Reclamation of *Aphanomyces*-Infested Sugarbeet Fields Amended with Spent Lime

[1]C.E. Windels, [1]J.R. Brantner, [1]A.L. Sims & [2]C.A. Bradley

[1]Univ. Minnesota, NW Res. & Outreach Ctr.

[2]North Dakota State Univ., Fargo

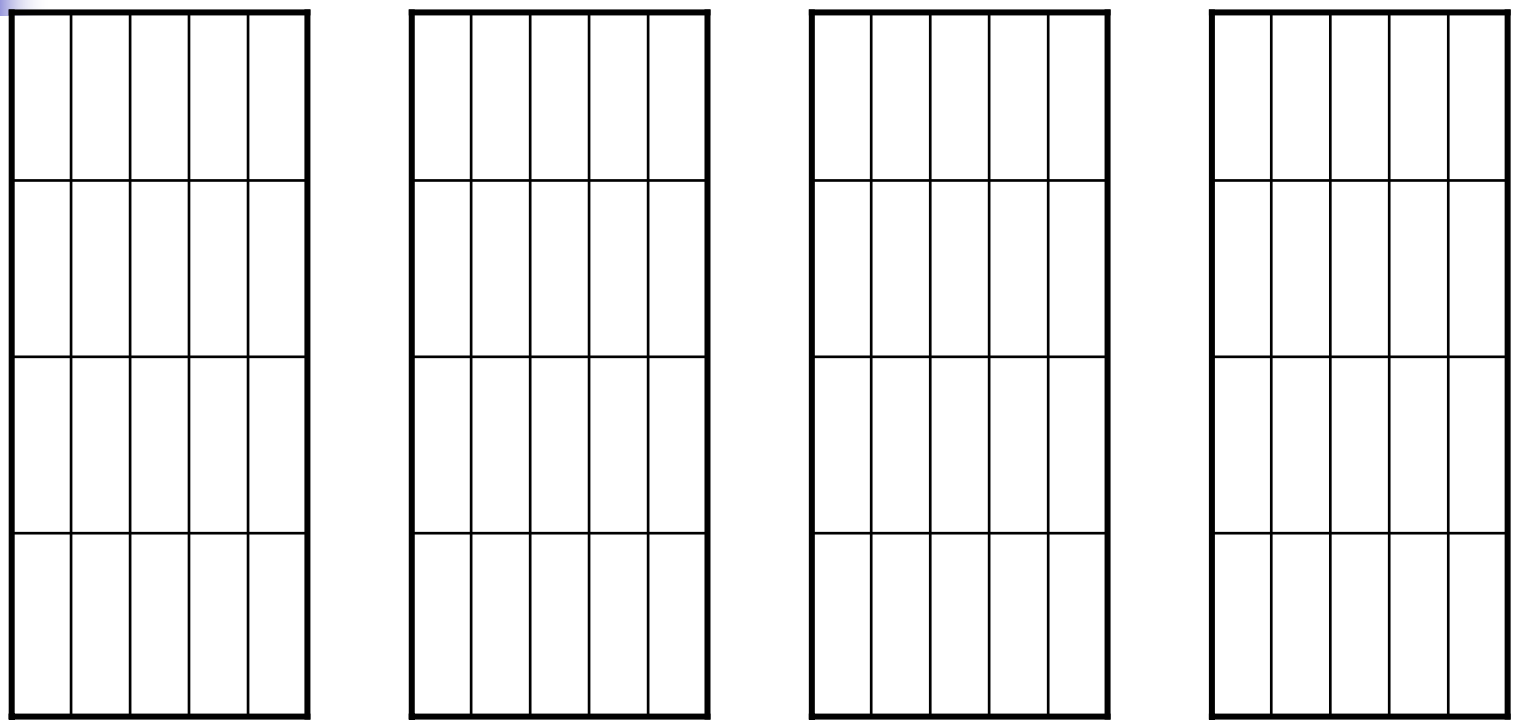
Objectives: Long-term

- Amounts spent lime needed to reduce Aphanomyces root rot on sugarbeet
- Duration of disease suppression
- Mechanisms of disease suppression

Field Trial Establishment

- Hillsboro, ND (Aph SIV = 48)
- Lime applied in October, 2003
  - 0, 5, 10, 20, 30 T wet weight/A =
  - 0, 3.3, 6.5, 13, 19.5 T dry weight/A
- Breckenridge, MN (Aph SIV = 98)
- Lime applied in April, 2004
  - 0, 5, 10, 15, 20 T wet weight/A =
  - 0, 2.7, 5.3, 8, 10.6 T dry weight/A

Experiments (2005 – 2008)



2005
1 year

2006
2 years

2007
3 years

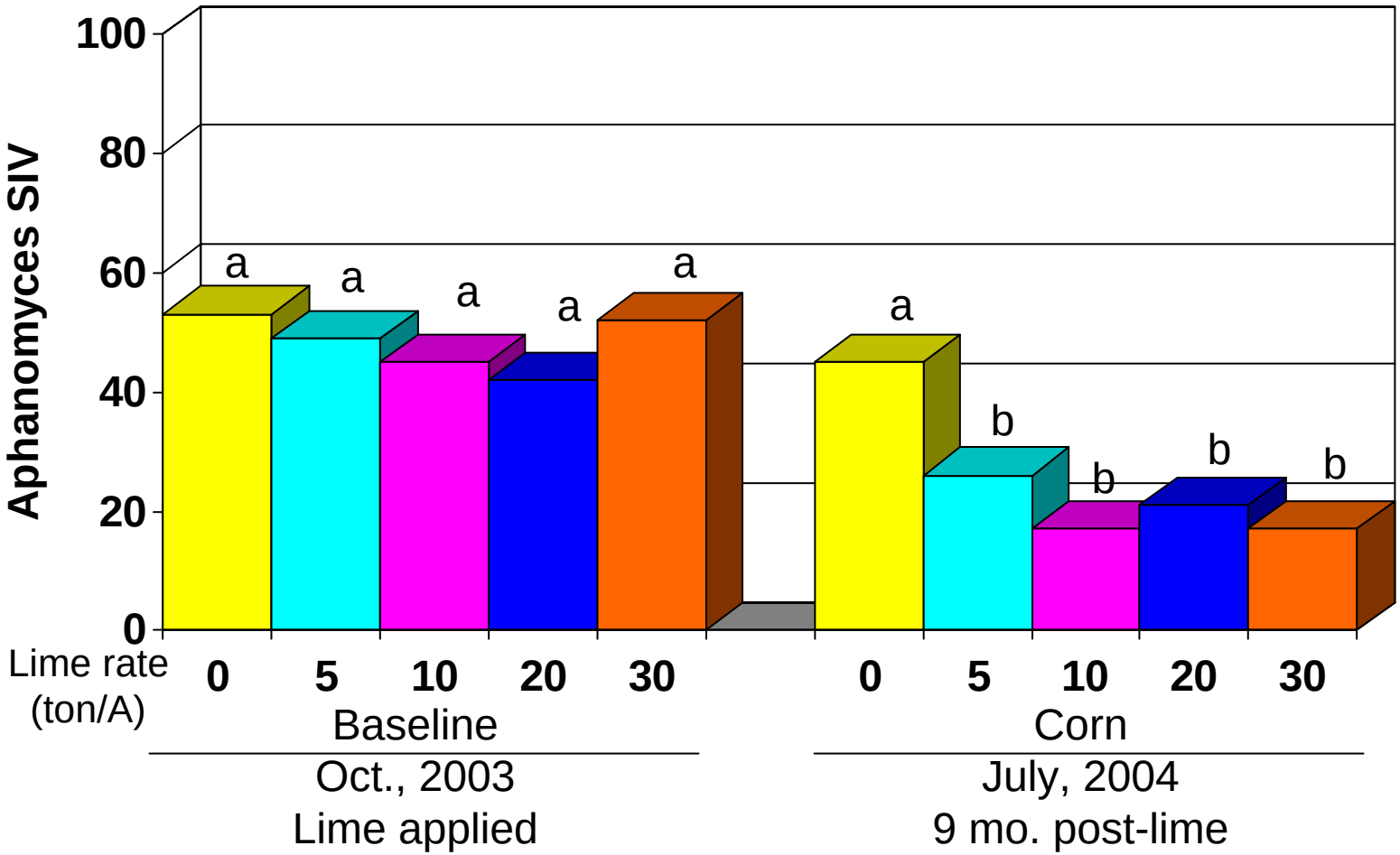
2008
4 years

Sugarbeet sown in 1 experiment/year
Rotation crops sown 3 experiments/year

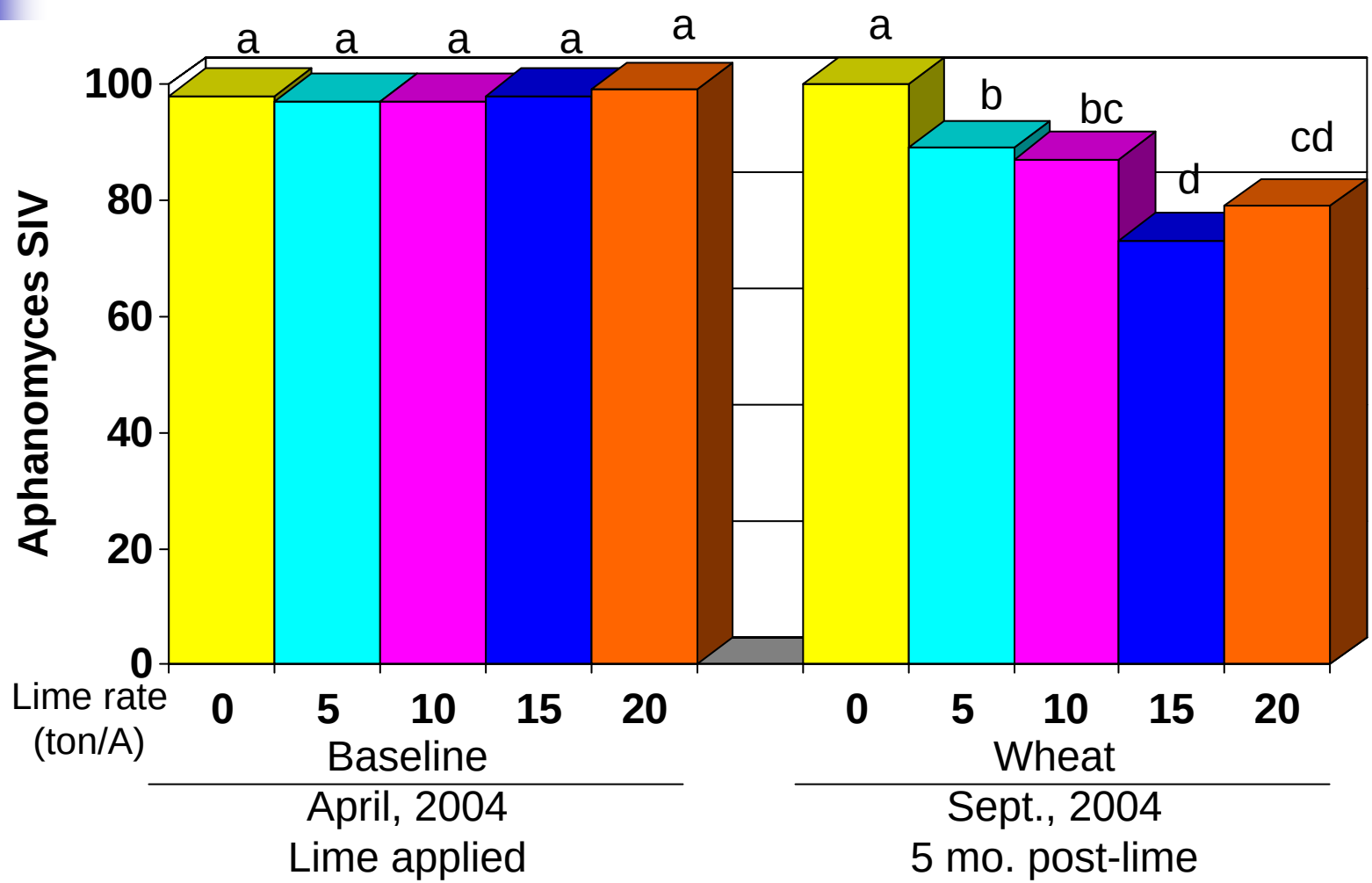
Objectives

- Aphanomyces soil index values
  - 0-100 scale (assay of soil samples)
  - Activity & populations of *A. cochlioides*
- Populations of soil microorganisms
  - Bacteria, *Bacillus*, *Streptomycetes*,
  - fluorescent pseudomonads, fungi
- Sugarbeet
  - Root rot ratings
  - Yield & quality

Hillsboro: Aphanomyces Soil Index Values



Breckenridge: Aphanomyces Soil Index Values



2005: Sugarbeet Trials

- Sugarbeet varieties
  - Crystal 820 + 45g Tach. (Resistant)
  - Seedex Magnum (susceptible)
- Subplot of each lime treatment
  - Sown early May
  - 2-inch spacing
- Harvested September 28

Hillsboro: 2005 - Sugarbeet

Lime	Stand/80 ft row
(T/A)	4WAP
0	280
5	295
10	286
20	309
30	316
LSD(*P=0.05)*	NS

NS = Not significantly different

WAP = weeks after planting

Hillsboro: 2005 - Sugarbeet

Lime	Stand/80 ft row	
(T/A)	4WAP	Harvest
0	280	104 a
5	295	116 ab
10	286	124 b
20	309	128 b
30	316	128 b
LSD(*P=0.05)*	NS	15

NS = Not significantly different

WAP = weeks after planting

Hillsboro: 2005 - Sugarbeet

Lime (T/A)	Stand/80 ft row		RRR (0-7)
	4WAP	Harvest	
0	280	104 a	2.2
5	295	116 ab	2.0
10	286	124 b	2.0
20	309	128 b	2.1
30	316	128 b	1.9
LSD(*P=0.05*)	NS	15	NS

NS = Not significantly different

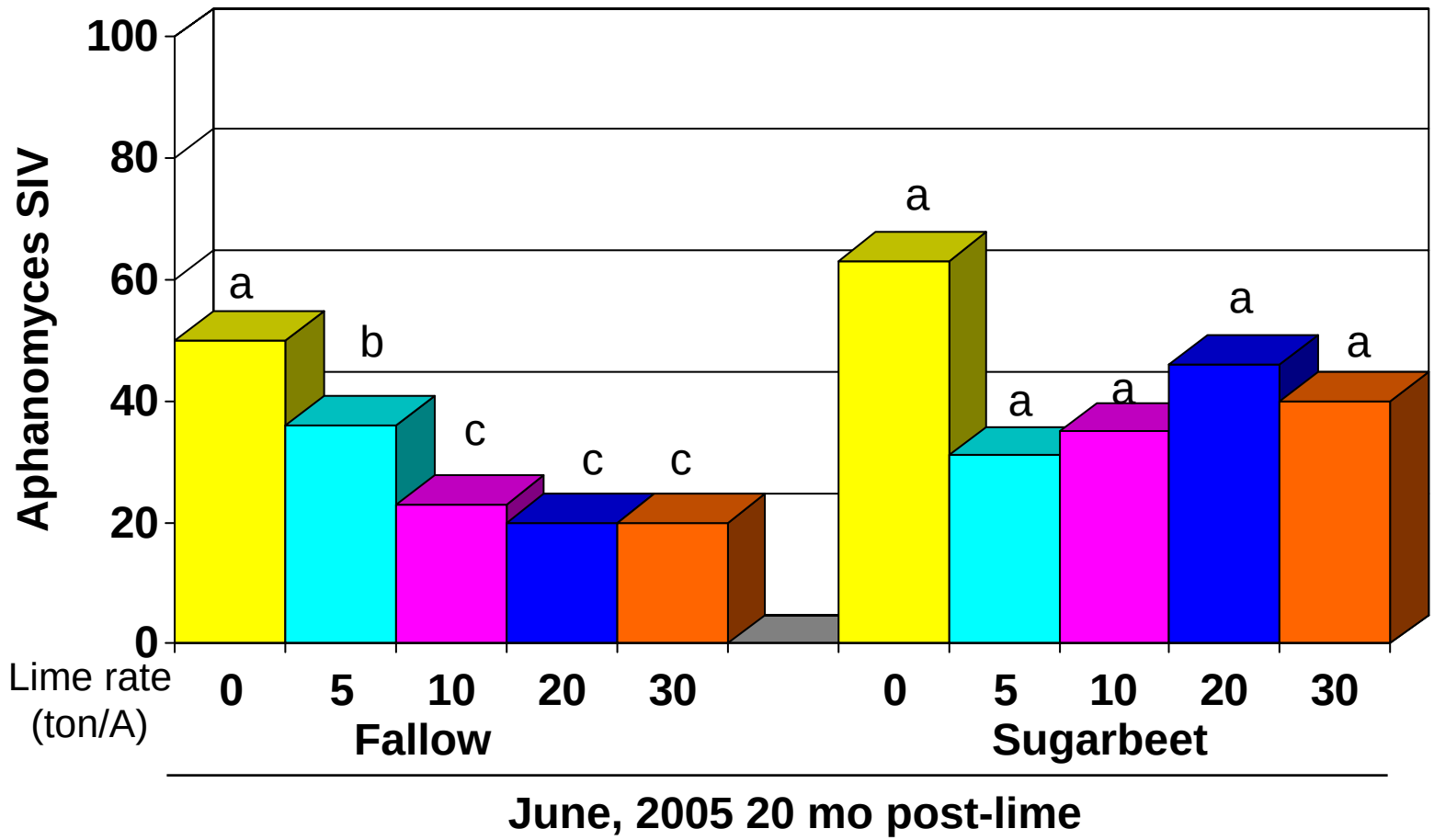
WAP = weeks after planting

Hillsboro: 2005 - Sugarbeet

Lime	Yield	Sucrose			Gross return
(T/A)	(T/A)	%	lb/T	lbs recov/A	($/A)
0	14.6 a	17.0	316	4602 a	533 a
5	17.6 b	17.1	319	5613 b	656 b
10	17.8 b	17.3	323	5762 b	682 b
20	17.1 b	17.6	329	5647 b	681 b
30	18.9 b	17.5	328	6218 b	749 b
LSD (*P=0.05*)	2.4	NS	NS	871	118

NS = not significantly different

Hillsboro: Aphanomyces Soil Index Values



Breckenridge: 2005 - Sugarbeet

Lime	Stand/80 ft row
(T/A)	4 WAP
0	284
5	307
10	309
15	285
20	310
LSD (*P=0.05*)	NS

NS= not significantly different

WAP =weeks after planting

Breckenridge: 2005 - Sugarbeet

Lime	Stand/80 ft row	
(T/A)	4 WAP	9 WAP
0	284	32 a
5	307	78 b
10	309	88 bc
15	285	80 b
20	310	95 c
LSD (*P=0.05*)	NS	15

NS= not significantly different

WAP =weeks after planting


No lime


5 ton lime


10 ton lime


15 ton lime


20 ton lime

Breckenridge: 2005 - Sugarbeet

Lime	Stand/80 ft row		
(T/A)	4 WAP	9 WAP	Harvest
0	284	32 a	21 a
5	307	78 b	64 b
10	309	88 bc	73 b
15	285	80 b	64 b
20	310	95 c	79 b
LSD (*P=0.05*)	NS	15	17

NS= not significantly different

WAP =weeks after planting

Breckenridge: 2005 - Sugarbeet

Lime (T/A)	Stand/80 ft row			RRR (0-7)
	4 WAP	9 WAP	Harvest	
0	284	32 a	21 a	6.0 a
5	307	78 b	64 b	3.9 b
10	309	88 bc	73 ab	3.7 b
15	285	80 b	64 b	3.7 b
20	310	95 c	79 b	3.6 b
LSD (*P=0.05*)	NS	15	17	0.5

NS= not significantly different

WAP =weeks after planting

No lime

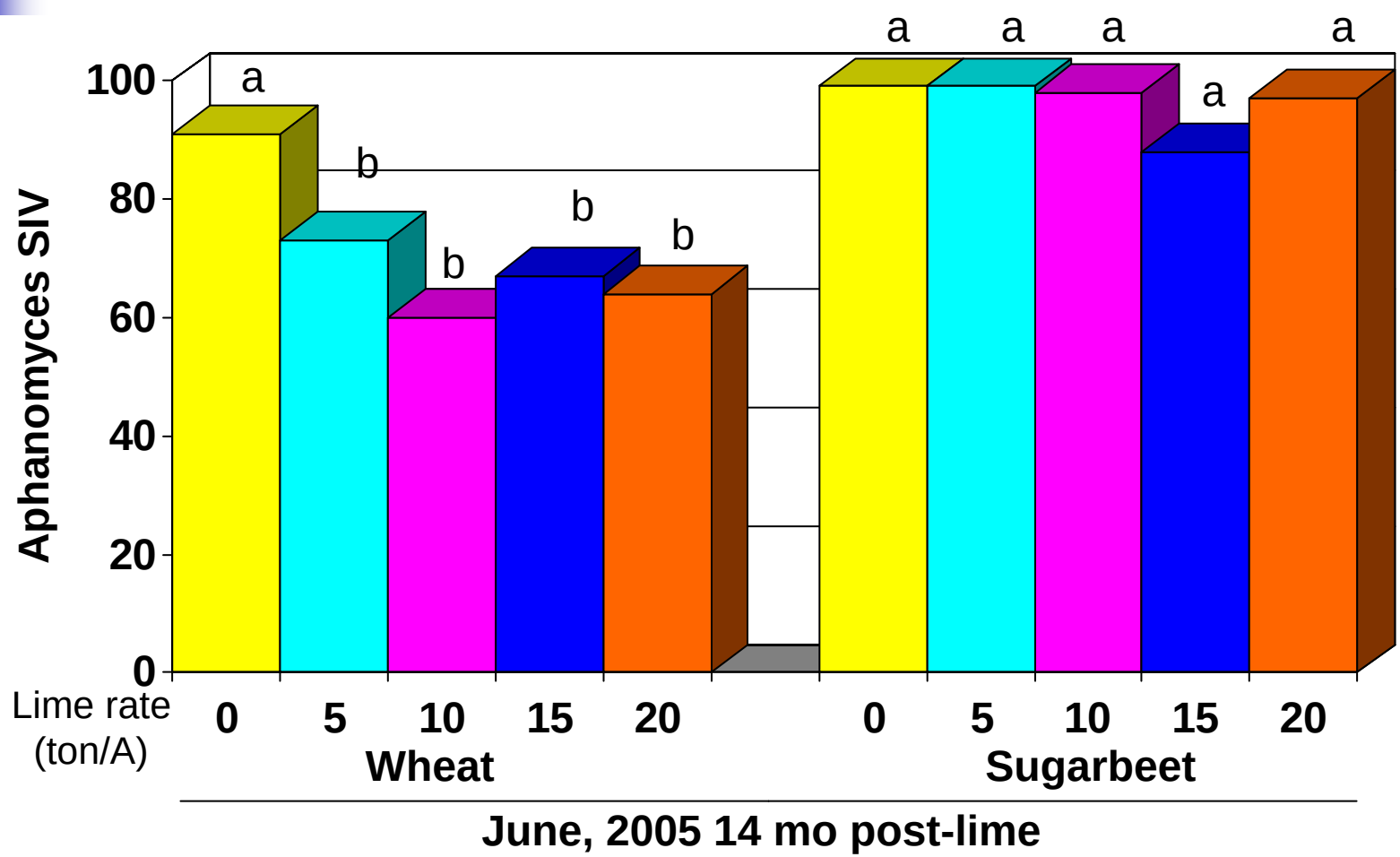
20 ton lime

Breckenridge: 2005 - Sugarbeet

Lime (T/A)	Yield (T/A)	Sucrose %	Sucrose lb/T	Sucrose lbs recov/A	Gross return ($/A)
0	6.3 a	13.8	244	1559 a	156 a
5	18.0 b	14.2	253	4550 b	455 b
10	19.9 bc	14.6	261	5188 bc	519 b
15	20.3 bc	14.1	249	5044 c	504 b
20	22.3 c	14.3	252	5609 c	561 b
LSD (*P=0.05*)	4.1	NS	NS	1018	102

NS = not significantly different

Breckenridge: Aphanomyces Soil Index Values



Summary

- Aphanomyces SIVs decreased within months after application (except when sugarbeet sown, returned to baseline values)
- Aphanomyces root rot of sugarbeet decreased ~1 year after application
- Sugarbeet yield, quality, and economic return increased in absence or presence of Aphanomyces root rot
- Benefits occur at 5 T/A but improve as rates increase

Acknowledgements

- Sugarbeet Research & Education Board
- UM Rapid Agricultural Response Fund
- Chad Kritzberger, Hillsboro cooperator
- Pat Freese, Breckenridge cooperator
- Tim Leshuk, Cody Kritzberger, American Crystal agriculturists
- Jon Warner, Mark Borud, Mike Metzger, Minn-Dak agriculturalists
- Mary Johnshoy, Kim Hoff, Jeff Nielsen (UM, NWROC)
- Lenny Luecke (NDSU), Others
- American Crystal and Seedex