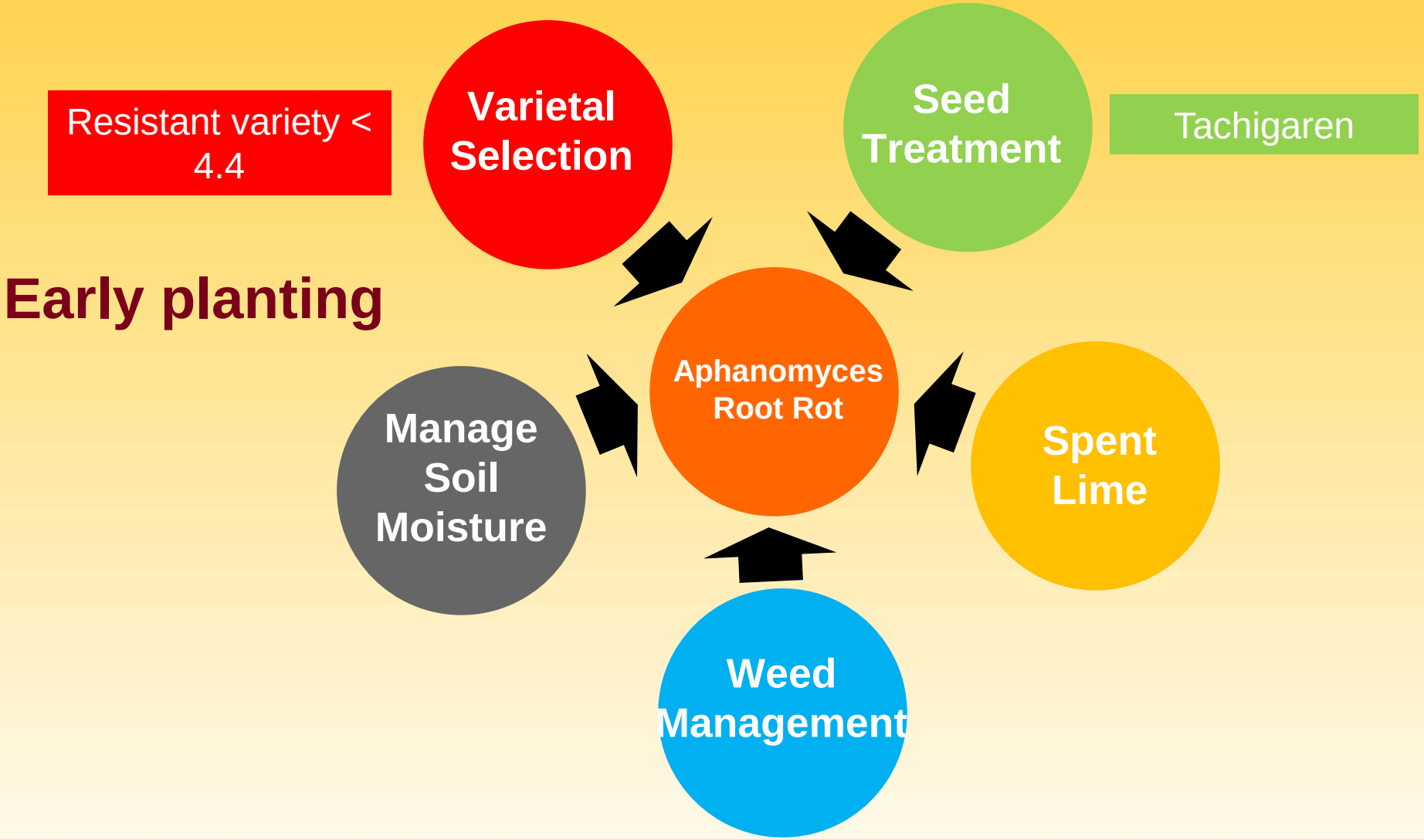


For fields with Aphanomyces:

Current lime rate

No lime	• Add 5-10 ton/A spent lime
5 ton/A	• Add 5 ton/A spent lime
10+ ton/A	• Apply based on field history

Integrated Management of Aphanomyces



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- American Crystal Sugar Company quality lab
- Minn-Dak Farmers Cooperative
- Southern Minnesota Beet Sugar Cooperative

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Questions?

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