

Proceedings from the 6th Annual Nutrient Management Conference

**6th Annual
NITROGEN:
MINNESOTA'S GRAND
CHALLENGE & COMPELLING
OPPORTUNITY CONFERENCE**



**Tuesday,
February 18, 2020**

**Arrowwood Conference Center
Alexandria, MN**

 UNIVERSITY OF MINNESOTA | EXTENSION

**6TH ANNUAL
NITROGEN: MINNESOTA'S GRAND CHALLENGE
& COMPELLING OPPORTUNITY CONFERENCE**

Sessions 9:00 a.m.-3:25 p.m.

■ GENERAL SESSION

8:30 a.m.	<i>Registration</i>	
9:00 a.m.	<i>Welcome</i> Tom Rothman	University of Minnesota
9:05 a.m.	<i>Lessons Learned in 2019, Opportunities for 2020</i> Angie Peltier Chryseis Modderman Brad Carlson	University of Minnesota University of Minnesota University of Minnesota
9:55 a.m.	<i>Importance of Urban and Non-urban Nutrient Reductions</i> Dana Vanderbosch	Minnesota Pollution Control Agency
10:30 a.m.	<i>Break</i>	
10:45 a.m.	<i>Modeling the Cost-effectiveness of Practices to Reduce Watershed Nutrient Loads</i> Bill Lazarus	University of Minnesota
11:45	<i>Lunch</i>	

■ BREAKOUT SESSION #1

12:45 p.m.	<i>Evaluating N Stabilizers</i> R. Jay Goos	North Dakota State University
1:25 p.m.	<i>Recent findings in N Management Research</i> Brad Carlson	University of Minnesota
2:05 p.m.	<i>Irrigation and Nitrogen Management for Profitable Corn Production and Groundwater Quality Protection</i> Vasu Sharma	University of Minnesota
2:45 p.m.	<i>Where Do U of M Recs Come From? N Calculator Updates</i> Dan Kaiser	University of Minnesota

■ BREAKOUT SESSION #2

12:45 p.m.	<i>Minnesota's Nutrient Reduction Strategy- Progress Toward Milestone Goals</i> Glenn Skuta	Minnesota Pollution Control Agency
1:25p.m.	<i>Minnesota's Groundwater Protection Rule Update</i> Larry Gunderson	Minnesota Department of Agriculture
2:05p.m.	<i>Cover Crops, N Additions, and Soil Health</i> Anna Cates	University of Minnesota
2:45 p.m.	<i>Urea and Urea Additives</i> Karina Fabrizio	University of Minnesota
3:25 p.m.	<i>Adjourn</i>	

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Minnesota's Agricultural Fertilizer
Research & Education Council














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Cover crops, N additions, and soil health

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The Minnesota Office for Soil Health is a collaborative of the Minnesota Board of Water and Soil Resources and the University of Minnesota Water Resources Center

www.wrc.umn.edu/mosh

WHAT WE'LL DO HERE...

- Why cover crops?
- How cover crops?
- Do cover crops add N, or require more N?

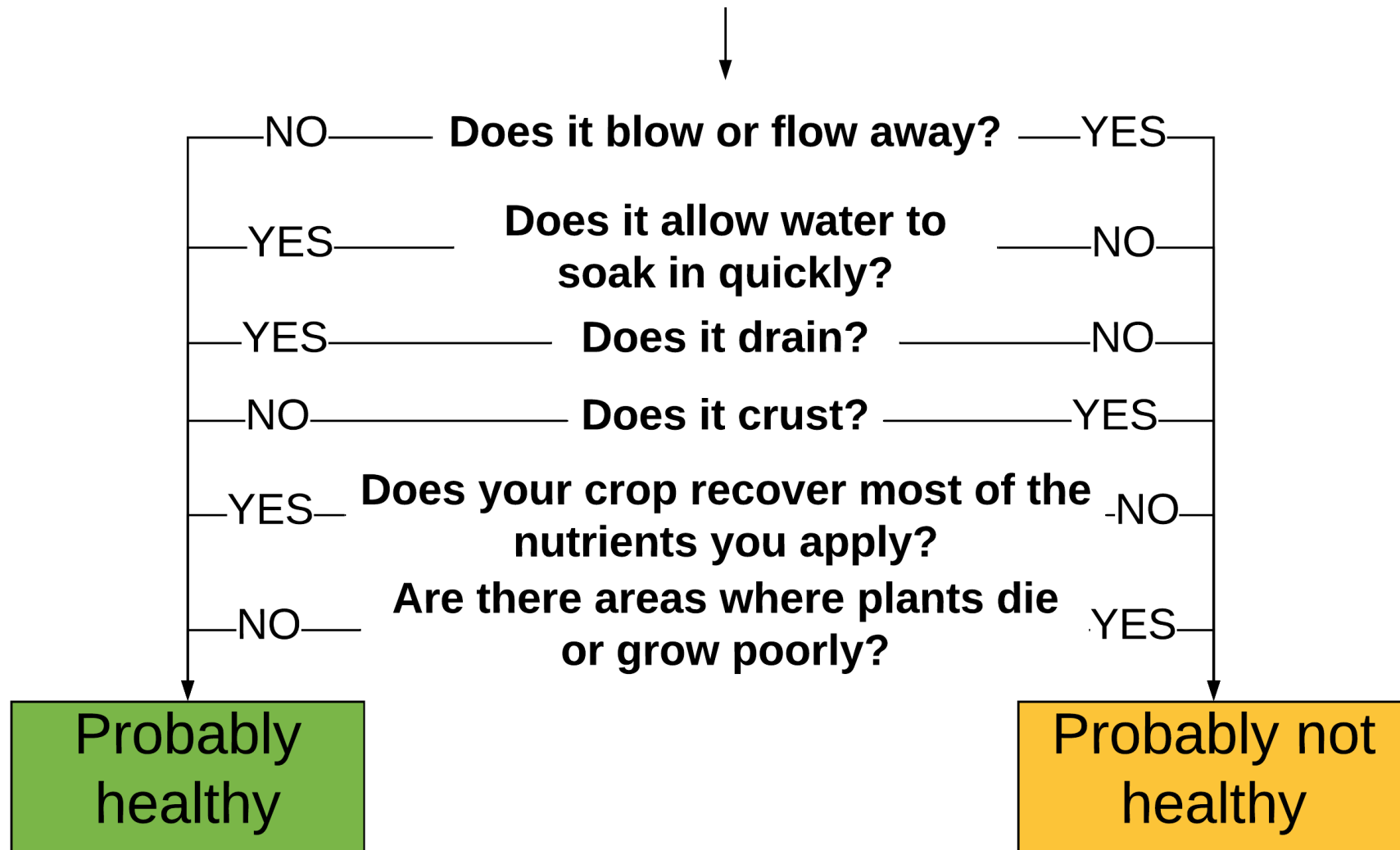
SOIL HEALTH IS....

*The continued capacity of the soil to function
as a vital living ecosystem*

What functions do we care about?



Is your soil healthy?

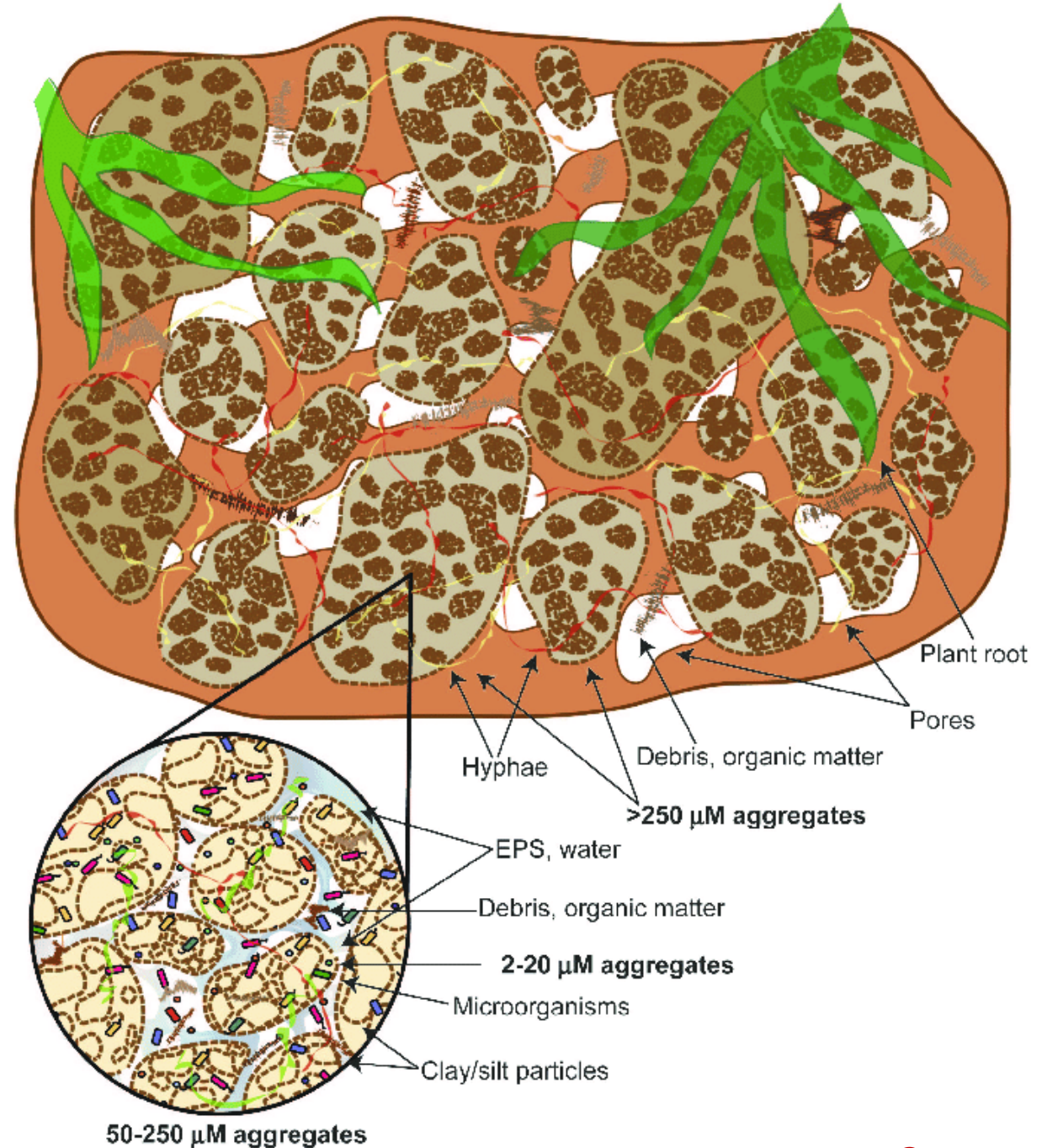


Andrew McGuire, WSU

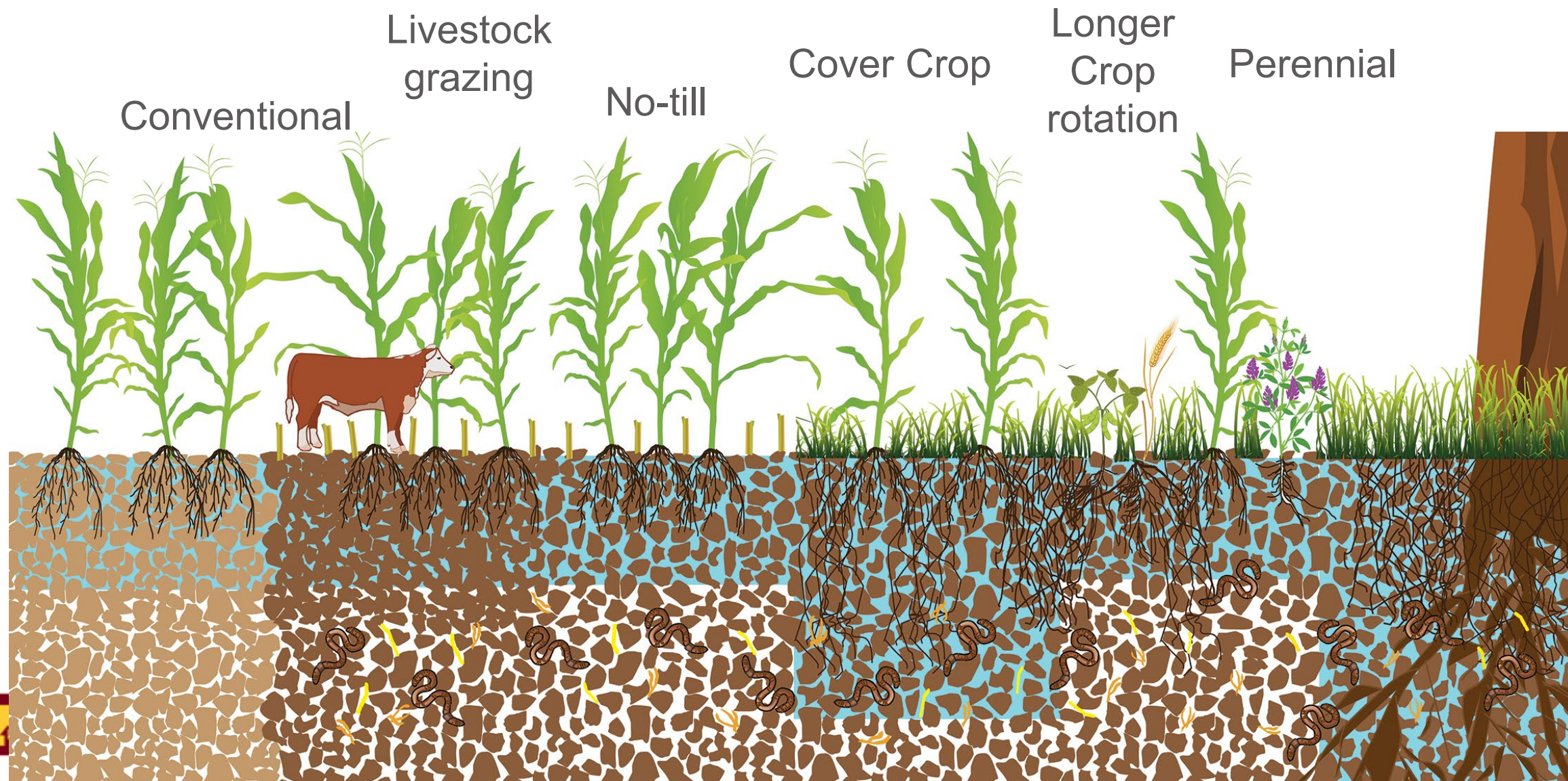


UNIVERSITY OF MINNESOTA EXTENSION

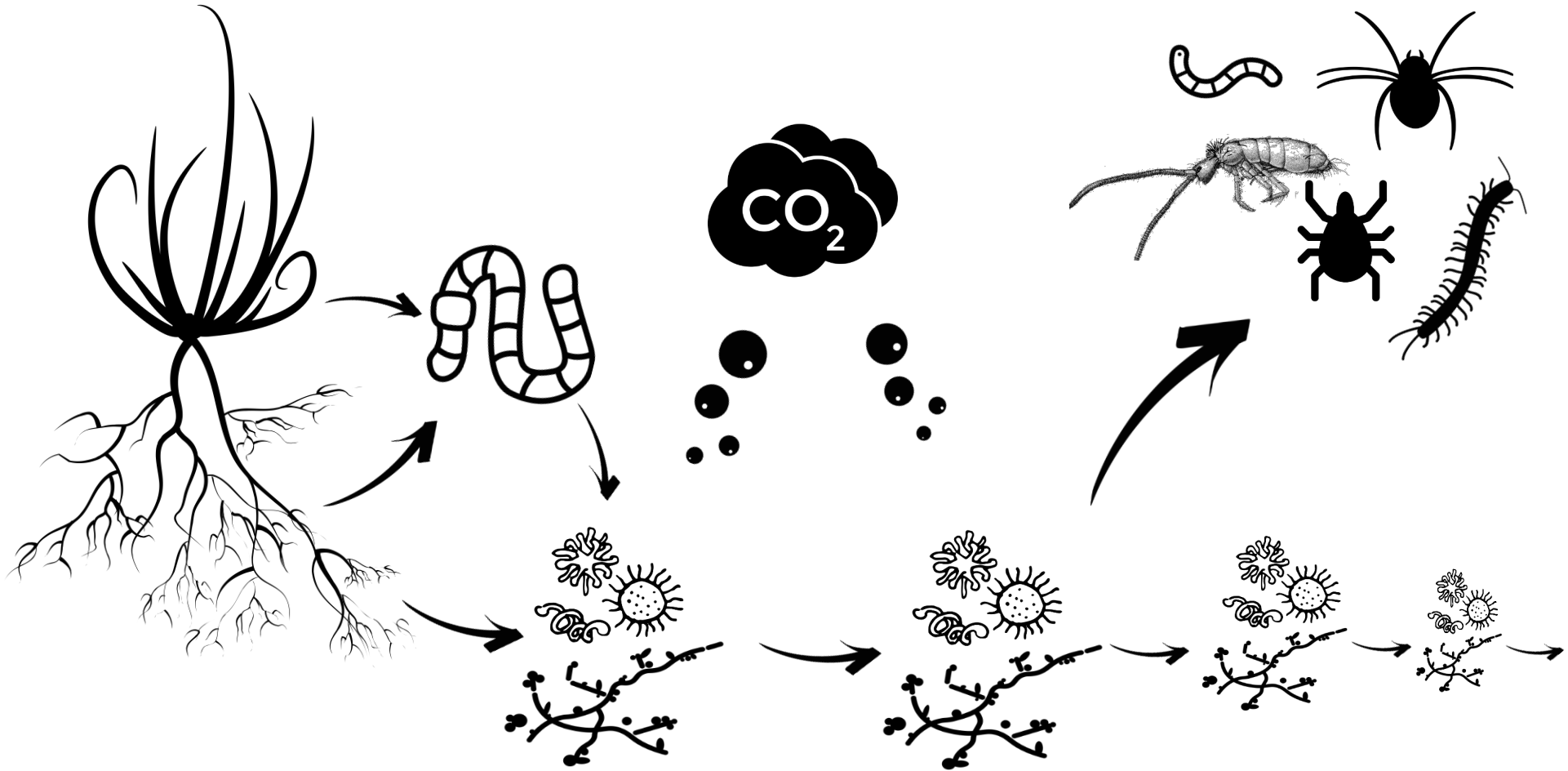
SOIL BIOLOGY BUILDS SOIL STRUCTURE, FUNCTION FOLLOWS STRUCTURE



INFILTRATION INCREASES WITH COVER CROP



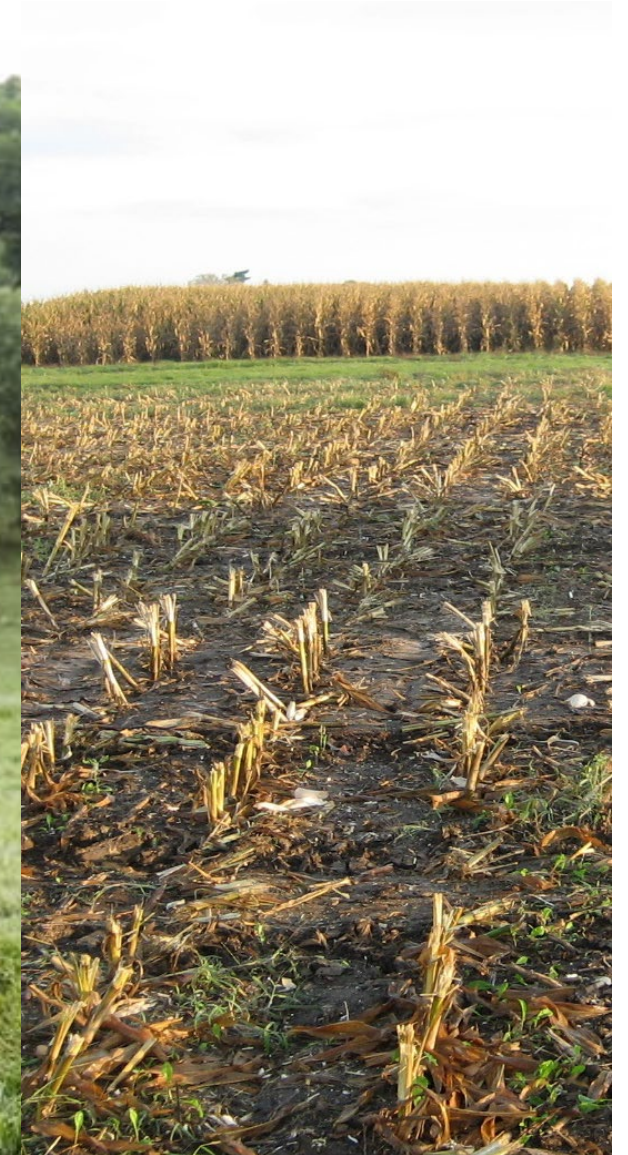
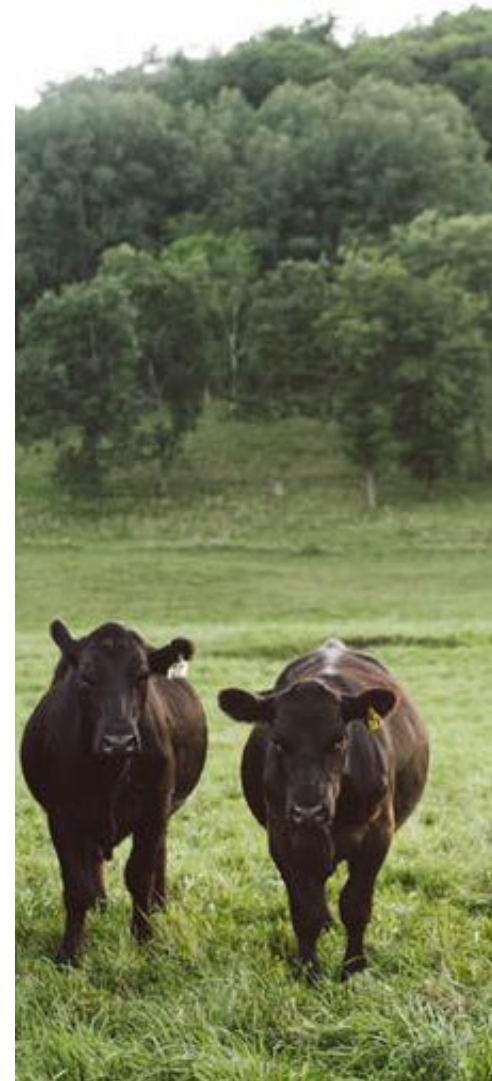
BIOLOGY DRIVES FUNCTION VIA STRUCTURE



Icons from Alice Noir, iconosphere, Lea Lortal, Miroslava, ProSymbols, Colleen Wilson, Creative Mania, kiddo, Vectors Market, Guilhem, Gregory Montigny and Symbolon from the Noun Project

SOIL HEALTH PRINCIPLES

- Keep the soil covered
- Minimize disturbance
- Increase crop diversity
- Keep living roots in the ground
- Integrate livestock



COVER CROPS INTEGRATE PRINCIPLES

- Keep the soil covered
- Minimize disturbance
- Increase crop diversity
- Keep living roots in the ground
- Integrate livestock



Photo: Martin Larsen, Olmsted County

MANY CHOICES OF COVER CROPS

Species: Winter-hardy? N-fixer? Big roots?



Photos: Indiana Conservation Cropping Systems Initiative, UMN Extension



MANY CHOICES OF COVER CROPS

Seeding: interseeded or post-harvest?



Photos: Martin Larsen, Olmsted County



MANY CHOICES OF COVER CROPS

Planting: Green? Glyphosate? Roller crimp?



Photos: Martin Larsen, Olmsted County and Indiana Conservation Cropping Systems Initiative

A TOOL TO EVALUATE SOME OF THE CHOICES

Midwest Cover Crops Council

mccc.msu.edu

Selector Tools

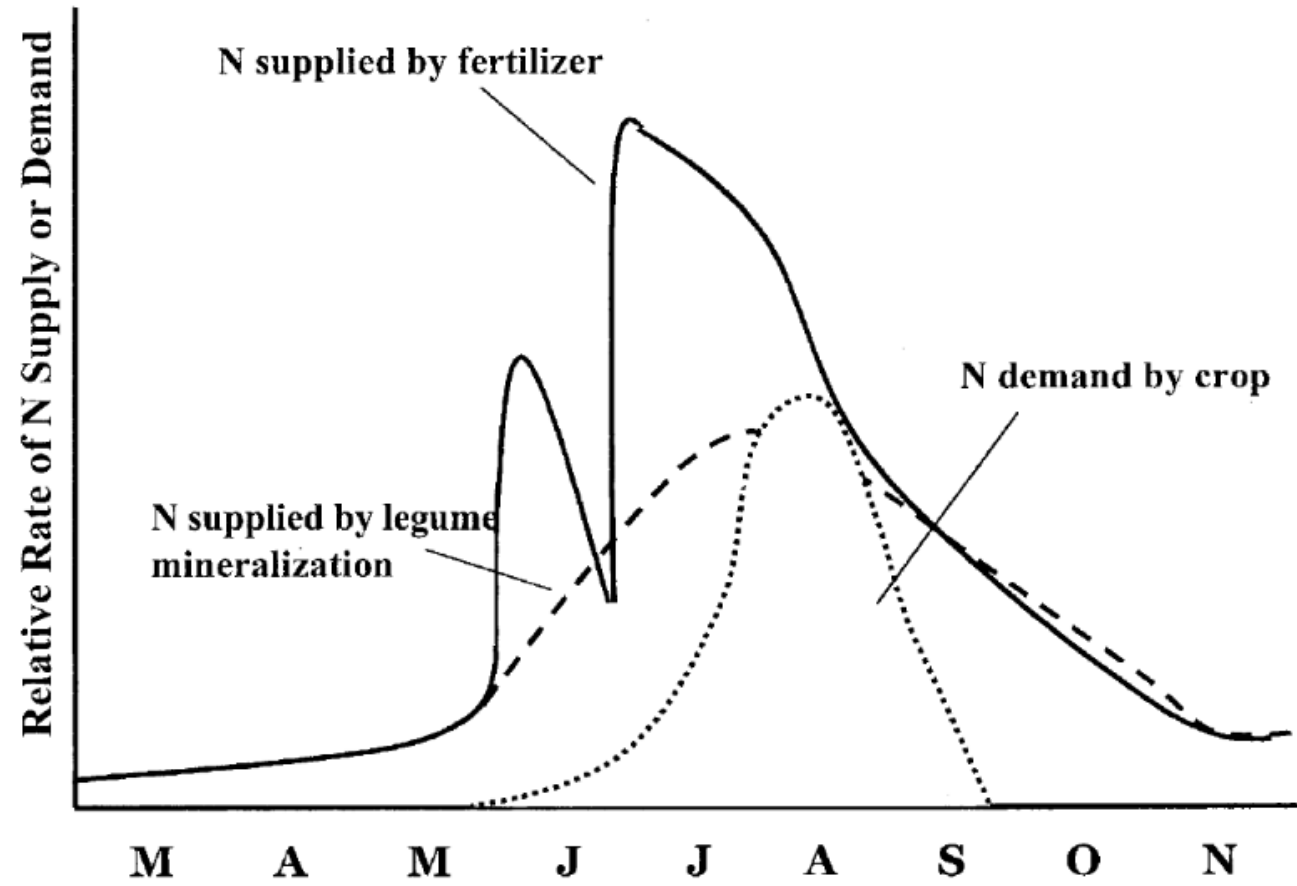
Row Crop Tool

- Indiana
- Illinois
- Iowa
- Kansas
- Michigan
- Minnesota
- Missouri
- Nebraska
- North Dakota
- Ohio
- Ontario
- South Dakota
- Wisconsin
- Ontario
- NRCS
- ARS

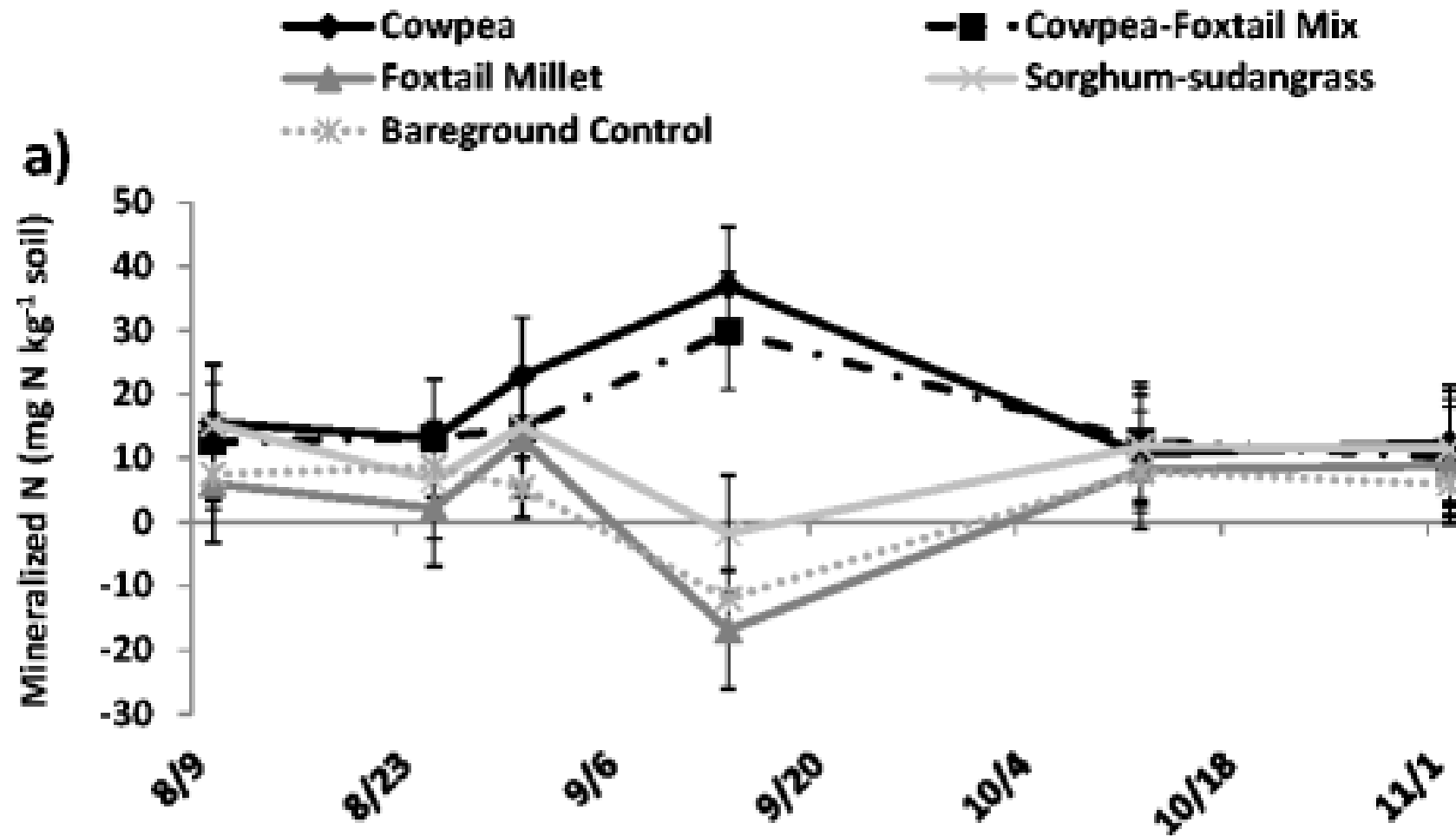
HOW WILL COVER CROPS AFFECT N?



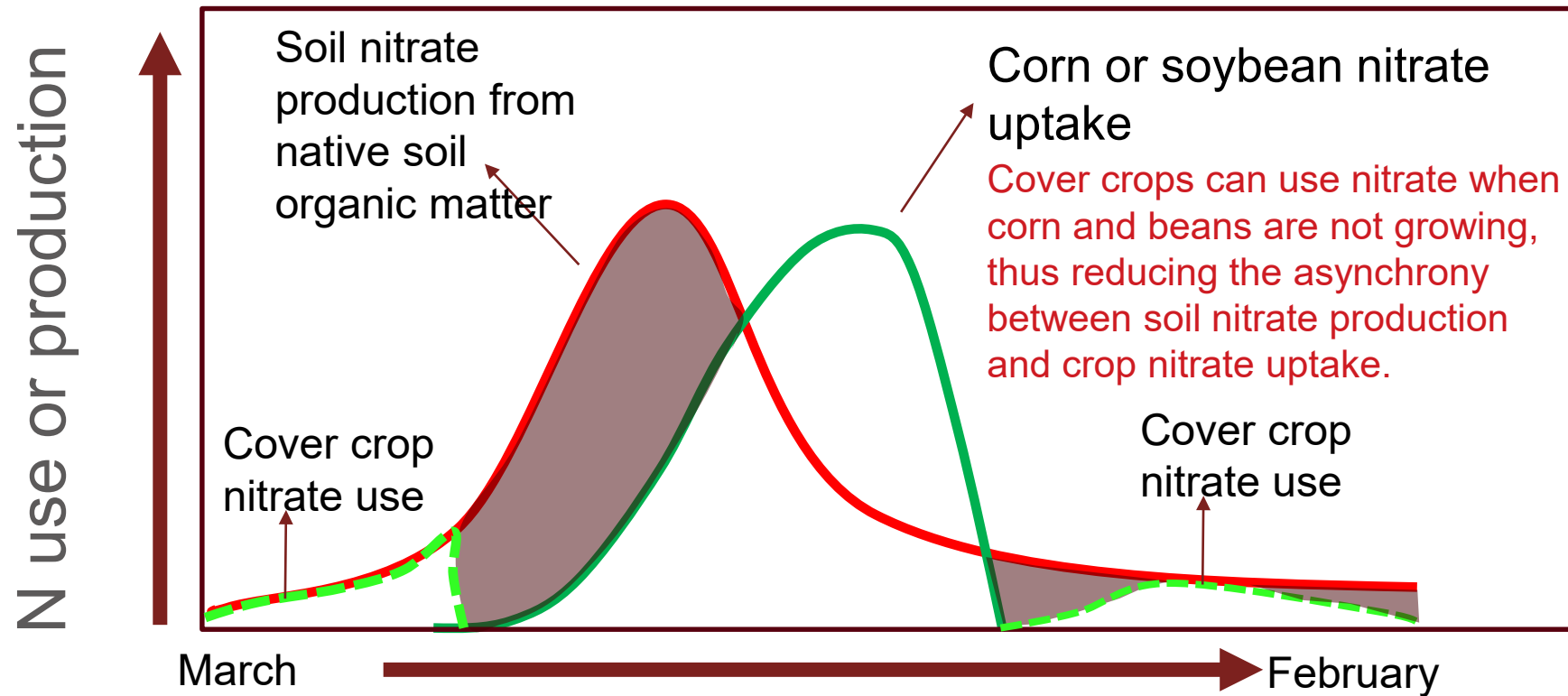
LEGUME COVERS CAN SLOWLY RELEASE N



COVERS RELEASE N AT DIFFERENT RATES



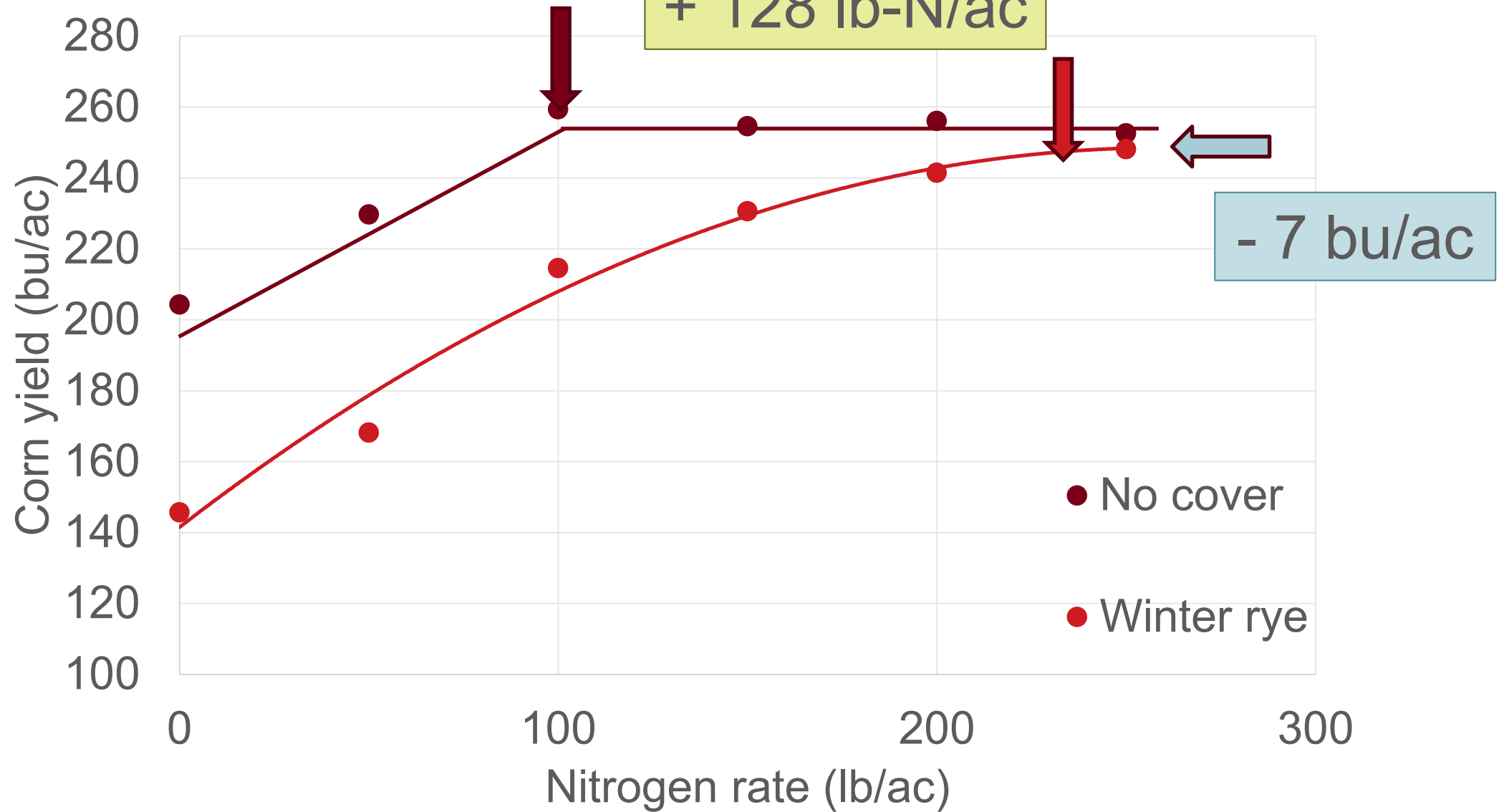
COVER CROPS REDUCE NITRATE LEACHING

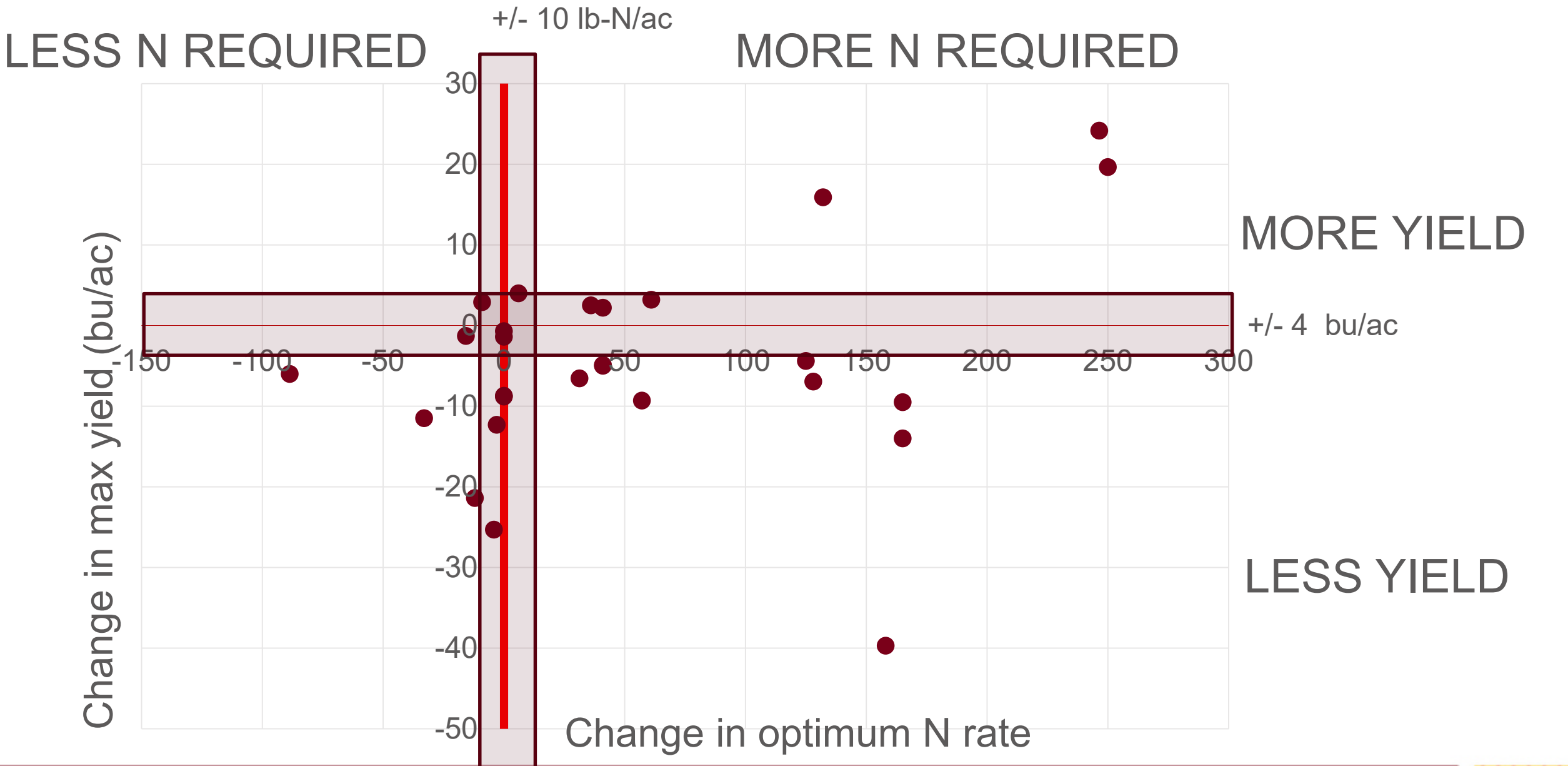


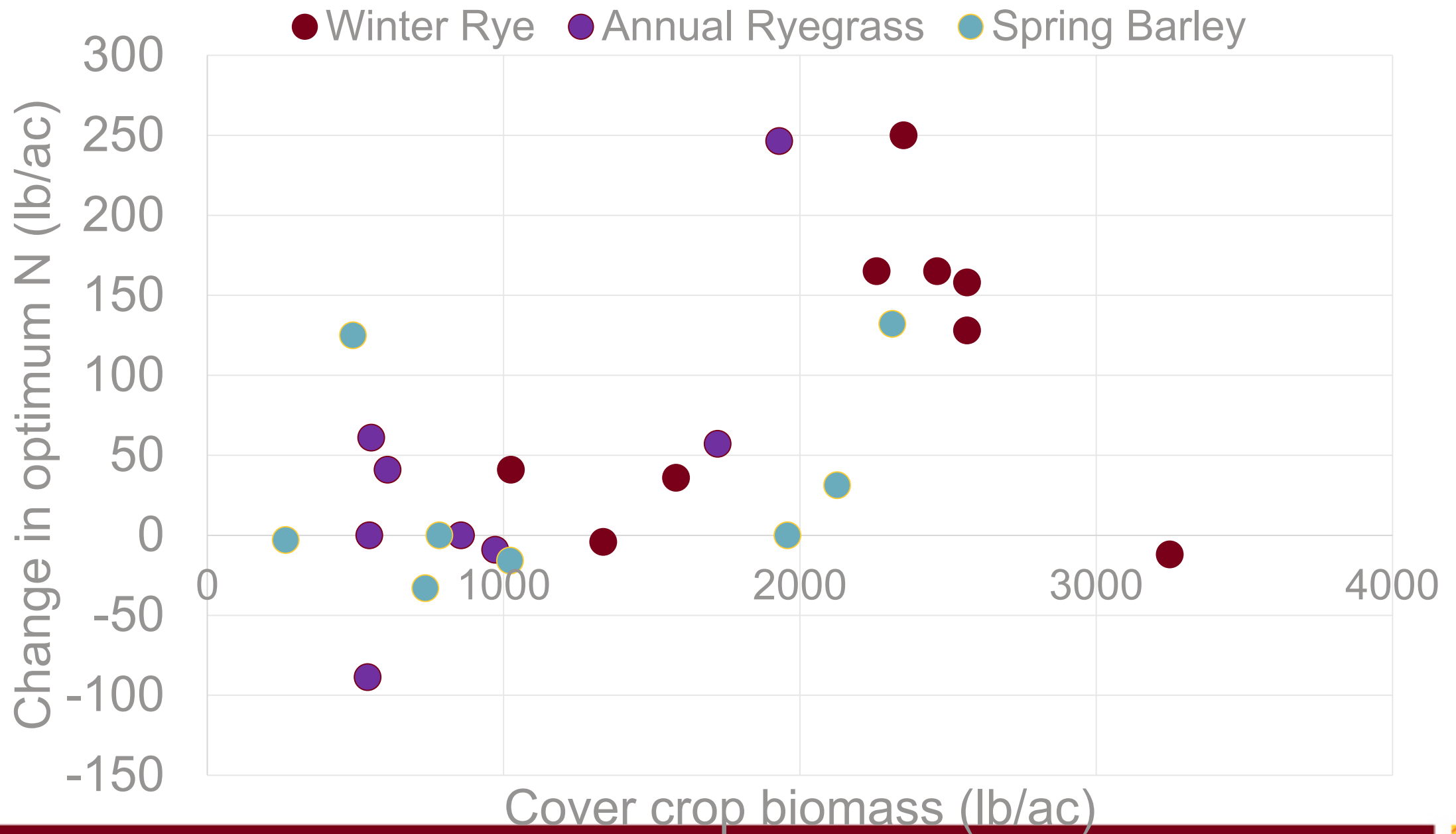
*In the shaded areas, the soil produces nitrate, but there is no crop to use it.
As a result, some nitrate is lost to waterways.*



Arlington 2017







HOW MUCH N DO COVERS TAKE UP?

Cover crop biomass (lb/ac)	Estimated N uptake (lb/ac)
<1,000	<25
1,000–2,000	25–45
>2,000	>50

*There was no clear effect when winterkilled cover crops were used based on Wisconsin research (inset).



Nitrogen Immobilization

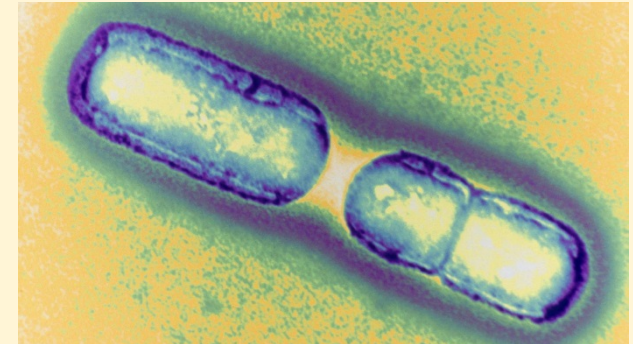
Cover Crop

C:N ratio about 40:1



Bacteria

C:N ratio about 5:1



Nitrogen Immobilization

Cover Crop

C:N ratio about 40:1



Consume enough
carbon from the rye
for respiration &
body structure

Bacteria

C:N ratio about 5:1



Nitrogen Immobilization

Cover Crop

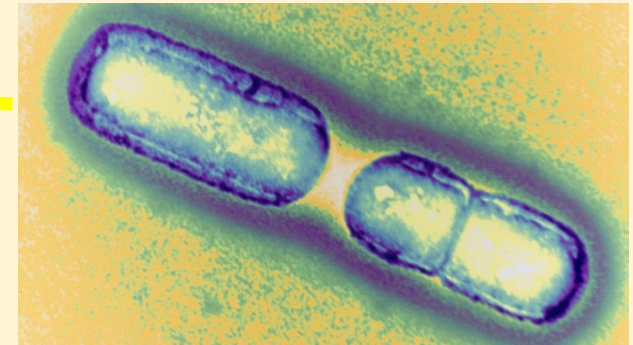
C:N ratio about 40:1



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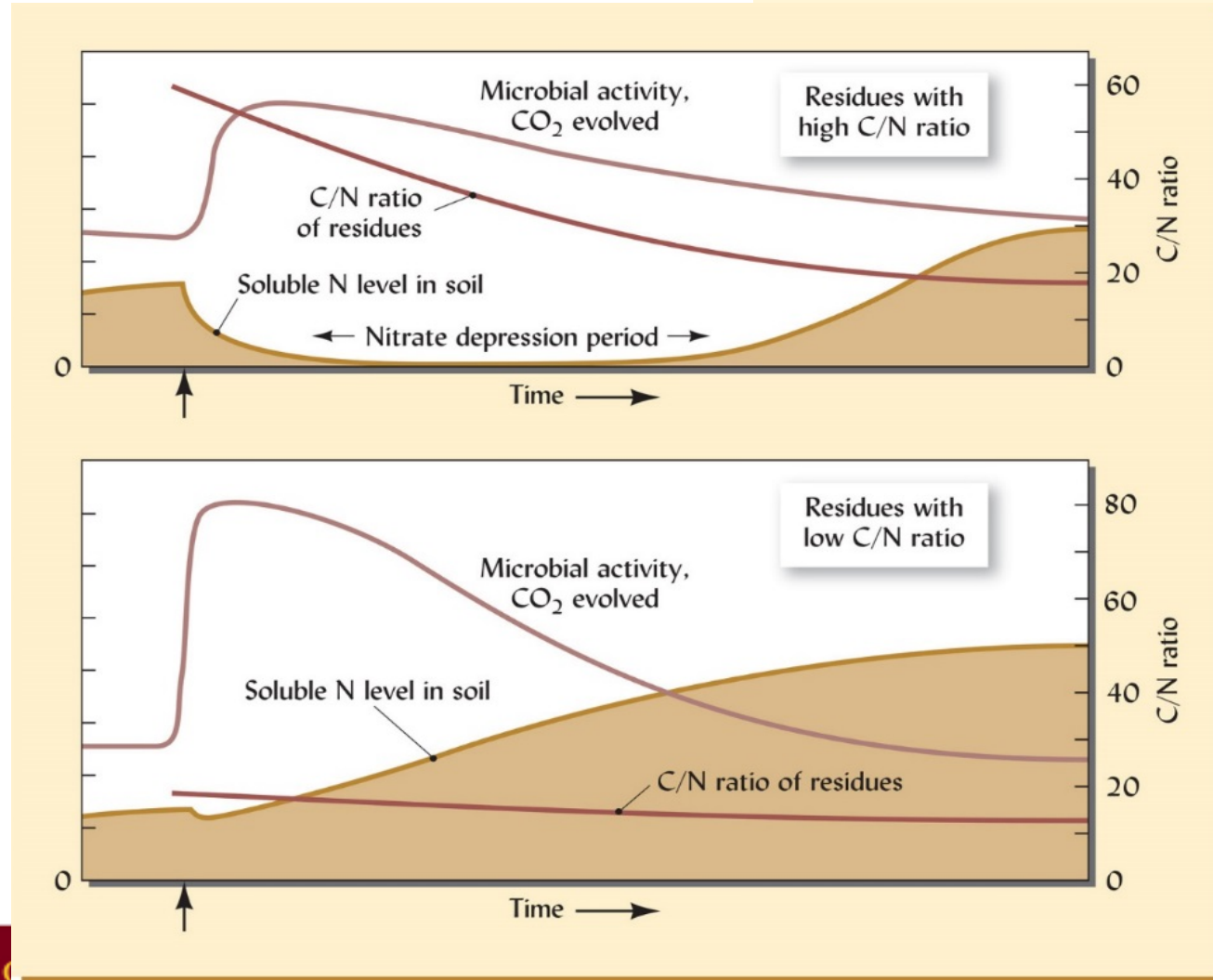
C:N ratio about 5:1



N C C C C C
N C C C C C
C C C C C Soil N
C C C C C Soil N
C C C C C Soil N
C C C C C Soil N
C C C C C Soil N
C C C C C Soil N
C C C C C Soil N



Microbes prefer low C/N ratio residue



Immobilization is temporary

Bacteria

C:N ratio about 5:1



Consume two
bacteria to get
enough carbon for
function and
reproduction
Total C:N of 10:2

Bacteria Feeding Nematode

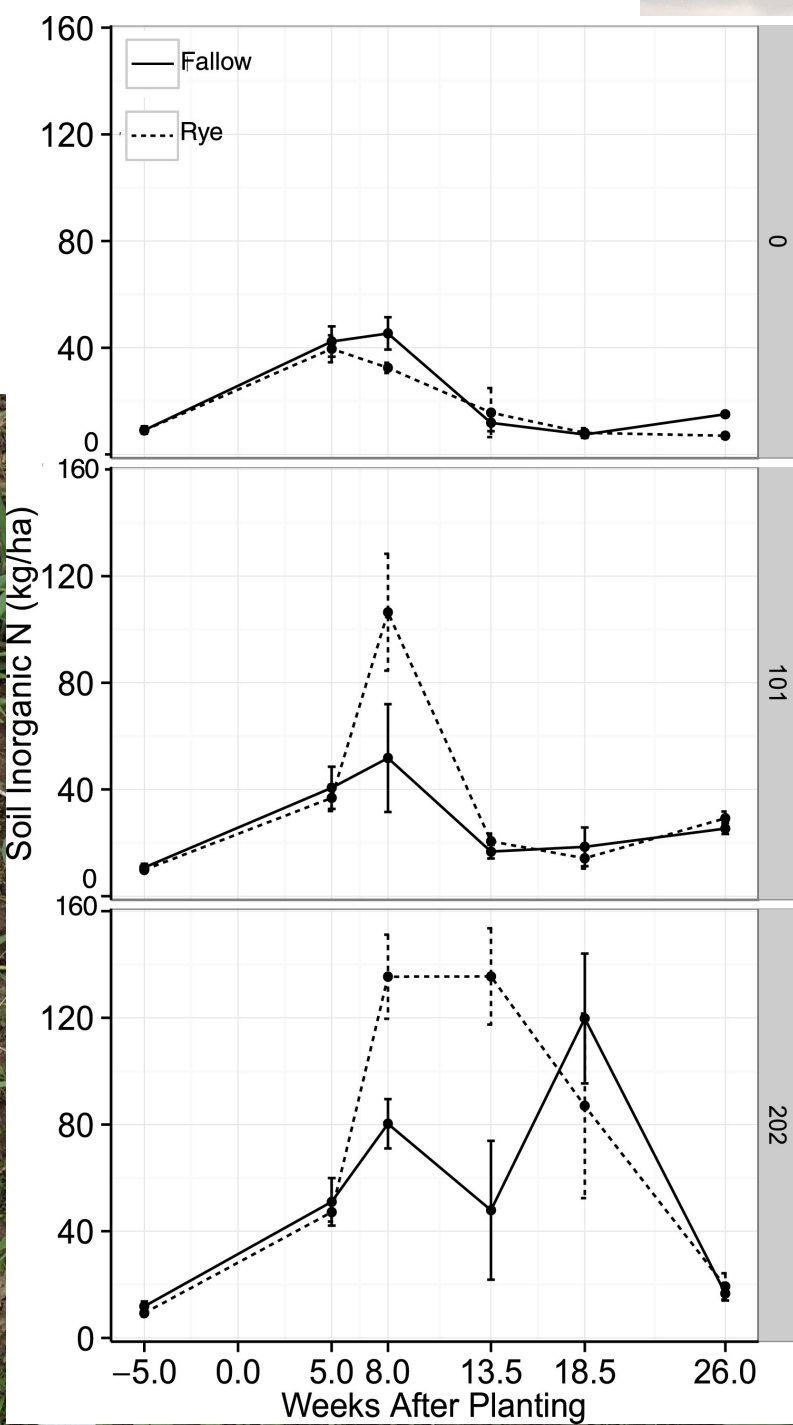
C:N ratio about 10:1



Only
Needs
1 part N

Excrete 1
part N to soil
solution-
Available N





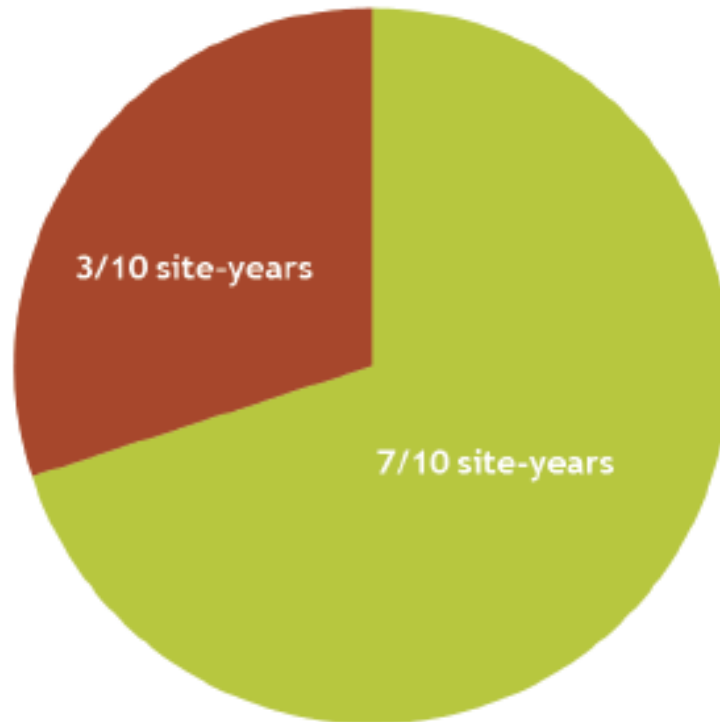
Boost the proportion of
N in your starter
Give it time

Snapp & Surapur 2018

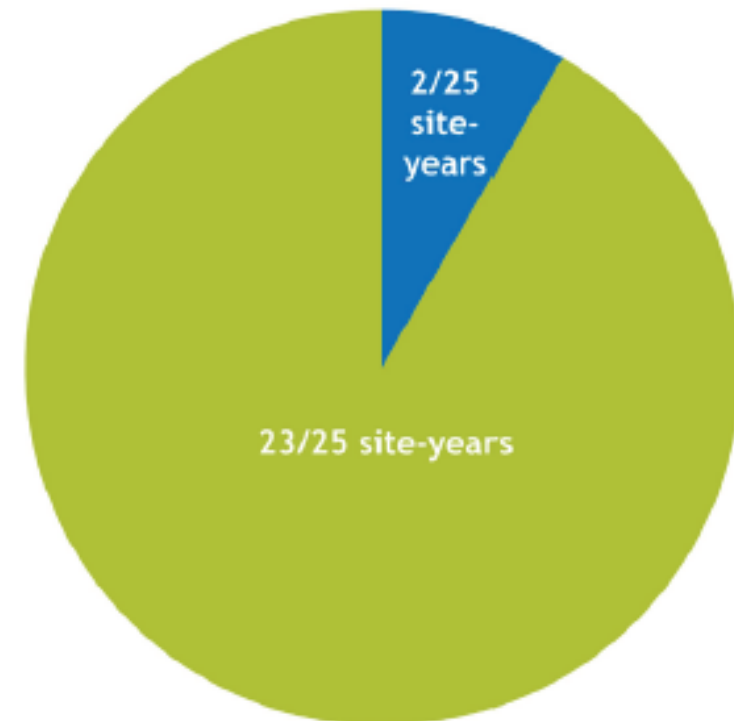
WILL WE LOSE YIELD? CORN

Figure 1. Trends with respect to cover crop effect on corn yields at 10 site-years from 2009 to 2010 and 25 site-years from 2011 to 2017.

Corn yields, 2009-2010



Corn yields, 2011-2017

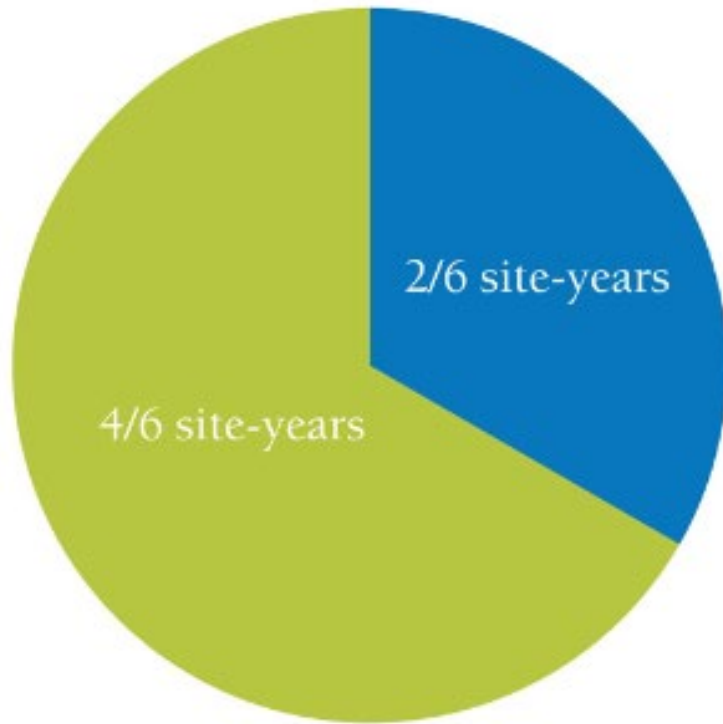


■ Yield improvement ■ No change ■ Yield reduction

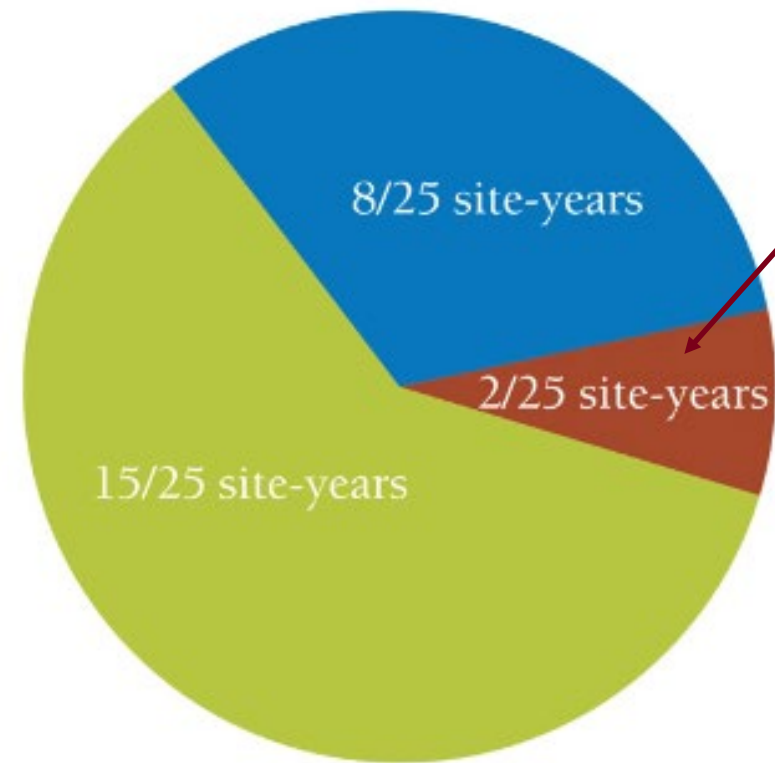
WILL WE LOSE YIELD? SOYBEAN

Figure 2. Trends with respect to cover crop effect on soybean yields at 6 site-years from 2009 to 2010 and 25 site-years from 2011 to 2019.

Soybean Yields 2009-2010



Soybean Yields 2011-2019



Planter
setting
issues

■ Yield improvement

■ No change

■ Yield reduction

Data from Practical Farmers of Iowa



POST-CORN, GOING TO SOY: USE CEREAL RYE

- Why?
 - Rye is winter hardy and tolerant of residual herbicide
- How?
 - Interseed at R5-R6 if you can
 - Terminate with glyphosate
 - Strip-till or no-till soybean

Liz Stahl, Axel Garcia y Garcia



MINNESOTA COVER CROP RECIPE MCCC-114

Post Corn, Going to Soybean: Use Cereal Rye

This publication is intended to provide a starting point for farmers who are new to growing cover crops. With experience, farmers may fine-tune the use of cover crops for their systems.

Introduction
Fitting cover crops into a corn-soybean rotation in

on the label of any applied herbicides. (In the Resources section, see Managing Risk When Using Herbicides and Cover Crops in Corn and Soybean.)

- **Seed purchase**—Order cover crop seed early from a reputable source. Use good-quality tagged seed that has

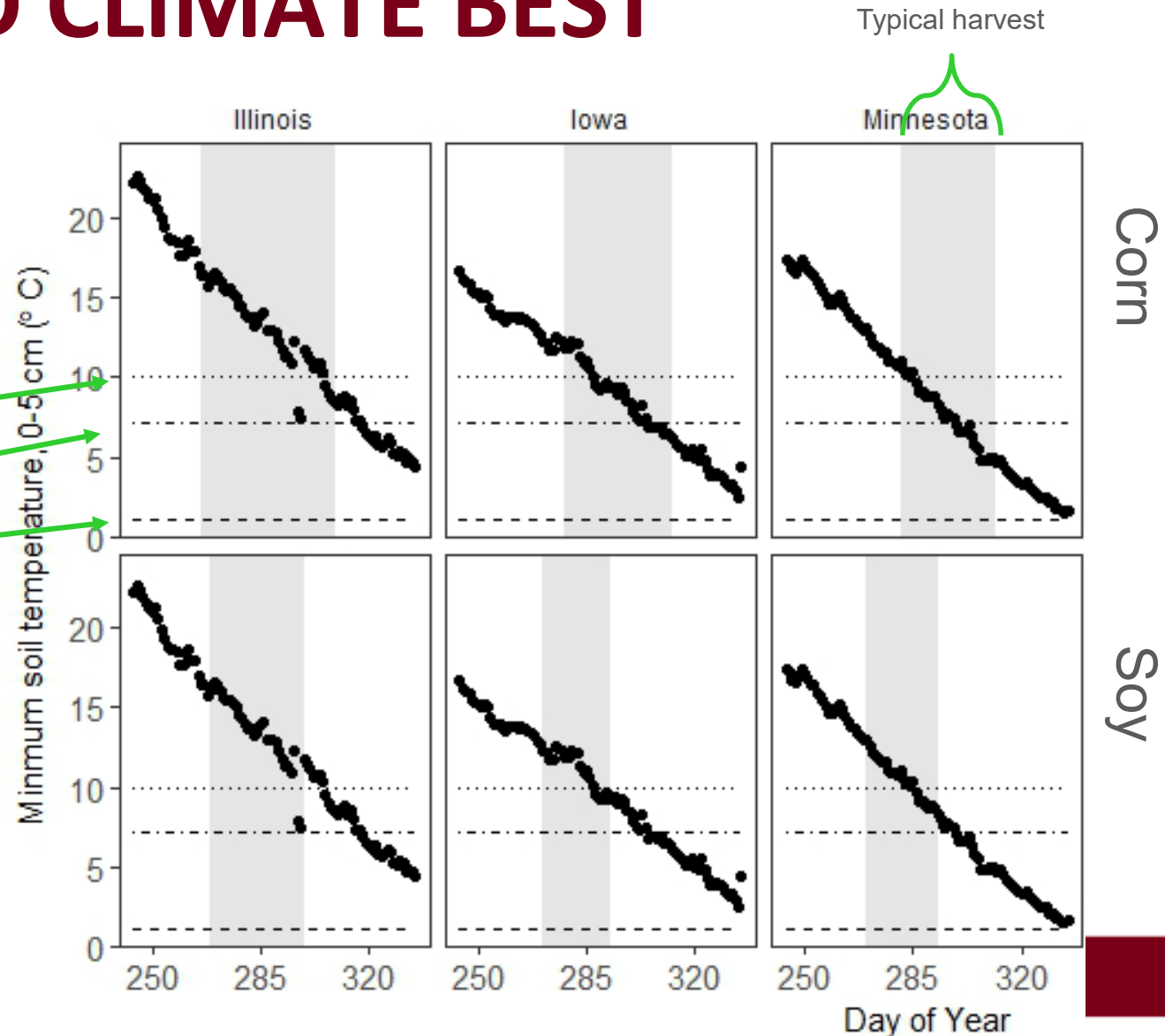
RYE FITS A COLD CLIMATE BEST

Germination
temperature

Clover, 50 F

Brassica, 45 F

Rye, 34 F



WHAT ABOUT THE COST?

- Seed: grasses will be cheaper than brassicas or legumes
- Planting method: use what's readily available
- Weed control: a heavier stand might eliminate a post-emergence spray
- SWCD support: use it to experiment



PLANTING COVERS AND NO/LOW-TILL GO TOGETHER

- Allows for more cover crop growth
- Speeds up soil structure development
- $1 + 1 > 2$
- Saves money



PLANTING COVERS AND NO/LOW-TILL GO TOGETHER

Crop Enterprise Analysis (Farms Sorted By Tillage System)

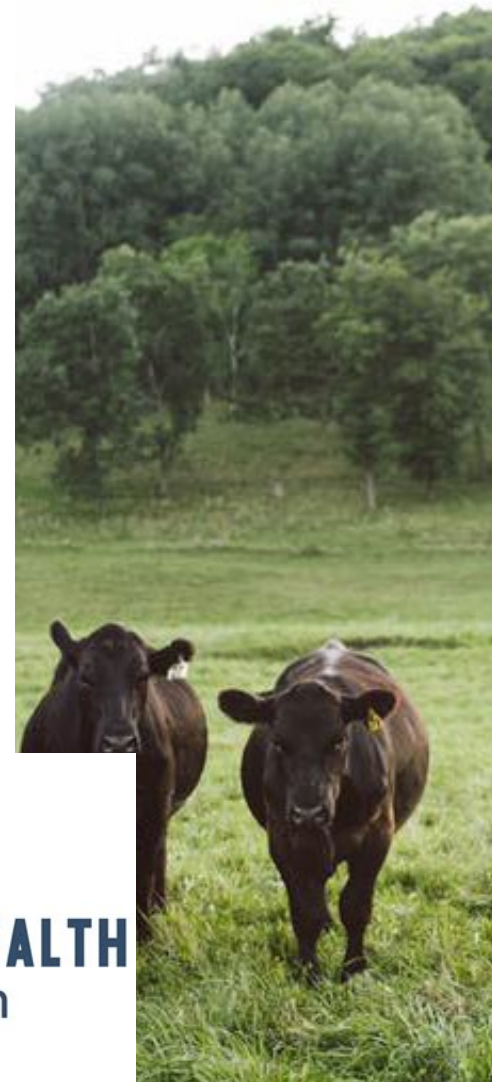
Soybeans on Cash Rent

	<i>Avg. Of All Farms</i>	<i>Moldboard</i>	<i>Chisel/ Reduced</i>	<i>No Till</i>	<i>Ridge Till</i>	<i>Strip Till</i>
Yield per acre (bu.)	49.24	53.43	49.13	46.68	54.48	53.27
Gross return per acre	526.91	562.20	526.78	493.32	585.40	550.76
Total direct expenses per acre	382.16	411.15	384.30	349.79	367.88	374.60
Return over direct exp per acre	144.75	151.05	142.48	143.53	217.52	176.15
Net return per acre	83.55	85.86	81.12	89.28	160.59	104.96
Labor & management charge	30.65	31.13	30.37	29.38	40.27	36.42
Net return over lbr & mgt	56.64	55.58	54.10	66.70	121.43	81.31



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- Integrate livestock
- ... talk to people





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Are you a cover cropper
interested in Farm
Business Management
Program? Email me
about scholarship \$.