Improving Disease and Agronomic Management for Sugarbeet Production

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Update on NDSU Greenhouse Project

OVERALL PROJECT RENDERING LOOKING WEST-NORTHWEST

helenske design group
architecture • construction management

ND Agricultural Experiment Station Greenhouse Com

North Dakota State University, Fargo, ND


10/25/2010 12:35

Meeting Room

Preparation Room

Inoculation Room

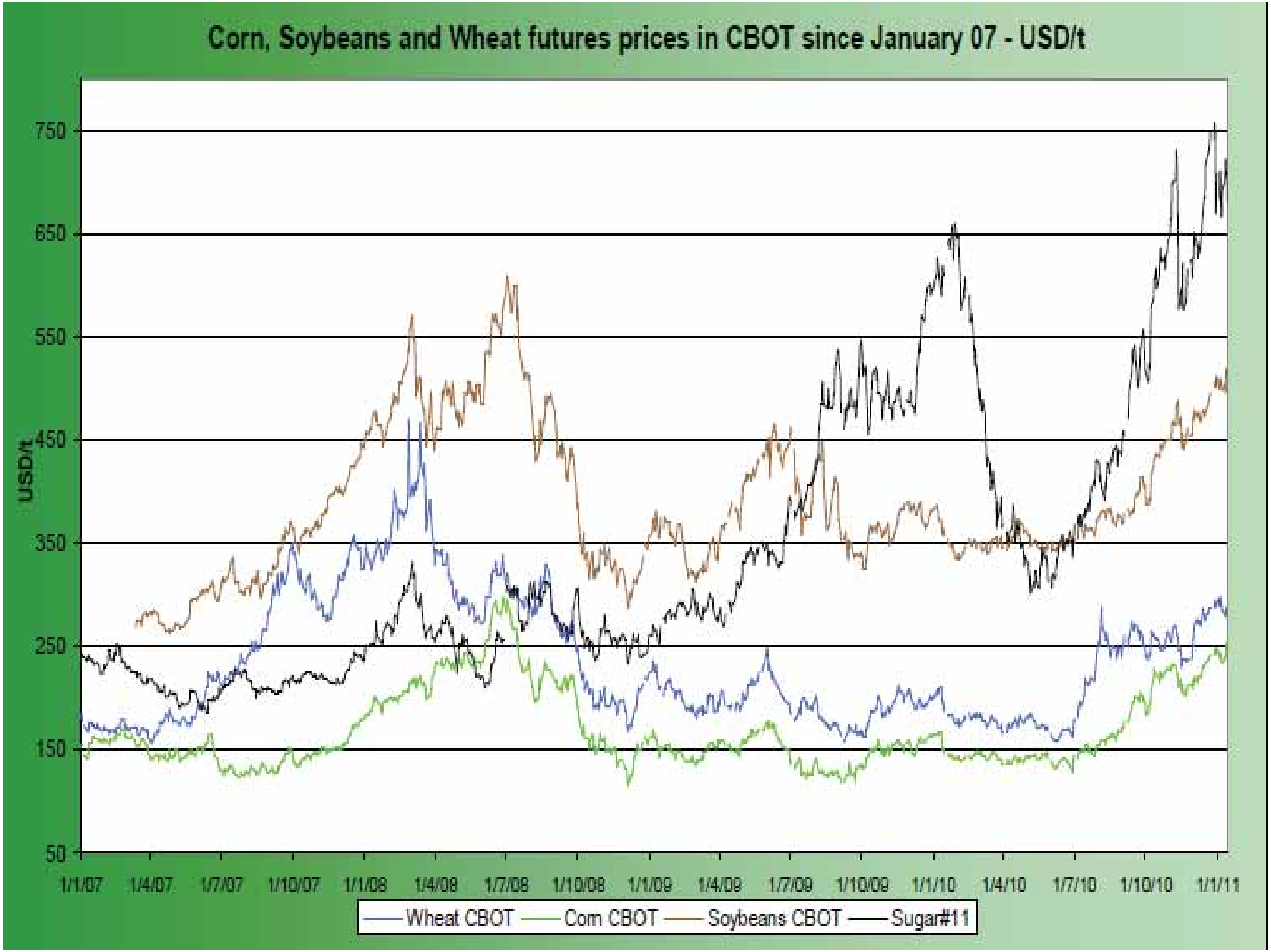

Laboratory Space

Spray Chamber

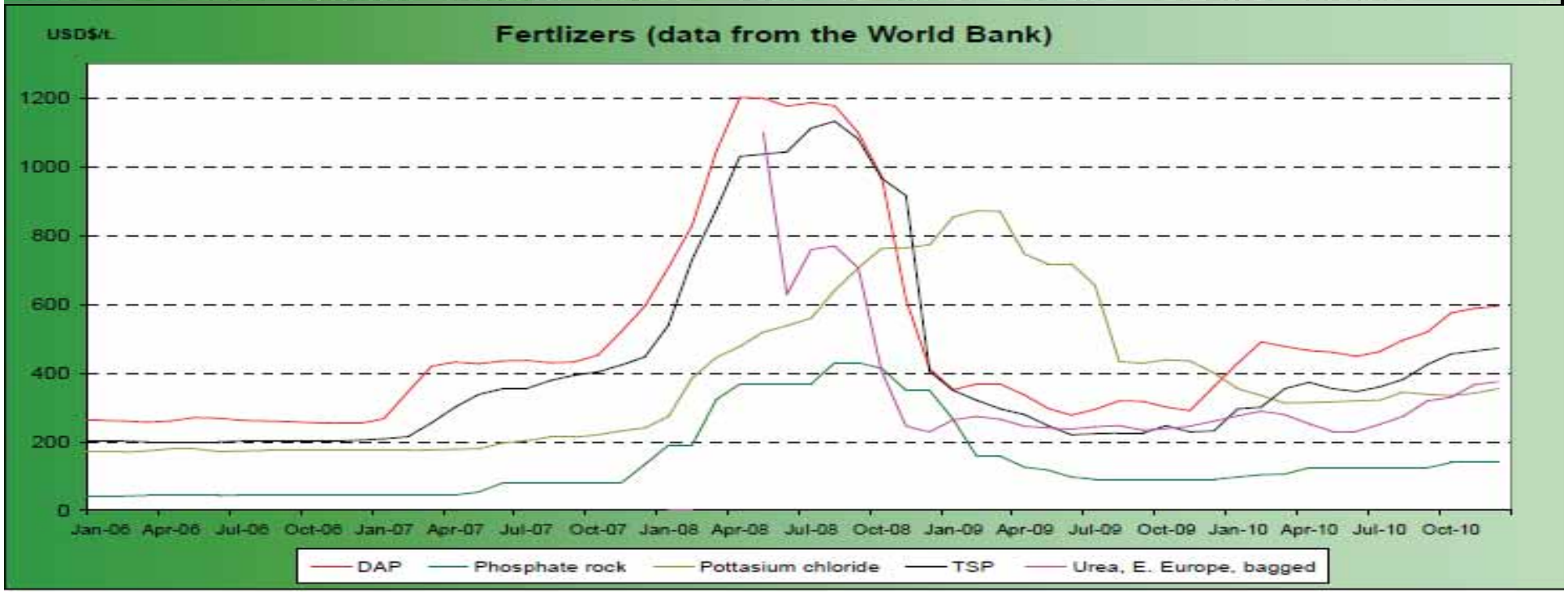
Misting Chamber

Thank You for Your Support!


Sugar Prices #11 and #5 since January 08
850
750
650
550
450
350
250
150
USD/t
1/1/08
1/4/08
1/7/08
1/10/08
1/1/09
1/4/09
1/7/09
1/10/09
1/1/10
1/4/10
1/7/10
1/10/10
1/1/11
Raw sugar #11
Refined sugar #5


Corn, Soybeans and Wheat futures prices in CBOT since January 07 - USD/t
USD/t
750
650
550
450
350
250
150
50
1/1/07
1/4/07
1/7/07
1/10/07
1/1/08
1/4/08
1/7/08
1/10/08
1/1/09
1/4/09
1/7/09
1/10/09
1/1/10
1/4/10
1/7/10
1/10/10
1/1/11
Wheat CBOT
Corn CBOT
Soybeans CBOT
Sugar#11


Crude oil futures prices (NYMEX) (daily based, since january 2006)
130
110
90
70
50
30
13/1/06
16/7/06
16/1/07
19/7/07
19/1/08
21/7/08
21/1/09
24/7/09
24/1/10
27/7/10

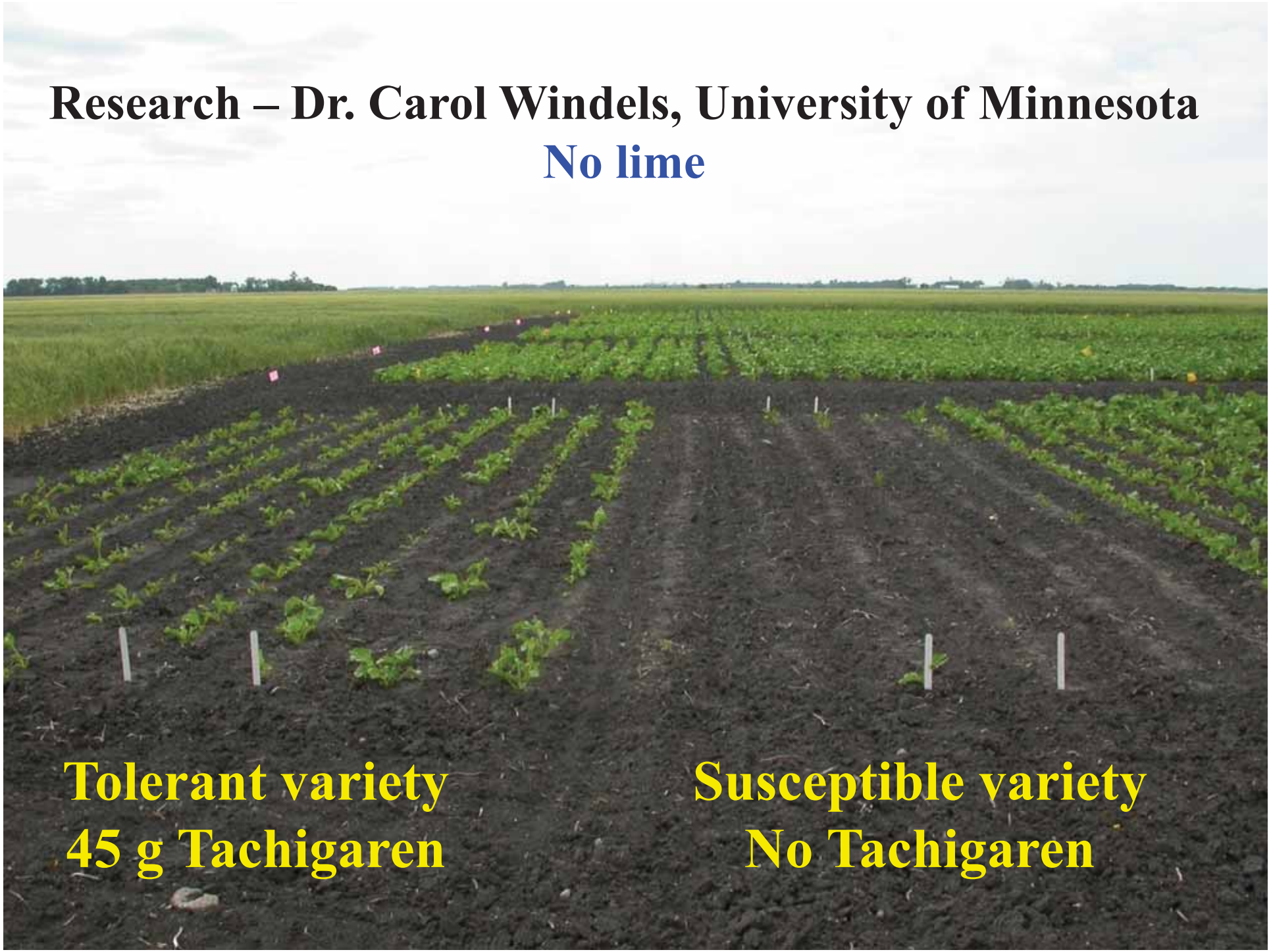

USD$/t
Fertlizers (data from the World Bank)
1200
1000
800
600
400
200
0
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Apr-07
Jul-07
Oct-07
Jan-08
Apr-08
Jul-08
Oct-08
Jan-09
Apr-09
Jul-09
Oct-09
Jan-10
Apr-10
Jul-10
Oct-10
DAP
Phosphate rock
Pottasium chloride
TSP
Urea, E. Europe, bagged

Aphanomyces Root Rot

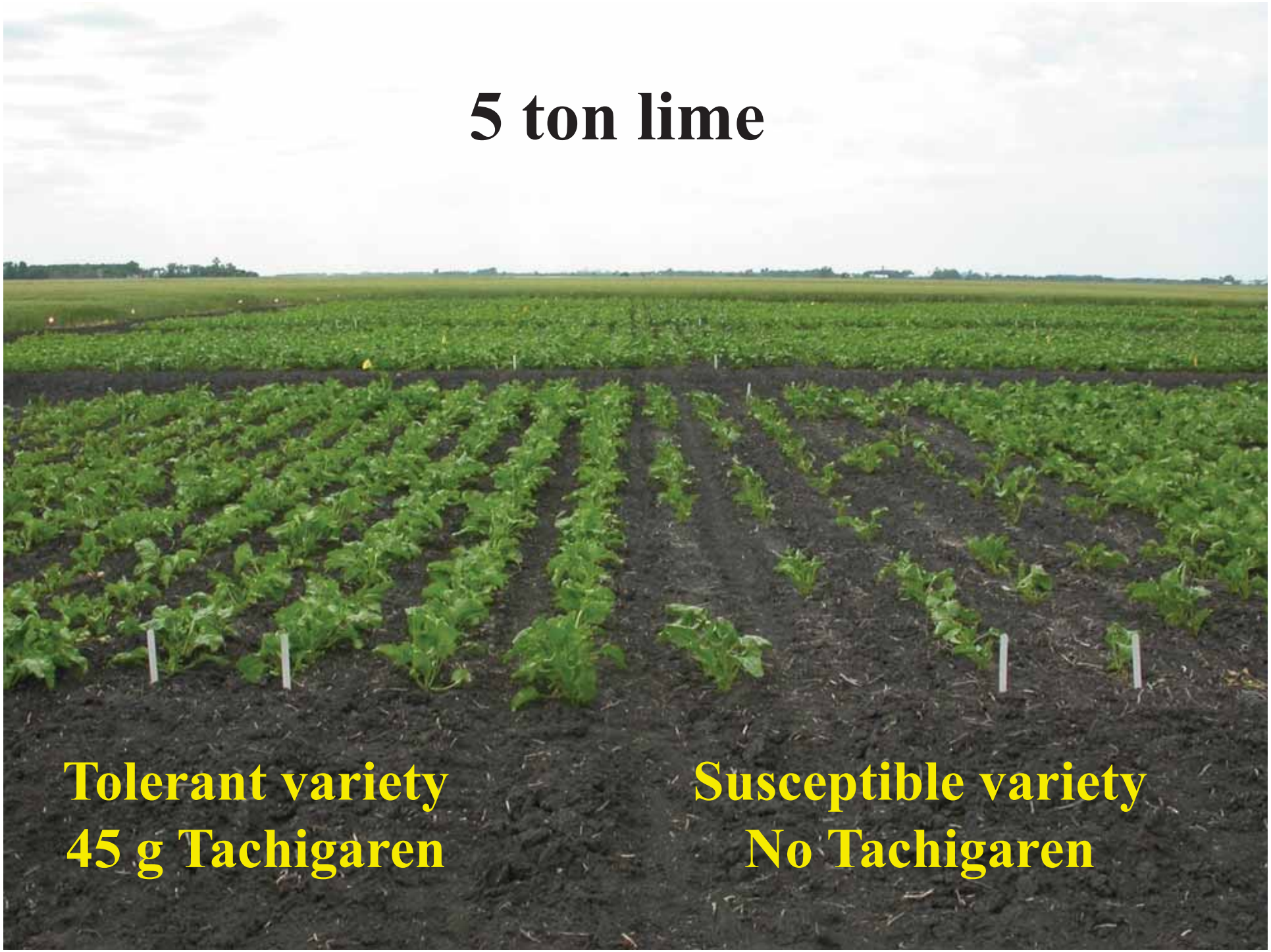
- **Aphanomyces root rot continues to be a problem, particularly in warm, wet years**
- **Use Aphanomyces tolerant varieties**
- **Treat seeds with tachigaren (20 g or 45 g)**
- **Research done by Dr. Carol Windels showed that application and incorporation of precipitated calcium carbonate (waste lime) in fields infected with *A. cochlioides* resulted in reduced disease infection which led to higher plant stand and higher recoverable sucrose per acre.**
- **Use of waste lime is highly recommended.**

Research – Dr. Carol Windels, University of Minnesota

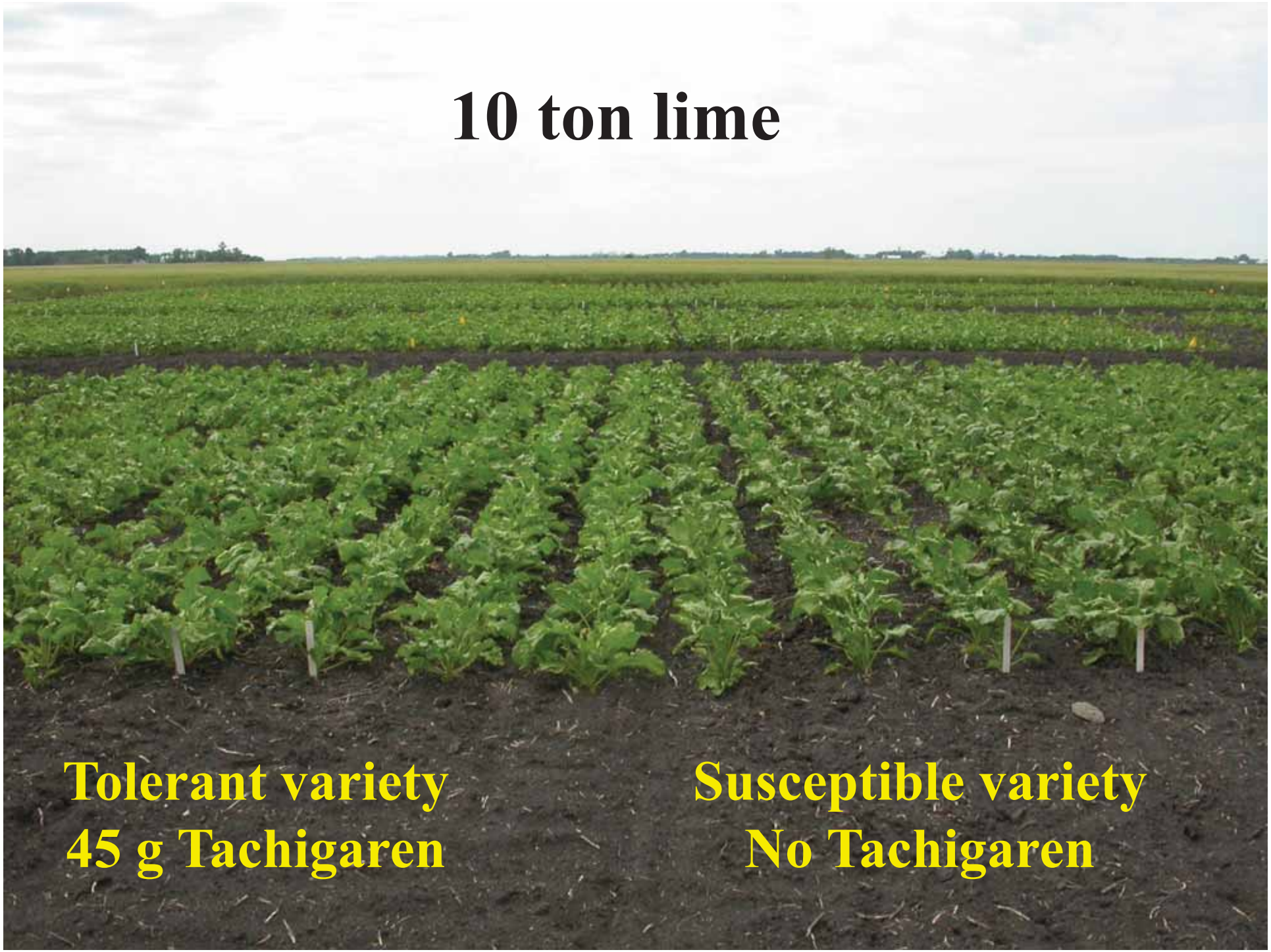
No lime

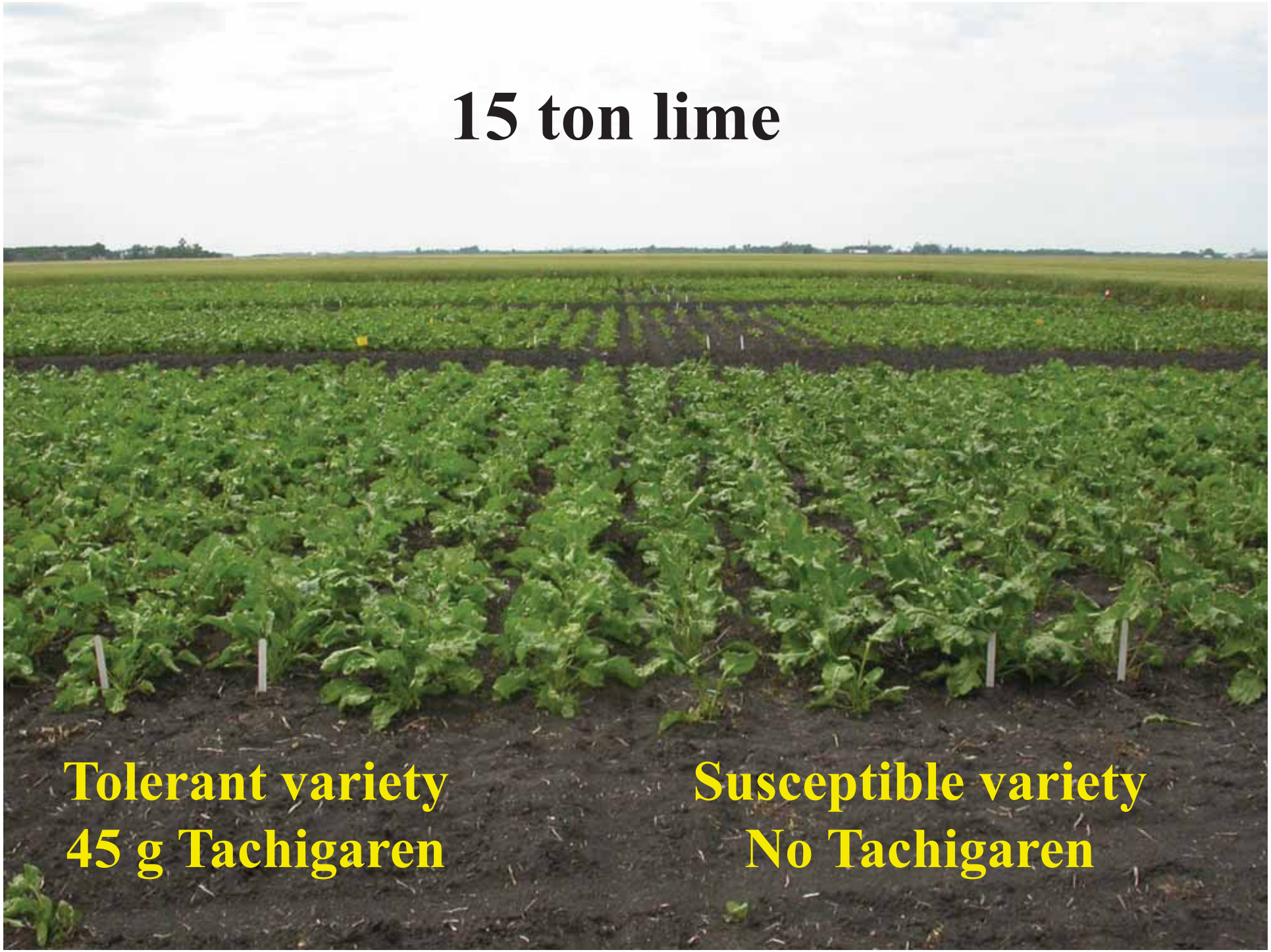


5 ton lime

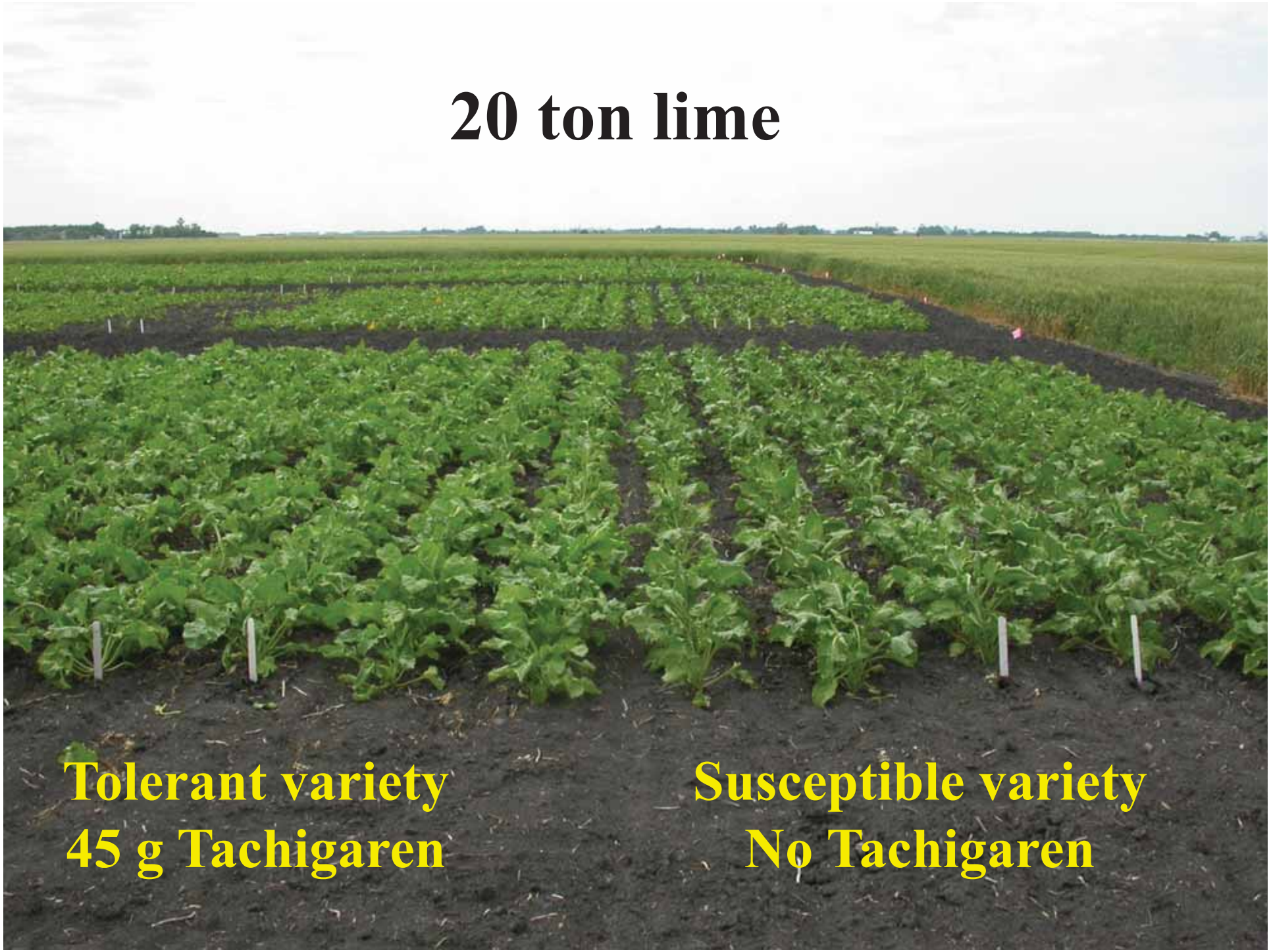

Tolerant variety
45 g Tachigaren
Susceptible variety
No Tachigaren

10 ton lime


Tolerant variety
45 g Tachigaren
Susceptible variety
No Tachigaren


15 ton lime
Tolerant variety
45 g Tachigaren
Susceptible variety
No Tachigaren

20 ton lime


Tolerant variety
45 g Tachigaren
Susceptible variety
No Tachigaren

Effect of Waste Lime on Sugarbeet at Breckenridge (2005-2008)

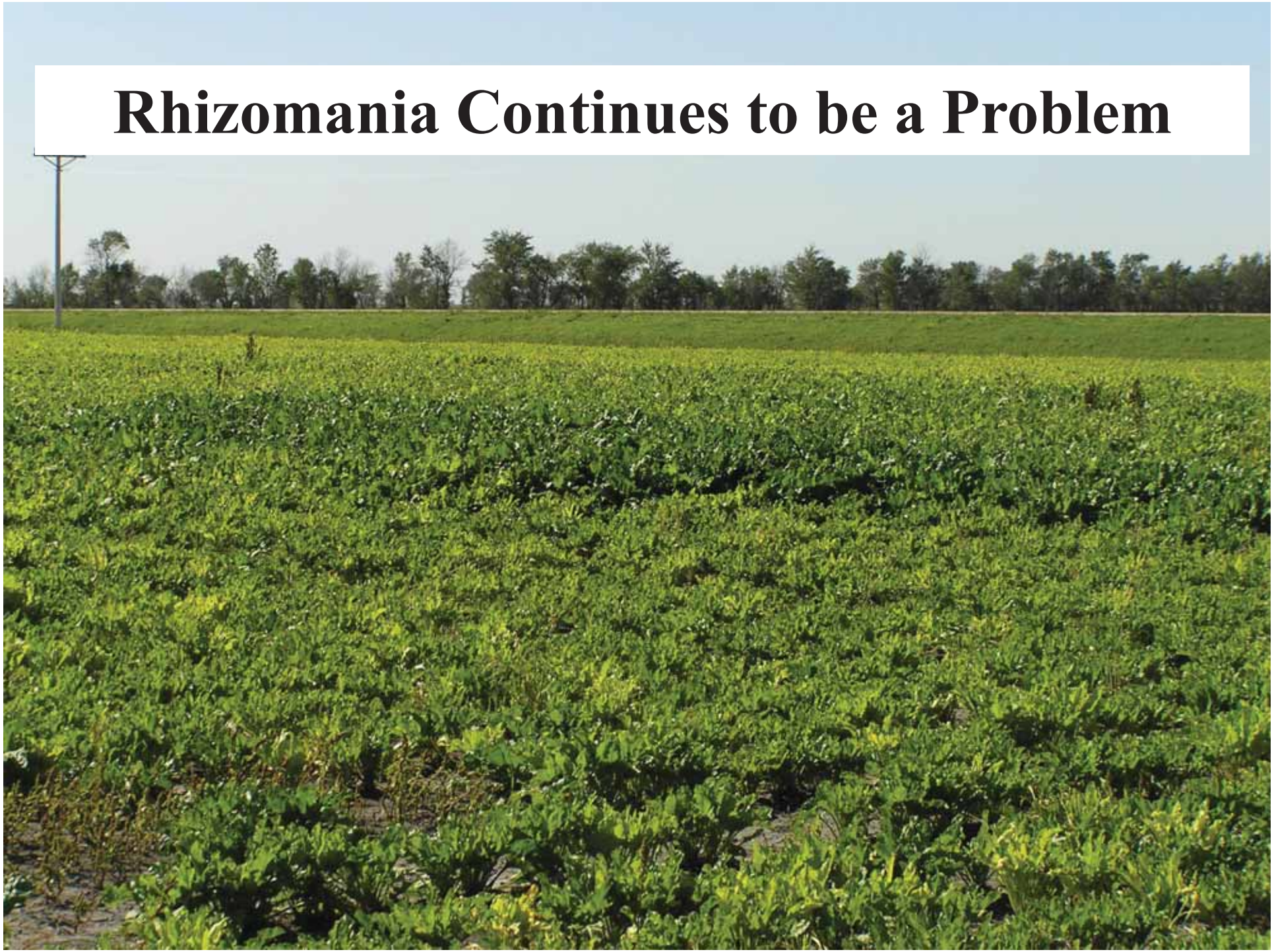
Lime (tons/A)	Har-vested Stand	Root Rot Rating[1]	Yield (T/A)	Sucrose concen-tration (%)	Recover-able Sucrose (lb/A)
0	58	4.9	13.2	14.5	3459
5	83	3.6	22.4	15.2	6120
10	93	3.3	24.5	15.3	6730
15	91	3.2	25.4	15.2	6898
20	96	3.2	26.0	15.2	7076

[1] Aph RRR on 0-7 scale (0=healthy, 7=root completely rotted)

Summary

- Spent lime significantly reduced Aphanomyces root rot.
- Plant stand, beets at harvest, yield and quality of sugarbeet increased with waste lime application.
- Benefits occurred with waste lime at 5 T/A but improved with increased rates.

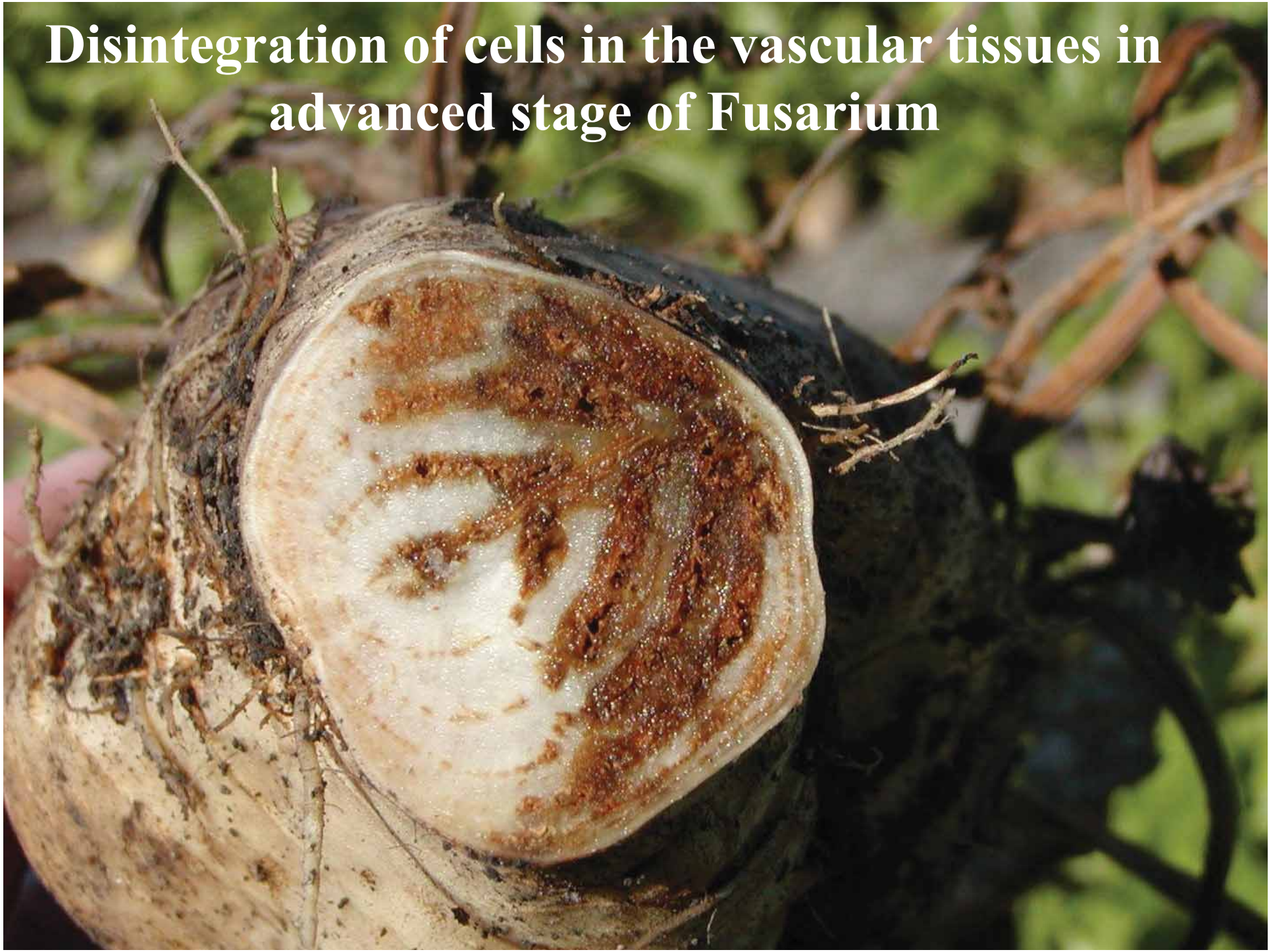
Rhizomania Continues to be a Problem



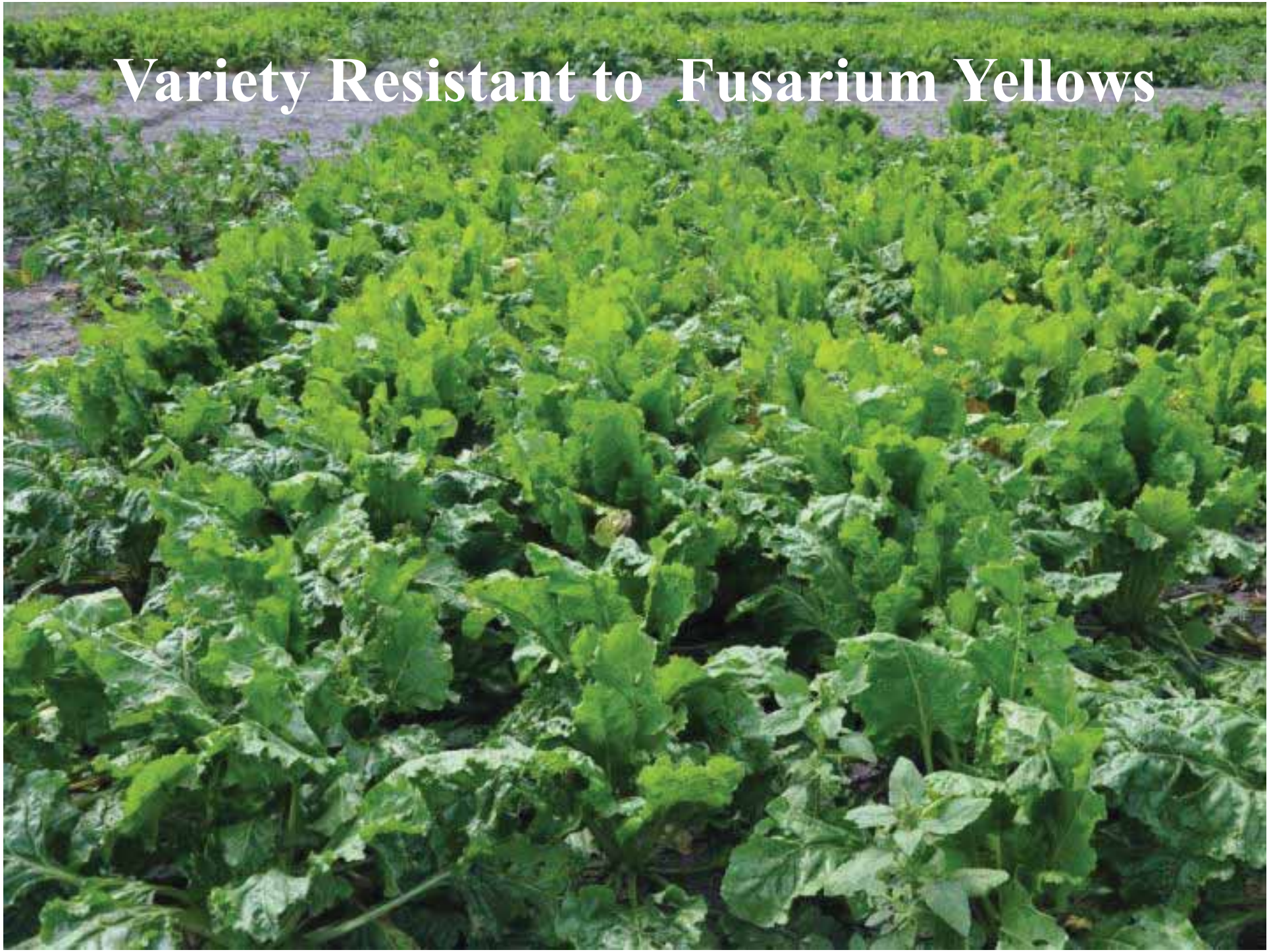
Summary - Rhizomania

- ✓ **In severely infested Rhizomania fields, use rhizomania resistant varieties with highest amount of rhizomania resistance for good disease control and acceptable levels of recoverable sucrose.**

Fusarium Yellows


Disintegration of cells in the vascular tissues in advanced stage of Fusarium

Fusarium Yellows – Susceptible Variety


Variety Resistant to Fusarium Yellows

Comparing Respiration Rates - 2004

Variety	30 days	60 days	120 days
Healthy			
A	**5.35**	**6.32**	**9.47**
Diseased			
B	***10.06***	***15.43***	***31.78***

The respiration rates (mg CO_2/kg roots/hr) for diseased roots was 2 to 2.5 times that of healthy roots from the same field – Dr. Larry Campbell

Comparing Sucrose Content

Roots	***20 days***
Healthy	**16.6 %**
Diseased	**11.0 %**

Summary – Fusarium Yellows

- ✓ **Observe fields for symptoms of Fusarium Yellows. Send samples to NDSU or Crookston for confirmation of the disease.**
- ✓ **Use approved resistant varieties for fields identified with Fusarium.**
- ✓ **Use longer rotation to reduce build-up of Fusarium.**
- ✓ **Enhance field drainage and improve soil tilth.**

Growers Field in Moorhead – Cercospora leaf spot

Cercospora Leaf Spot - 2010

- Planted May 19, inoculated 6 July
- 26 July, 9, 20 August, 2 September
- Headline – 9 fl oz
- Eminent – 13 fl oz
- Inspire XT – 7 fl oz
- Proline + Premier NIS – 5 oz + 0.125% v/v
- SuperTin 4L – 8 fl oz
- (Topsin + Super Tin) –7.6 fl oz + 6 fl oz

Efficacy of Fungicides Used Alone in Controlling *Cercospora beticola*

Treatments @ 14 d	*CLS*	*RSA*
Nontreated Check	10.0	4,789
Proline + AG08011	4.8	9,000
Inspire XT + AG08011	6.0	8,770
Headline EC	6.3	7,540
Headline SC	6.3	7,828
SuperTin 4L	7.3	7,089
AgriTin	8.5	6,070
Eminent	8.3	6,670
LSD *P*=0.05	0.8	1,082

Nontreated Check

Proline

Inspire XT

Headline

SuperTin

Agritin

Eminent

Efficacy of Fungicides in Alternation at Controlling *Cercospora beticola*

Treatments @ 14 d	*CLS*	*TA*	*% S*
Nontreated Check	10.0	22.7	13.5
(Topsin+SuperTin)/Proline/H-line	5.0	32.5	16.4
Headline / SuperTin / Proline	6.5	31.4	15.9
Inspire XT / SuperTin / Headline	6.8	28.6	16.0
Proline / SuperTin / Headline	7.3	28.9	15.4
Eminent /SuperTin / Headline	8.5	27.2	14.9
LSD P=0.05	*0.7*	*2.5*	*0.7*

Efficacy of Fungicides in Alternation at Controlling *Cercospora beticola*

Treatments @ 14 d	*CLS(1-10)*	*RSA (lb)*
Nontreated Check	10.0	5,451
(Topsin+SuperTin)/Proline/H-line	5.0	9,901
Headline / SuperTin / Proline	6.5	9,164
Inspire XT / SuperTin / Headline	6.8	8,440
Proline / SuperTin / Headline	7.3	8,174
Eminent /SuperTin / Headline	8.5	7,402
LSD *P*=0.05	0.7	973

Is it Economical to Manage *Cercospora beticola* with Fungicides?

Treatments @ 14 d	*Net Return $/A*
Nontreated Check	872
(Topsin+SuperTin)/Proline/H-line	1,497
Headline / SuperTin / Proline	1,400
Inspire XT / SuperTin / Headline	1,284
Proline / SuperTin / Headline	1,242
Eminent /SuperTin / Headline	1,118
LSD *P*=0.05	156

$246-625

Nontreated Check

(SuperTin +Topsin)/Proline/Headline

Headline / SuperTin / Proline

Inspire / SuperTin / Headline

Proline / SuperTin / Headline

Eminent / SuperTin / Headline

Eminent/SuperTin/Headline/ SuperTin

Quadris: Inspire/SuperTin/Headline
RSA 9557 lbs

Fungicide Efficacy on *C. beticola* sensitive and resistant to triazole fungicides

Efficacy of Individual Fungicides at Controlling *Cercospora beticola (C.b)*

Treatments	*Susceptible C.b*		*Resistant C.b*	
	CLS	*RSA*	*CLS*	*RSA*
Control	10	4789	10	5444
SuperTin 4L	7.3	7089	6.8	8077
Headline	6.3	8094	6.3	9128
Eminent	*8.3*	*6670*	*10*	*6169*
Proline + NIS	*5.0*	*8094*	*8.5*	*7390*
Inspire XT	*5.8*	*8269*	*7.5*	*8285*
LSD *P*=0.05	0.8	932	0.8	845

Efficacy of Individual Fungicides at Controlling *Cercospora beticola (C.b)*

Treatments	*Susceptible C.b*		*Resistant C.b*	
	CLS	*RSA*	*CLS*	*RSA*
Control	10	4789	10	5444
SuperTin 4L	7.3	7089	6.8	8077
Headline	6.3	8094	6.3	9128
Eminent	*8.3*	*6670*	*10*	*6169*
Proline + NIS	*5.0*	*8094*	*8.5*	*7390*
Inspire XT	*5.8*	*8269*	*7.5*	*8285*
LSD *P*=0.05	0.8	932	0.8	845

Nontreated Check (Top picture - Sensitive isolate; bottom – resistant isolate)



Susceptible *C. beticola* isolates

Eminent **Inspire XT** **Proline**

Resistant *C. beticola* isolates



SuperTin

Headline

Summary - CLS

- Conditions were favorable for CLS starting early in the season.
- Rotation of effective fungicides effectively controlled Cercospora leaf spot and resulted in significantly higher tonnage, quality and RSA than the non-treated check.
- Fungicide resistance is real – do not overuse fungicides; do not use fungicides of similar chemistries back to back; always rotate different chemistries or mixtures of different chemistries.

Summary

3 applications

(Topsin+SuperTin) /Proline or Inspire/ Headline

Headline / SuperTin / Proline
Inspire XT / SuperTin / Headline
Proline / SuperTin / Headline

2 applications

(Topsin + Supertin) / Headline
Inspire or Proline / Headline

1 application

Use a different chemistry from last application in 2010

Plant Populations

Plant Populations for Conventional Sugarbeet

Treatment Plants / 100' row	Spacing between plants	Plants per acre
100	12"	23,760
125	9.6"	29,700
150	8"	35,640
175	6.8"	41,580
200	6"	47,520
225	5.3"	53,460

Plant Stand

Treatment Plants /100’ row	Plant Count at Harvest	% of Thinned Stand
100	102	102
125	122	98
150	135	90
175	165	94
200	172	86
225	175	78


100 plants / 100’ row


175 plants / 100’ row


125 plants / 100’ row


200 plants / 100’ row


150 plants / 100’ row


225 plants/ 100’ row

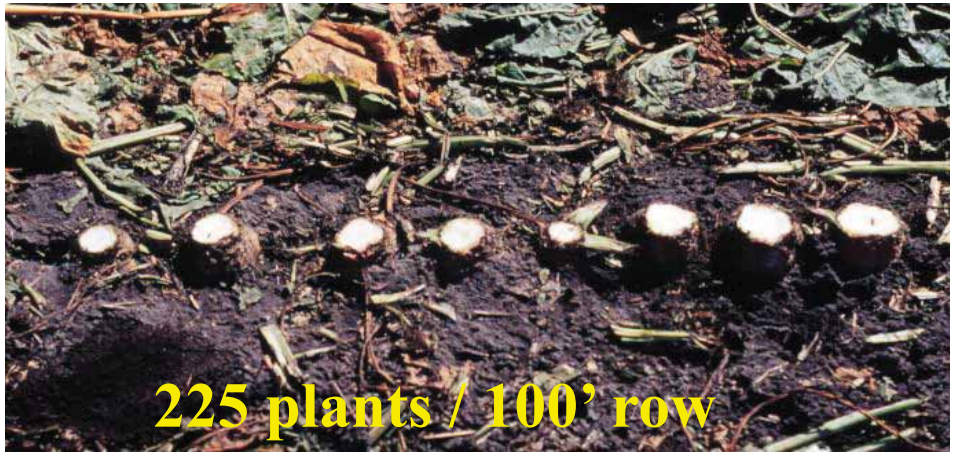

100 plants / 100’ row


175 plants / 100’ row


125 plants / 100’ row


200 plants / 100’ row


150 plants / 100’ row


225 plants / 100’ row

Recoverable Sugar / Acre - 2003

Plants /100' row	Recoverable Sugar Acre
100	5911
125	6473
150	6372
175	*6493*
200	6088
225	6054
LSD(P=0.05)	968

- **No significant difference among treatments in RSA**
- **175 plants/100 ft row had highest RSA**

Results - 2004
Recoverable Sucrose / Ton

Plants /100' row	Variety A	Variety B
100	294 d	295 cd
125	306 a-d	304 a-d
150	312 a-d	312 a-d
175	*321 a*	315 ab
200	314 abc	*319 a*
225	299 bcd	314 abc

Results - 2004
Recoverable Sucrose / A

Plants /100' row	Variety A	Variety B
100	7173 b	7798 ab
125	7753 ab	7737 ab
150	8225 a	8069 ab
175	*8342 a*	*8227 a*
200	7849 ab	8030 ab
225	7550 ab	7755 ab

Roundup Ready Sugarbeet – 2010 (Early)

Plants /100' row	Early Planting		
	T/A	% S	RSA
50	19.1	15.3	5303
75	23.9	15.3	6671
100	25.9	15.3	7233
125	26.9	14.8	7258
150	27.7	14.8	7481
175	28.6	14.9	7862
200	28.4	15.1	7853
225	30.0	14.8	8108
LSD (P=0.05)	3.01	0.7	893

Roundup Ready Sugarbeet – 2010 (Late)

Plants /100' row	*Late Planting*		
	T/A	% S	RSA
50	16.3	13.9	4017
75	18.3	14.3	4656
100	17.5	14.1	4395
125	19.4	14.2	4976
150	20.3	14.1	5066
175	21.1	14.4	5502
200	22.6	14.5	5928
225	21.6	14.4	5636
LSD (P=0.05)	3.01	0.7	893

Roundup Ready Sugarbeet - 2010

Plants /100' row	Early Planting			*Late Planting*		
	T/A	% S	RSA	T/A	% S	RSA
50	19.1	15.3	5303	16.3	13.9	4017
75	23.9	15.3	6671	18.3	14.3	4656
100	25.9	15.3	7233	17.5	14.1	4395
125	26.9	14.8	7258	19.4	14.2	4976
150	27.7	14.8	7481	20.3	14.1	5066
175	28.6	14.9	7862	21.1	14.4	5502
200	28.4	15.1	7853	22.6	14.5	5928
225	30.0	14.8	8108	21.6	14.4	5636
LSD (P=0.05)	3.01	0.7	893	3.01	0.7	893

Conclusion – Conventional Variety

- **Research indicated that a plant population of 175 plants / 100 ft row would produce the highest recoverable sucrose per acre with no adverse impact on quality when planting conventional sugarbeet varieties.**
- **If planting conventional variety, a high plant population will cover the ground early and may help to reduce weed populations.**

Conclusion – Roundup Ready Variety (If Legal to Plant)

- **Research indicated that a plant population of 175 to 225 plants / 100 ft row would produce the highest recoverable sucrose per acre with no adverse impact on quality when planting Roundup Ready sugarbeet varieties.**
- **Plant as early as possible for highest yield and quality.**
- **Research indicated that an early planted field with a population of 75 plants/100 ft row should not be replanted.**

Acknowledgements –Thank You

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- Kevin Ekzler, Vince Ulstad, and Kevin Nelson for research to be conducted on their farms.
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