Bob Hecht
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Recommending the Use of Gypsum—What to Consider?

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Recommending the Use of Gypsum—What to Consider?

We will discuss:

- Limitations in marketing gypsum.
- Soils and crops to target for gypsum applications.
- What to consider when making gypsum recommendations.
- How do we know what rate to apply?

Soil Solutions, LLC

"Bringing Global Resources to the Marketplace."

Factors Limiting Gypsum Use in Agriculture:

1.Higher margin markets for gypsum producers. (ie. drywall, etc.)

2.Ag Gypsum is more difficult to spread than fertilizer.

3.Low margin product for ag retailers.

4.Difficult for retailers to understand and explain benefits.

5. Perception that a by-product should be free or little cost. Need to sell benefits/value.

“PRO CAL 40” As Pure As Snow!!

Questions to Answer……
1.Are all soils responsive?
2.What rate should we apply?
3.Can we apply too much?
4.Which crops will respond the best?
5.Can it be applied on the soil surface in no-till? Should it be incorporated?
6. Will our gypsum perform the same as mined gypsum?

PRO CAL40

Crops that we apply PRO CAL 40 to are:

Corn Soybeans Wheat

Alfalfa Potatoes Pumpkins Melons Tomatoes

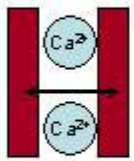
What soils do we target for gypsum applications?

Sodium Affected Soils/Alkali Soils

Alkali Soil = Sodic Soil

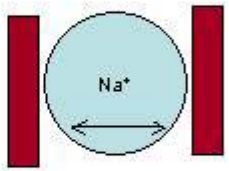
Saline and Sodic Soils

- **Sodic Soil**
  - Floculation Van der Waals Attraction
  - Short range attraction



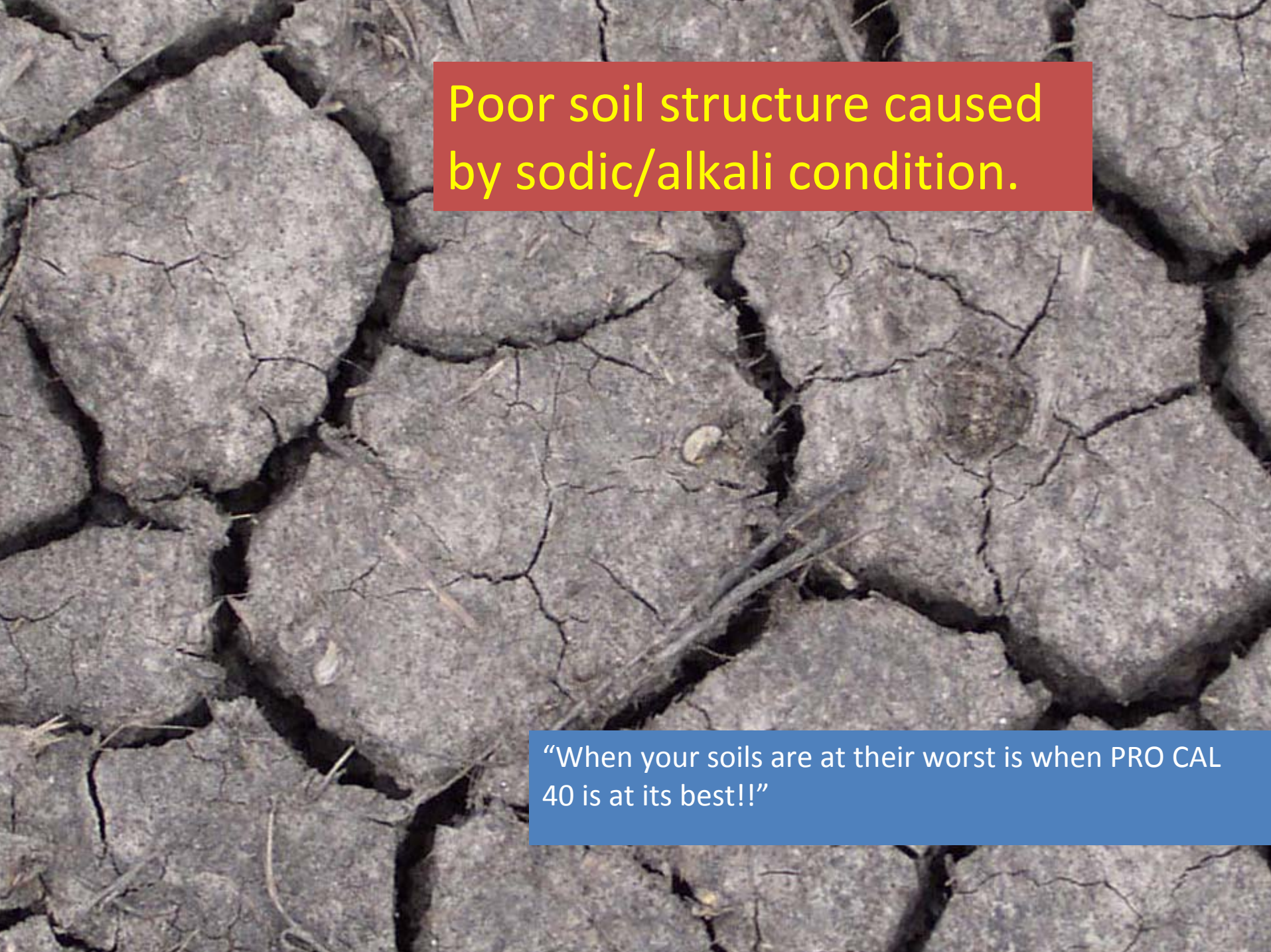
Floculated

Small hydrated ionic radius



Dispersed

Large hydrated ionic radius


Poor soil structure caused by sodic/alkali condition.
“When your soils are at their worst is when PRO CAL 40 is at its best!!”

Soil Solutions, LLC

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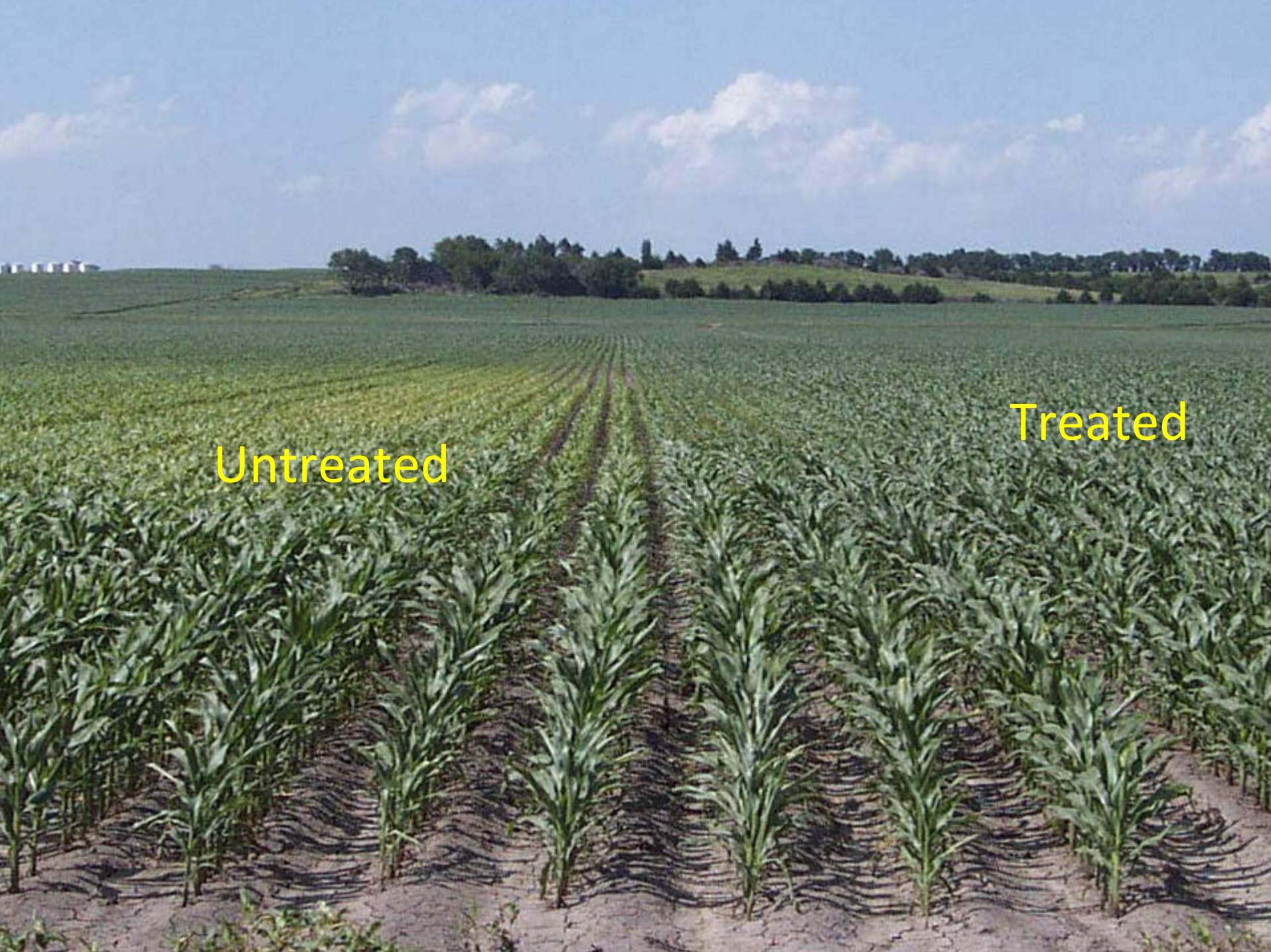
Treated
Untreated


Untreated
Treated

Sodium levels were decreased. Nutrient availability was increased when PRO CAL 40 was applied to this soil.

Changes in Soil Test Levels
Alkali Soil
One Year Following Application of PRO CAL 40

	P1	P2	K	pH	Na	%Na	%Mg	%Ca	Zn
Before App.	7	52	265	8	337	6.6	44.7	45.7	1.4
After App.	19	55	379	6.4	68	1	34.2	52.5	2.2

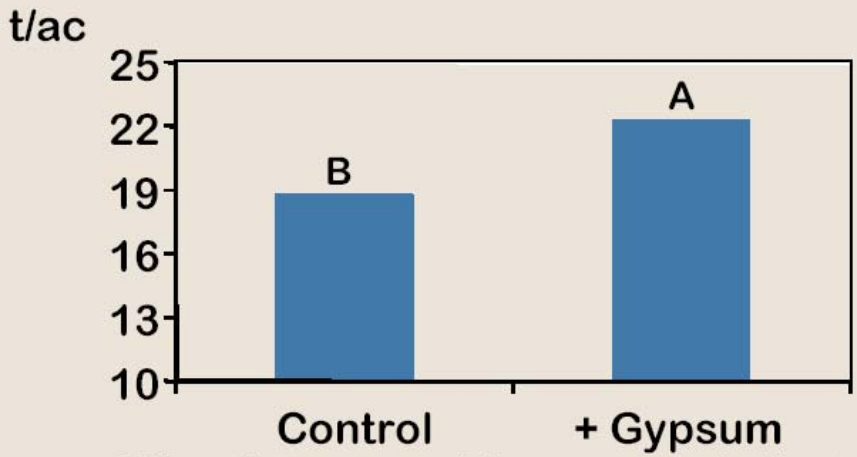
Luton, IA

Eroded hillsides respond well to gypsum


Poor Soil Structure


Untreated
Treated

Effect of Gypsum on Cumulative Alfalfa Yields at Wooster, OH (2000 - 2002)



Different letters over each bar represent a significant difference at $p \leq 0.05$.

Alfalfa Responds To “PRO CAL 40”

	Yield Increase, lb/A
Second Cutting	+1181
Third Cutting	+364
Total from 2 cuttings	+1545

Rhea Cattle Co.
Arlington, NE
(First and Last cuttings were not yield checked)

“PRO CAL 40” Increased Protein by 1.2% over Untreated.


Alfalfa Responds to PRO CAL 40
Better Nutrient Uptake
Better Aeration
Better Nitrogen Fixation
10 03 2008

Alfalfa Responds to PRO CAL 40

Better Nutrient Uptake

Better Aeration

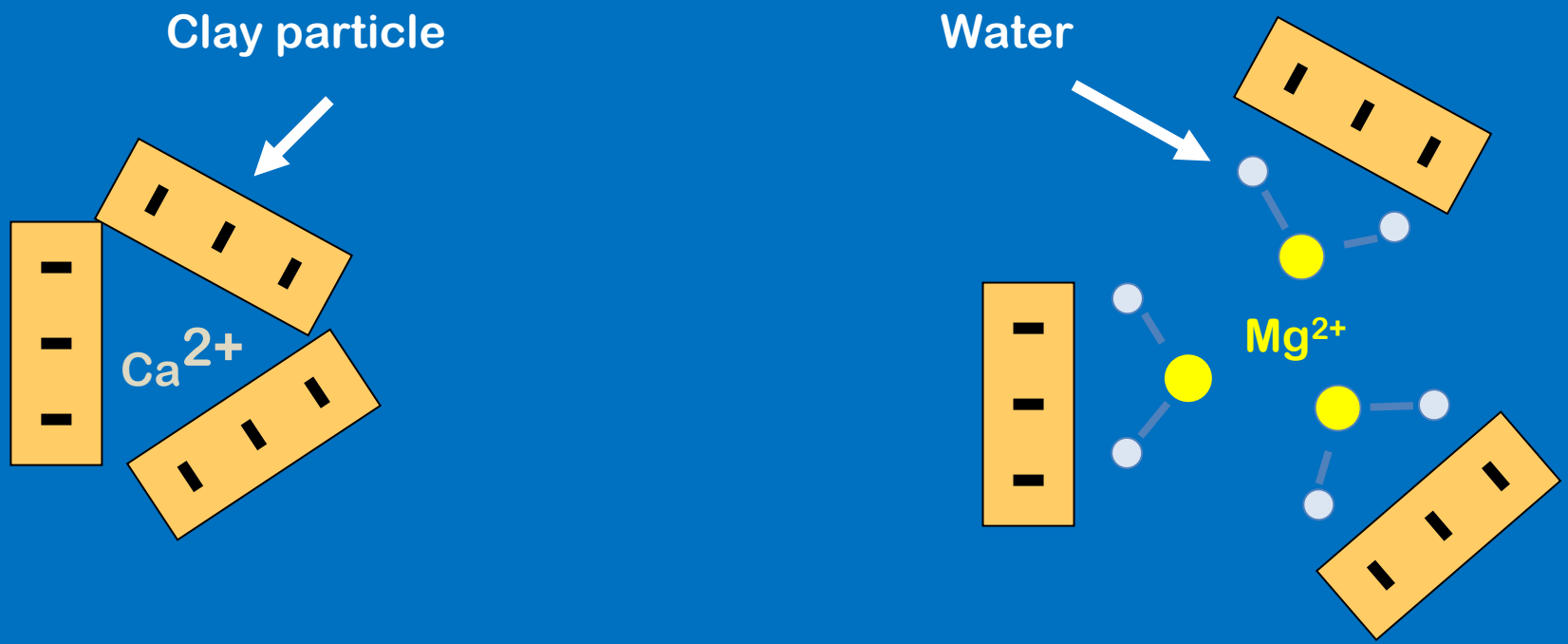
Better Nitrogen Fixation

Untreated vs. Treated Alfalfa

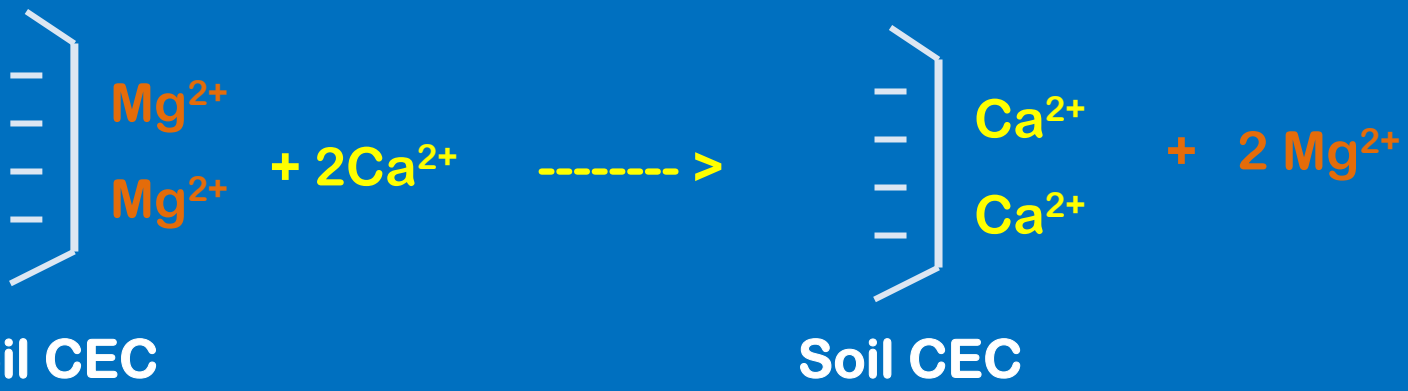

Alfalfa is very responsive to gypsum

Target soils with high magnesium levels

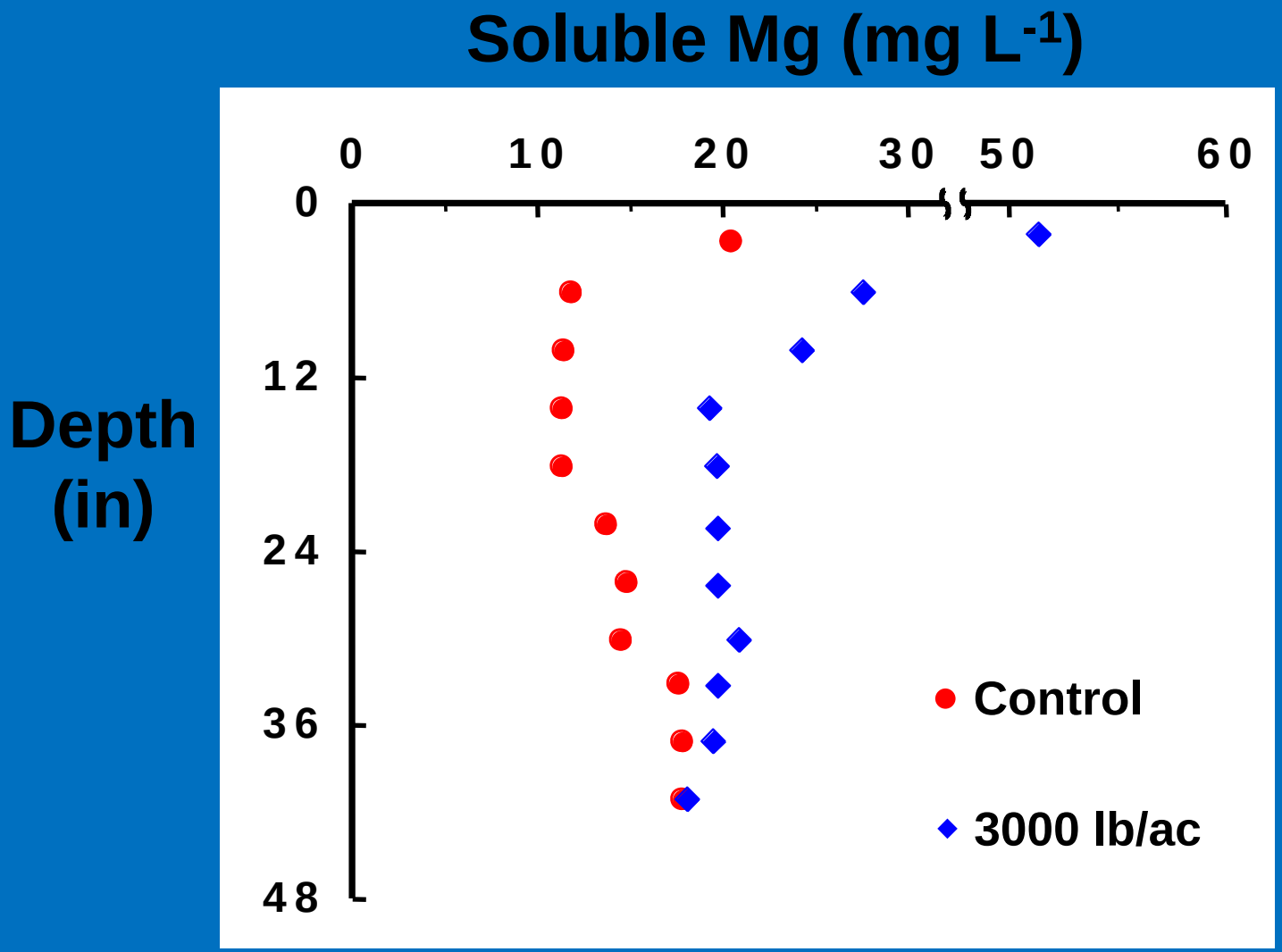
Soil dispersion is mainly caused by highly hydrated Na^{+} and Mg^{2+} attracted to the surface of clay particles as exchangeable cations.



Mechanism to increase water-soluble Mg^{2+}



Water-soluble Mg increases with depth even though FGD-gypsum contains almost no Mg.




500
300
02 10 2009

“PRO CAL 40” Effects on Leachate Levels

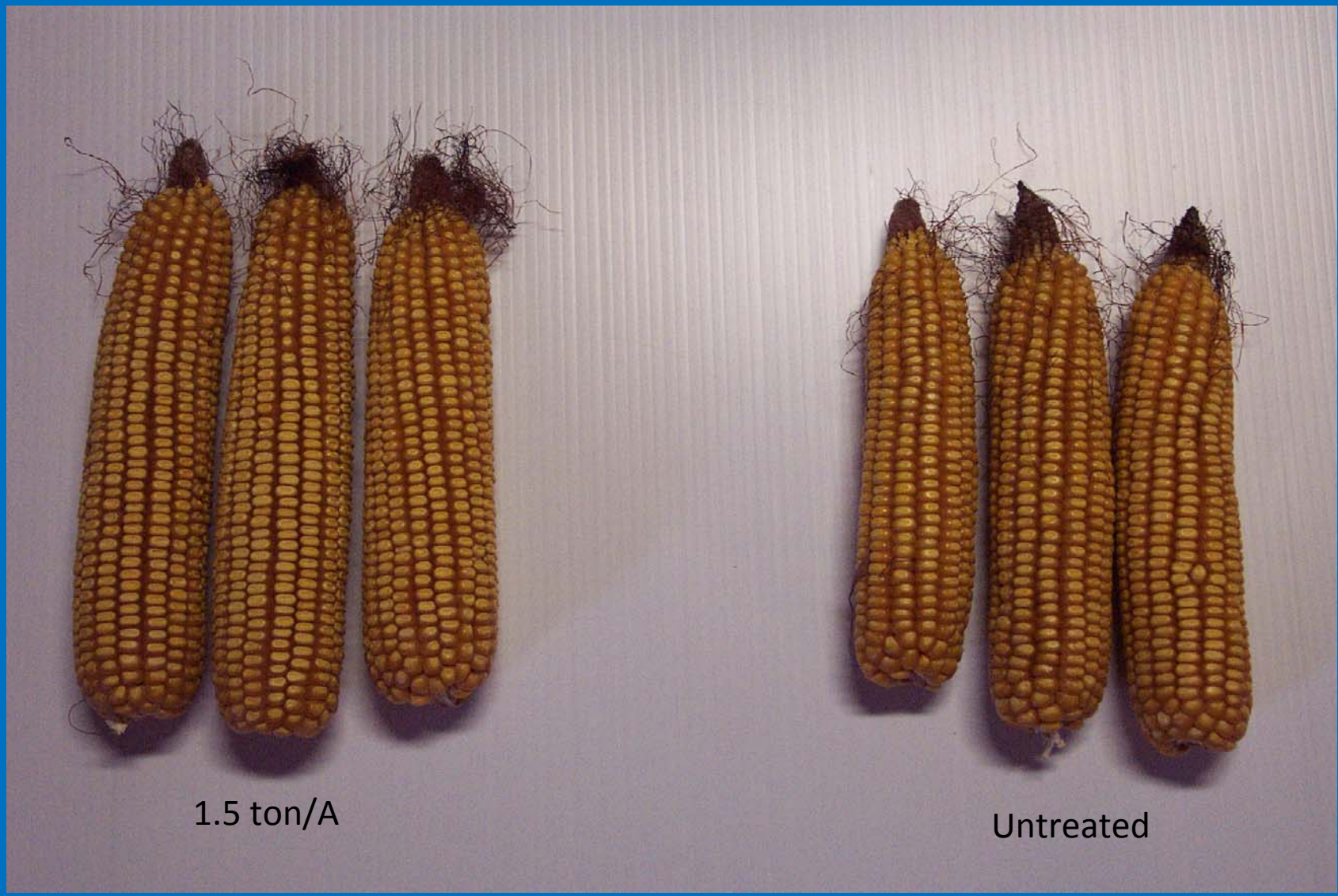
	PRO CAL 40(2T/A)	Untreated
	PPM	PPM
Calcium	396	37
Magnesium	70	9
Potassium	162	7

(Archer)


Treated
Untreated


Untreated


Treated with
PRO CAL 40



Producer reported a 30 bushel response


Treated
Untreated


Treated
Untreated

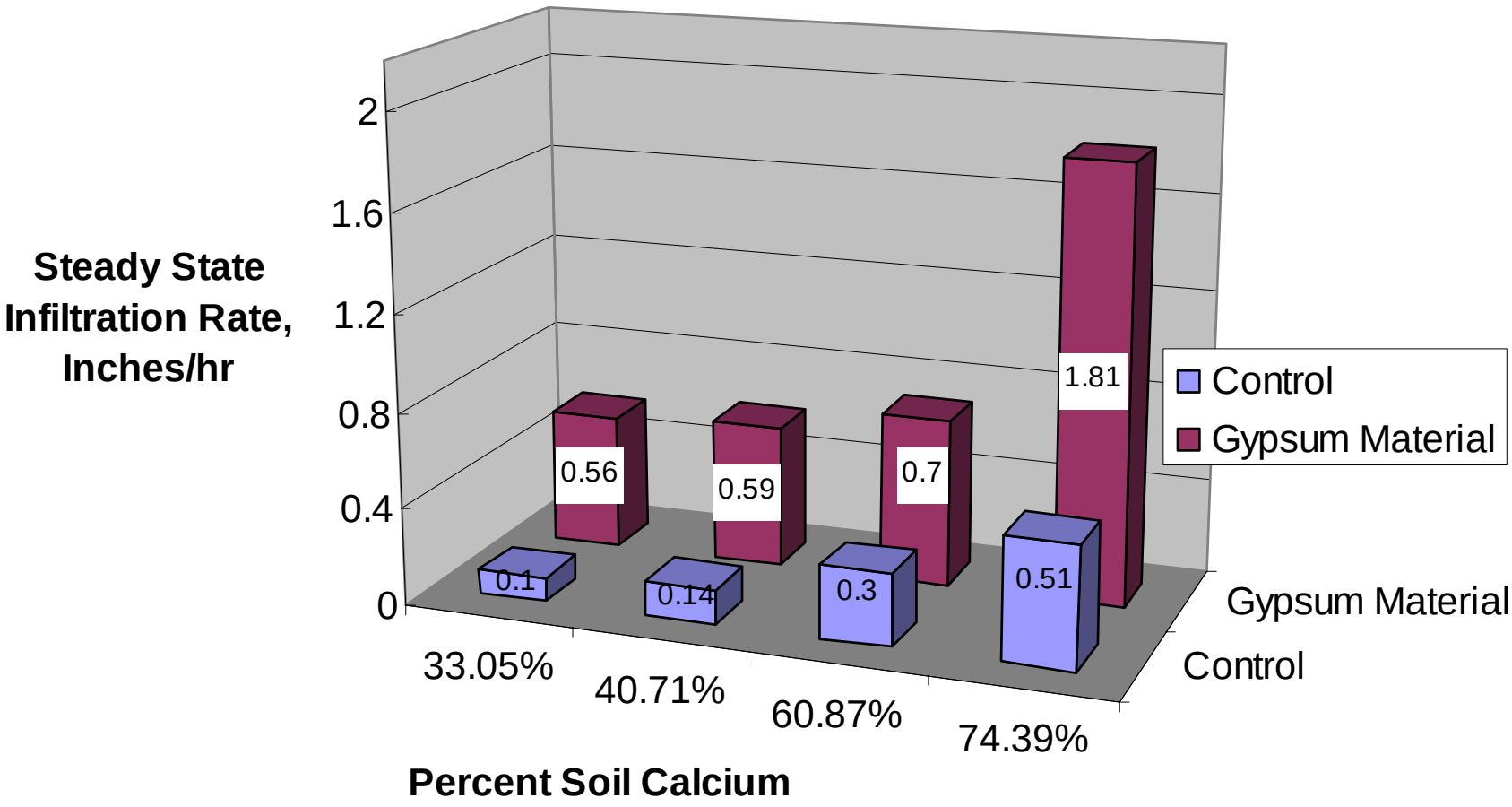
Soil Test Comparisons

Laboratories	CEC	Mg, ppm	Ca, ppm	Mg, %
Comm. A	20	665	2660	28
Comm. B	19.2	735	2173	31.9
Comm. C	--	--	--	--
Univ. D	20.2	206	3538	9
Univ. E	38.6	1504	4935	32.5

What soils do we target for gypsum applications?

Soils With Infiltration/Drainage Problems

Effect of Calcium on Infiltration Rates



Percolation Rates Increase With Calcium Sulfate

Treatment	Depth of Water Standing after 24 hrs., In.	Percolation ml/24 hrs.
Check	.50	86
Sulfur, 1 ton	.23	86
$CaSO_4$, 1 ton	.18	190
Ca SO_4, 5 tons	.15	280

McGeorge et al. (1956), Irr. Plots; Impermeable soil.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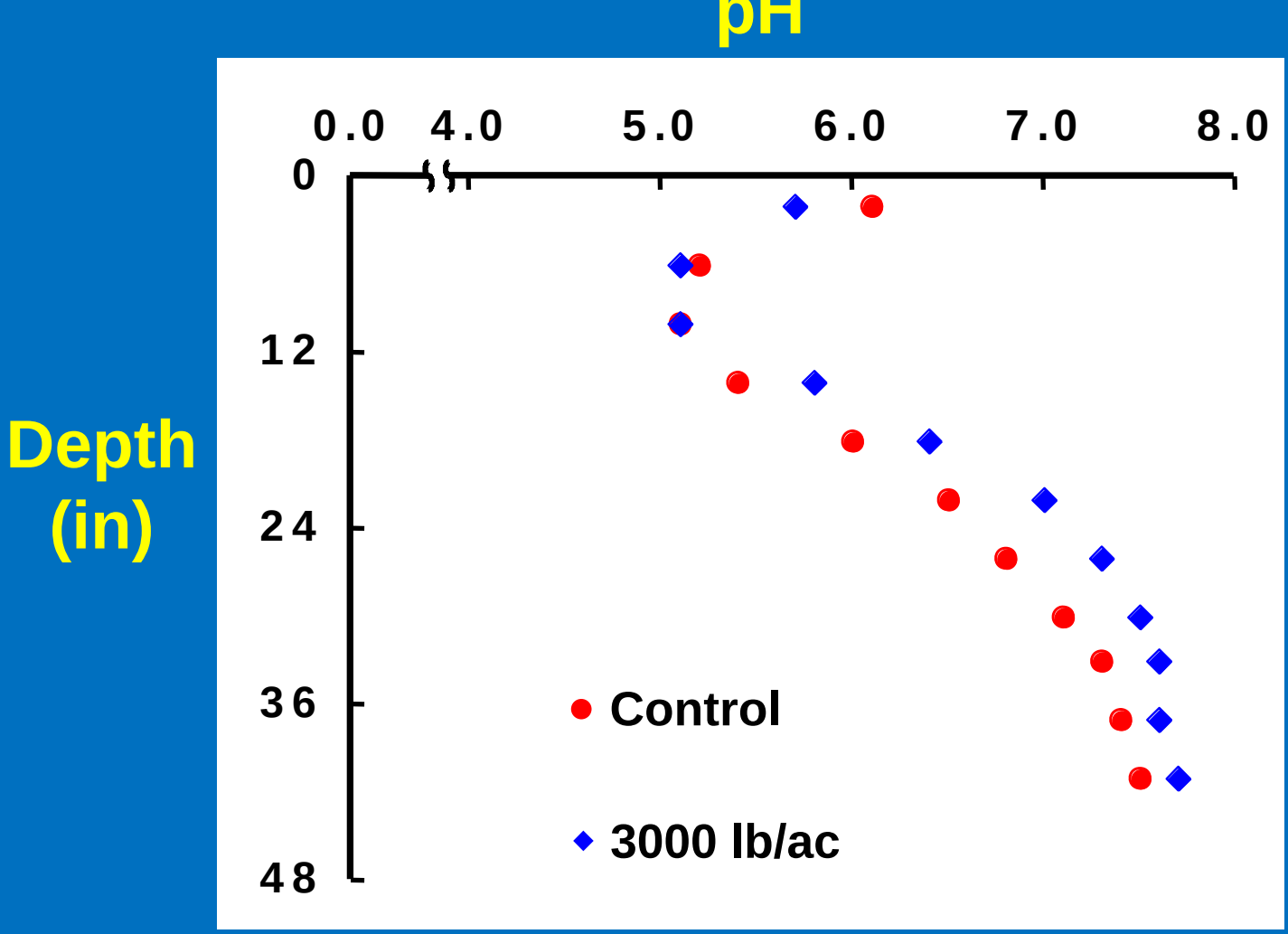
High pH soils are also a target.

Gypsum has no consistent effect on soil pH.



PRO CAL 40 as a Soil Amendment in High pH Soils

"It (iron chlorosis) is not completely understood, since both soil chemistry and plant physiology is involved. The most common theory is that bicarbonates form in these soils and interferes with the plant's ability to develop its green color. The calcium sulfate reacts quickly in soils with adequate moisture to reduce the ill effects of soil bicarbonates."

Dr. Dick Wiese, UNL (retired)

Effect of Bicarbonate on Iron Concentration in Corn Seedlings

	Bicarbonate Concentration, meq/l			
Plant Part	0	5	10	20
	Iron Conc. (PPM)			
Young Leaves	80	57	38	32
Old Leaves	140	100	46	43
Roots	3410	2560	1770	1380

1997 Journal of Plant Nutrition 20: 1731-1753

Using Calcium Sulfate To Reduce Iron Chlorosis

Treatment	Rate, Method	Yield, Bu/A
	--1982--	
Check	0, In Band by Row	25
Gypsum	450#, In Band by Row	44

**Band is 3” deep and 1 ½” to side of row.

	--1983--	
Check	0, In Row at Planting	19
Gypsum	75#, In Row at Planting	30

University of Nebraska


Treated
Untreated
Treated

Monsanto Iron Chlorosis Plot

Varieties differ in response to PRO CAL 40

Variety		With PRO CAL 40	Untreated	Yield Diff.
		Bu/A	Bu/A	Bu/A
AG 2801		59.63	47.56	12.07
AG 2403		68.6	61.09	7.51
DKB 25-51		70.78	63.63	7.15
AG 2703		69.08	67.48	1.6
DKB 29-51		58.48	56	2.48
AG 3005		53.9	54.34	-0.44
AG 3401		63.69	62.94	0.75


14 04 2002

Recommendation Philosophy

Recommendations are developed with an assumption that one equivalent of a calcium will displace an equivalent of either sodium or magnesium on the soil exchange sites. Calcium has the greatest attraction for the soil particle.

Equation for Sodium Reclamation:

[(((PPM Na/230) - (0.02 X CEC)) X 2000)) +
(((PPM Mg/120) - (0.20 X CEC)) X 2000)))] =
# of PRO CAL 40

For Example: Na level = 320 ppm
Mg level = 840 ppm
CEC = 19.5

[(((320 PPM Na/230) - (0.02 X 19.5 CEC)) X 2000)) +
(((840 PPM Mg/120) - (0.20 X 19.5 CEC)) X 2000))))] =
# of PRO CAL 40

[((1.39 - .39) X 2000) + ((7- 3.9) X 2000)] = 2000 + 6200 = 8200# or about 4.1 tons per acre

Equation for Soils With High Magnesium:

[(((PPM Mg/120) - (0.20 X CEC)) X 2000) +
((pH -7.2) X 2000)] =
# of PRO CAL 40

If pH is less than 7.2 then that part of the equation is zero.

Research Needs

1. What affect calcium sulfate has on alfalfa nodulation/nitrogen fixation.
2. How does calcium sulfate affect soil microbiology?
3. Long term affects of calcium sulfate use in soils with high bicarbonate levels.
4. Using calcium sulfate to improve soil structure more quickly in no till cropping.
5. Study soil mineralogy to determine what other soil factors could be used to predict soil sealing and soil “plating” and predict calcium sulfate responses.
6. Use of calcium sulfate to ameliorate high aluminum subsoils in Nebraska sand hill soils.
7. How does the use of calcium sulfate in conjunction with surface tiling improve the efficiency of the tiles and change soil nutrient status.

Summary

1. Gypsum benefits need to be sold.
2. Gypsum has value and should not be devalued by offering for free.
3. Educate producer to how gypsum can improve crop production.
4. Soil Tests should be used to determine most responsive soils and what rate to apply.
5. Follow up with customer….help evaluate response.


Use of PRO CAL 40: An environmentally friendly, agronomic sound and economical practice!!
Thank You For Your Attention