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Pete Fandel
Illinois Central College
Illinois Council on Best Management Practices

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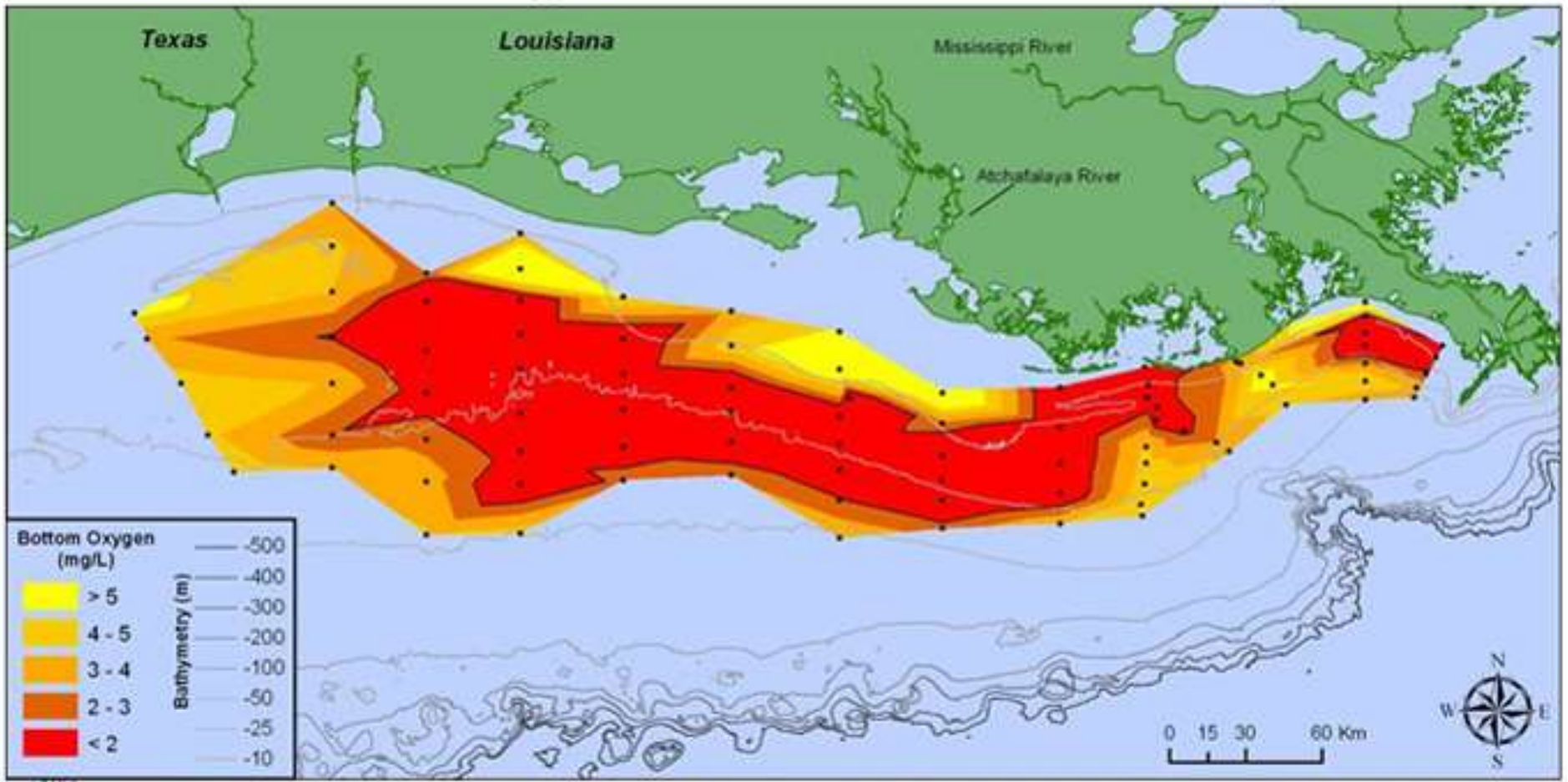
July 2013 Hypoxic Zone

Bottom-water dissolved oxygen across the Louisiana shelf from July 22-28, 2013



Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

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Mississippi River Watershed

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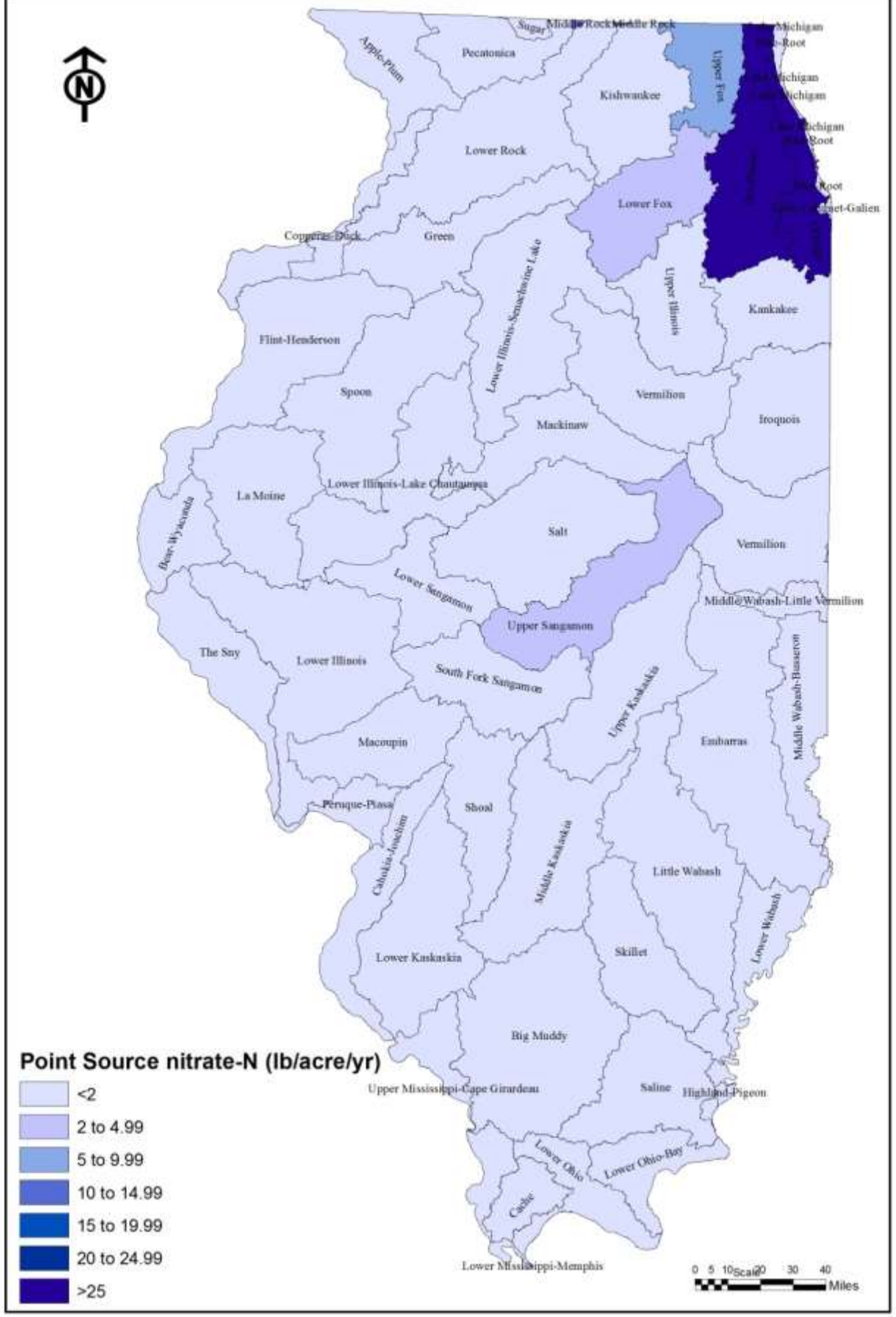
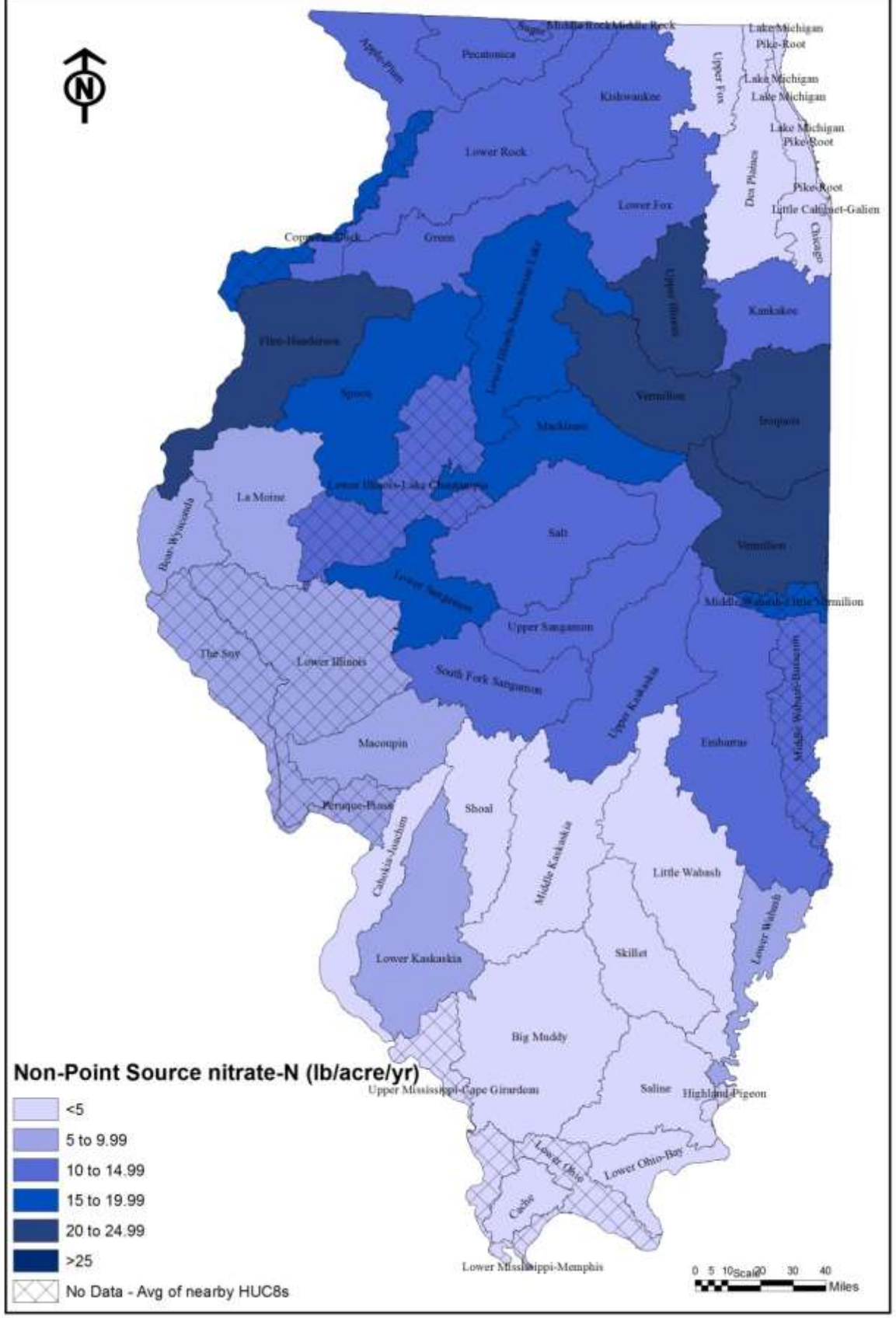
HUC8 Point Source nitrate-N Yields



HUC8 Non-Point Source nitrate-N Yields

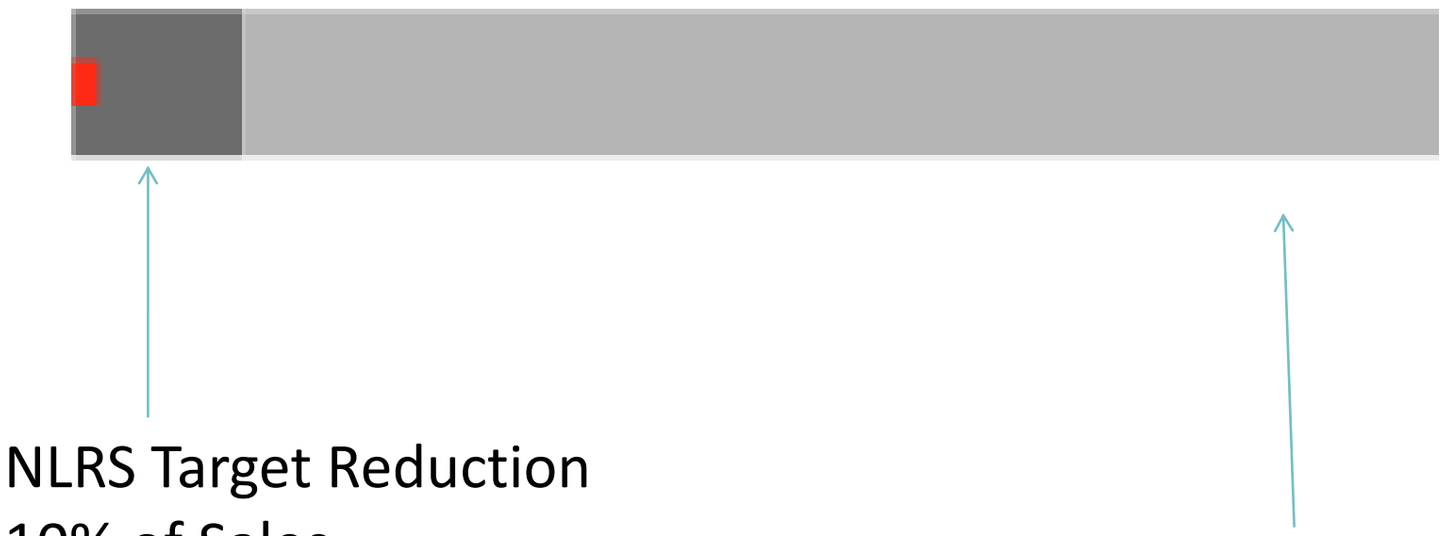


Nitrogen

N Sales in 2012 was 2,293,812,952 pounds

Target Reduction is 225,000,000 pounds

That's a 10% increase in utilization needed



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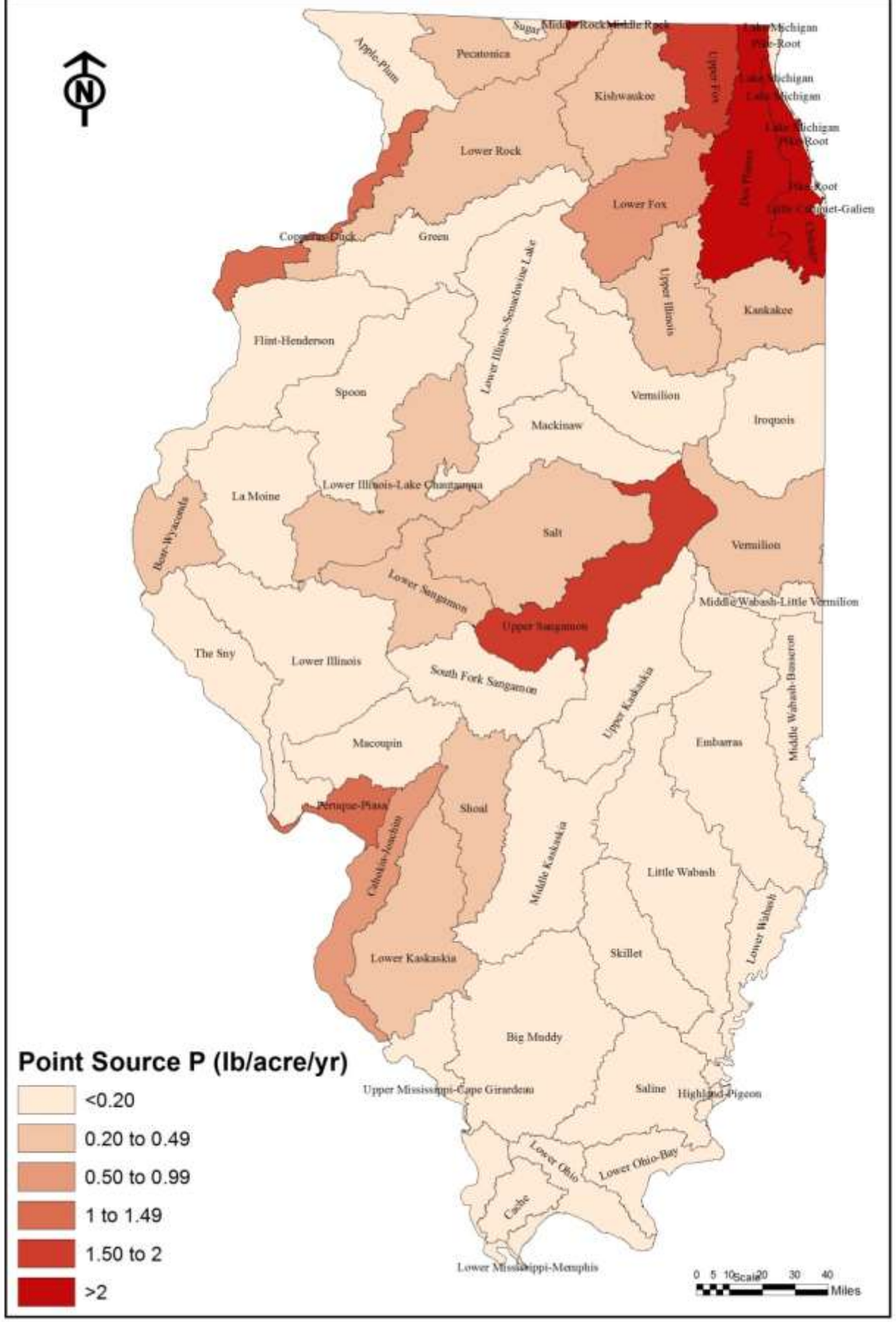
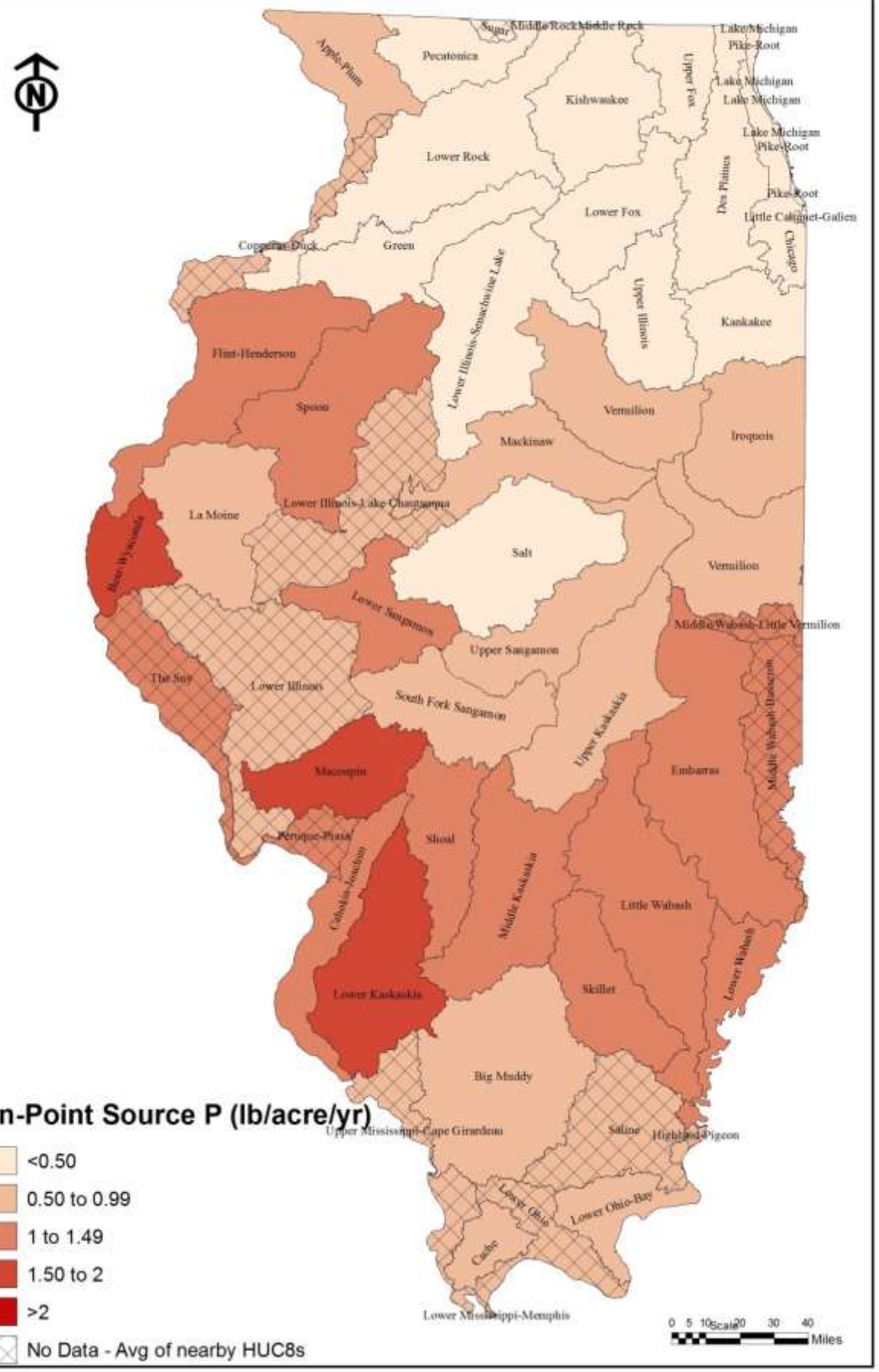
HUC8 Point Source P Yields



HUC8 Non-Point Source P Yields



Phosphorus

1977, P_2O_5 sales peaked at 1,174,190,000 lbs

P_2O_5 Sales in 2012 was 758,052,000 pounds

(a 35% reduction in use from 1977)

LNRS Target Reduction is 18,000,000 pounds

That's 2% increase in efficiency needed in utilization compared to sales

Cover crops
Will they work for you?

- What are you trying to accomplish with cover crops
- Takes commitment
- Requires learning curve
- Must adapt to own farm and soils
- Can be very cost effective
- Has significantly increased soil productivity
- Maybe next step in increasing yields to meet goals
- Provides greatest benefit when combined with no-till farming

Drilling produces the best stand, the quickest

Seeding annual ryegrass with rolling harrow


Gandy
Orbit-Air
JOHN DEERE

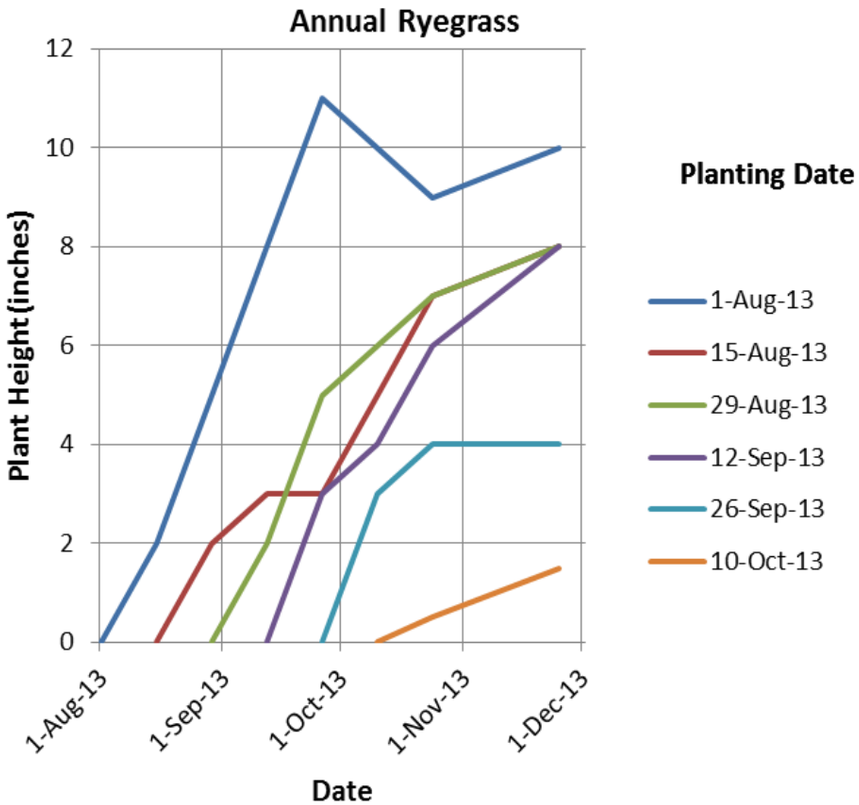
Aerial Seeding Turnips, Oats and Rye

Annual Ryegrass

photo date 11-14-2013

Plant date 9-12-2013- 2months

Plant date 8-15-2013- 3 months



Annual Ryegrass

Sept. 30th seeding 20#/a 2 different varieties

Annual ryegrass is
6-7 months old April 1
With extensive root system

Variety also determines
Size, condition, uptake

Treat it like an established
Forage grass-tall fescue
or bromegrass

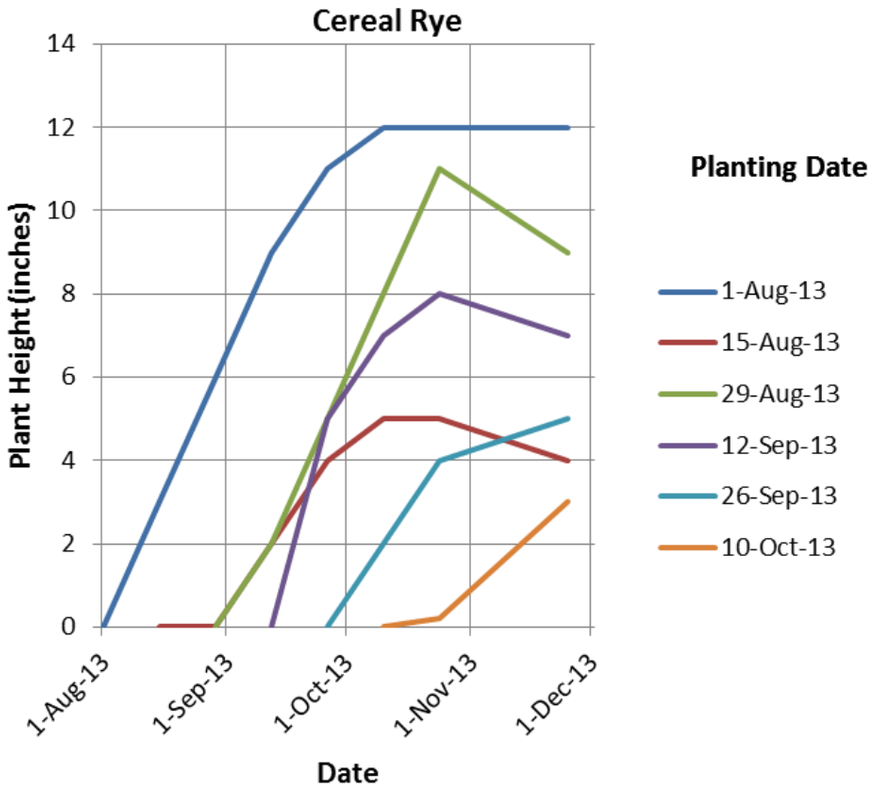
(March 15)

Cereal Rye

photo date 11-14-2013

Plant date 9-12-2013- 2 months

Plant date 8-15-2013-
drill /emergence problem



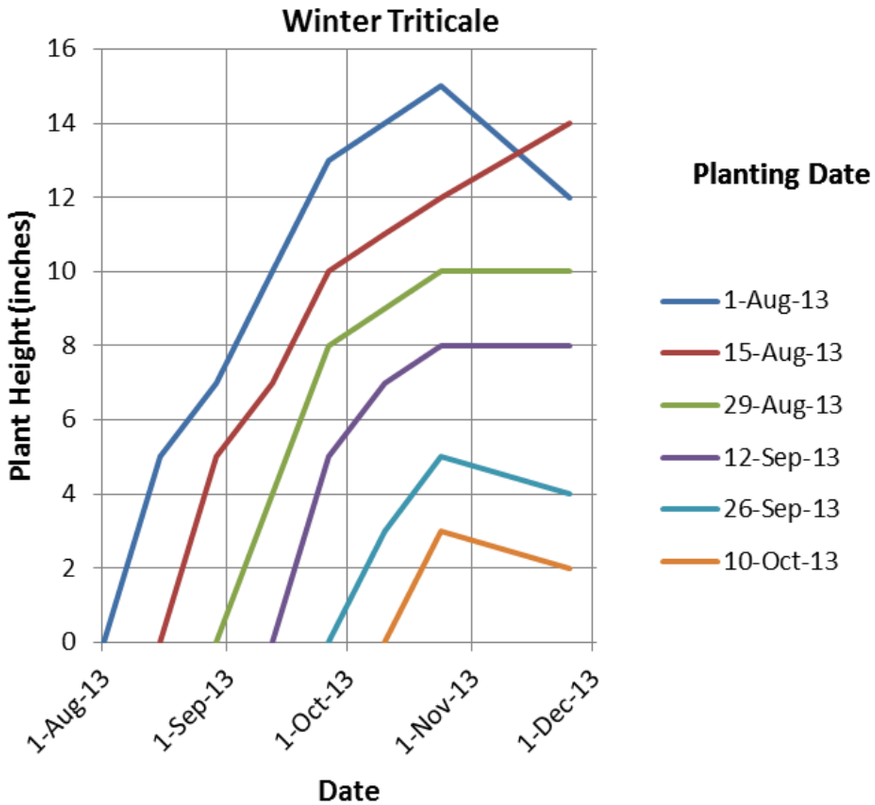
Wisconsin border, as of Octob

Winter Triticale

photo date 11-14-2013

Plant date 9-12-2013- 2 months

Plant date 8-15-2013- 3 months

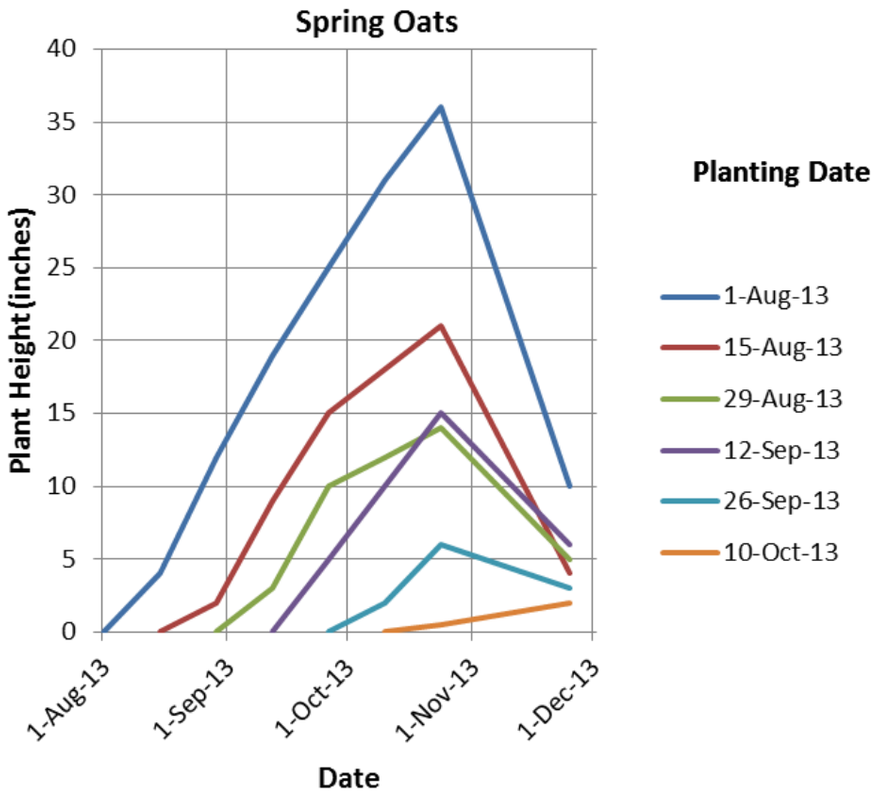


Spring Oats

photo date 11-14-2013

Plant date 9-12-2013- 2 months

Plant date 8-15-2013- 3 months

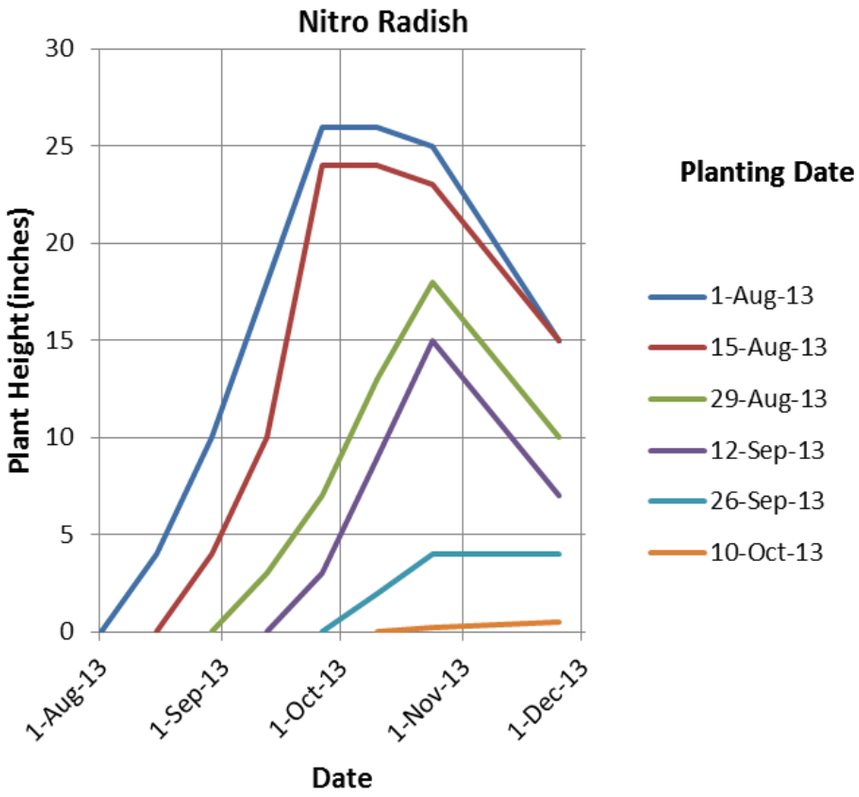


Oilseed Radish

photo date 11-14-2013

Plant date 9-12-2013- 2 months

Plant date 8-15-2013- 3 months



planting date Oct 1 Sept. 15 Aug. 15

as of November 12 at Effingham

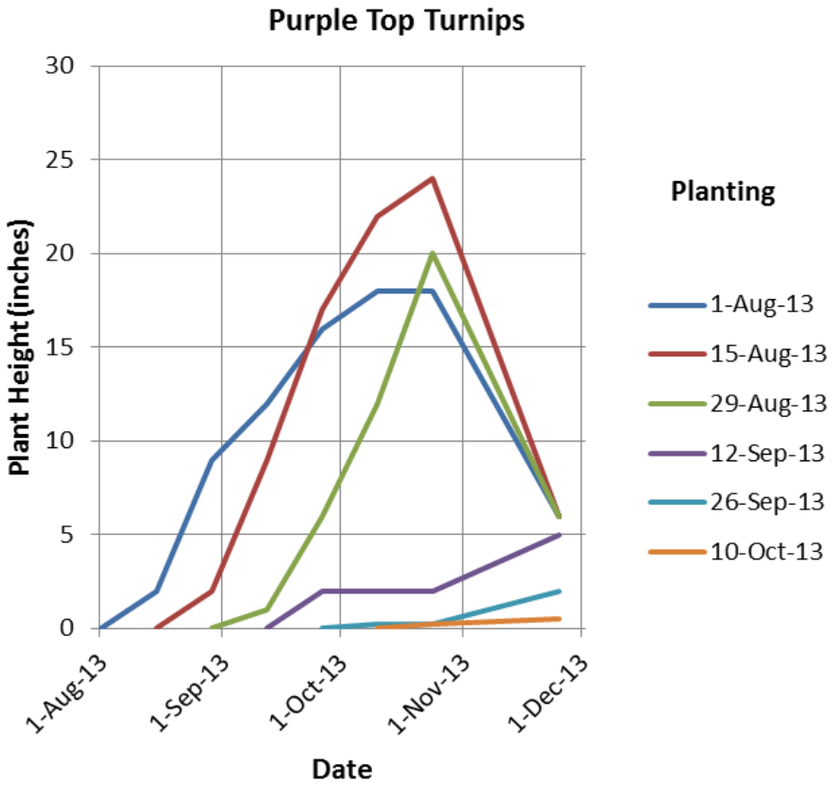
Radish- which one do you want

Pasca brassica groundhog radish Appin Turnip

Purple Top Turnip

photo date 11-14-2013

Mid August/vs. Mid Sept.

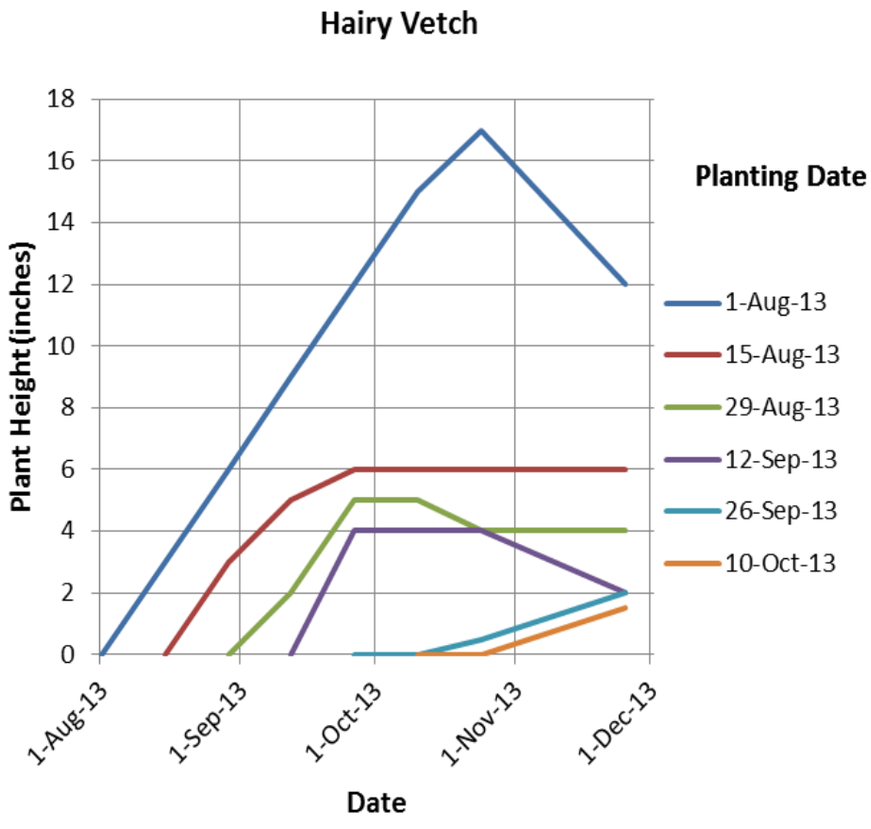


Hairy Vetch

photo date 11-14-2013

Plant date 9-12-2013- 2 months

Plant date 8-15-2013- 3 months

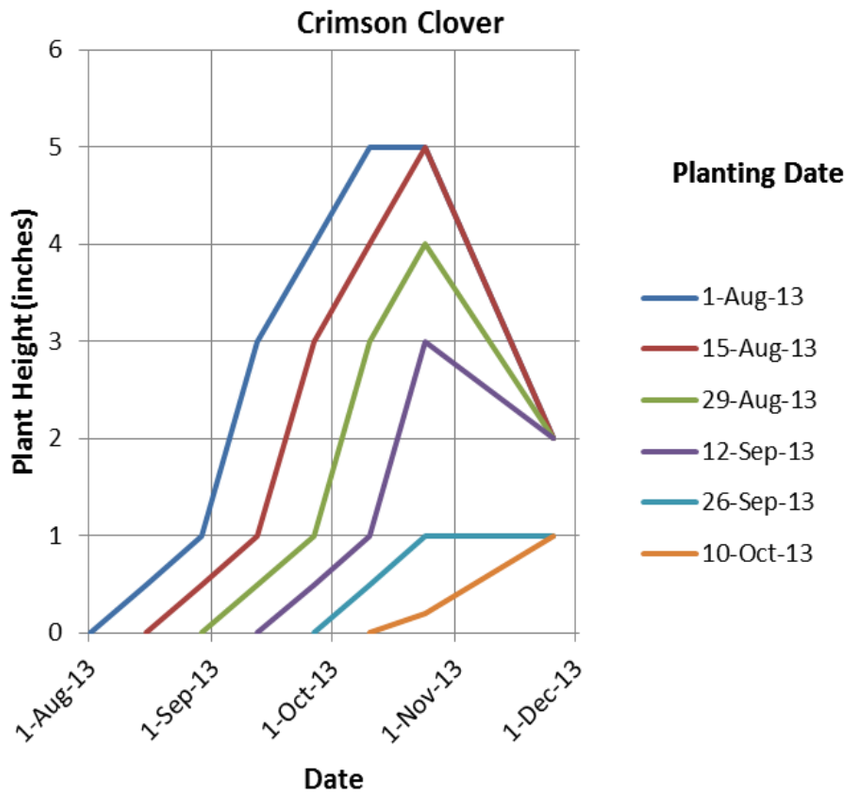


Crimson clover

photo date 11-14-2013

Plant date 9-12-2013- 2 months

Plant date 8-15-2013- 3 months



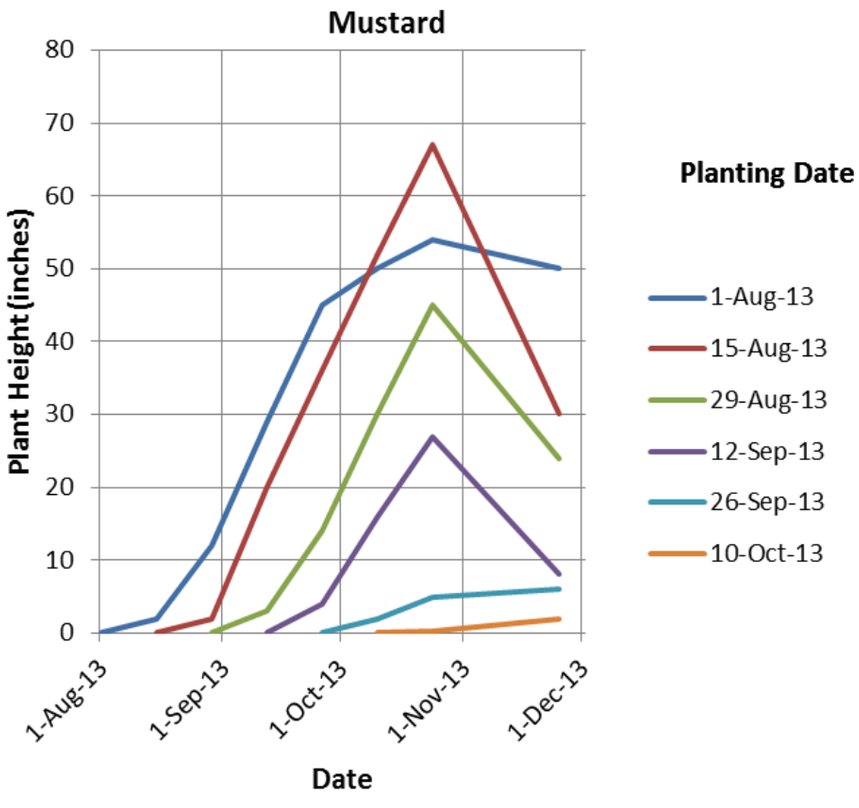
Variety does make a difference on bloom time

Crimson Clover

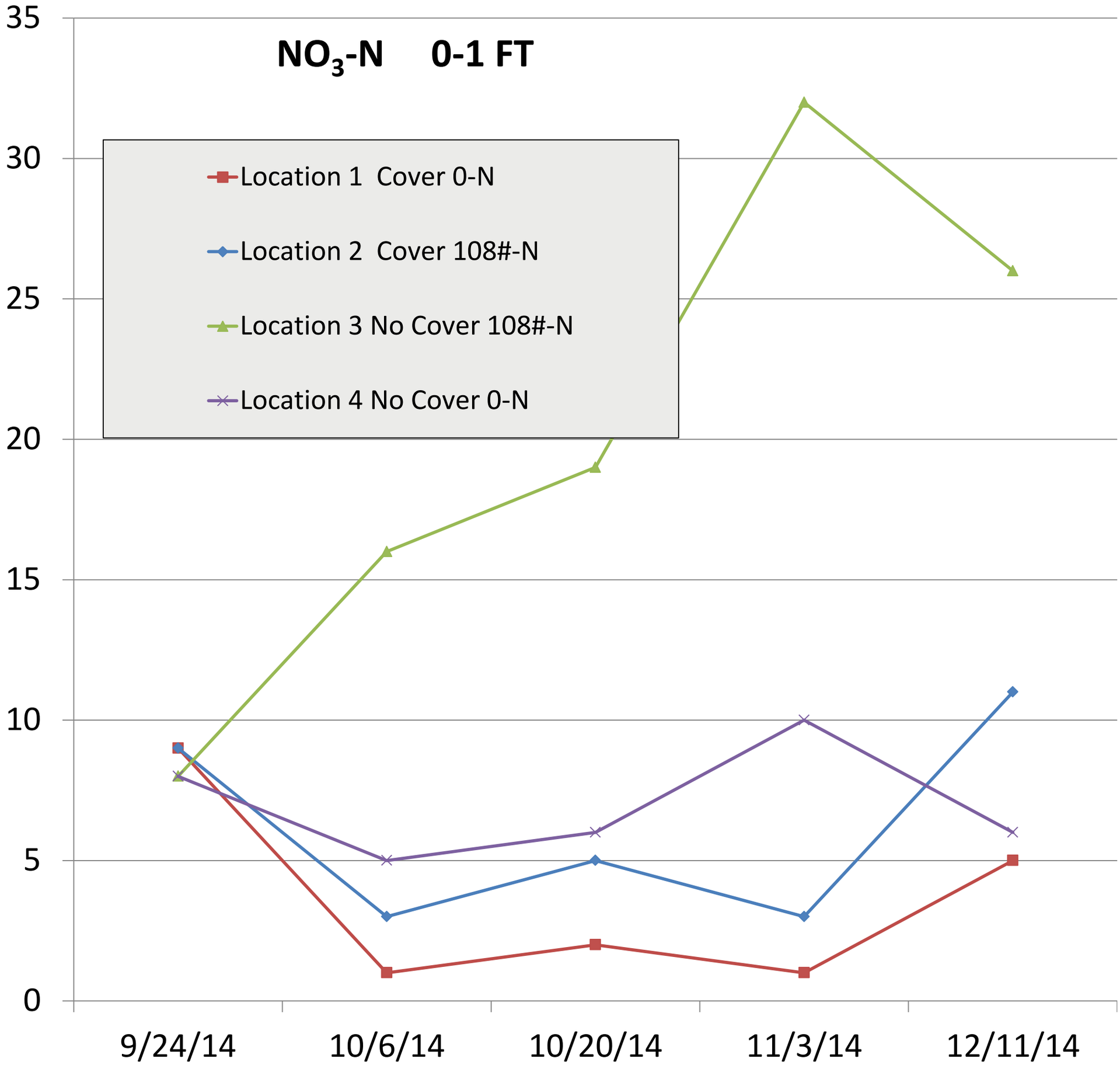
Brassica’s

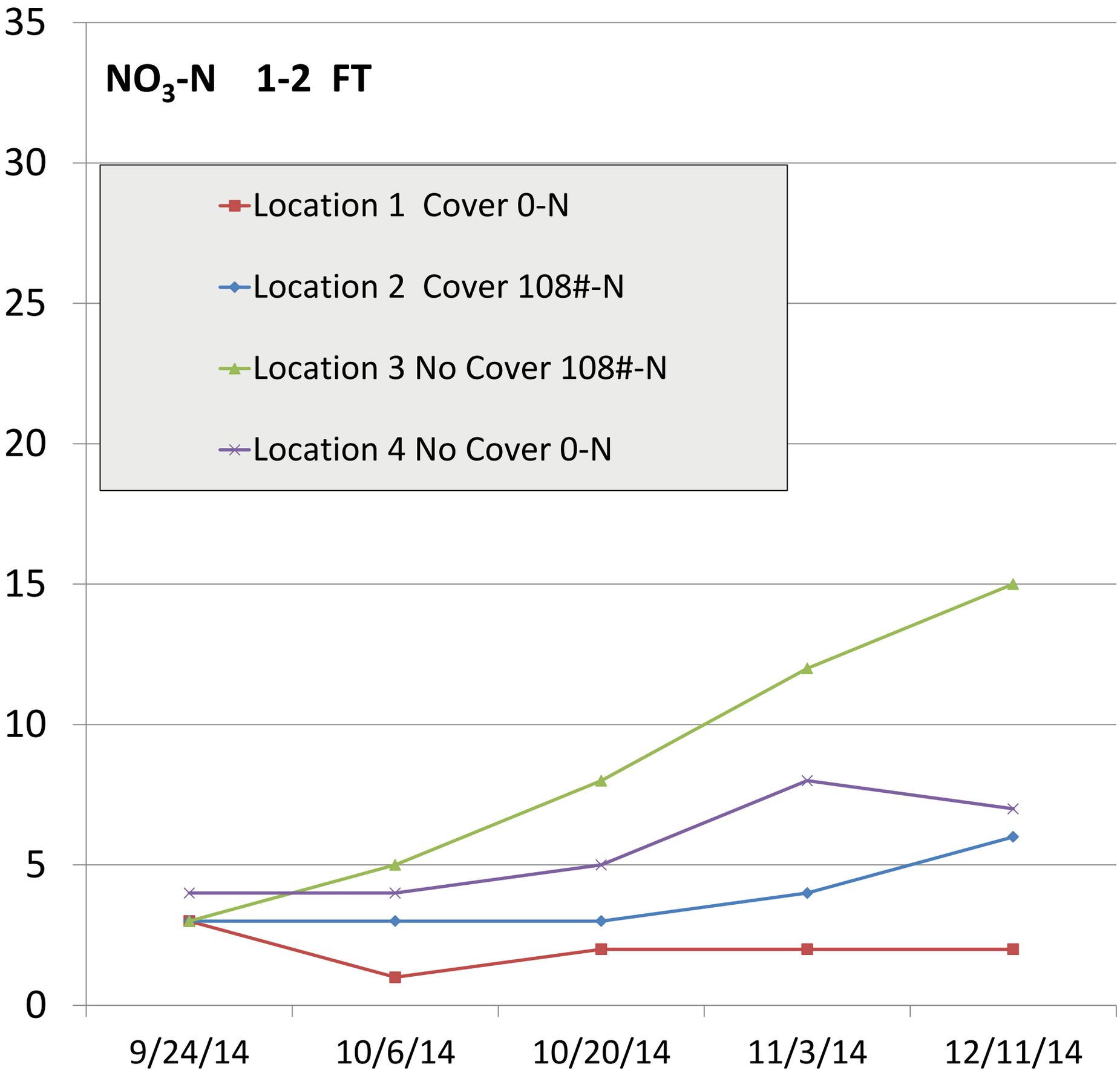
Plant date 9-12-2013- 2 months

photo date 11-14-2013

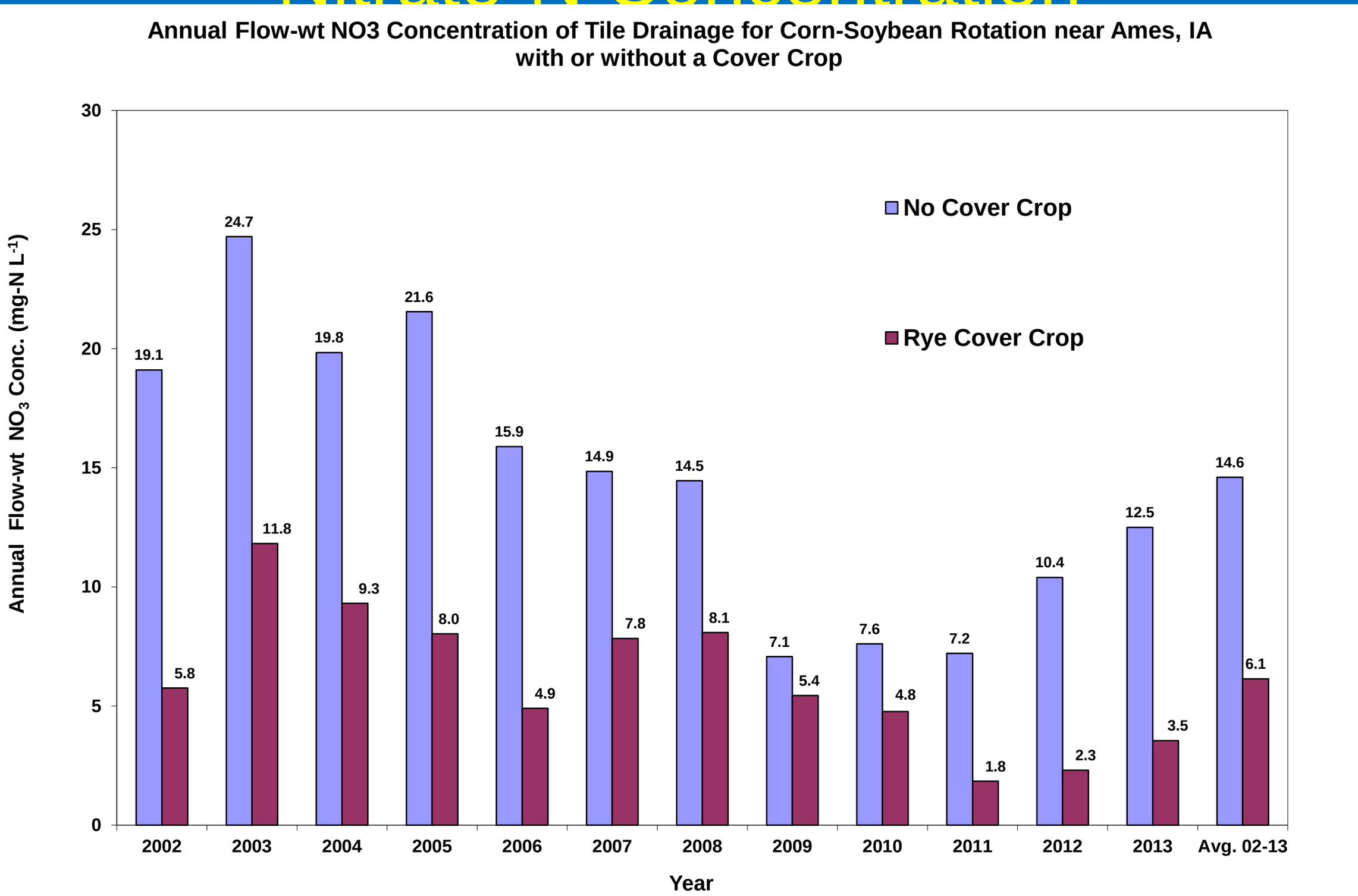


Plant date 8-15-2013- 3 months


NO_3-N 0-1 FT
Location 1 Cover 0-N
Location 2 Cover 108#-N
Location 3 No Cover 108#-N
Location 4 No Cover 0-N
35
30
25
20
15
10
5
0
9/24/14
10/6/14
10/20/14
11/3/14
12/11/14


NO_3-N 1-2 FT
35
30
25
20
15
10
5
0
Location 1 Cover 0-N
Location 2 Cover 108#-N
Location 3 No Cover 108#-N
Location 4 No Cover 0-N
9/24/14
10/6/14
10/20/14
11/3/14
12/11/14

Nitrate-N Concentration



Total Nitrate-N Lost 2002-2013 in Tile Drainage

Treatment	Nitrate-N lost	
	12-yr total lbs/acre	12-yr avg lbs/acre
Corn-soybean	428	36
Corn-Soyb w. Rye	191	16
Reduction	237	20
% Reduction	55	

	Cover Crop Shoot Biomass	Cover Crop Shoot N Concentration	Cover Crop Shoot N Content	Cover Crop Reduction of Drainage N Loss
	lbs/acre	%	lbs N/acre	lbs N/acre
Avg 02-13	1526	2.86	38	20
Sum 02-13	18307		457	237

Reduction of Nitrate Leaching with Rye – Four Other Iowa Sites

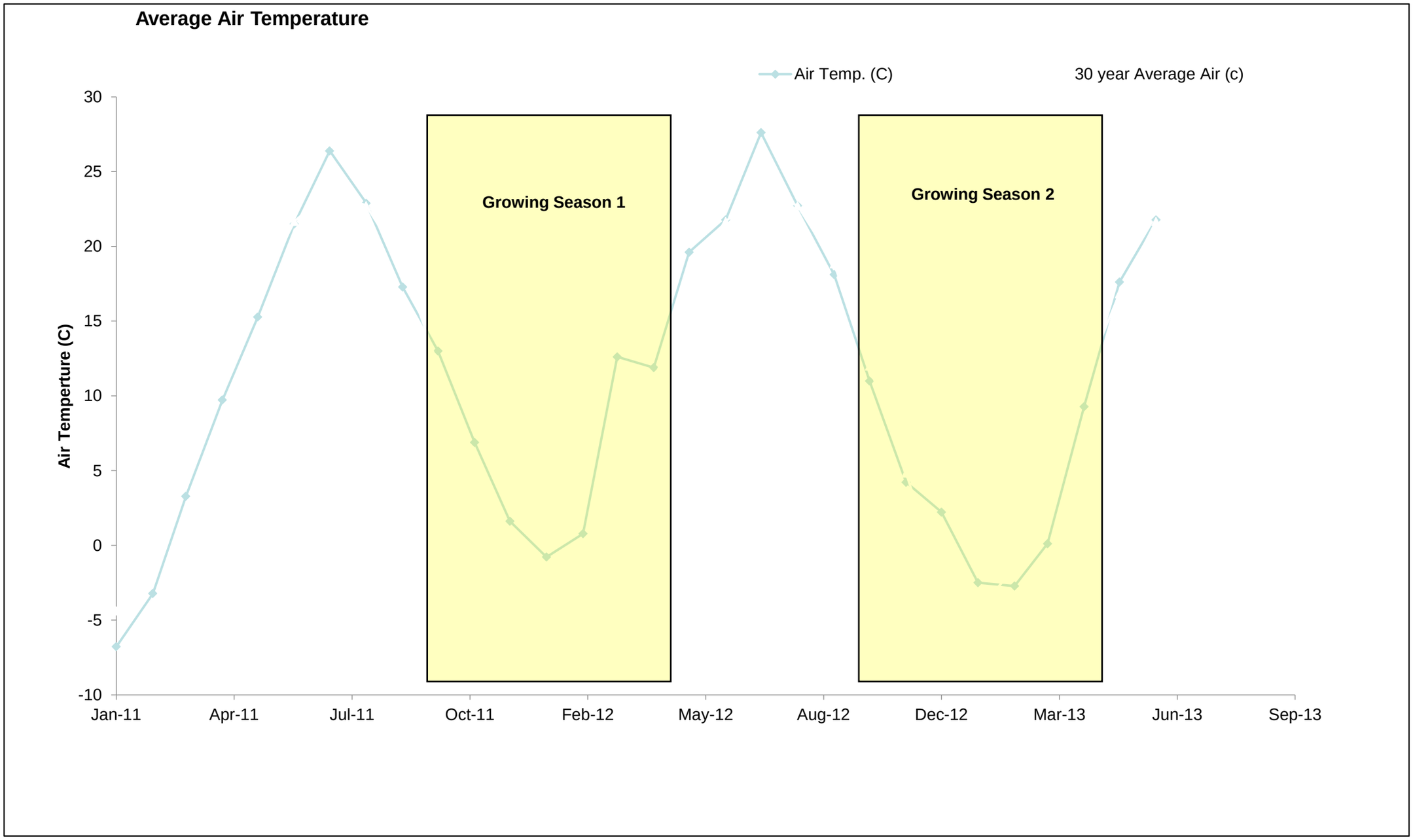
- Nashua, Iowa 22 – 29%
- Gilmore City, Iowa 15 -20%
- COBS Experiment, Kelly, Iowa 36%
- Tim Smith farm, Eagle Grove, Iowa 48%

Data from Matt Helmers, Eileen Bader, Tim Smith, and A.L. Daigh

Why Does Cover Crops Effectiveness Vary from Site-to Site?

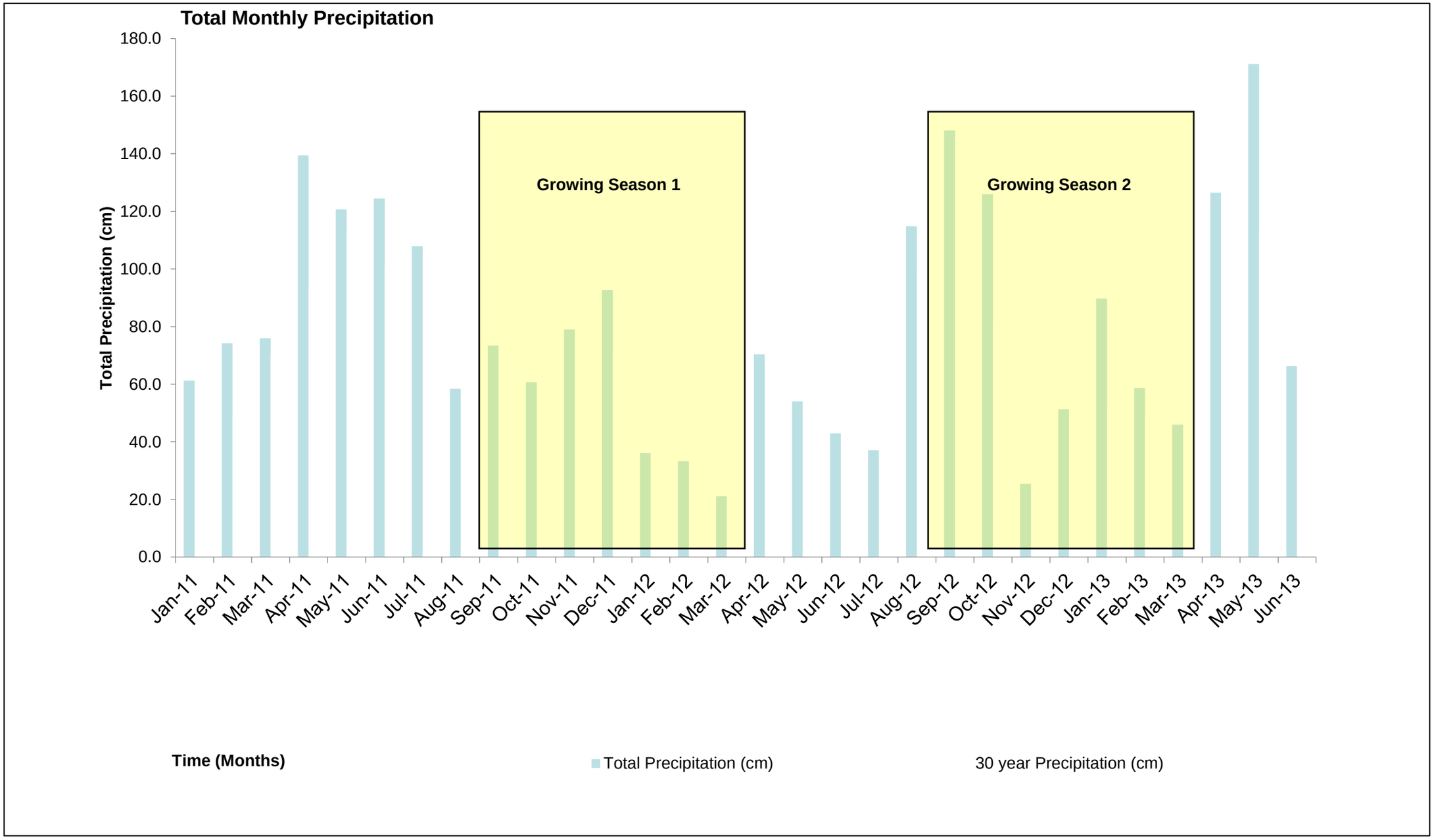
Would expect it to vary
Different amounts of cover crop growth
Different weather at the sites
Different soil types – OM, texture
Tile spacing, tile depth, effectiveness
Different crop management
Different field history

Weather Data



The first cover crop growing season was on average 3 C° warmer than the second year.

Weather Data



Second Year 2012/2013 had 149mm more precipitation.

Variable weather conditions between years allowed comparison of cover crops under two weather extremes.

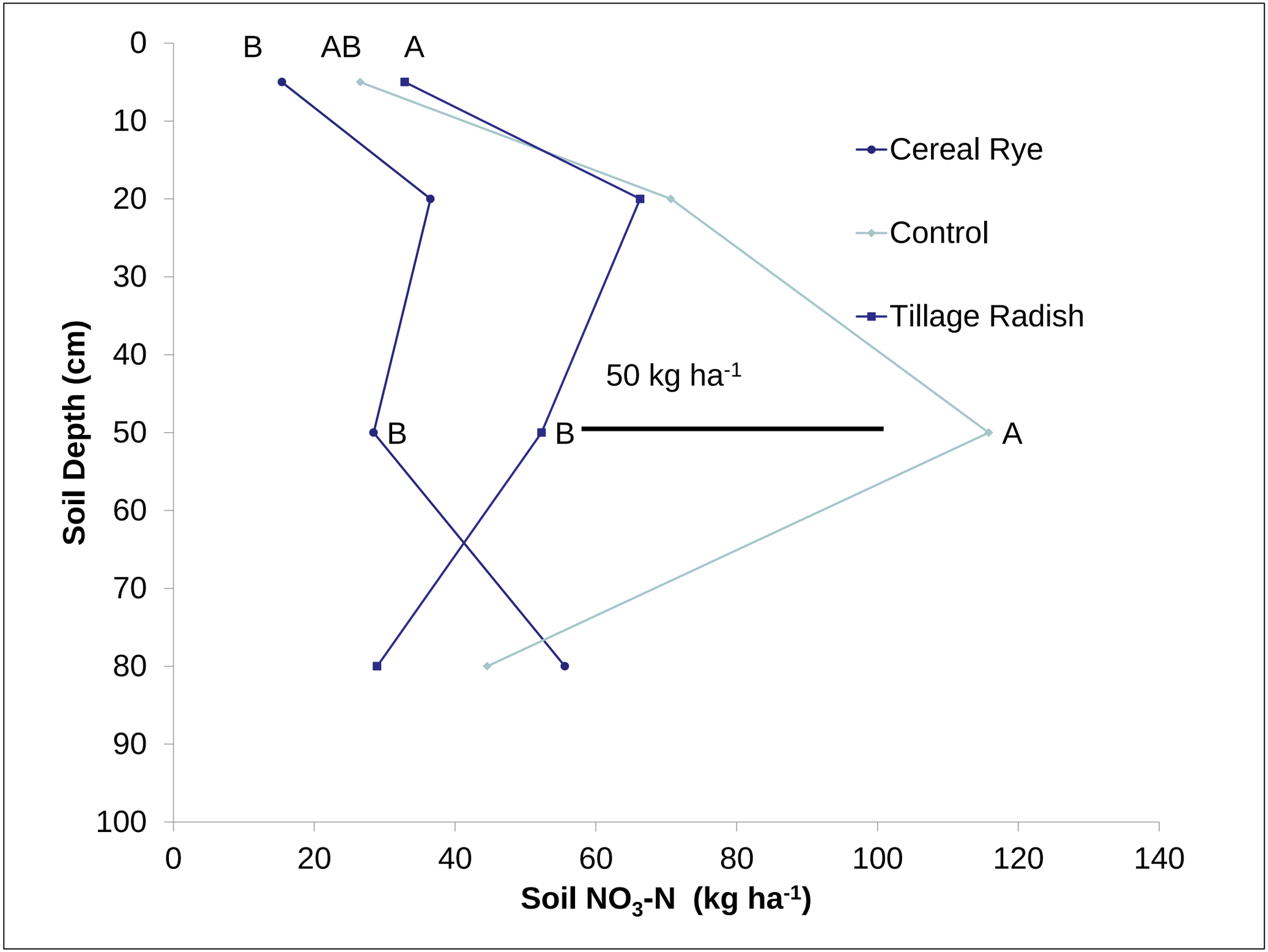
Objective 1: Investigate the effectiveness of two cover crop species to reduce nitrate leaching following fall applied N.

Cover Crop Biomass Accumulation and N Uptake

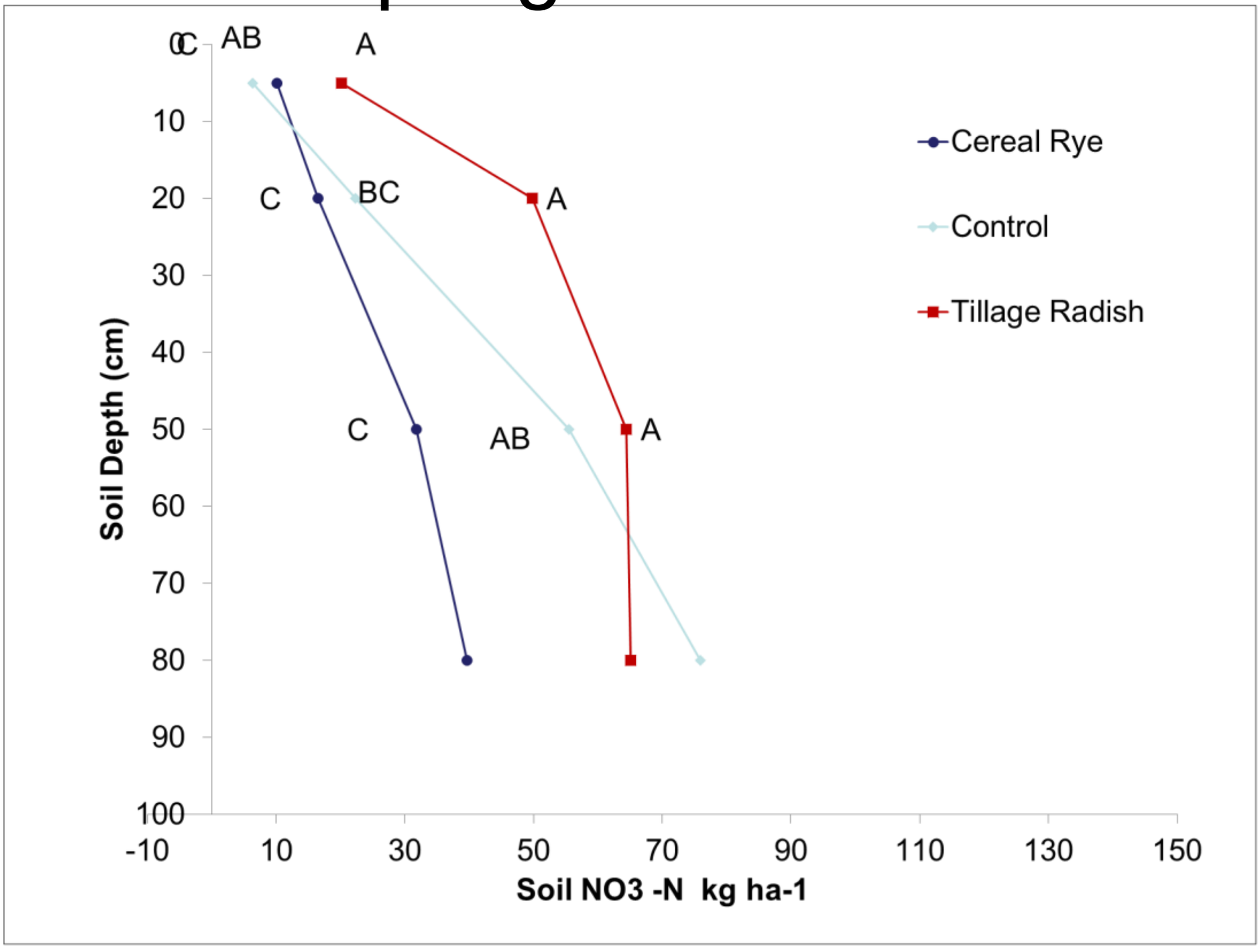
	Biomass (kg ha^{-1})		Nitrogen Uptake (kg N ha^{-1})	
Year	2011- 2012	2012- 2013	2011- 2012	2012- 2013
Tillage Radish	6561.9 Aa	3707.5 Ab	226.8	131.9
Cereal Rye	3906.5 Ba	5585.5 Bb	188.1	249.9

In both years, tillage radish and cereal rye demonstrated the potential to absorb the majority of fall applied N.

Results- Spring 2012 Soil Nitrate by Depth



Results- Spring 2013 Soil Nitrate



What did we learn?

Objective 1

Both tillage radish and cereal rye demonstrated the potential to absorb nearly the full rate of fall applied N.

Fall application of N into a standing cover crop significantly reduces nitrate leaching.

Cover crops impacted the distribution of spring inorganic N.

Objective 2

Weather influences how cover crops impact spring soil mineralization.

In both years, the tillage radish treatment resulted in significantly greater inorganic N compared to both the control and cereal rye treatments.

Early mineralized N is potentially susceptible to loss by leaching and denitrification.

The inclusion of Cover Crops into conventional cropping systems has the potential to increase the efficiency of fall applied N.

Soil Quality
in central Illinois

18month old
No decompos
Poor Soil act

Severe roo

Tillage reduced OM
Top 8” 3%,
below untilled 5.5+
%

Plumer

Healthy Soil=…a soil that has a high capacity to function under a wider range of conditions

Build Organic Matter it stores nutrients

Each 1 % of O.M. contains:

10,000 lbs. of C

1000 lbs. of N

100 lbs. of P

100 lbs. of S

.3”-1” of H2O

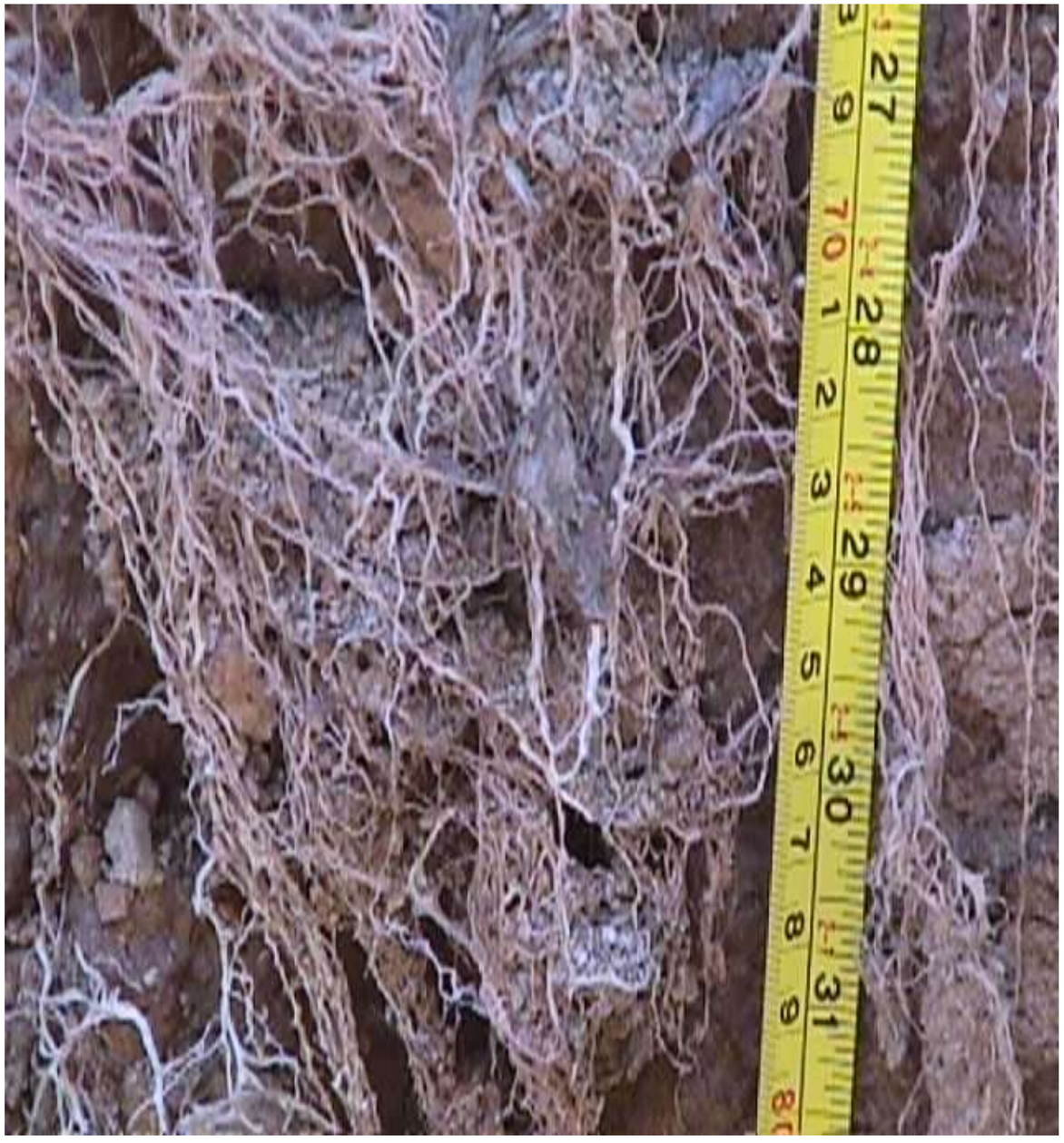
Rooting systems

in claypan/fragipan soils

•Oil seed radish	macro pores, 4-16”
•Tap root	16-24”
•Rape	10-15”
•Oats	fibrous, 8-15”
•Hairy vetch	fibrous, 12-15”
•Annual ryegrass	fibrous, 28-60”
•Cereal rye	fibrous 18-24”
•Austrian winter pea	variable, 8-14”
•Wheat	fibrous, 10-16”
•Triticale	fibrous, 10-20”
•Turnips	macro pores, 4-8”

Disk and field cultivate

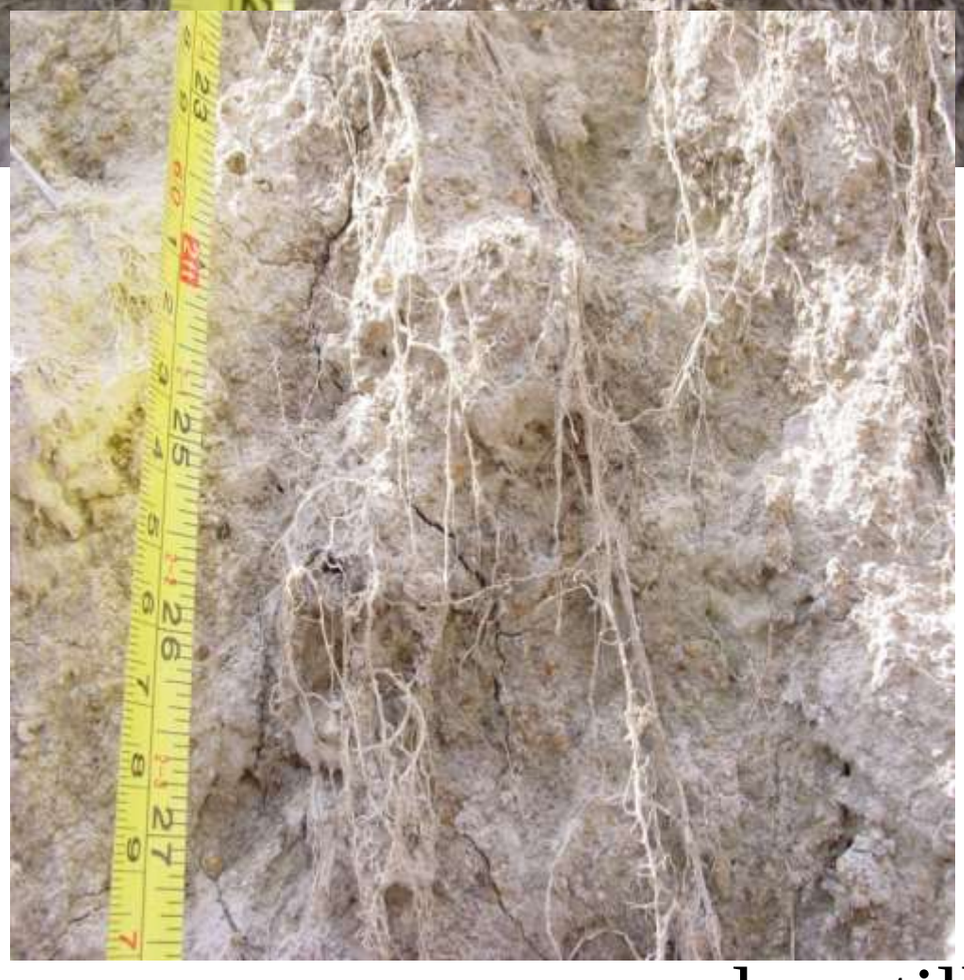
Note lack of structure



6 years no-till
plus cover crop
in fragipan soil

20
To
23”

23 to
28”



37
to

43”

46 to
50”

6 years cover crops and no-till effects on corn root development

Continuous no-till with spring

Soil after 8 years of cover crop-
Adjacent to previous pictures

Development of OM to depth of 12”

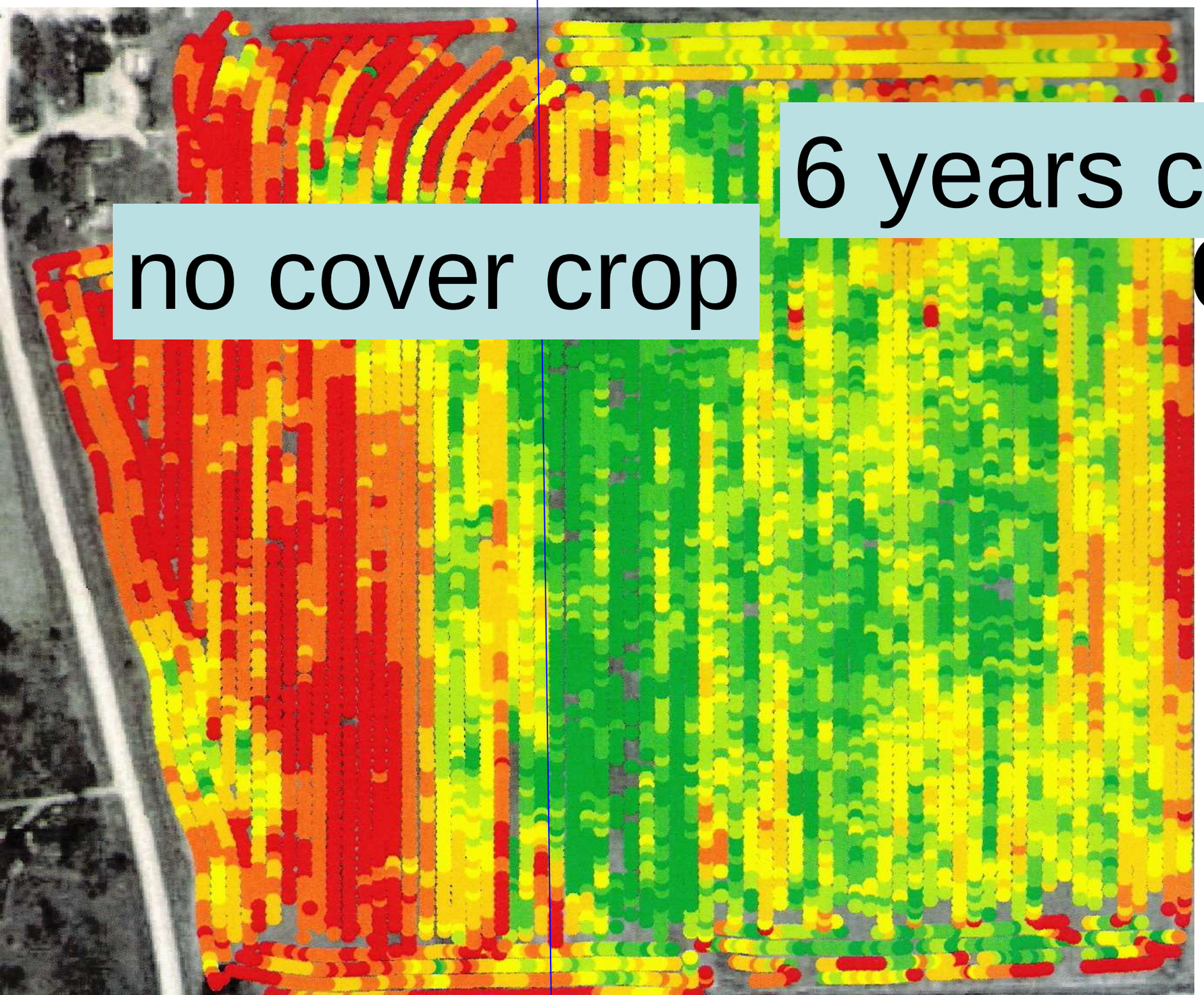
Notice white silt deposits

Shows silt layer breaking up

6 years no-till

Notice white layer is gone

6 years no-till & cover crops


no cover crop
6 years cover crop
ects
Estimated Volume (Dry)
(bu/ac)
175.40 - 205.00 (4.92 ac)
161.48 - 175.40 (5.85 ac)
148.63 - 161.48 (5.93 ac)
133.71 - 148.63 (6.01 ac)
111.64 - 133.71 (6.06 ac)
88.70 - 111.64 (6.13 ac)
12.08 - 88.70 (6.02 ac)

Oats 30#, radish 2#, vetch 12#

Oats 20#, radish 2#