SUSTAINABLE ELEMENTS OF COVER CROP SYSTEMS



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S.E.N.D.
Soil Ecosystem and Nutrient Dynamics

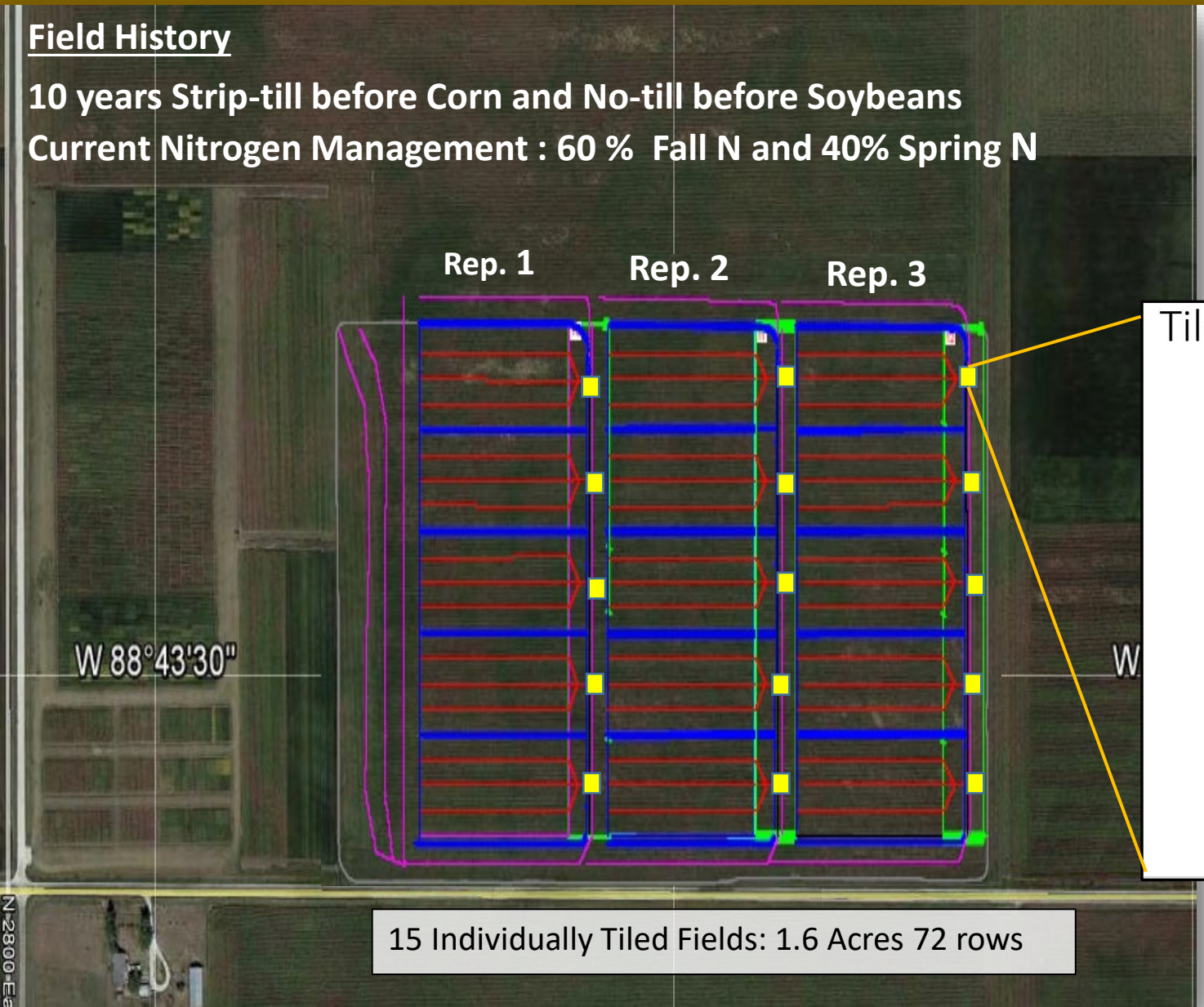

Prevents Nutrient Loss
Promotes Nutrient Use Efficiency
Elements
of a High performing Cover Crop System
Prevents Soil Loss
Produces Competitive Yield

Research Design

Field History

10 years Strip-till before Corn and No-till before Soybeans

Current Nitrogen Management : 60 % Fall N and 40% Spring N



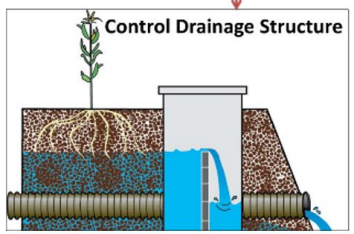
15 Individually Tiled Fields: 1.6 Acres 72 rows

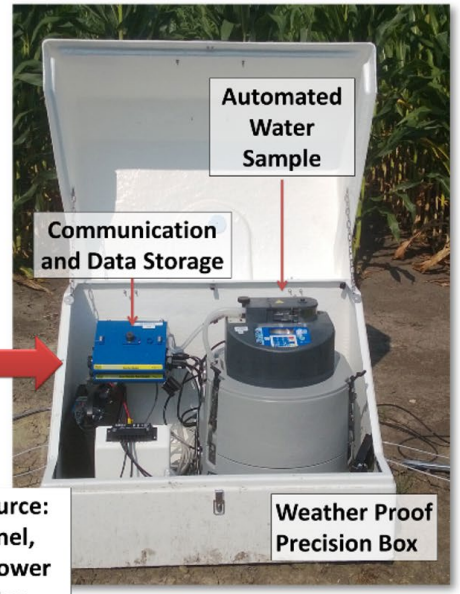
Long-term Study: 2014-Present

Corn and Soybean Rotation

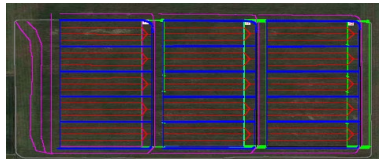
Mollisol with 3.4% SOM

Tile Monitoring Station





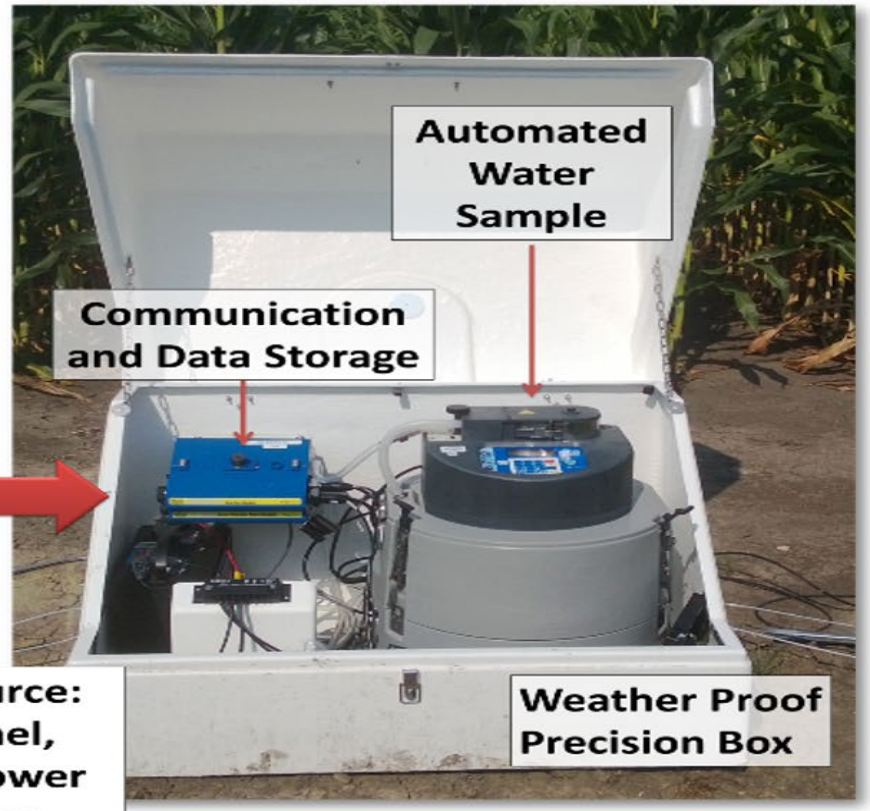
Long-term Tile Drainage Experiment, Lexington, IL



No Cover Crop Control rate of NO_3-N loss via tile drainage is **29 (lbs A^{-1} Yr^{-1})** relative to only **15 (lbs A^{-1} Yr^{-1})** for Cover Crop treatment, which equate to a **48%** reduction in nitrate loss annually (7-year Period).

The effect of cover crops on surface water quality: A paired watershed experiment in the Lake Bloomington watershed

Tile Monitoring Station



Power Source: Solar Panel, Battery, Power Converter

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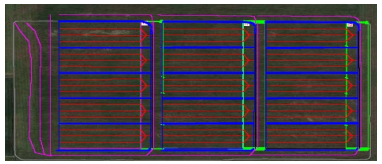
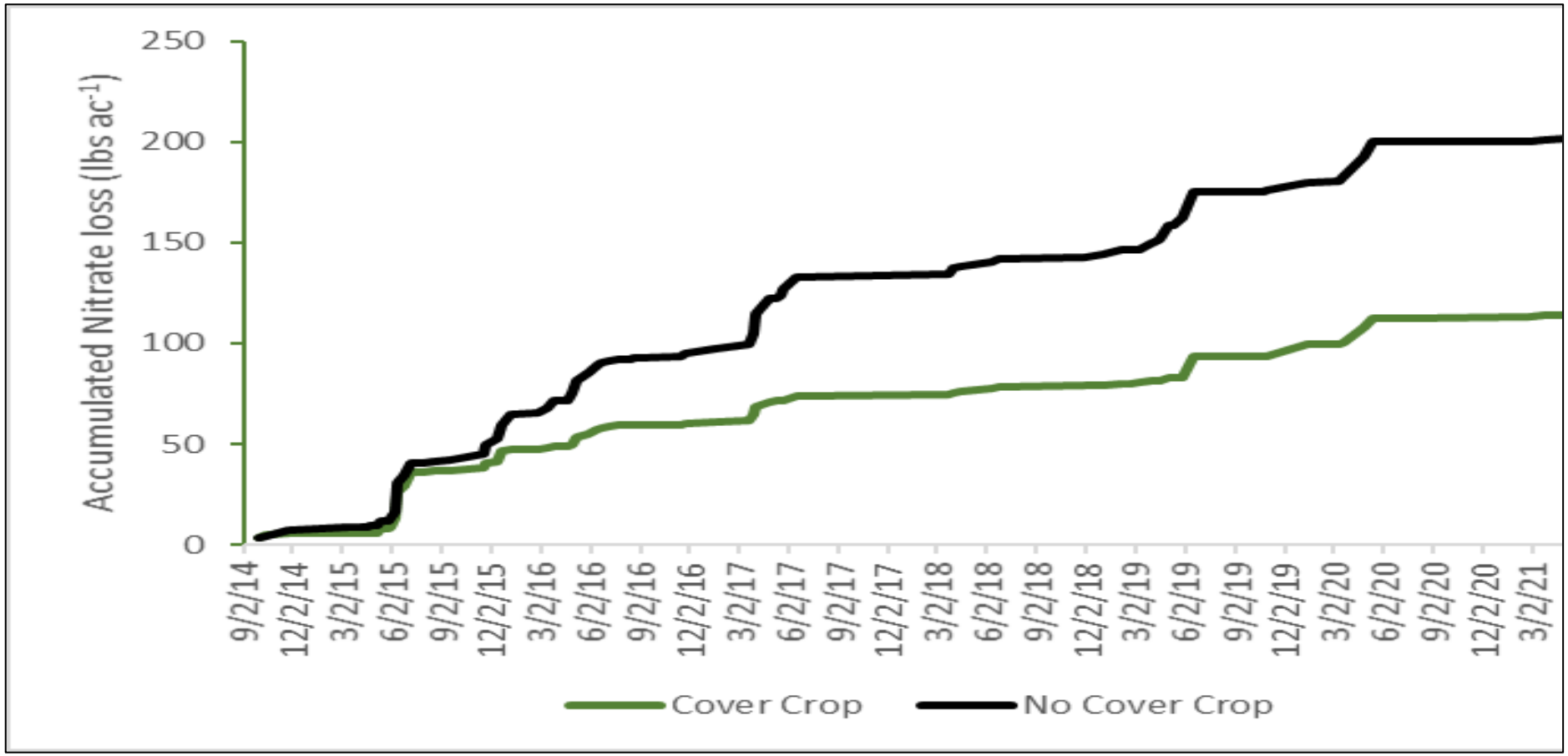


Nitrate Loss Via Tile-Drainage



35% reduction in Nitrate Load (lbs/1000 gal/day) over a 5-year period from 2018-2022.

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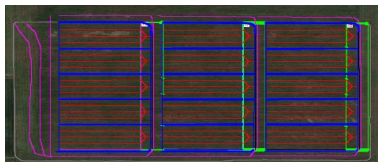
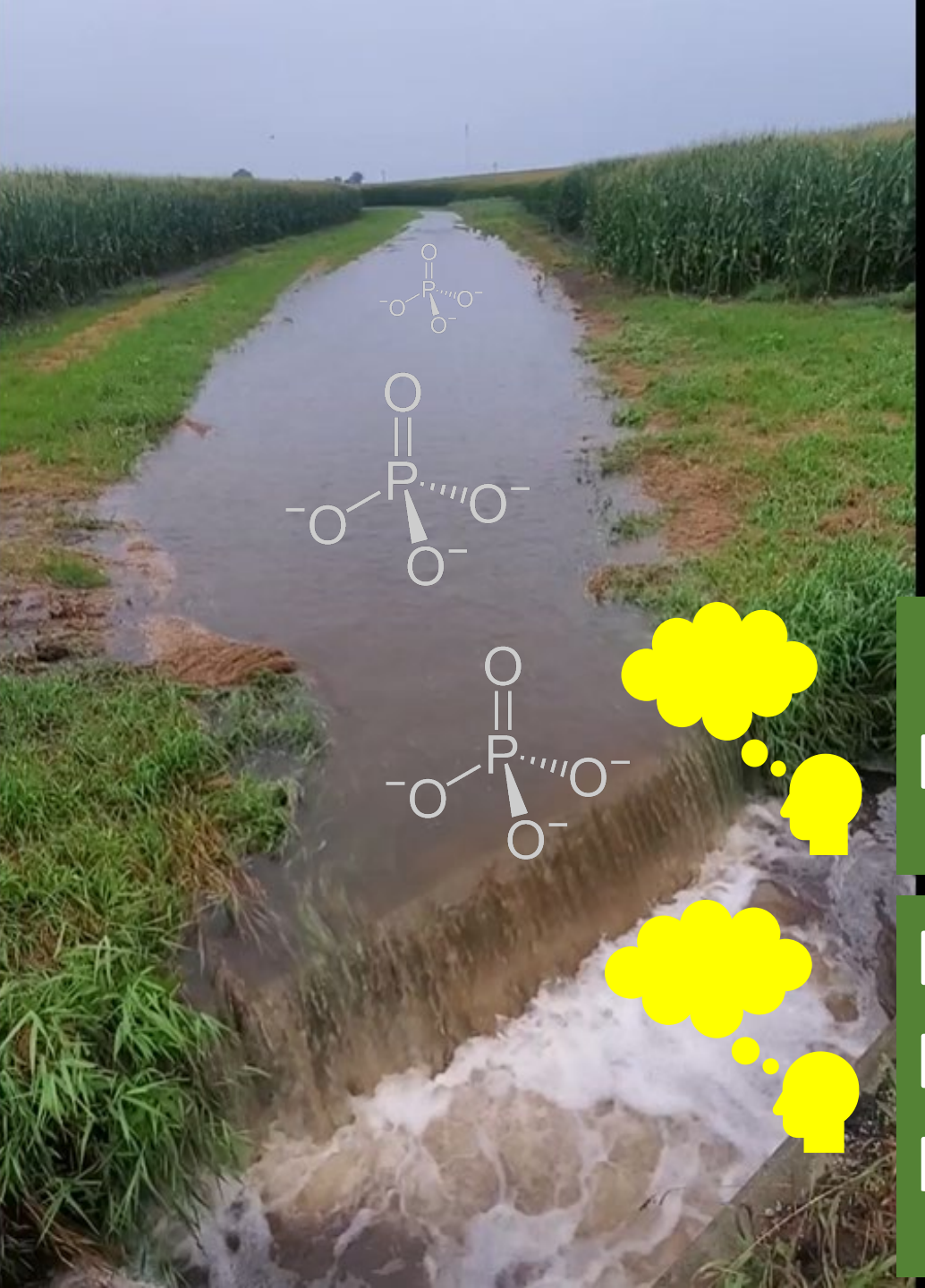
Soil Ecosystem and Nutrient Dynamics





What About Cover Crops and Phosphorus?

Do cover crops promote the loss of Dissolve Reactive P?

Does cover crop species impact Dissolve reactive P loss in surface Runoff?

Impact of long-term Cover Crop Management on DRP loss

Objective

- Determine the impact long-term cover crop species management on soil P sorption.

Research Site:

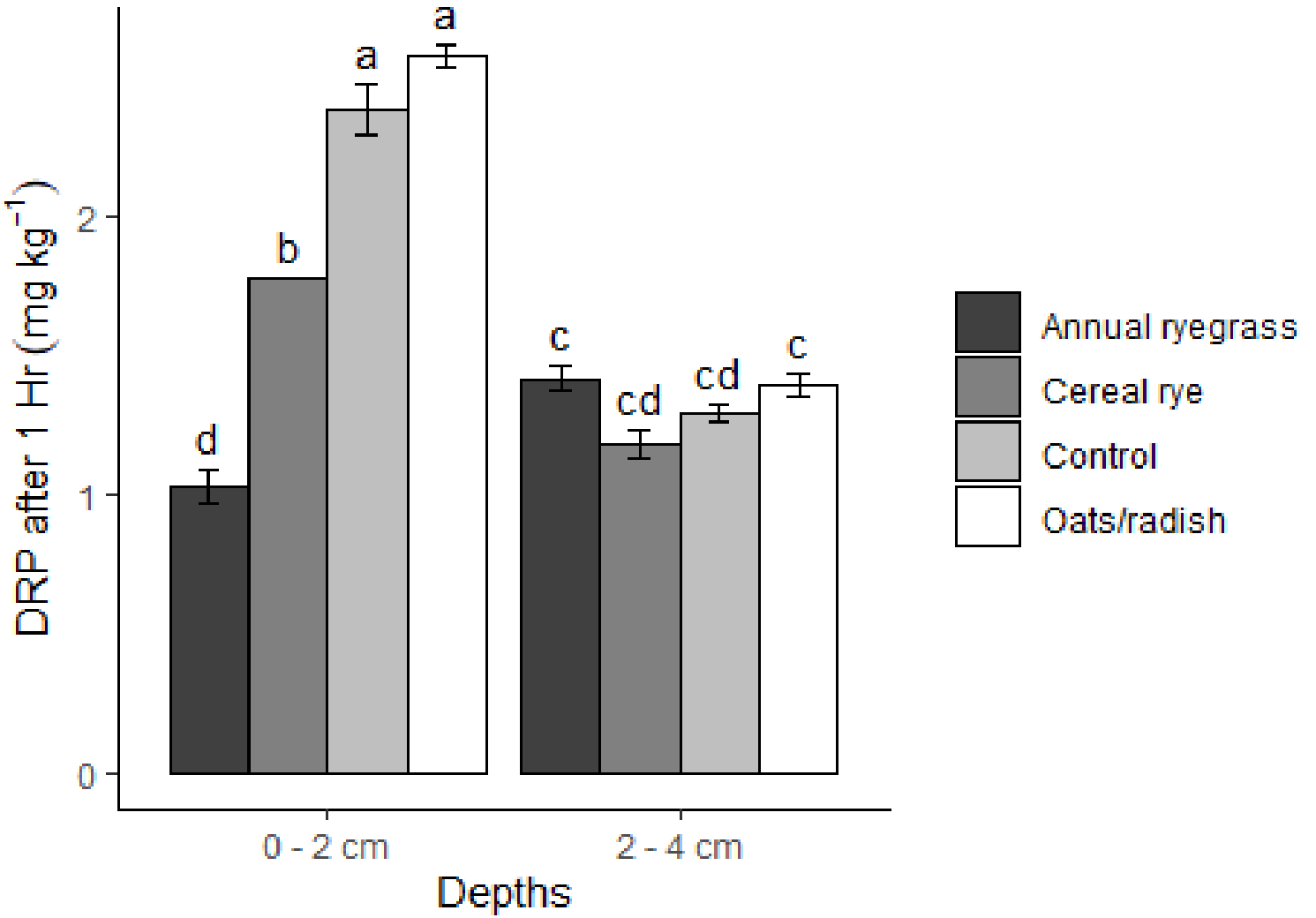
- Arcadian IN (Central IN)
- 9 years of cover crop management
- Treatments ***(Control, Cereal Rye, Radish/Oats, Annual Ryegrass)***

Impact of long-term Cover Crop Species on DRP loss

Greater P release from 0-2 cm depth

No-till no cover crops = Radish Oats

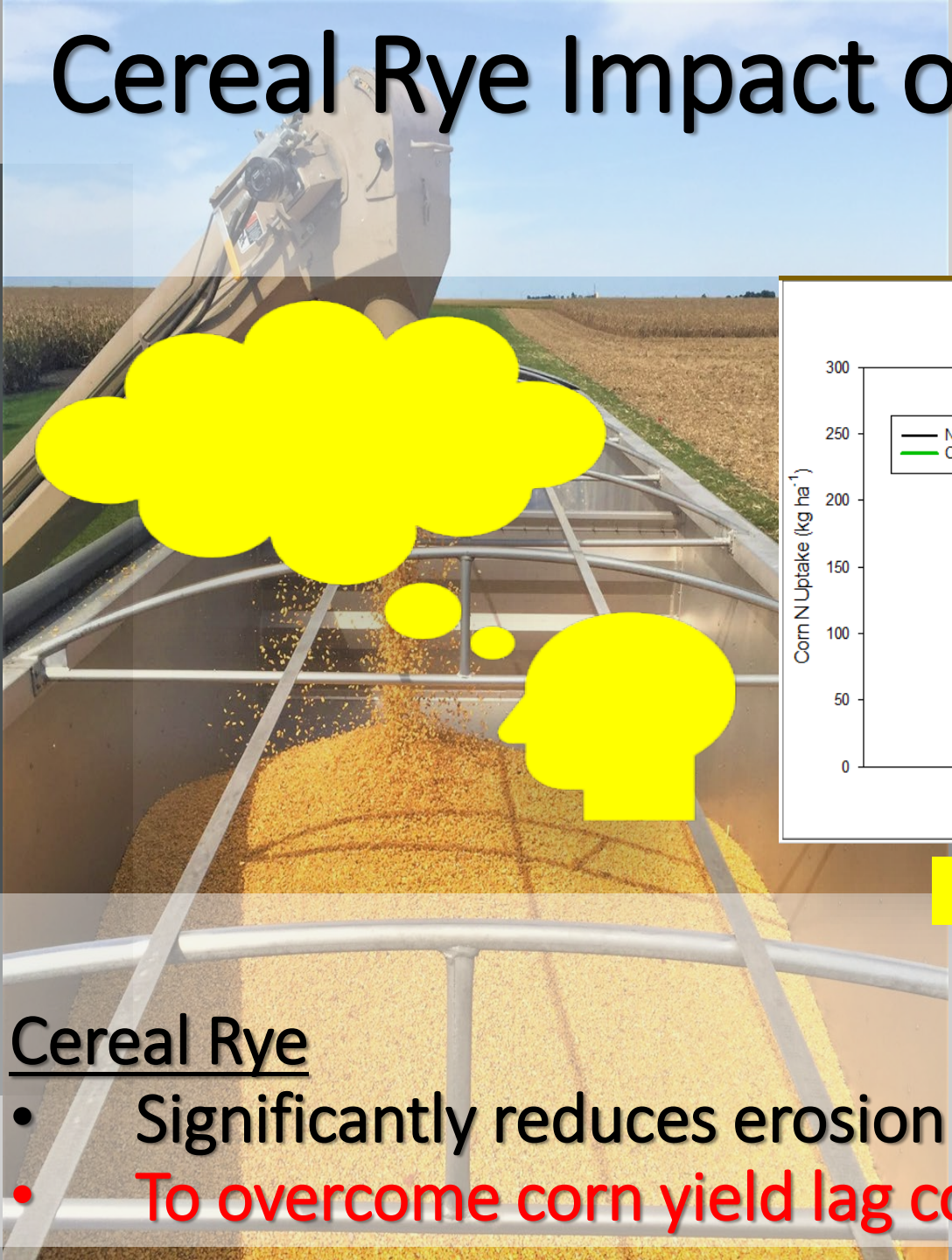
Radish/Oats>CR>AR at the 0-2cm depth

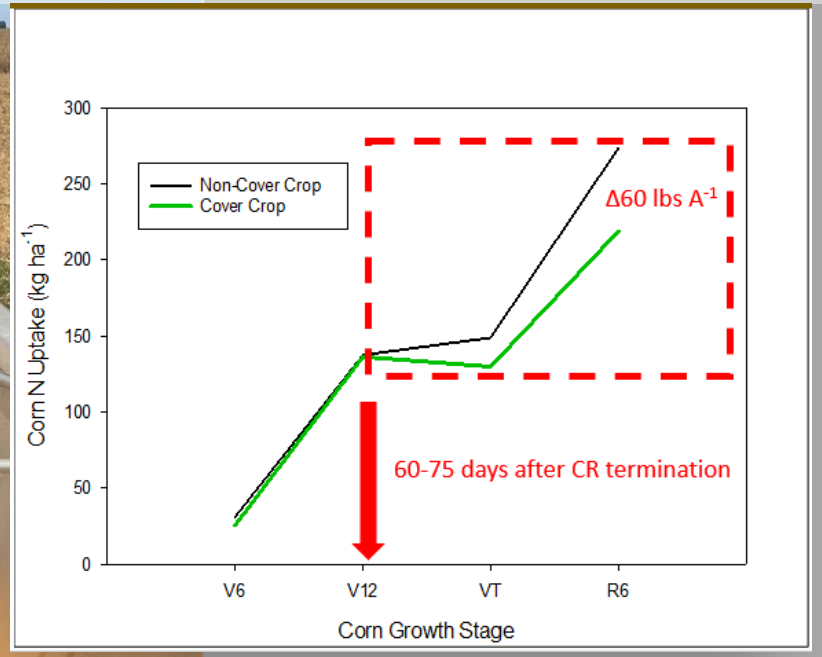


Competitive Cash Crop Yields

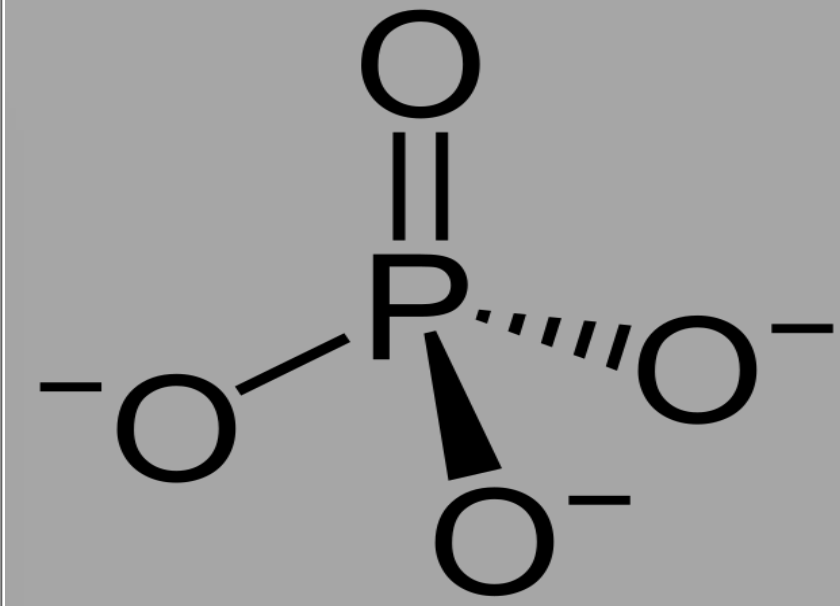
Can we maintain our environmental impact, while managing for competitive yield?

Cereal Rye Impact on Corn N Uptake and Grain Yield





Reduced N Uptake



Slow N Release

Cereal Rye

- Significantly reduces erosion and NO_3-N losses via Tile
- To overcome corn yield lag could requires greater N rates.

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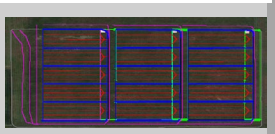
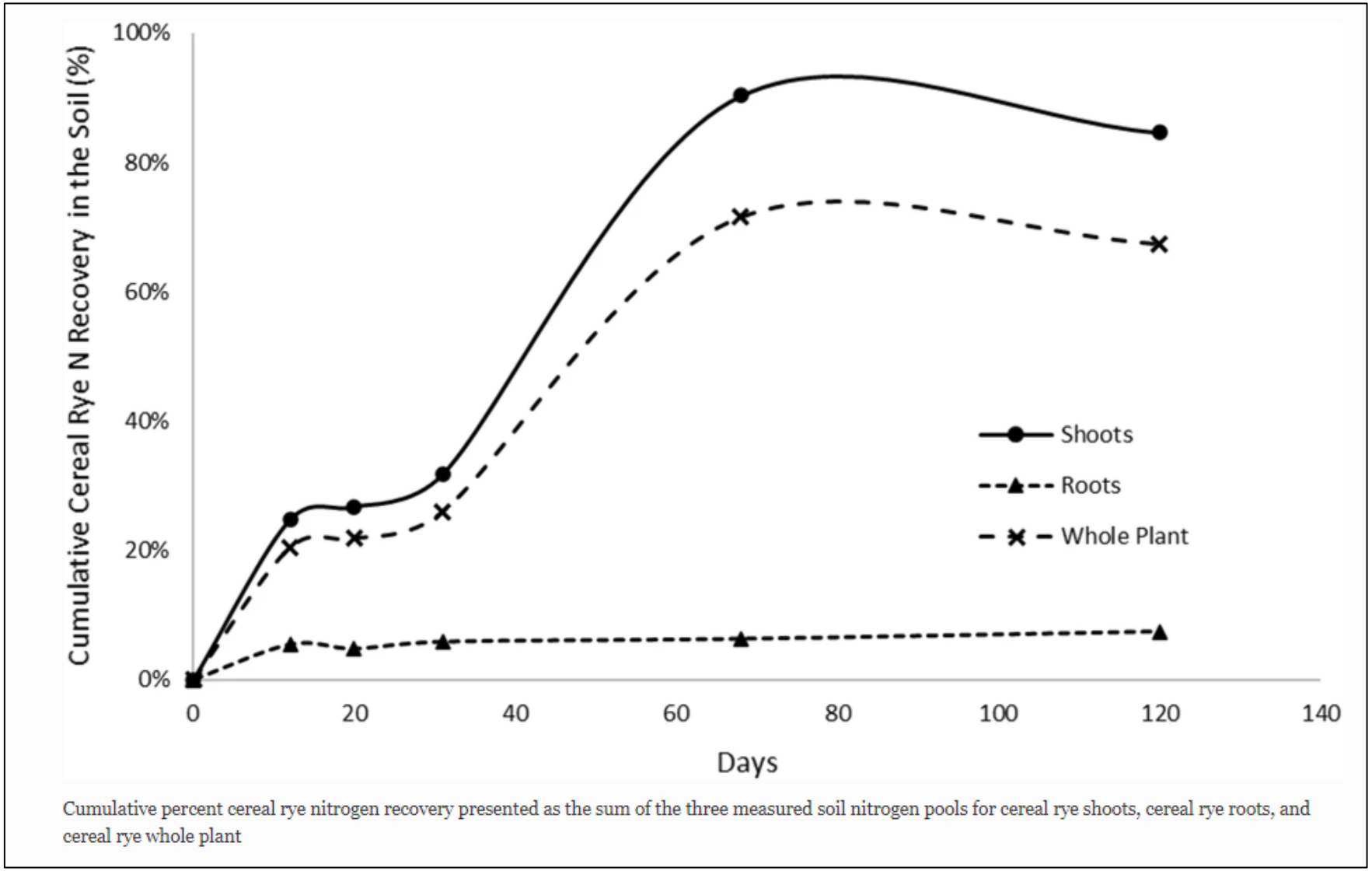
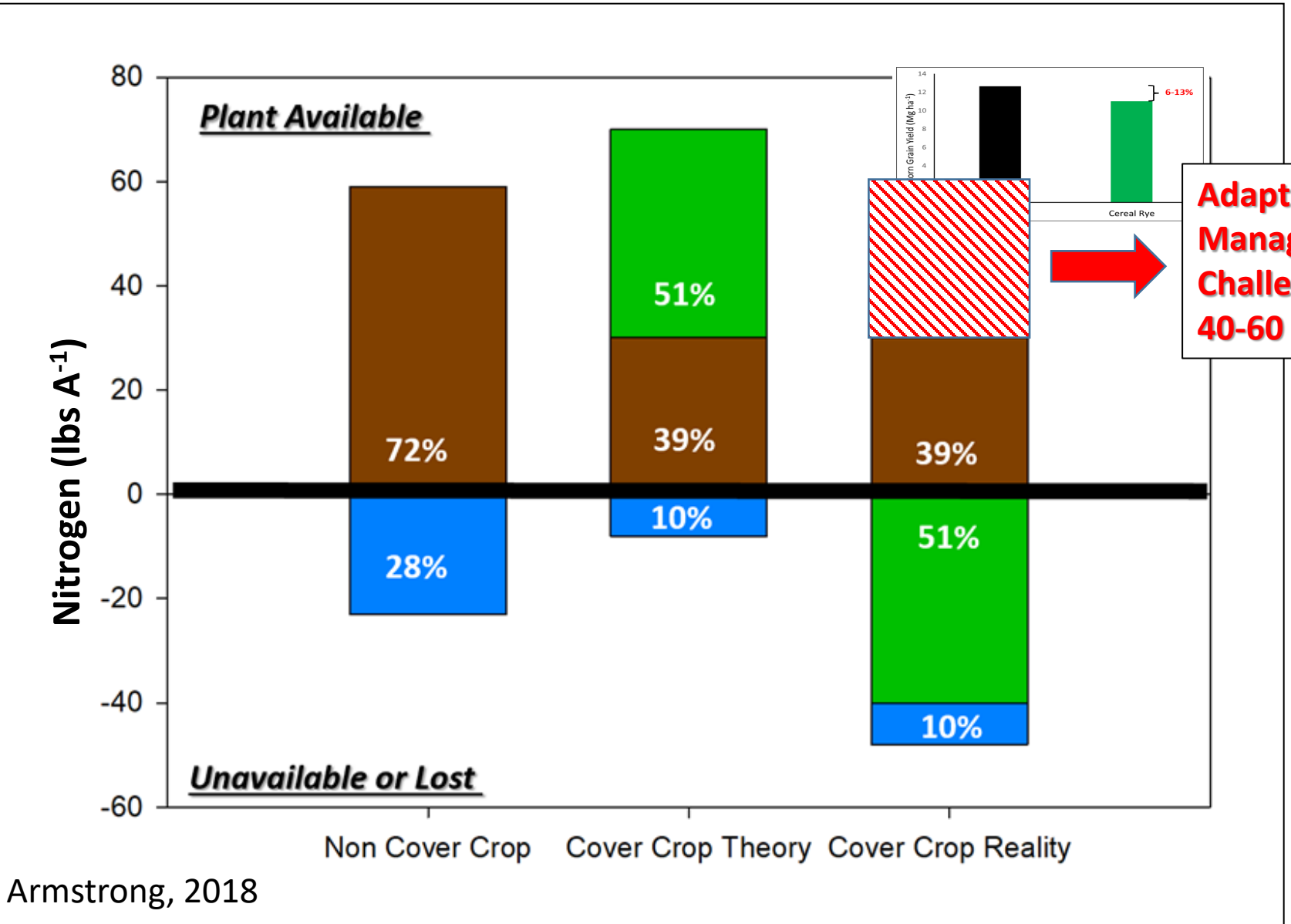


No Nitrogen Contributions from the Roots



Cumulative percent cereal rye nitrogen recovery presented as the sum of the three measured soil nitrogen pools for cereal rye shoots, cereal rye roots, and cereal rye whole plant

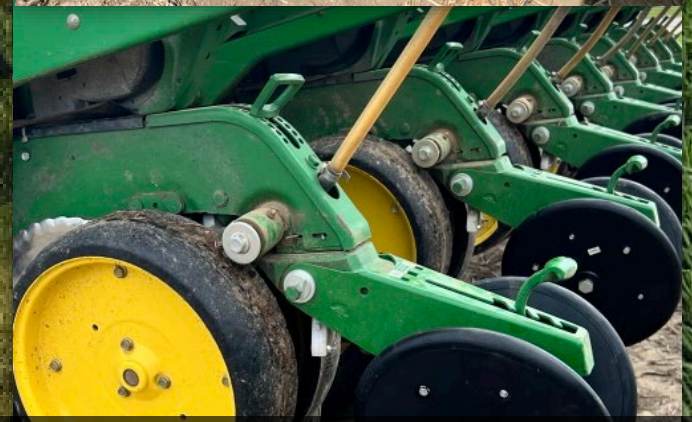
Changes in Soil Nitrogen Availability During the Life Cycle of Cereal Rye



Armstrong, 2018

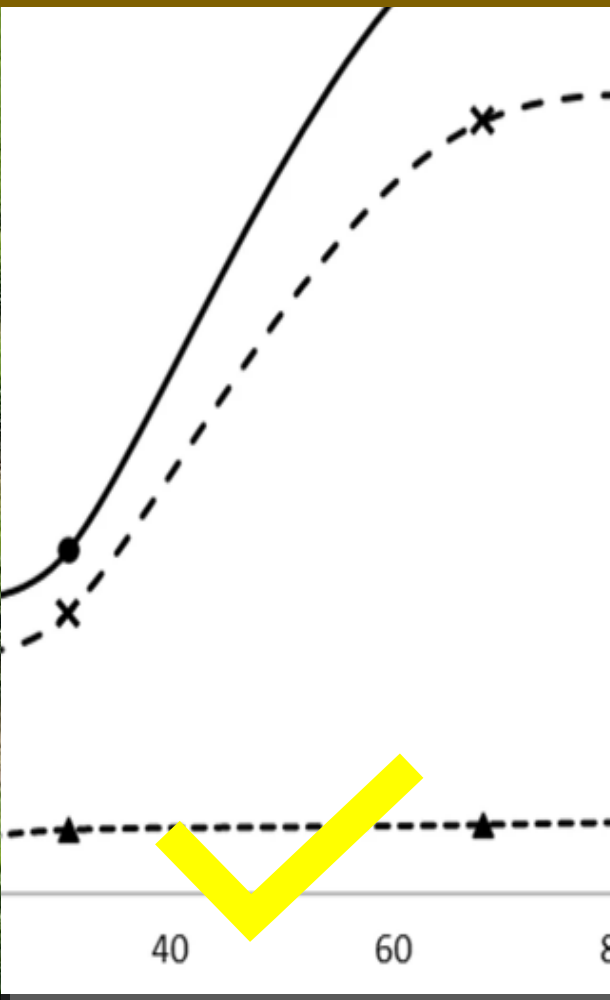
Next Generation Cover Crop and N Fertilizer Management that could reduce Yield Lag

N Application Rate and Timing



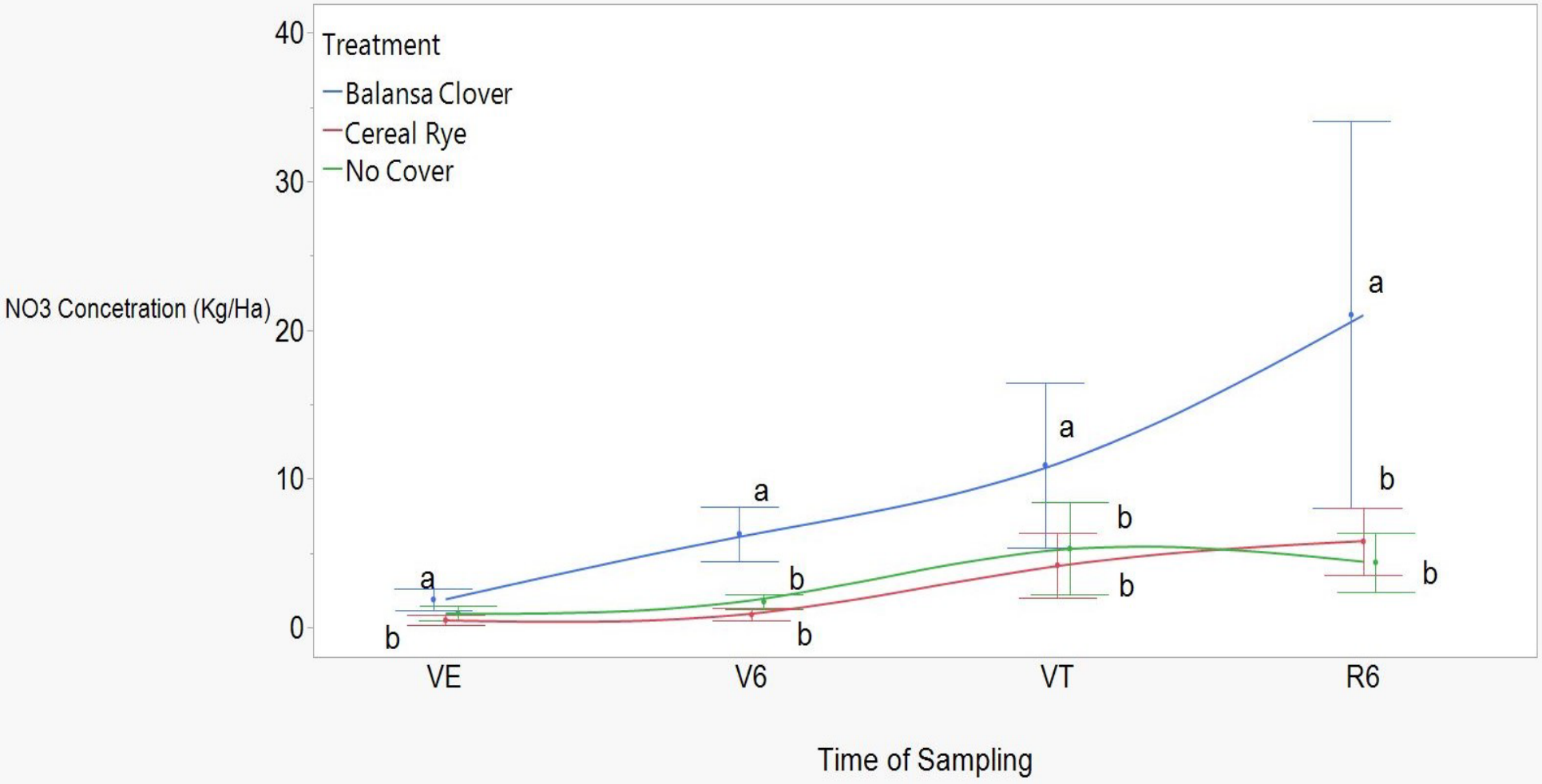
Planting Settings to protect population

Precision Planted Cover Crops



Overwintering Legumes

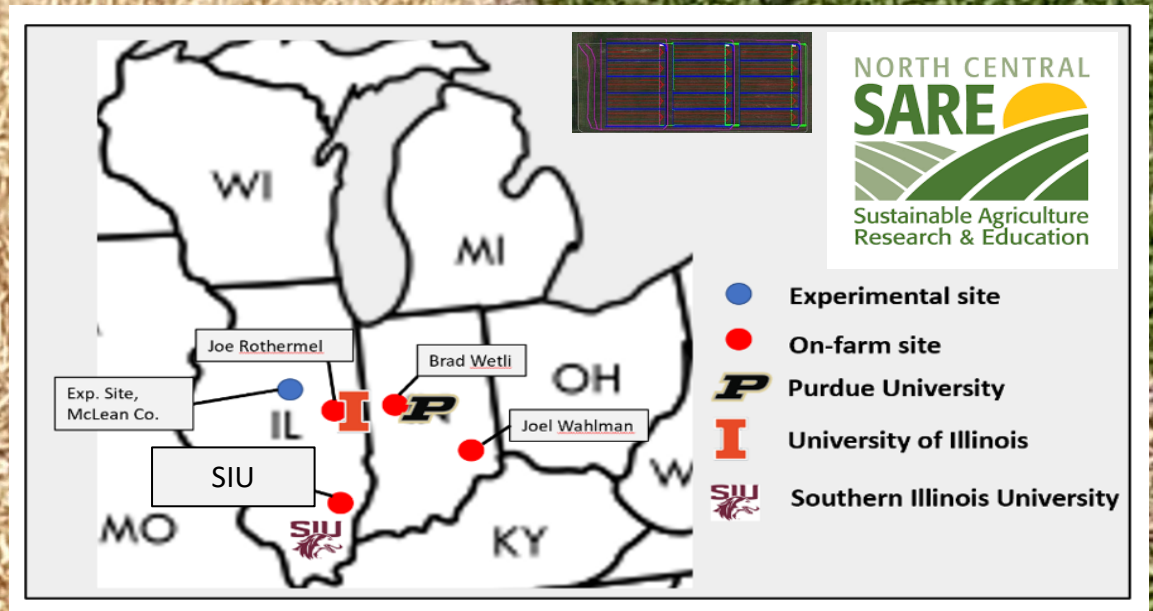
Nitrate Concentration over Corn Growth Season



Each error bar is constructed using 1 standard deviation from the mean.

Soil Depth 0-5cm

Precision Winter Cereal Rye Cover Cropping for Improving Farm Profitability and Environmental Stewardship



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Dr. Amir Sadeghpour (Associate Professor of Soil Management, Department of Plant, Soil, and Agricultural Systems, Southern Illinois University)
Dr. Andrew Margenot (Assistant Professor of Soil Science, Crop Science Department, University of Illinois)

Treatment Factors

Cover Crop Species

1. Balansa Clover
2. Cereal Rye

Planting Method

1. Conventional
2. Precision

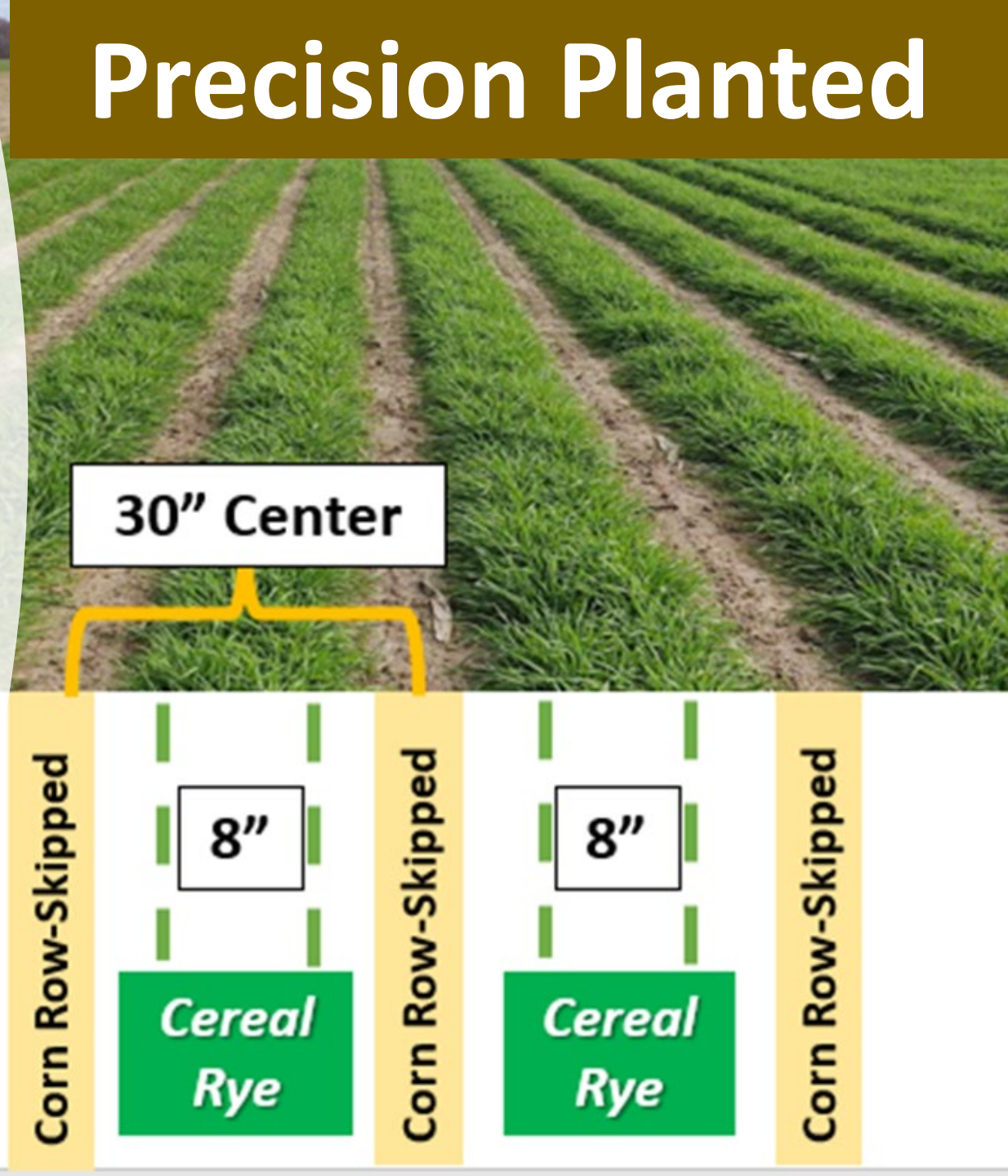
Cover Crop Seedinng Rate

1. Full
2. Reduced

Cover crops

- Planted Sept. 11th
- Terminated: CR (early April)
  BC (Late April-Early May)

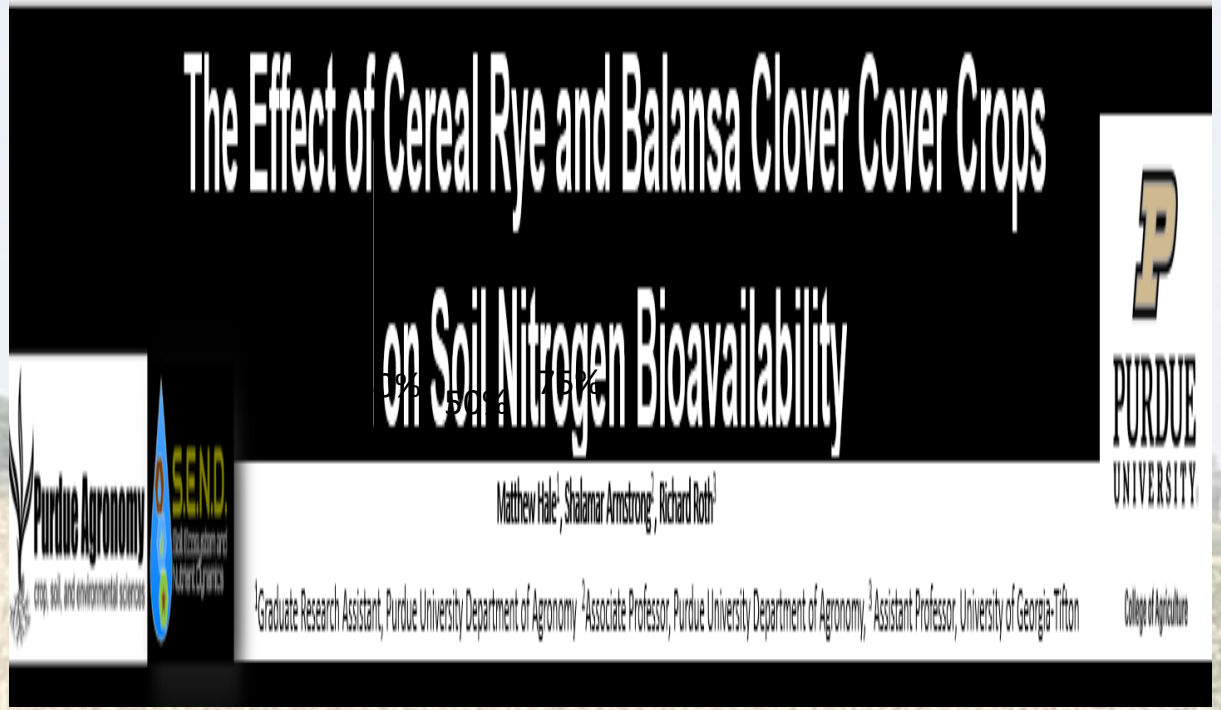
Precision Planted

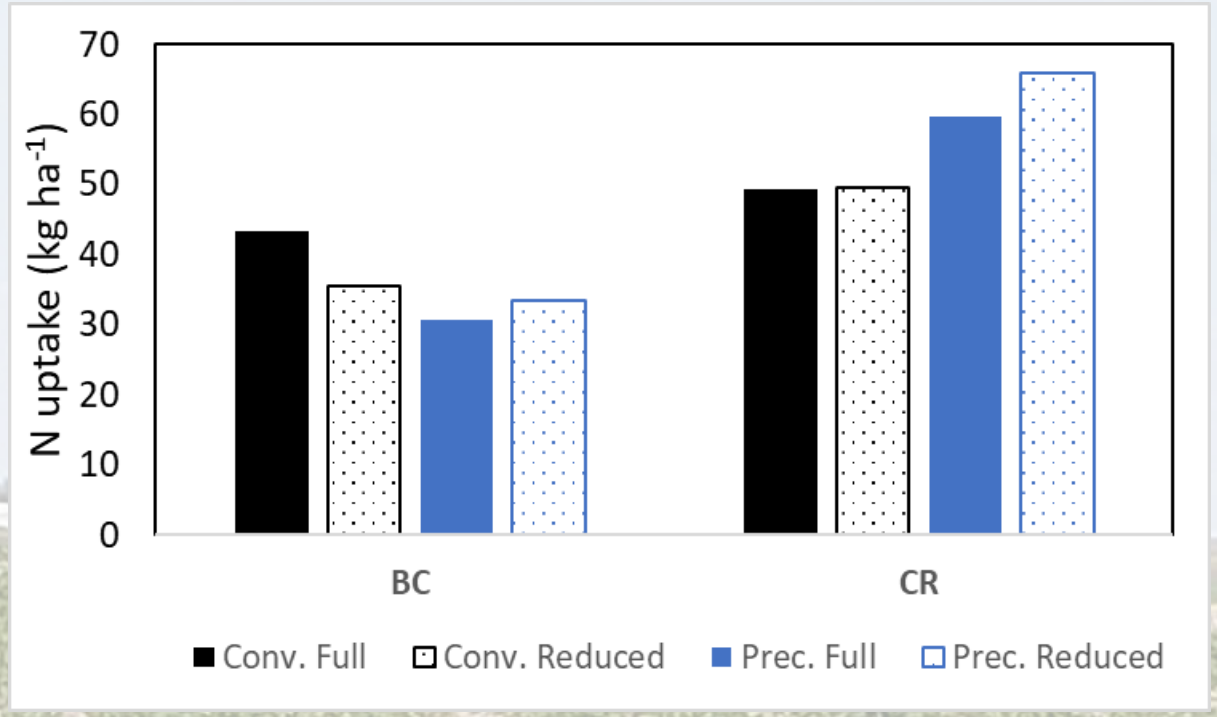


Patience!

Central IL (Joe's Farm)

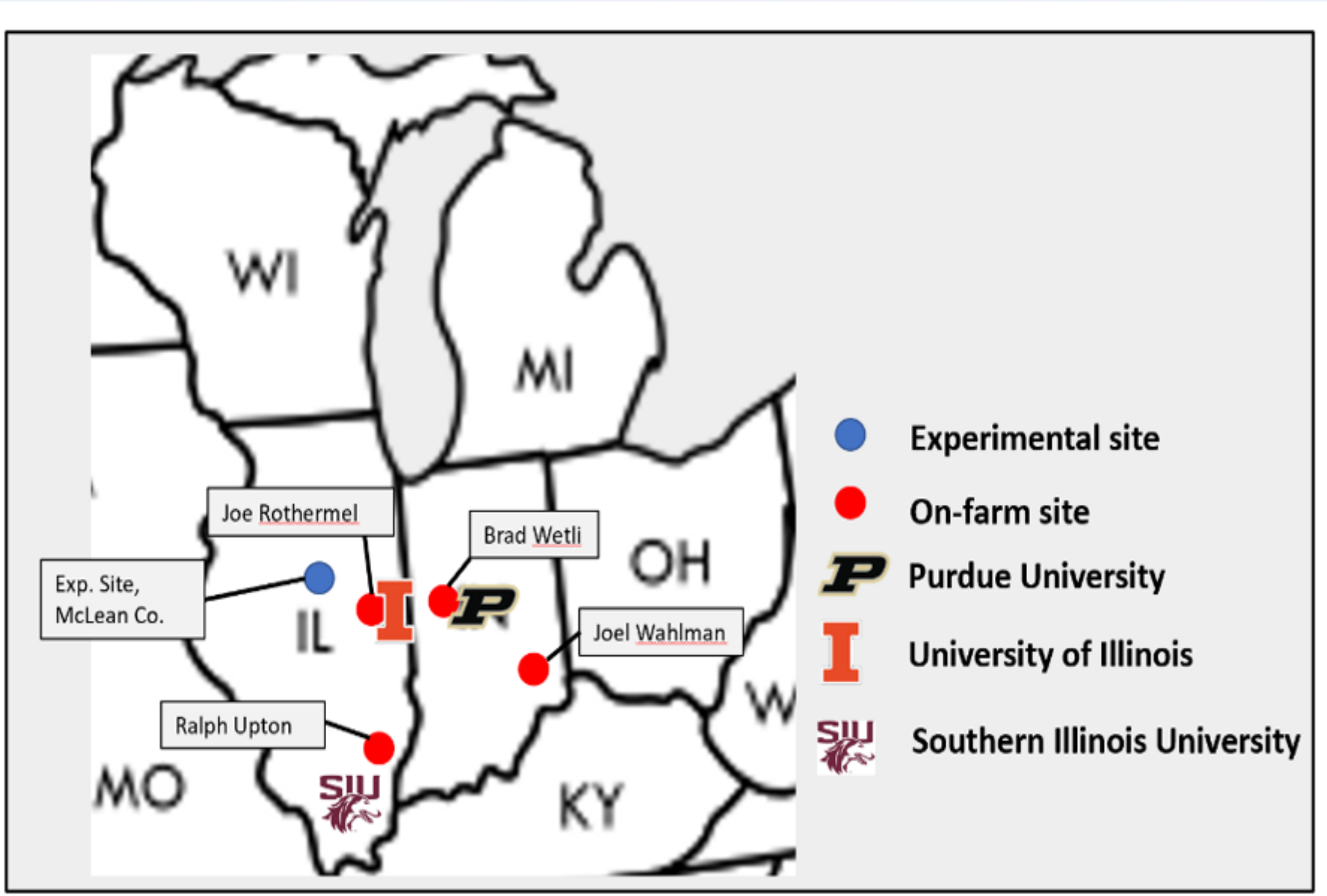
Cover Crop Performance



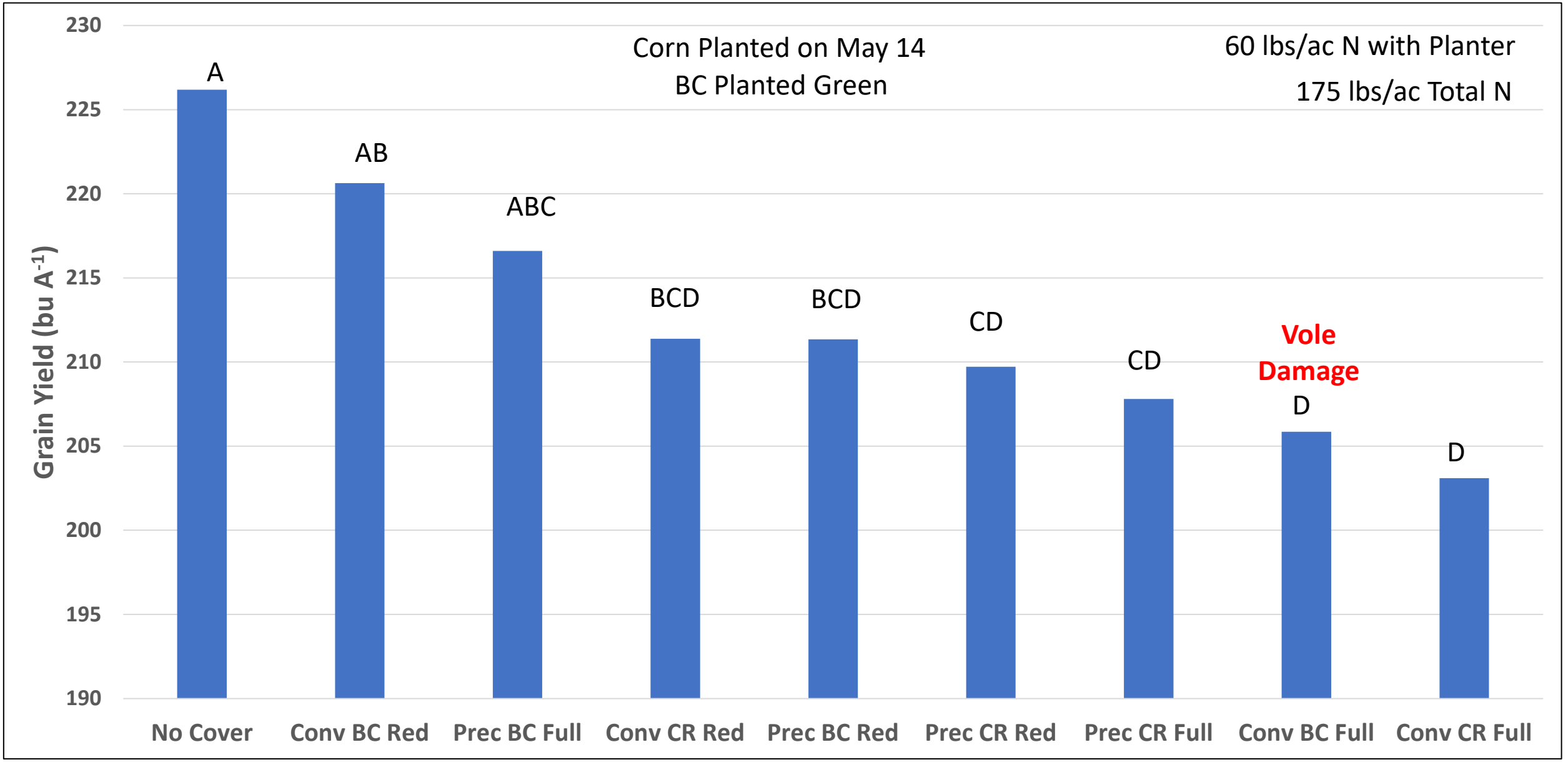


Note: Same cover crop biomass and N uptake with 50-75% less seed per acre.

Cover Crop Performance



Corn Yield 2021



Exploring A Cereal Rye Alternative (Balansa Clover)

Cover Crop Species

1. Balansa Clover
2. Cereal Rye

Planting Method

1. Conventional
2. Precision

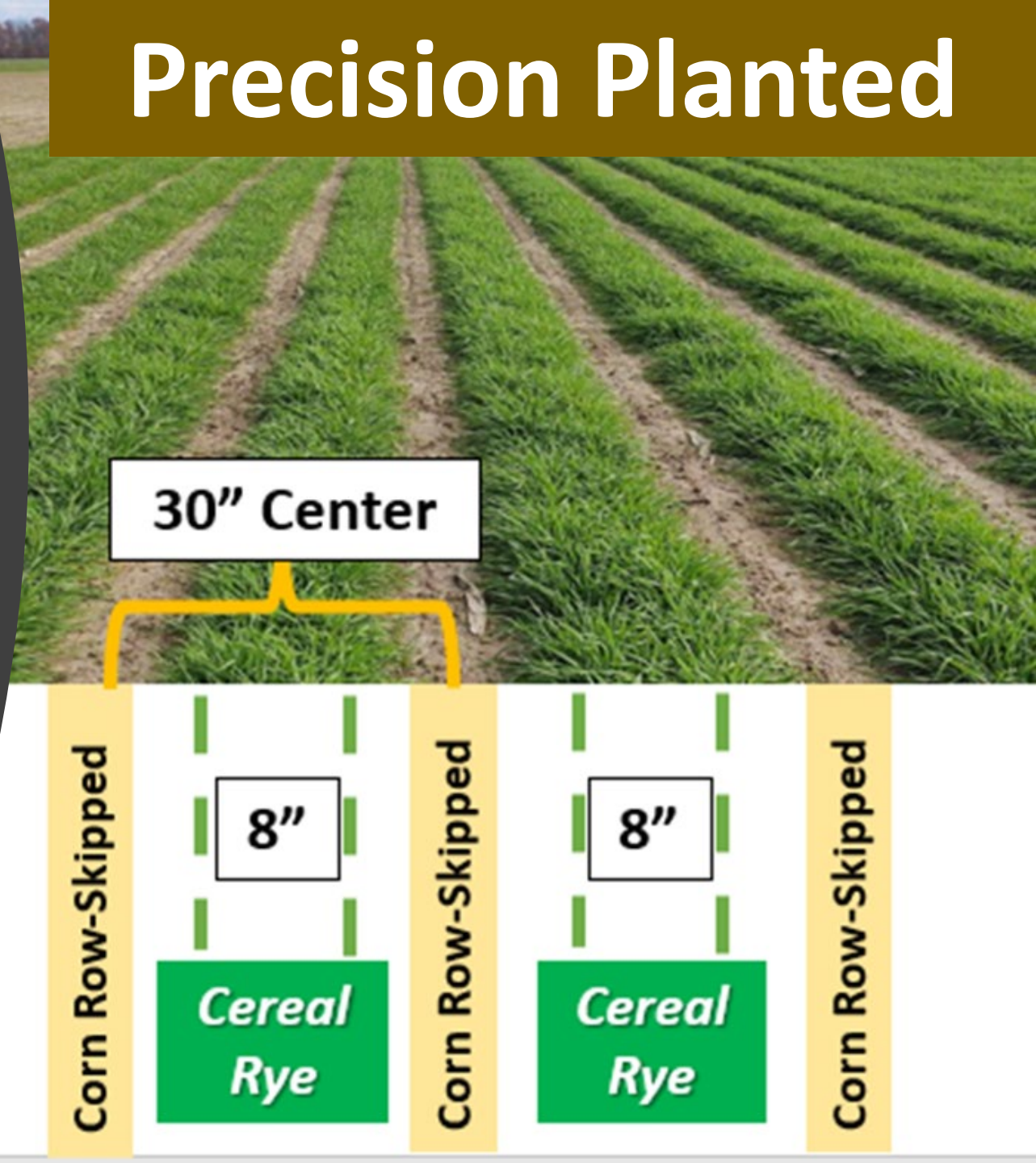
Nitrogen Rate

0, 40, 100, 150, 200, 250 lb A^{-1}

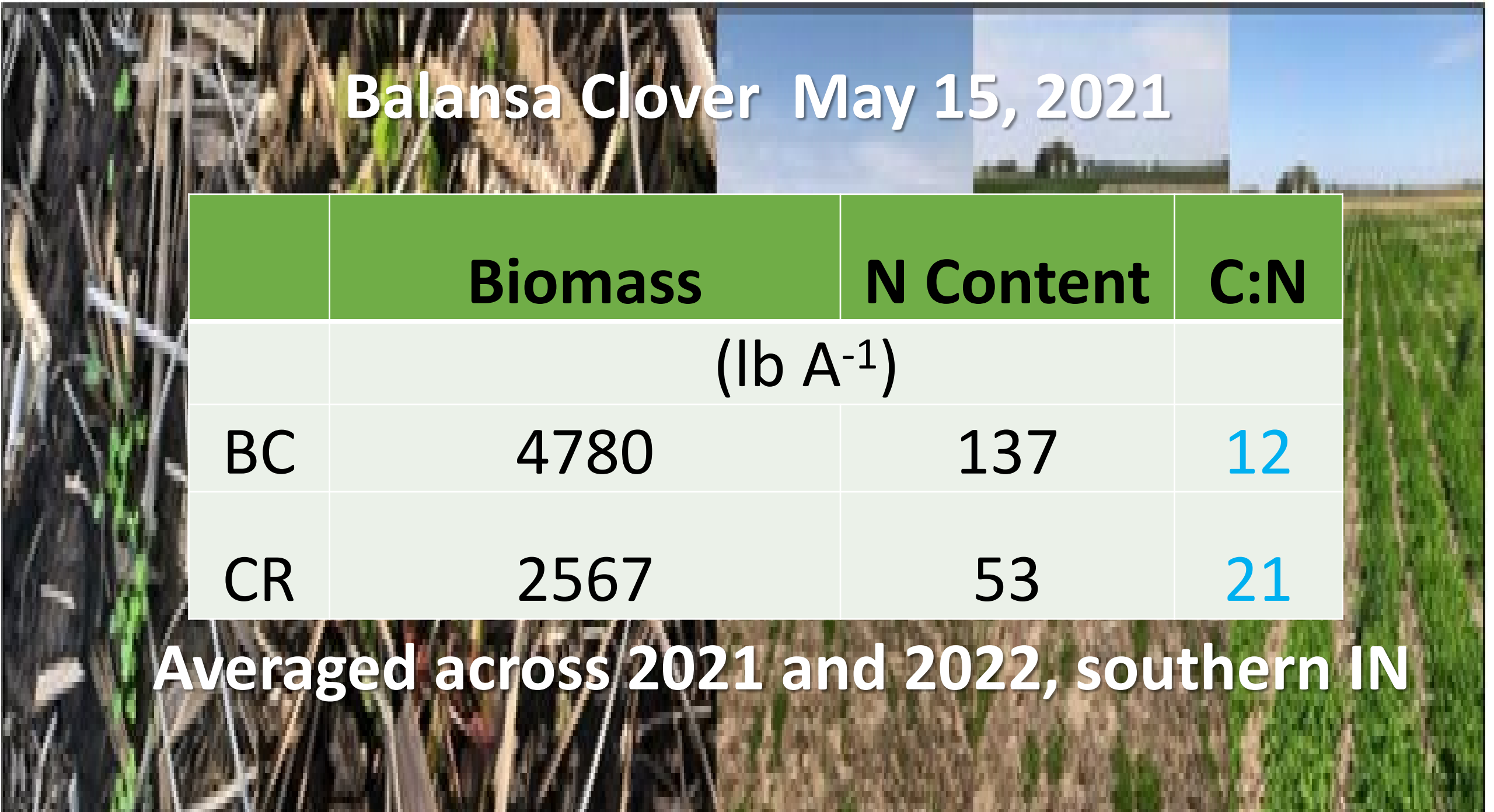
Cover crops

- **Planted Sept. 11th**
- **Terminated: CR (4/6) BC (5/20)**

Precision Planted



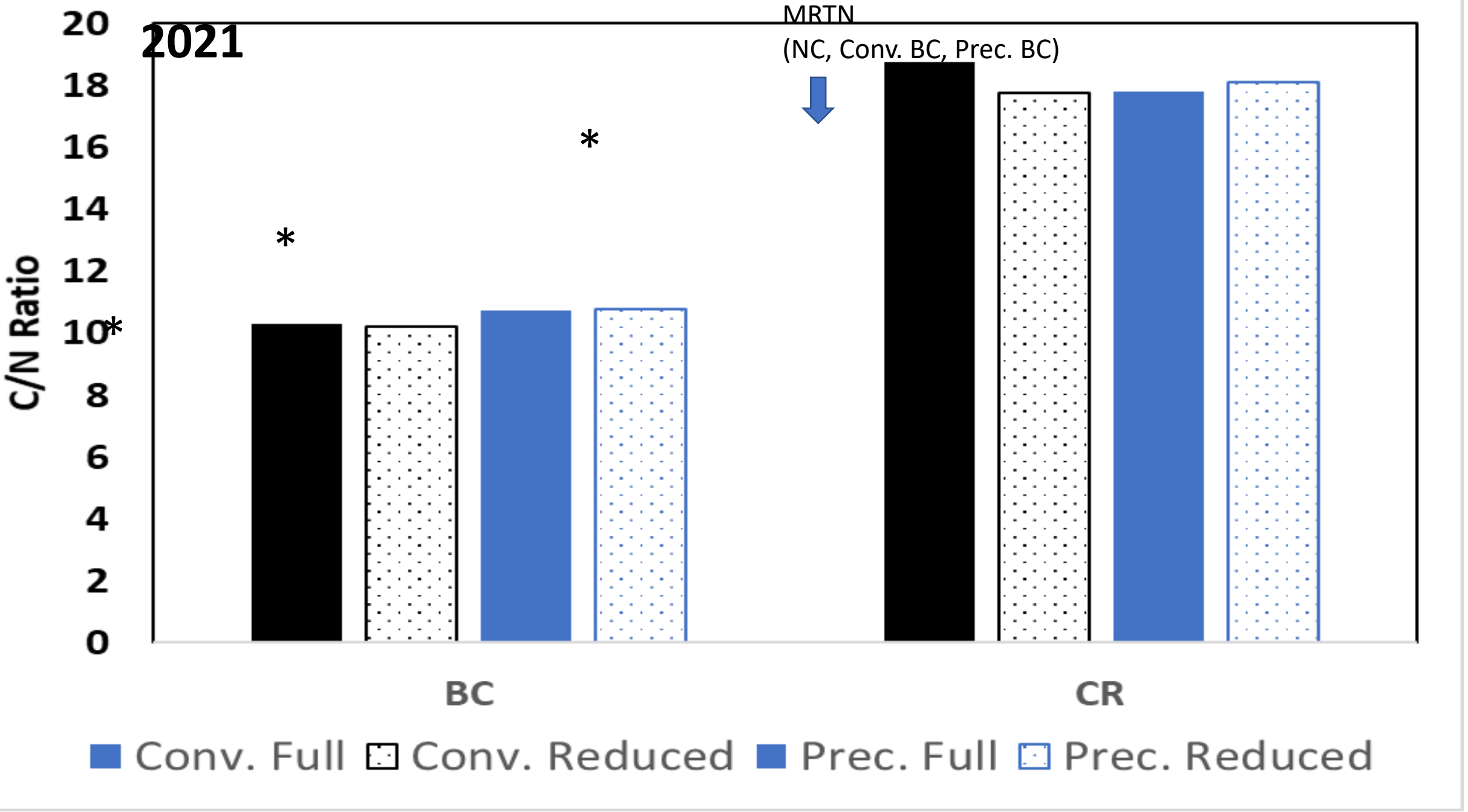
Patience!



Balansa Clover May 15, 2021

	Biomass	N Content	C:N
	(lb A^{-1})		
BC	4780	137	12
CR	2567	53	21

Averaged across 2021 and 2022, southern IN


2021
MRTN
(NC, Conv. BC, Prec. BC)
C/N Ratio
20
18
16
14
12
10
8
6
4
2
0
*
*
*
BC
CR
Conv. Full
Conv. Reduced
Prec. Full
Prec. Reduced

Harvest 2021


2022
MRTN BC
MRTN NC, PCR
MRTN CCR

Summary

- Precision planting cover crops at 50% lower seeding rate generated equal biomass, biomass C and N with equal or greater cash crop yield relative to the control.
- The inclusion of Balansa Clover generated 137 lb/A of N within the biomass, which could function as an N credit, depending on your residue management.
- Balansa Clover MRTN was 150 lb N/A, which was 100lbs N/A less than cereal rye plots and was 50lbs N/A less one of two years relative to no cover crop Control.
- The inclusion of Balansa Clover could be vital in the production of low carbon intensity corn due to its ability to generate an N credit and capture carbon within a No-till residue management system.

Questions

SEND LAB Website:
https://ag.purdue.edu/agry/armstrong-sendlab/

Corn Agronomy Website: https://thekernel.info

@covercropDr

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