

# ***John Lee: Project Update***

***Liming Acid Soils (in North Dakota?)***

***Soil Sampling After P & K Fertilization***

***Tile Drainage Update -Salinity & Sodium Changes***





*Liming Acid Soils*  
*Looking for Sandy Check Soil*  
*Found Soil pH 4.8*



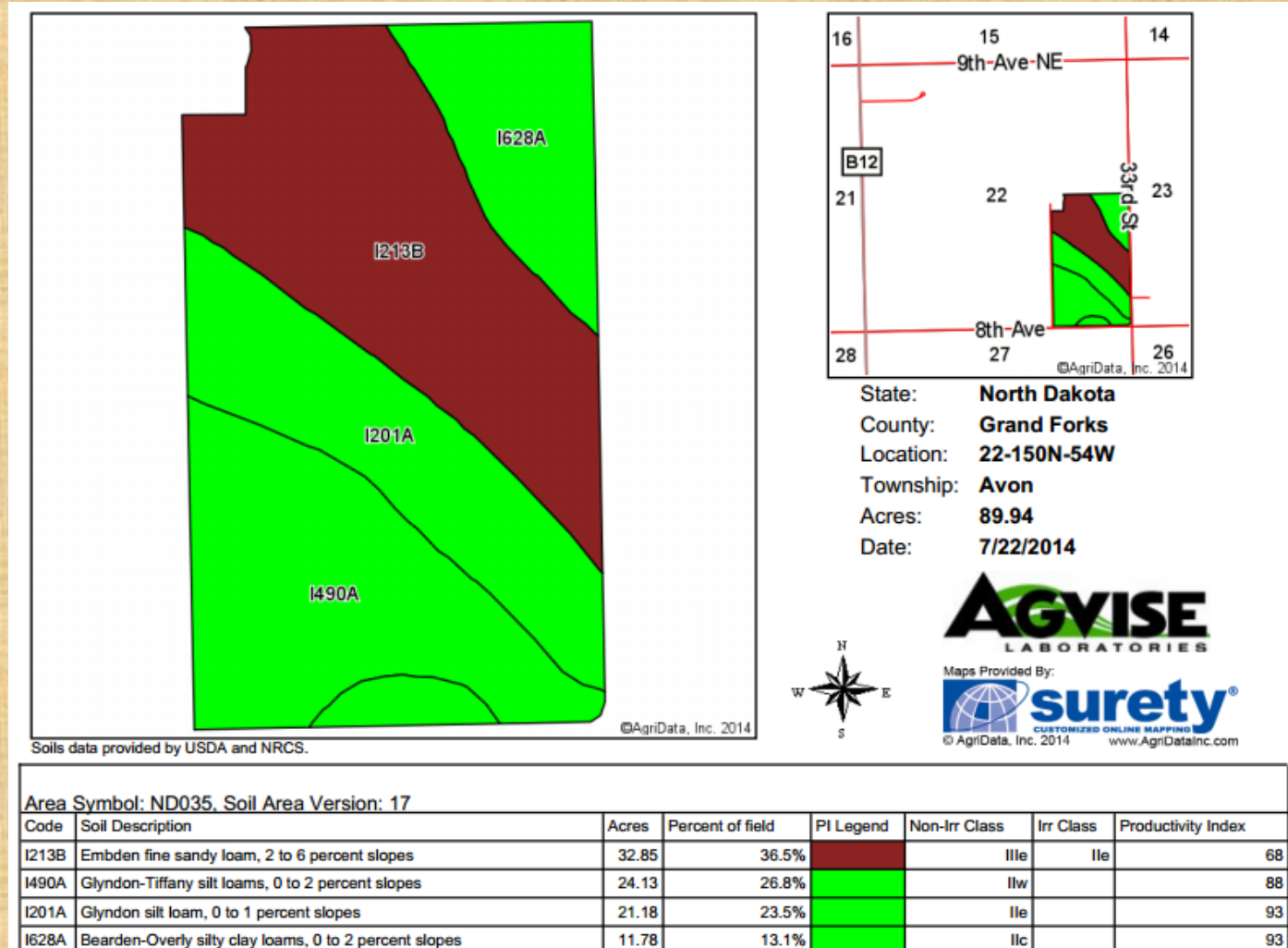
# *Why Apply Lime? (pH too low!)*

- Low pH causes problems (< pH 6.0 topsoil and subsoil)
  - legumes fixing Nitrogen (bacteria like higher pH)
  - Aluminum toxicity at low pH (<5.0)
  - P availability decreased at low pH
  - Acid soils may be low in calcium or magnesium
  - Low PH can reduced yield for alfalfa, soybeans and even wheat!



# Liming Demonstration Site

## Embden Fine Sandy Loam - PI 68



# *Soil Characteristics*

- Topsoil pH 4.8-5.0
- Buffer pH 6.4-6.5
- Subsoil pH 6.0
- OM 2.0%
- CEC 8 – 10

# *Lime Demo Project 2014*

- Treatments (Applied and tilled into soil May 22)
  - 2500 lb/a ENP (3250 lb/a beet lime)
  - 5000 lb/a ENP (6500 lb/a beet lime) Rate for most crops
  - 10,000 lb/a ENP(13000 lb/a beet lime) Rate for Alfalfa

Material	% Passing #8 sieve	% passing #20 sieve	% passing #60 sieve	Fineness Index	%CCE	% ENP	% Moisture	ENP/ton
Beet Lime	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>79%</b>	<b>79%</b>	<b>30%</b>	<b>1093</b>
Quarry Lime	<b>87%</b>	<b>63%</b>	<b>46%</b>	<b>61%</b>	<b>92%</b>	<b>56%</b>	<b>4%</b>	<b>1080</b>

Beet Lime is available at no charge, but the material is 30% water so it is expensive to transport



*Beet Lime is nasty, dusty material!*



*Lime with finer particles reacts faster*  
*“Beet Lime should react very fast”*

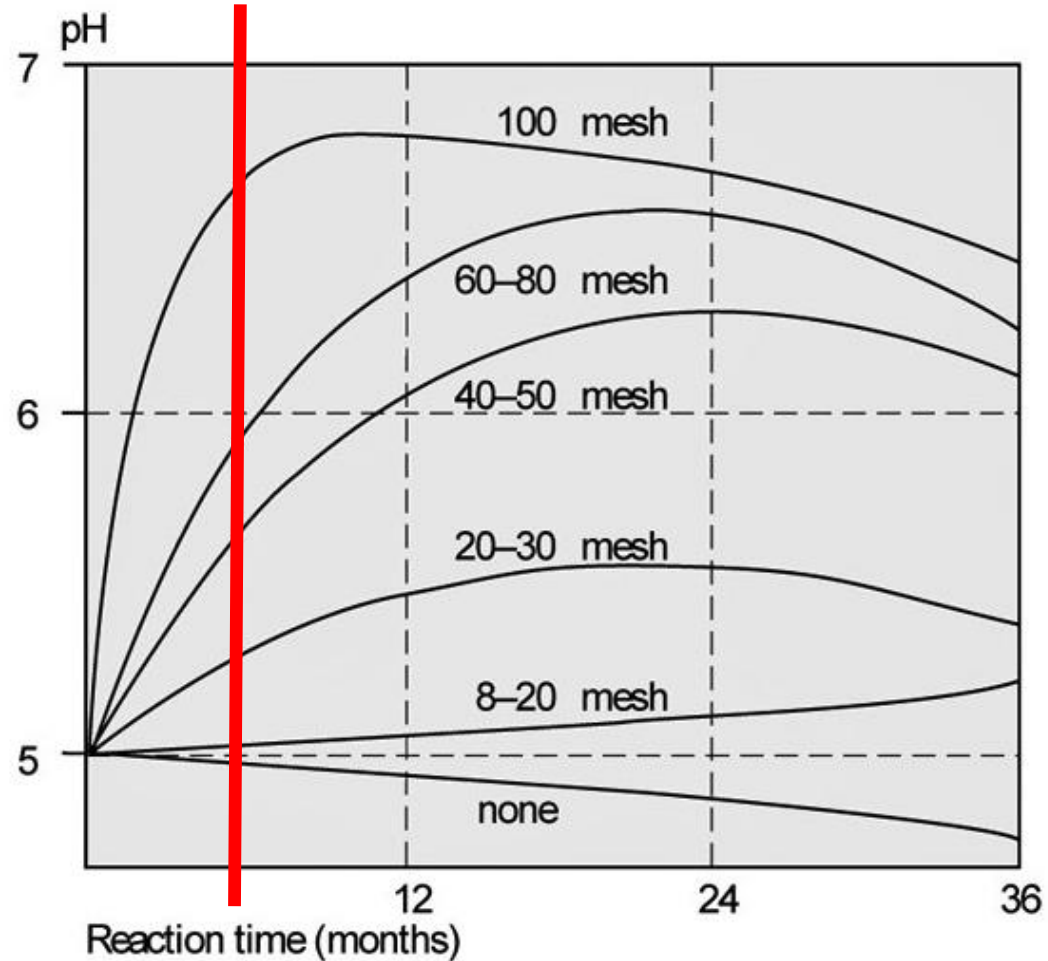


Figure 3. Effect of aglime fineness on speed of reaction.



# *Effect of lime on Soil pH (so far!)*

## *(Application May 22)*

<b>Beet Lime Rate</b>	<b>Soil pH 7-15-14</b>	<b>Soil pH 9-27-14</b>
Check	<b>4.8</b>	<b>4.8</b>
2500 lb/a ENP	<b>5.3</b>	<b>5.5</b>
5000 lb/a ENP	<b>5.7</b>	<b>5.6</b>
10000 lb/a ENP	<b>6.6</b>	<b>7.4</b>

*Effect of Lime on Wheat Yield and test weight*  
*Initial soil pH 4.7 (Full lime rate was 7500 lb/a)*

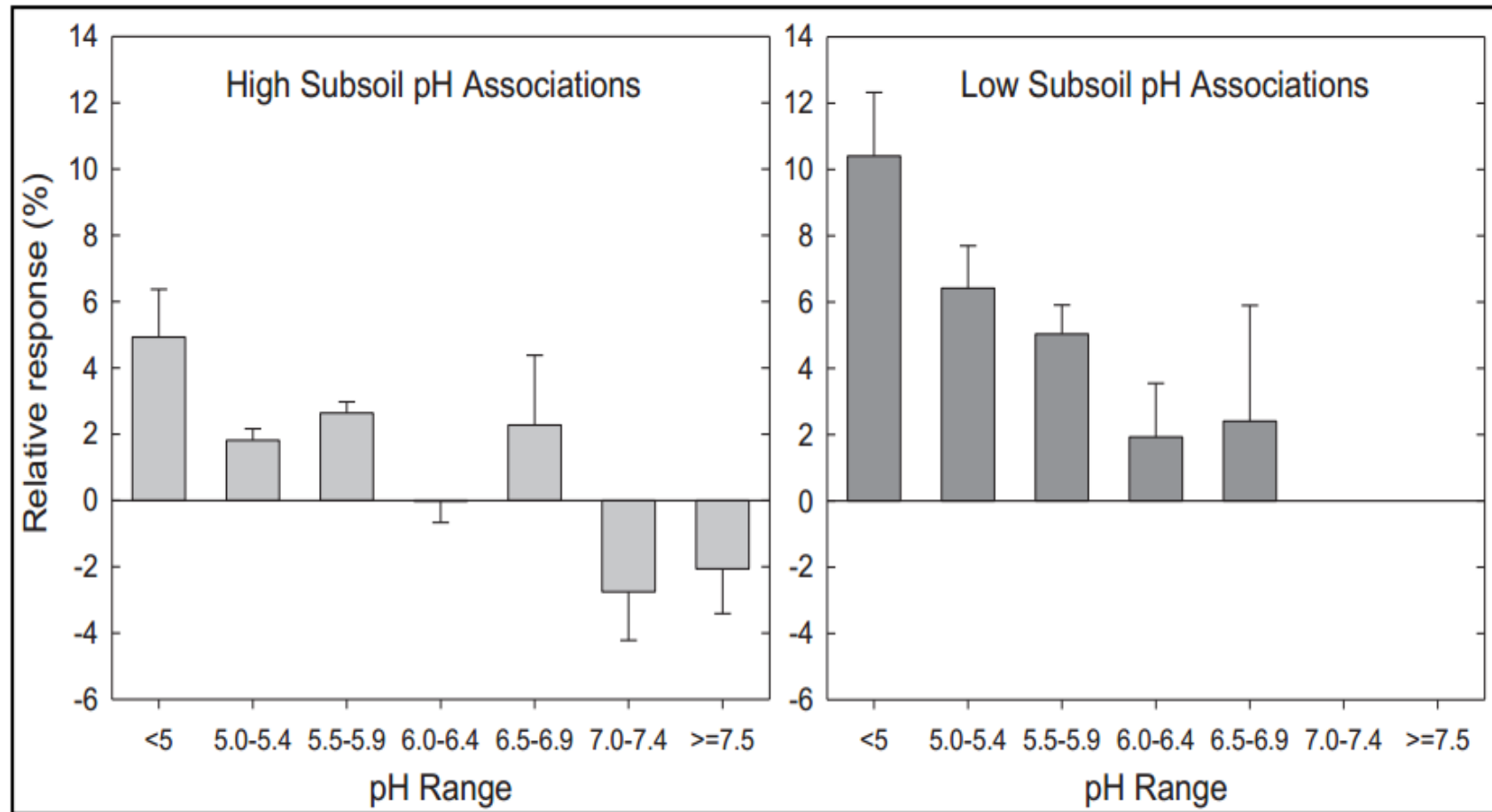
<b>Lime Rate</b>	<b>Yield</b>	<b>Test Weight</b>
ENP	Bu/a	Lb/bu
0	23 bu/a	46 lb/bu
3750 lb/a	42 bu/a	60 lb/bu
7500 lb/a	46 bu/a	61 lb/bu

Suderman. A.J. et Al. Kansas fertilizer research report 1994



# ISU - Mallarino and Pagani, 2011.

102 — 2011 Integrated Crop Management Conference - Iowa State University



**Figure 6.** Relative yield response (combined for corn and soybean) to 3 ton ECCE/acre according to pH for soil associations areas with or without high-pH subsoil (lines represent standard errors).

# *Topsoil and Subsoil pH Trends*

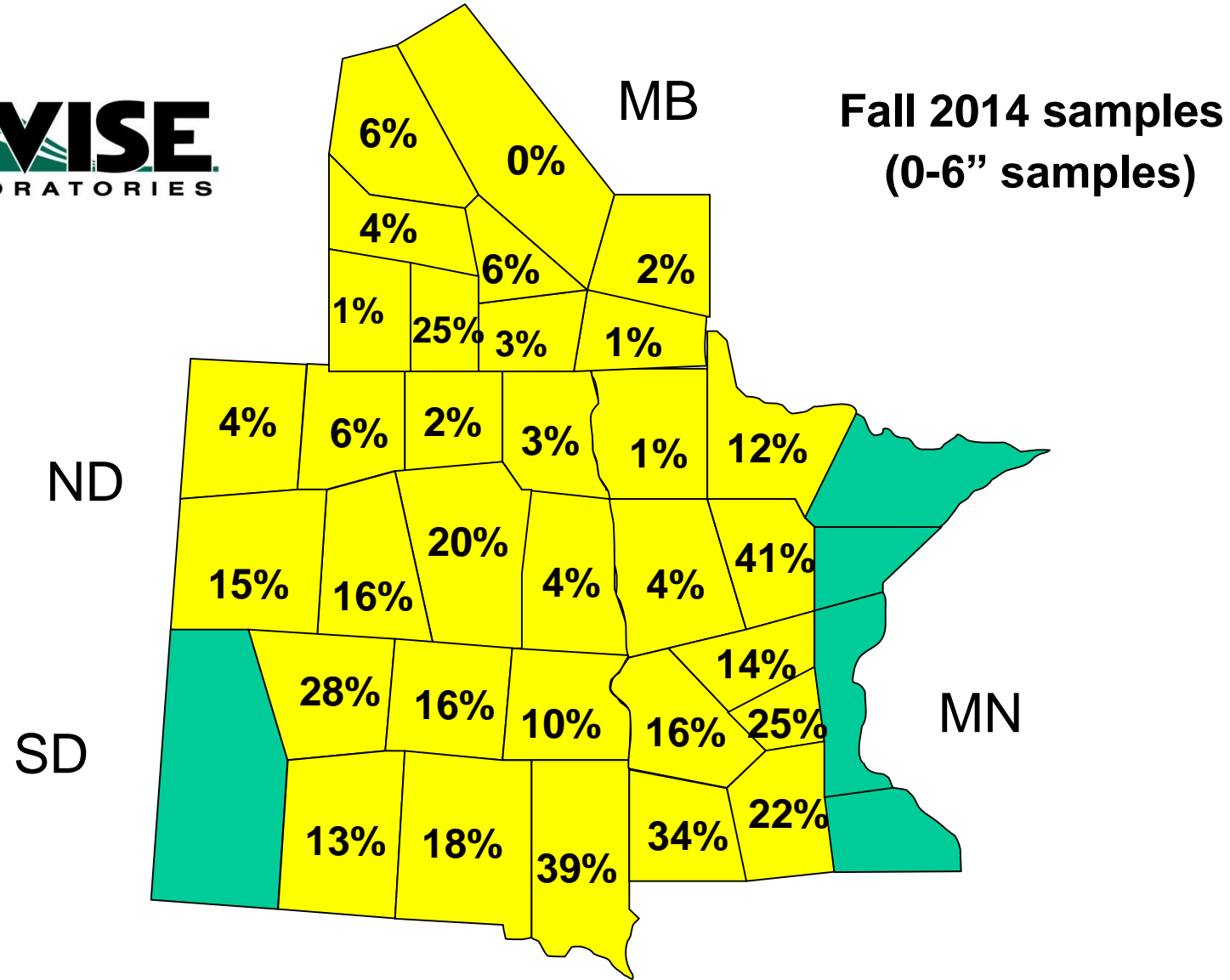
## *AGVISE laboratories 2013*

<b>Zip code area</b>	<b>% Topsoil Samples with pH less than 6.0</b>	<b>% Subsoil Samples with pH less than 7.0</b>
SW MN - 561, 562	19.3%	4.4%
NW MN - 565, 567	0.9%	0.3%
E SD - 571, 572, 573, 574	10.1%	7.5%
W SD - 575, 576, 577	10.8%	7.8%
E ND - 581, 582, 583, 584	3.5%	1.7%
W ND - 585, 586, 587, 588	5.9%	1.5%

***Zone and Grid sampling are showing us the very low pH areas in fields!***



# *% Soil Samples with Soil pH less than 6.0*



## *Acid Soils Becoming More common (<6.0)*

- More questions all the time on liming in areas that have never limed
- AGVISE now tests subsoil pH on all samples (at no extra charge)
- Zone and grid sampling is revealing very low pH areas in fields that may respond to lime
- Lime demonstration Project raises awareness of very acid soils in areas where they were not expected!
- We will be observing site and doing soil and tissue testing



# Questions?





# ***Soil Testing After P & K Application***

How Long do you have to wait?





# ***More Topsoil Spring/Summer Sampling in Growing Soybeans***

- Grid and zone topsoil testing in the spring/summer on soybean fields has increased rapidly in recent years
- Most of the soybean fields do not receive P & K fertilizer the fall before or that spring (P & K applied before corn)
- More fields seeded to soybeans are fertilized in the fall or in the spring just prior to seeding
- How will this affect spring/summer soil test levels for P & K

# ***How long Do you have to wait?***

## ***University Specialist Answers?***

- With lower rates ( $<50$  lb/a  $P_2O_5$   $<50$  lb/a  $K_2O$ )
  - Can soil sample right away with moderate rates
  - Wait 3-4 weeks after application
  - Must wait until next year
  - Don't really know
  - Depends

# ***Sampling Delay after P & K application***

- Fields to be soybean in 2015 (wheat or corn in 2014)
- Locations: 2 ND, 2 MN, 1 MB
- Fall 2014 and Spring 2015 application of P & K fertilizer
- Treatments (20' by 20' area)
  - Check
  - Treatment 1 – 50 lb/a  $P_2O_5$     50 lb/a  $K_2O$
  - Treatment 2 – 100 lb/a  $P_2O_5$     100 lb/a  $K_2O$
  - Treatment 1 – 200 lb/a  $P_2O_5$     200 lb/a  $K_2O$
- Tilled or not tilled (depending on grower practice)
- Soil Testing Before Application then Monthly Spring 2015



***P & K applied and tilled into topsoil  
(Other locations left to grower practices)***

Application area 20' by 20 '



# ***Sampling Delay – P & K Treatments***

## **Treatment 1**

50 lb/a  $P_2O_5$   
50 lb/a  $K_2O$

## **Treatment 2**

100 lb/a  $P_2O_5$   
100 lb/a  $K_2O$

## **Treatment 3**

200 lb/a  $P_2O_5$   
200 lb/a  $K_2O$



# Sampling Delay – P & K Treatments

## Fertilizer applied 9-19-14 Sampled 10-30-14

Check

Treatment 1

50 lb P<sub>2</sub>O<sub>5</sub> P 50 lb K<sub>2</sub>O

Treatment 2

100 lb P<sub>2</sub>O<sub>5</sub> P 100 lb K<sub>2</sub>O

Treatment 3

200 lb P<sub>2</sub>O<sub>5</sub> P 200 lb K<sub>2</sub>O

\*P 3 \*K 159

P 3 K 144

P 3 K 162

Ave 3 155

P 14 K 163

P 3 K 154

P 4 K 169

Ave 7 162

P 21 K 140

P 3 K 175

P 50 K 168

Ave 24 162

P 23 K 176

P 27 K 173

P 76 K 150

Ave 42 166

Little precipitation during 30 days between application and soil testing

\*Olsen P test ppm, Ammonium acetate exchangeable K ppm



# ***Expectations?***

- Fall P & K application will have less affect than Spring application
- Lower rates (will have less effect on soil test values)
- Fertilizer application will have little effect on June soil sampling when rates are moderate (<50 lb/a P<sub>2</sub>O<sub>5</sub> and <50 lb/a K<sub>2</sub>O)



***Interest in Tile Drainage  
Effect on Salinity - Long Term***

***Tile Demonstration Project  
2002- 2014***

***Local Field Tiled in 2002  
10 sites established for  
Sampling each fall***



# Tile installed 2002

A photograph of a green agricultural field, possibly corn, with a large, dark, bare patch in the center. The patch appears to be a result of tile installation, showing exposed soil and some sparse vegetation. The field is surrounded by a light blue sky and distant trees.

Location: 35 Miles SW of Grand Forks

**Sandy loam to loam texture**

pH 7.9-8.2

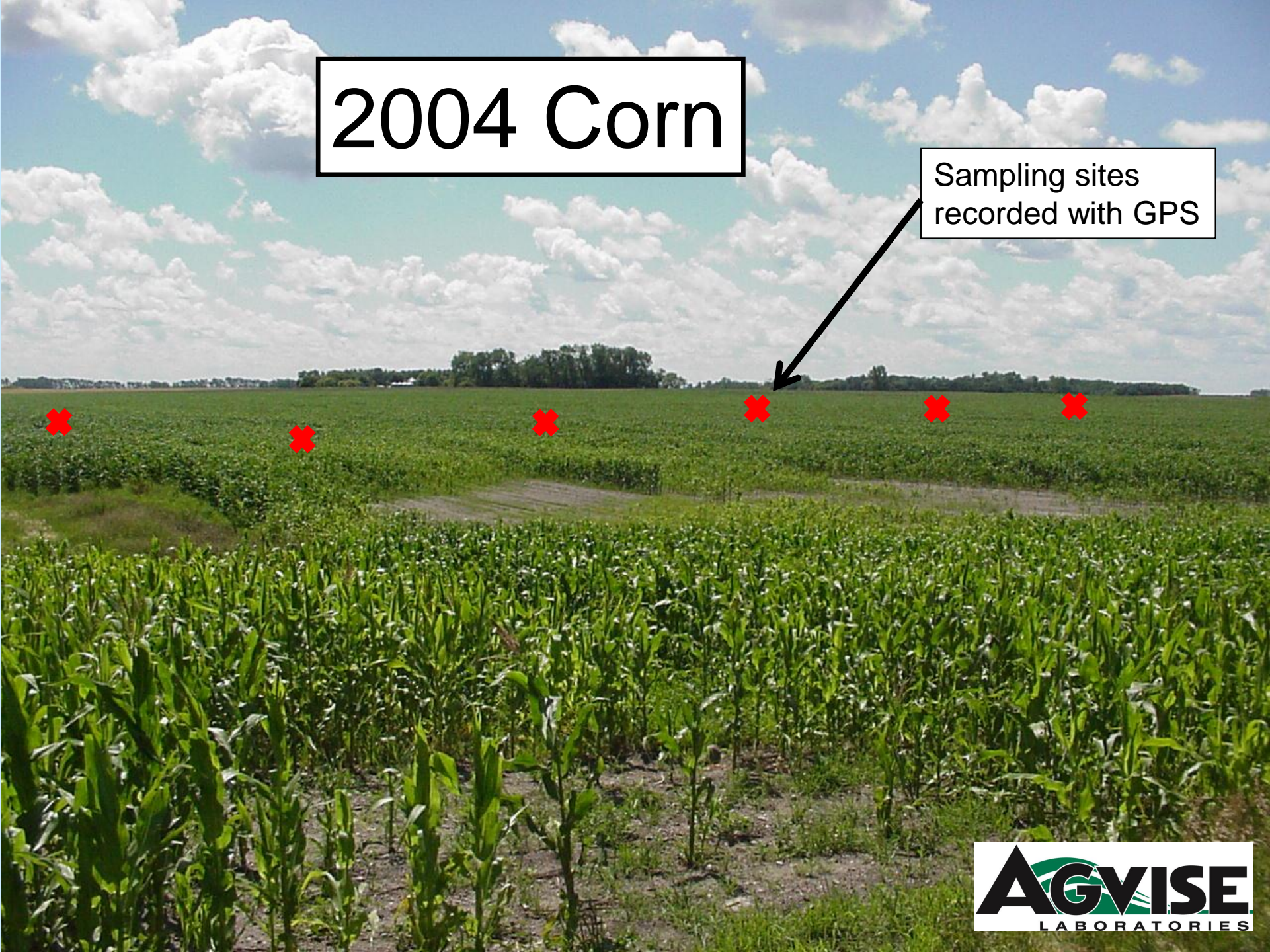
Carbonates 3-6%

%OM 4.0-5.5%



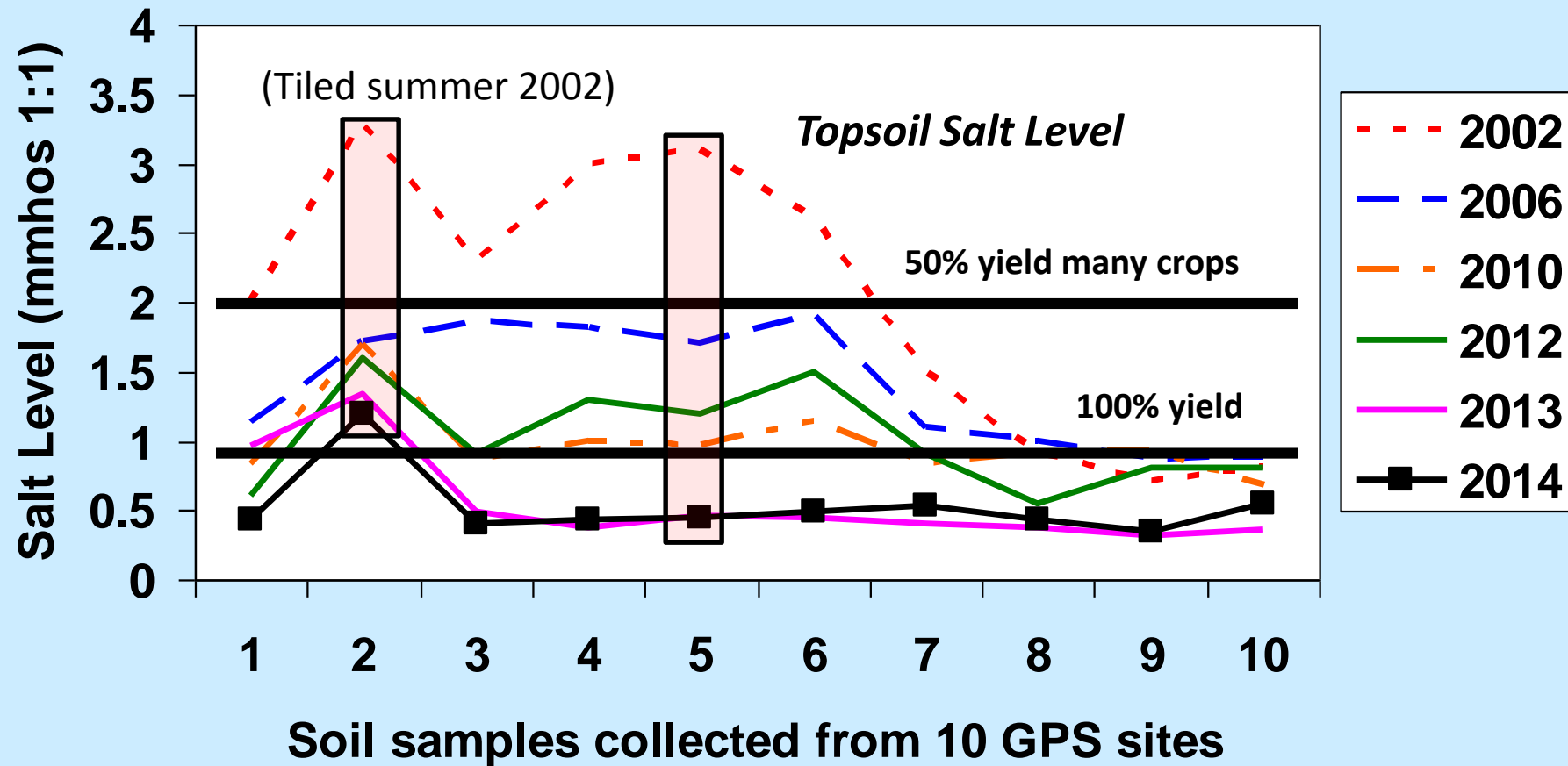
# 2004 Corn

Sampling sites  
recorded with GPS

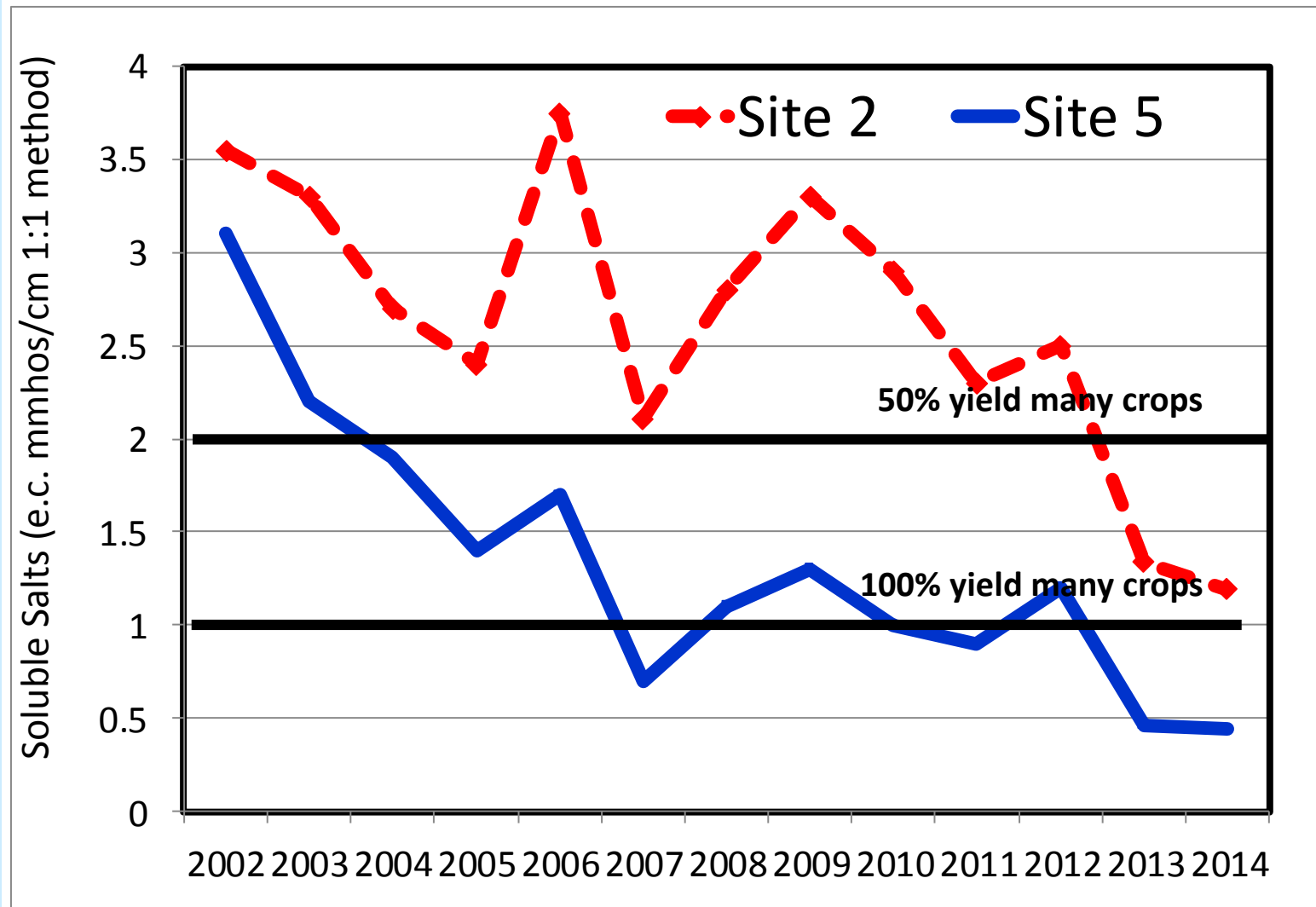


# ***Tile Drainage - Soluble Salts Demonstration Project***

## **Topsoil (0-6") Salinity (02, 06, 10, 12 13, 14)**



# ***Soluble Salt Trend of Two Sites Tile Drained Field (2002 – 2014)***





# ***Tile Project - Results So Far***

- *Topsoil salt levels decreased in years with excessive rainfall spring and fall.*
- *Several crops now produce good yields*
  - *Corn, soybeans, sunflowers*
  - *Iron chlorosis severity in soybeans is much less*
- *Subsoil salt levels take longer to be decrease*
- *High subsoil salt levels do not harm crops as much as high topsoil salt levels.*
- *Salinity can increase in dry years, even with tile drainage.*

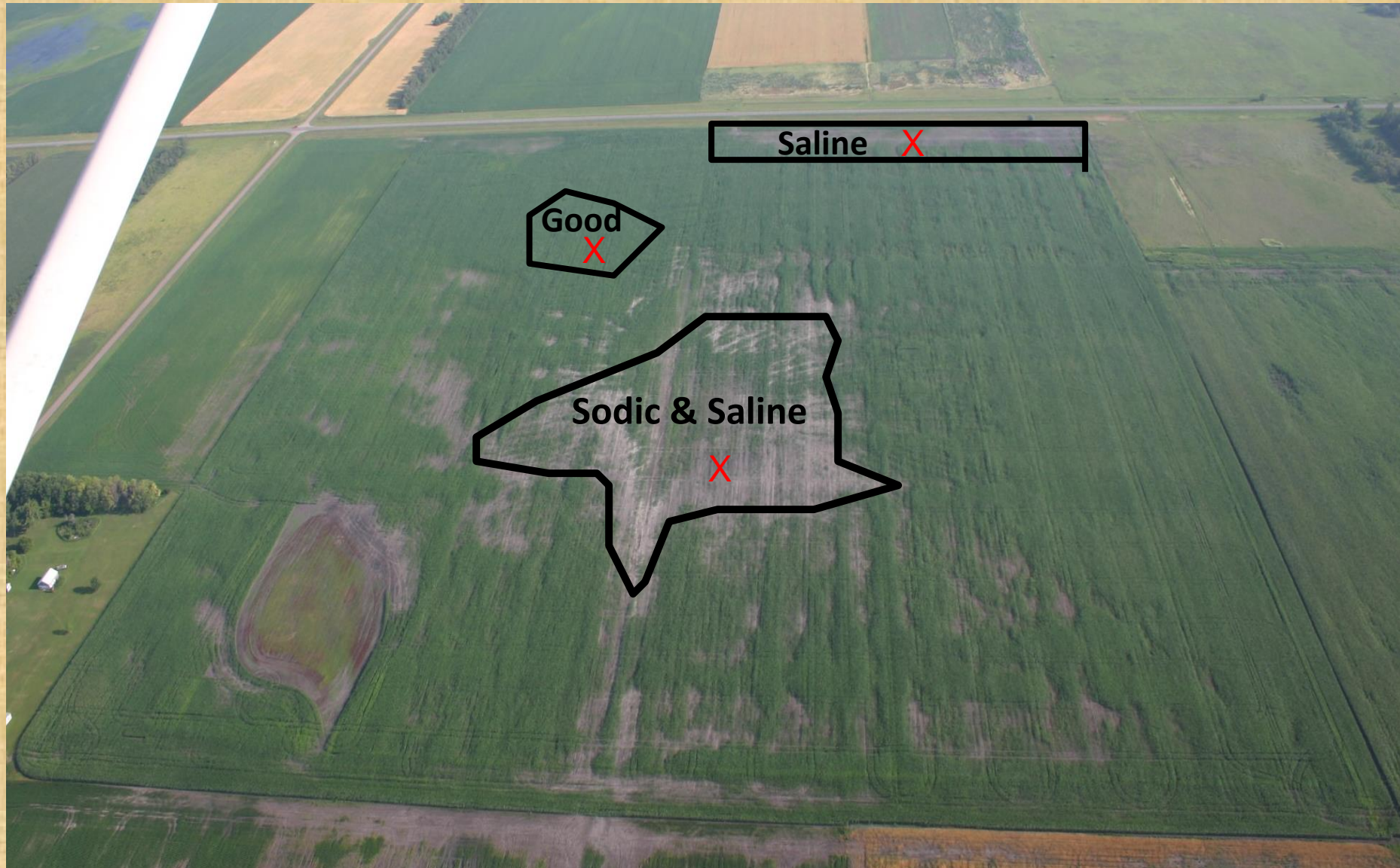


# ***Saline/Sodic Tile Project Mayville, ND 2008 – 2014***

- Field tiled - 2007
  - Most Acres : Low salt and low sodium
  - Some acres: Saline - High salt and low sodium
  - Some acres: Saline & Sodic - High salt and High sodium



**Greg Reidman – Consultant    Mike Kozojed – Farmer**

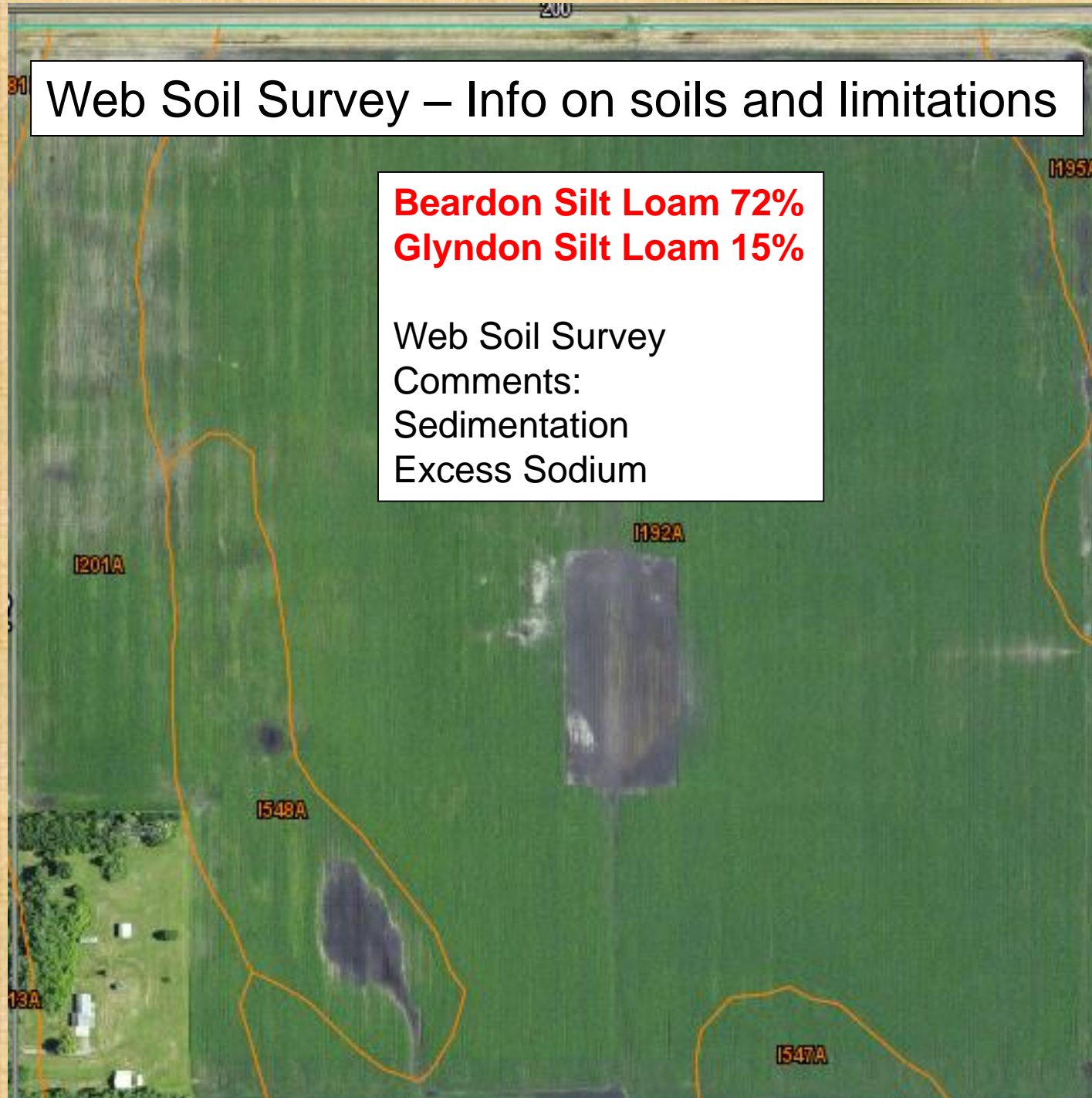




## Web Soil Survey – Info on soils and limitations

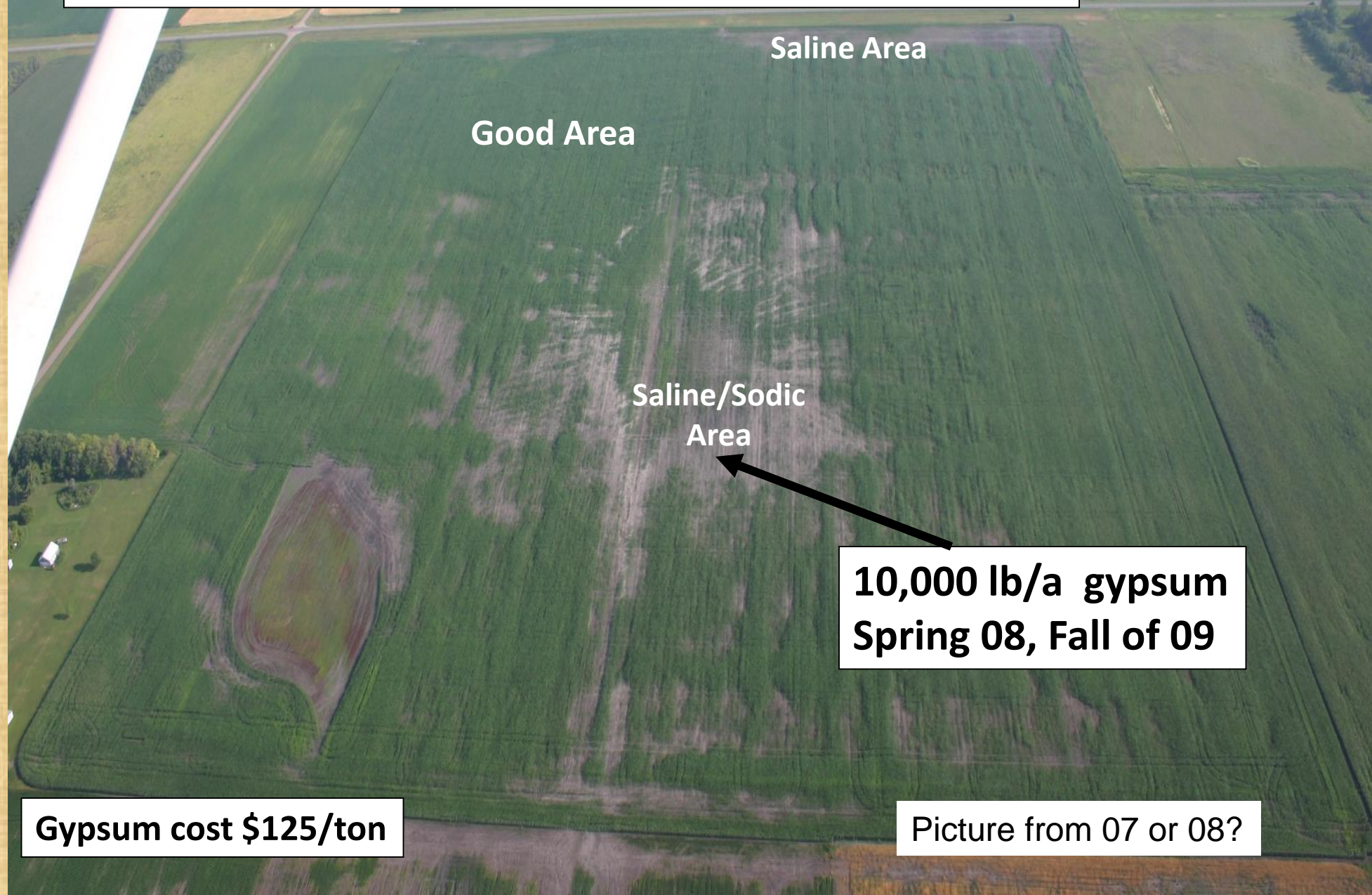
**Beardon Silt Loam 72%**  
**Glyndon Silt Loam 15%**

Web Soil Survey  
Comments:  
Sedimentation  
Excess Sodium





# Gypsum Application ( $\text{CaSO}_4$ )



Saline Area

Good Area

Saline/Sodic  
Area

10,000 lb/a gypsum  
Spring 08, Fall of 09

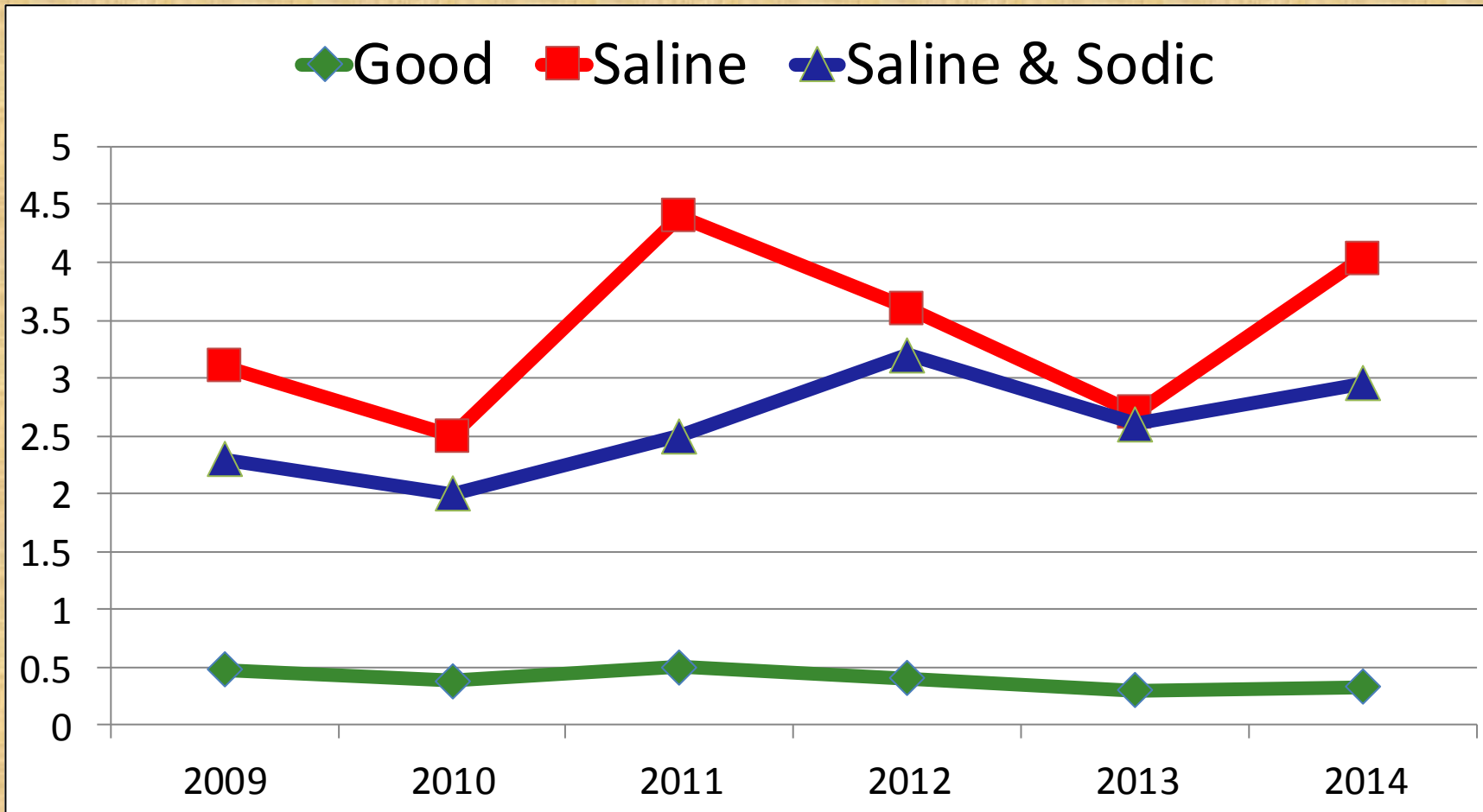
Gypsum cost \$125/ton

Picture from 07 or 08?

# Topsoil Salinity 2009-2014

*Routine salt method 1:1*

E.C. 1:1 method – mmhos/cm



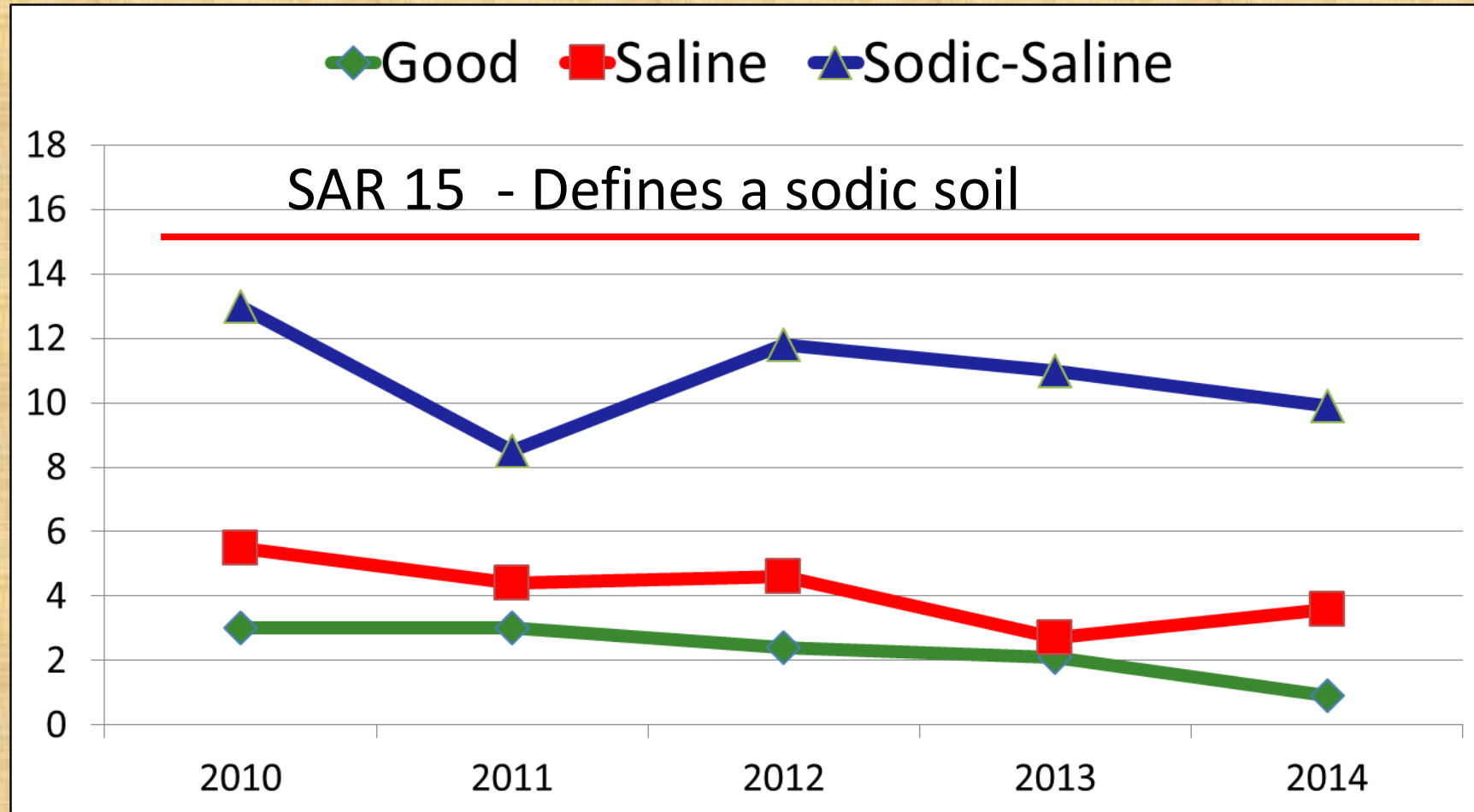
**Salinity will decrease be slower on fields with finer soil texture and depends on excessive rainfall**



# ***Topsoil SAR (Sodium Adsorption Ratio)***

## ***2010-2014***

SAR – Saturated Paste Method



$$SAR = \% Na$$

***Slow Expensive Test = Cheap Routine Test***

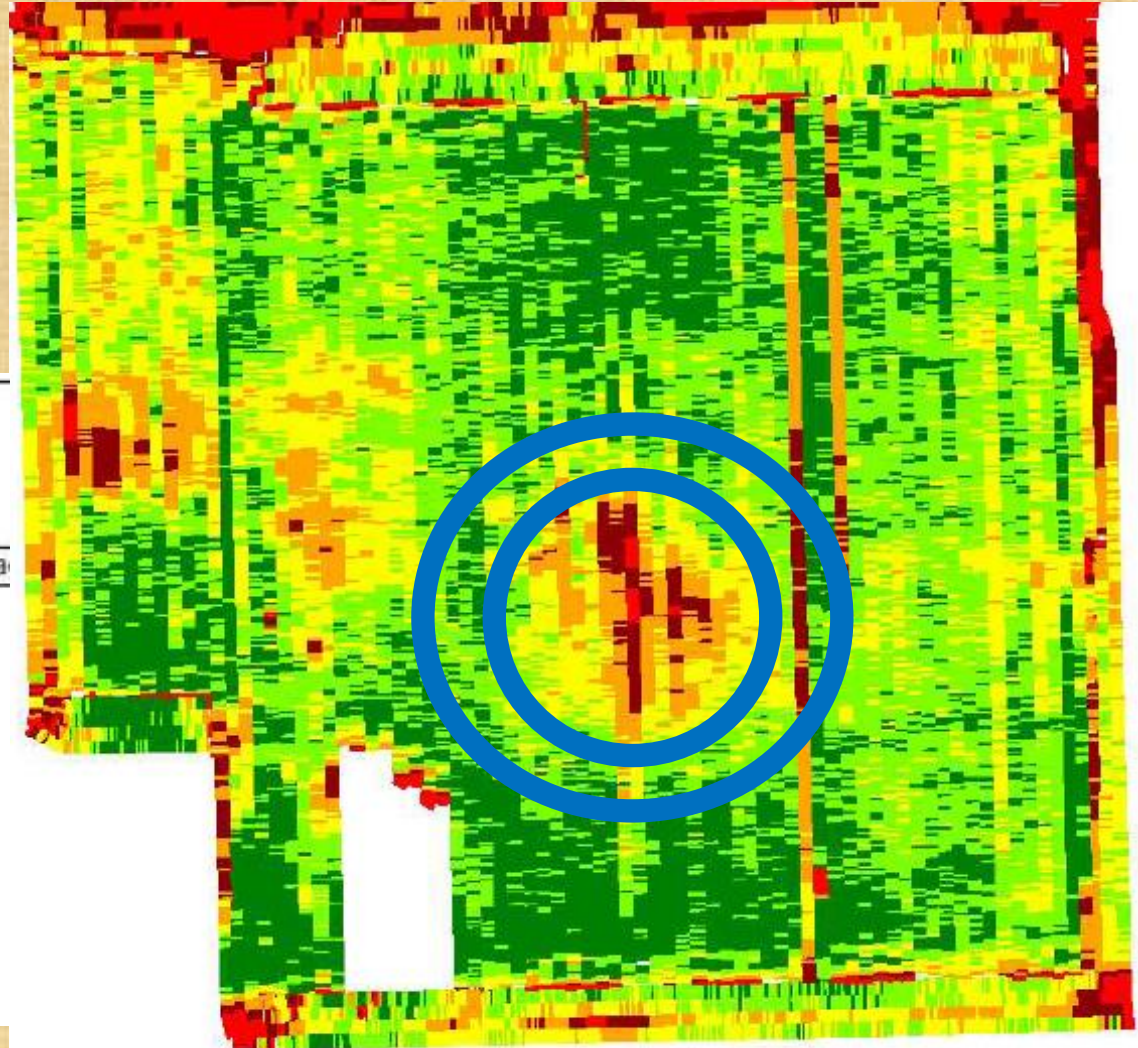
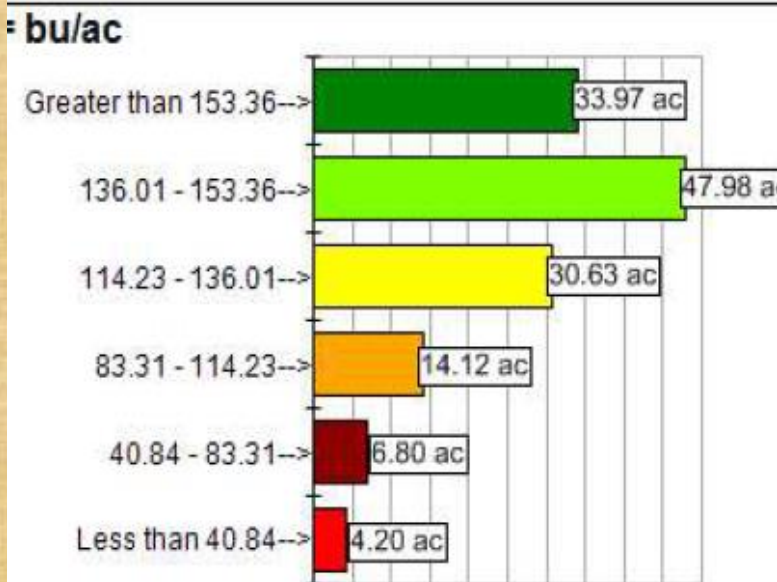
Sample ID	SAR (Sodium Adsorption Ratio) Special Test	%Na (Sodium) (Routine Test Method)
Good 0-6"	.9	.9
Good 6-24"	4.9	3.4
Good 24-48	5.3	4.3
Saline 0-6"	3.8	3.6
Saline 6-24"	3.8	4.0
Saline 24-48	2.9	3.4
Saline Sodic 0-6"	9.4	9.9
Saline Sodic 6-24"	10.4	10.7
Saline Sodic 24-48	11.3	10.0

**Just request K, Ca, Mg, Na on routine soil samples to get % Na (sodium)**

# ***Corn Yield 2014***

## ***(Continuous Corn Rotation)***

Averaged 133 bu/a  
Dry corn





# ***Tile Drainage Benefits “Before” Salts Leave***

- *Topsoil dries out earlier in the spring (earlier seeding)*
- *Crop can explore more of the soil profile (not growing in bucket of water)*
- *Less N fertilizer lost denitrification in wet years*
- *Less potential for soil compaction (spring and fall)*
- *More biological activity (air increases microbes)*

# ***Saline & Sodic Project Field 2014***

## ***Salt Method Comparison***

<b>Sire ID and depth</b>	<b>Soluble Salts (1:1) common</b>	<b>Soluble Salts Saturated paste Extract</b>	<b>Ratio Paste/ 1:1</b>
	Mmhos/cm	Mmhos/cm	
Good 0-6"	0.3	0.7	<b>2.3</b>
Good 6-24"	0.5	1.0	<b>2.0</b>
Good 24-36"	0.6	1.3	<b>2.2</b>
Saline 0-6"	4.0	8.2	<b>2.1</b>
Saline 6-24"	4.7	8.9	<b>1.9</b>
Saline 24-36"	3.2	7.7	<b>2.4</b>
Saline & Sodic 0-6"	3.0	6.1	<b>2.0</b>
Saline & Sodic 6-24"	3.1	6.0	<b>2.0</b>
Saline & Sodic 24-36"	1.9	3.9	<b>2.0</b>

# ***Questions***

