Organic no-till soybeans

Léa Vereecke, CCA

2023 Ohio Organic Grain Conference,
Archbold, Ohio

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Part 1

What's up with tillage?

Why till?

- Nutrient cycling
- Weed control
- Improved crop emergence
- Residue management/ disease control

Why no-till?

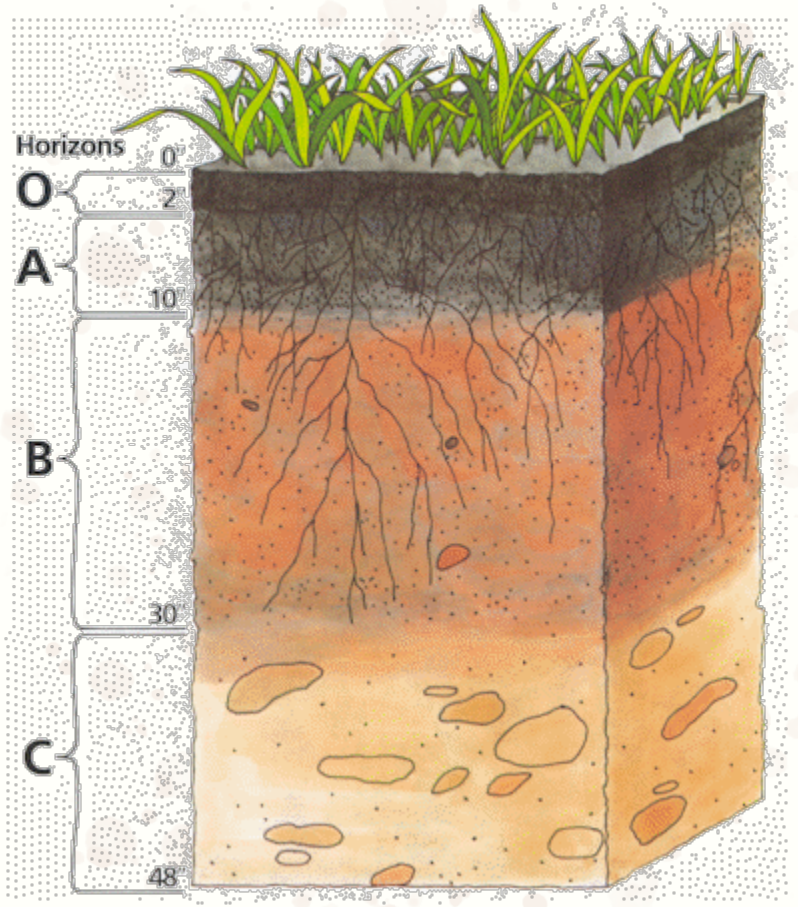
- Reduce erosion
- Increase carbon sequestration
- Improve soil health and structure
- Reduce labor and fuel use

Soil compaction?

Increase carbon sequestration?

"Zero Till practices increased SOC concentration and storage compared to conventional tillage operations **only for the surface layer** but not for the entire soil profile."

Deen and Kataki, 1987



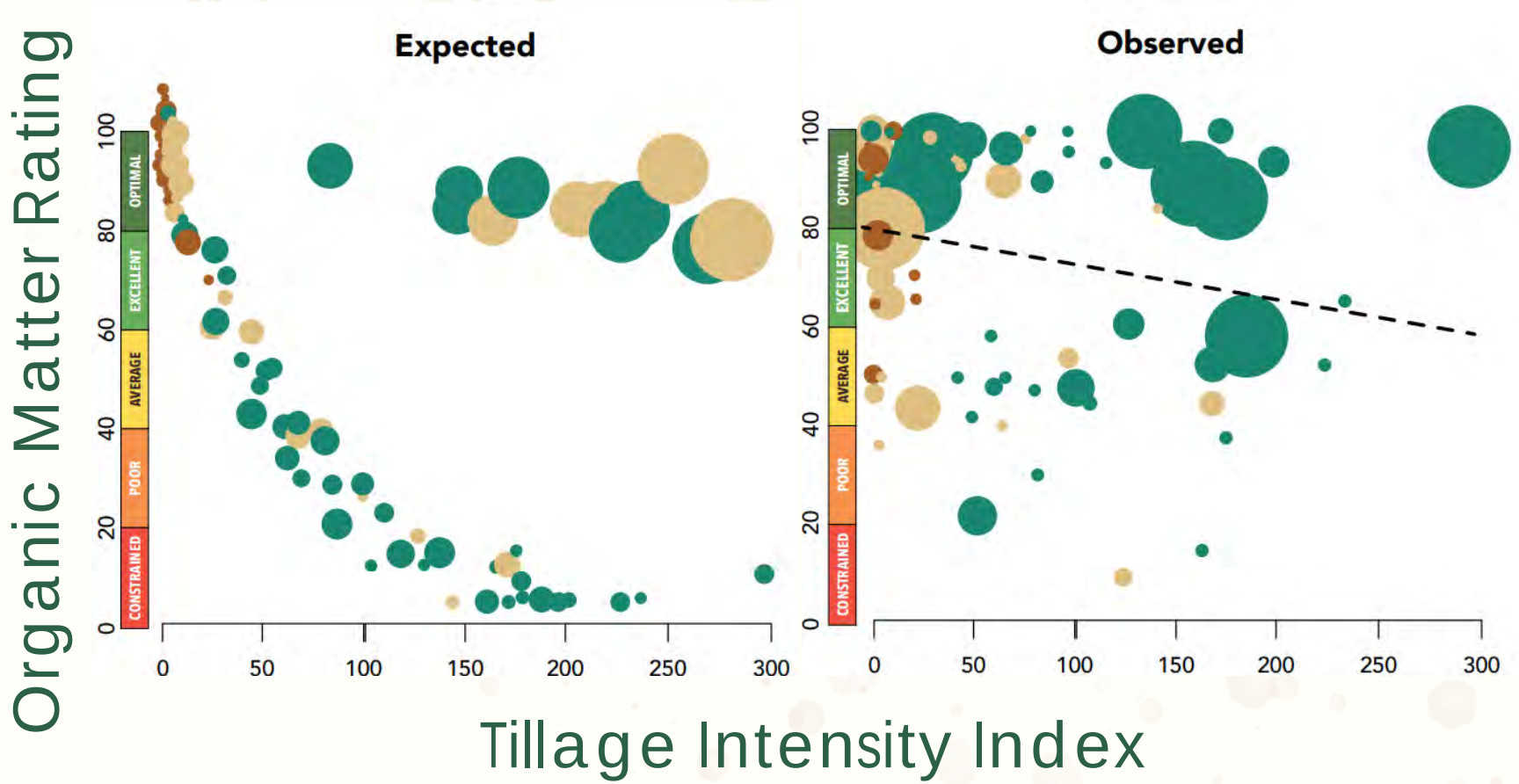
Increase carbon sequestration?

Pasa SUSTAINABLE AGRICULTURE

- Soil samples and field management records collected from over 100 farms in the Mid-Atlantic region
- Run through Cornell's Soil Health Testing protocol to benchmark key indicators of soil health

"Our data indicate it's possible to achieve optimal soil health while still conservatively tilling and cultivating to control weeds and terminate cover crops."

Increase carbon sequestration?



Organic matter inputs

- > 8 tons/ac
- 3 tons/ac
- < 2 tons/ac

Farm type

- Pastured livestock
- Row crop
- Vegetables

Reduce erosion?

4 systems

- Conventional no-till
- Conventional intensive till
- Organic reduce till
- Organic intensive till

Six-year crop rotation

winter wheat – corn – grain legumes (faba beans, peas) – winter wheat – two years of temporary ley

Intensive till - moldboard plow, rotary harrow

Organic Reduce Till - disk, rotary harrow, plane iron (see photo)

"Geohobel," Rath Maschinen

Seitz et al, 2018

Reduce erosion?

Sediment loss in ton/acre/hour during a 2.4 in/hour rain event:

- Conventional no-till – 0.1
- Organic reduce till – 0.3
- Organic intensive till – 0.8
- Conventional intensive till – 1.5

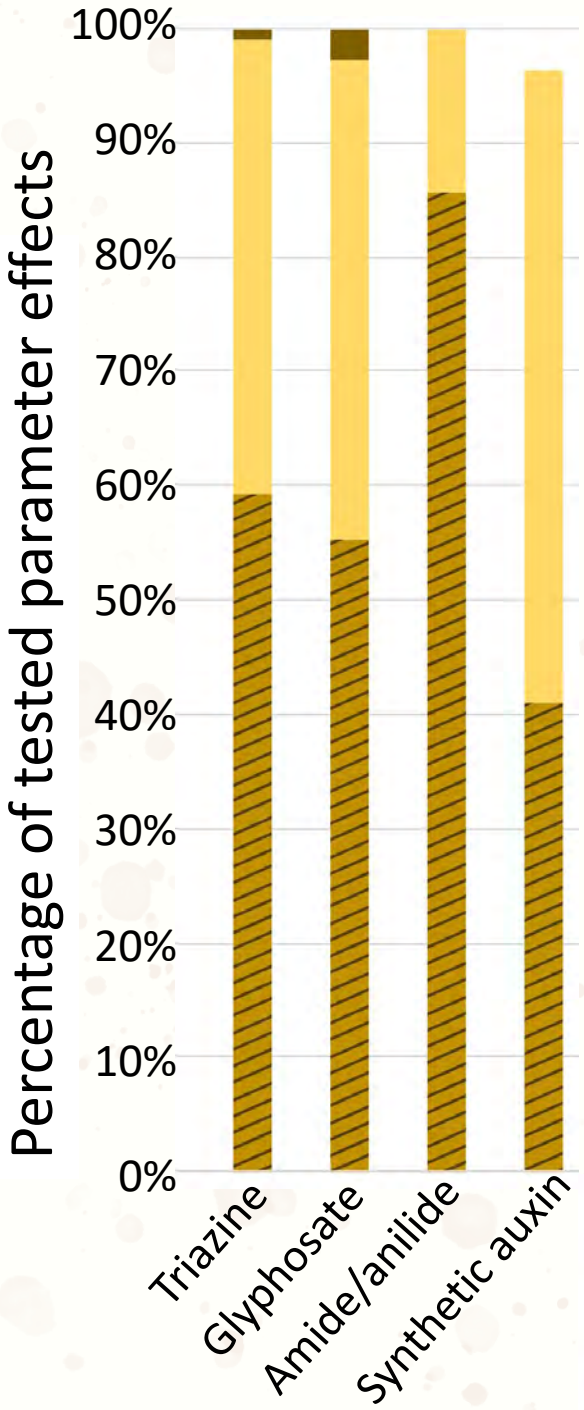
Seitz et al, 2018

"Soil surface cover and soil organic matter were the best predictors for reduced sediment delivery, [...] soil erosion rates were significantly lower when soil cover was above 30%."

Herbicides and Soil Biology

"Soils contain an abundance of biologically diverse organisms that perform many important functions such as nutrient cycling, soil structure maintenance, carbon transformation, and the regulation of pests and diseases."

(Gunstone at al, 2021)



- Mortality
- Abundance
- Biomass
- Behavior
- Reproduction
- Biochemical biomarkers
- Growth
- Richness and diversity
- Structural changes

Agrochemicals, Environmental Racism, and Environmental Justice in U.S. History

by Jayson Maurice Porter | Northwestern University | February 2022

THE ORGANIC CENTER

"**Agrochemical production** left a similar stain on the strip of the Mississippi River between Baton Rouge and New Orleans, known as Cancer Alley.
Due to pollution from nearly thirty chemical manufacturers, **cancer rates for the historically Black communities** in this industrial corridor are fifty times higher than the national average.[22]"

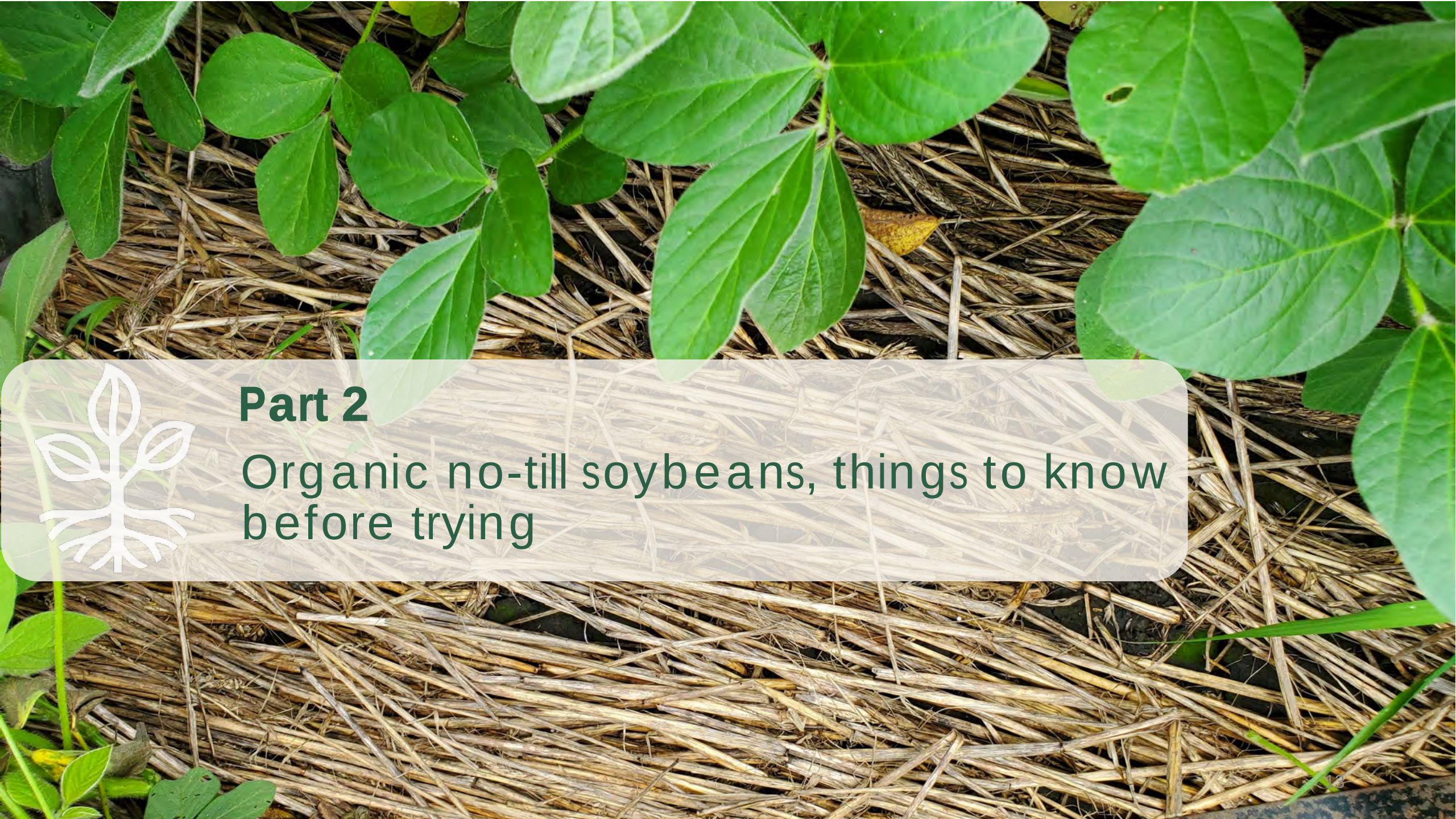
There is tillage and tillage

Tillage Can be Used **Responsibly**

This is NOT an endorsement to till MORE

It's a plea to build a profitable system with all the tools you have so you can continue to work towards tilling LESS

If you are passionate about no-till systems and your operation fails, the community loses innovative minds that want to move the needle closer to fully operational organic no-till.



Part 2

Organic no-till soybeans, things to know before trying

OGRAIN

DAWN EQUIPMENT COMPANY

IOWA STATE UNIVERSITY

ALBERT LEA SEED EST. 1923

WISCONSIN UNIVERSITY OF WISCONSIN–MADISON

McFARLANE MANUFACTURING CO

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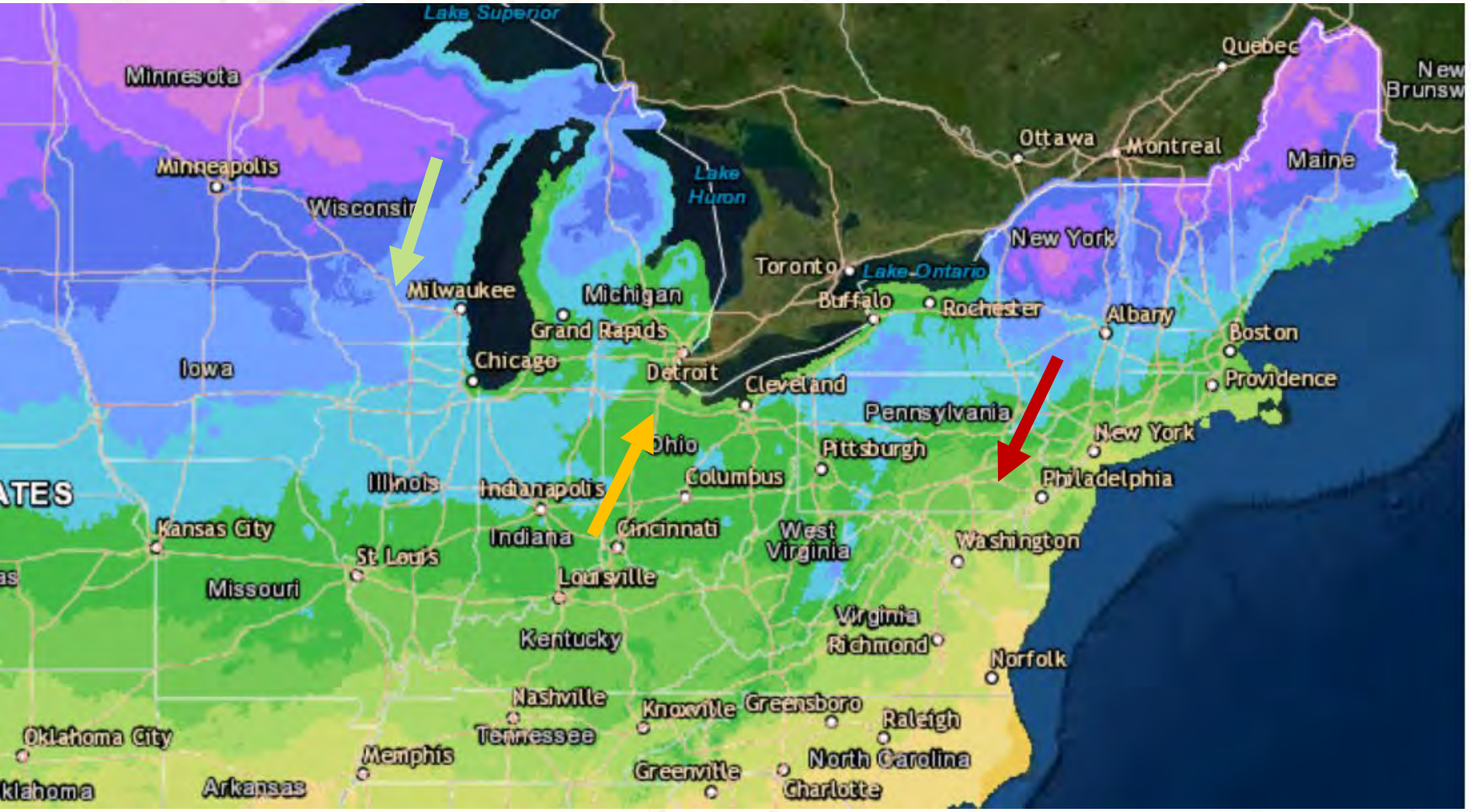
USDA NRCS

Conservation Innovation Grant

- 3 growing seasons (2019 – 2021)
- 2 crops – corn and soybeans
- 9 locations (farms and research stations)

2012 USDA Plant Hardiness Zone Map



- 1b (-55 to -50 °F/-48.3 to -45.6 °C)
- 2a (-50 to -45 °F/-45.6 to -42.8 °C)
- 2b (-45 to -40 °F/-42.8 to -40 °C)
- 3a (-40 to -35 °F/-40 to -37.2 °C)
- 3b (-35 to -30 °F/-37.2 to -34.4 °C)
- 4a (-30 to -25 °F/-34.4 to -31.7 °C)
- 4b (-25 to -20 °F/-31.7 to -28.9 °C)
- 5a (-20 to -15 °F/-28.9 to -26.1 °C)
- 5b (-15 to -10 °F/-26.1 to -23.3 °C)
- 6a (-10 to -5 °F/-23.3 to -20.6 °C)
- 6b (-5 to 0 °F/-20.6 to -17.8 °C)
- 7a (0 to 5 °F/-17.8 to -15 °C)
- 7b (5 to 10 °F/-15 to -12.2 °C)
- 8a (10 to 15 °F/-12.2 to -9.4 °C)
- 8b (15 to 20 °F/-9.4 to -6.7 °C)
- 9a (20 to 25 °F/-6.7 to -3.9 °C)
- 9b (25 to 30 °F/-3.9 to -1.1 °C)

No-till soybeans

Sept 20 – Oct 1
Plant rye

Mid-March
Rye stand assessment

Sep | Oct | Nov | Dec

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct

May 30 – June 5
Crimp rye
and plant
soybeans

Mid-Late October
Harvest

Optimize rye biomass production

Seeding date and rate

No later than October 1st

2-3million seeds/ac

Fertility

Nitrogen deficiency at seeding will result in poor tillering = less biomass

Seed bed preparation and seeding equipment

Preapare seed-bed like you would for a crop

Drill or broadcast followed by shallow incorporation


1


2

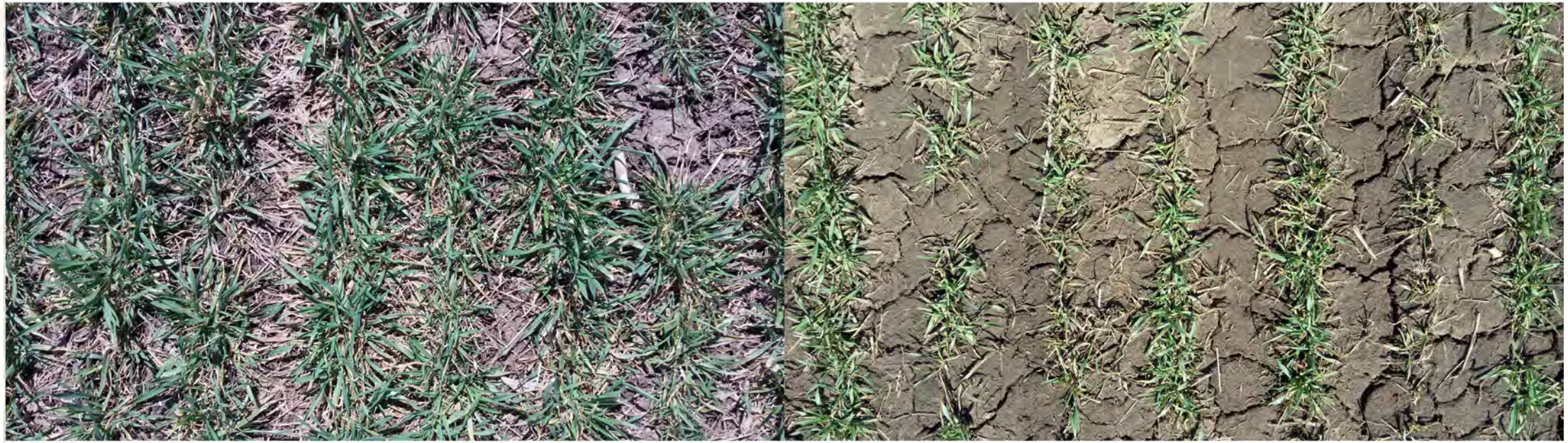

3


4

Triticale NE426GT
September 15th

Planting date

October 2nd



Rye Spooner
September 15th

Planting date

October 2nd

Same field, Same day

Adequate rye termination

Wait for 100% anthesis

Avoid Variety Non-Stated (VNS)

DAWN

I & J mfg.

McFARLANE AG MANUFACTURING

Get the blue-prints for free!

Are you thinking about implementing roller crimping and other no-till organic practices to protect soil health on your farm? Bring these blueprints to any local manufacturer (or build your own!) to get started.

Complete the form below to get the guide.

Name

First

Last

Email *

Zip Code *

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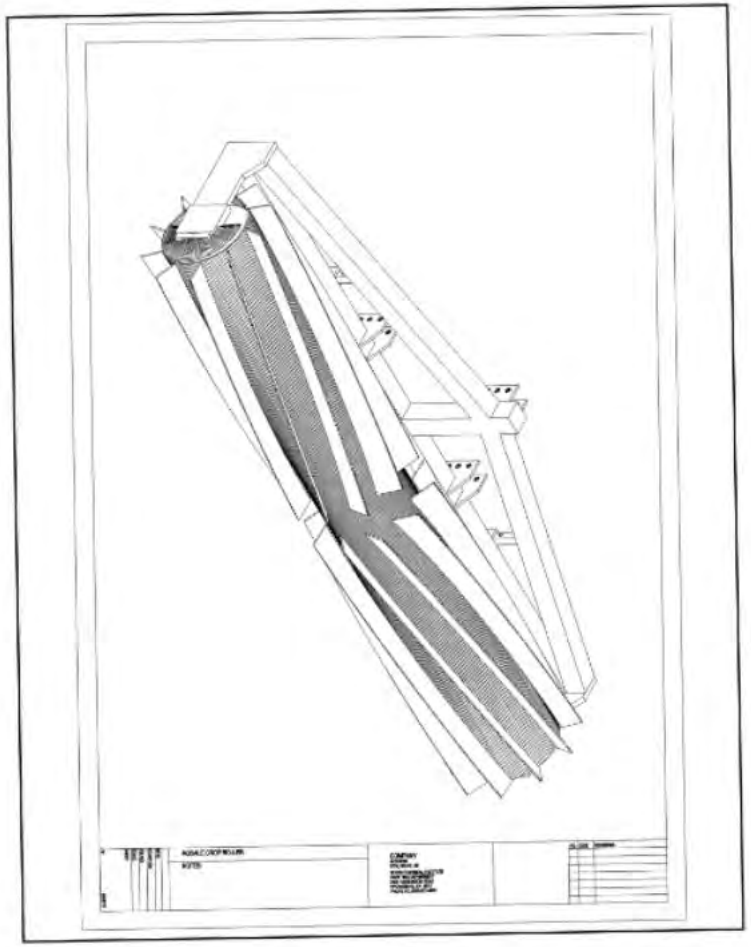

Soybean planting

- Seeding rate: 180-225k seeds/ac
- Seeding depth: in moisture, no deeper than
- Variety: need more research

In WI: successful with 1.7RM vs. 2.0 RM recommended

Soybean Planting

Planter set-up

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(1) Closing wheels

Rubber vs.

Dawn curvetine

Yetter paddle

Martin spiked

Dawn RCX

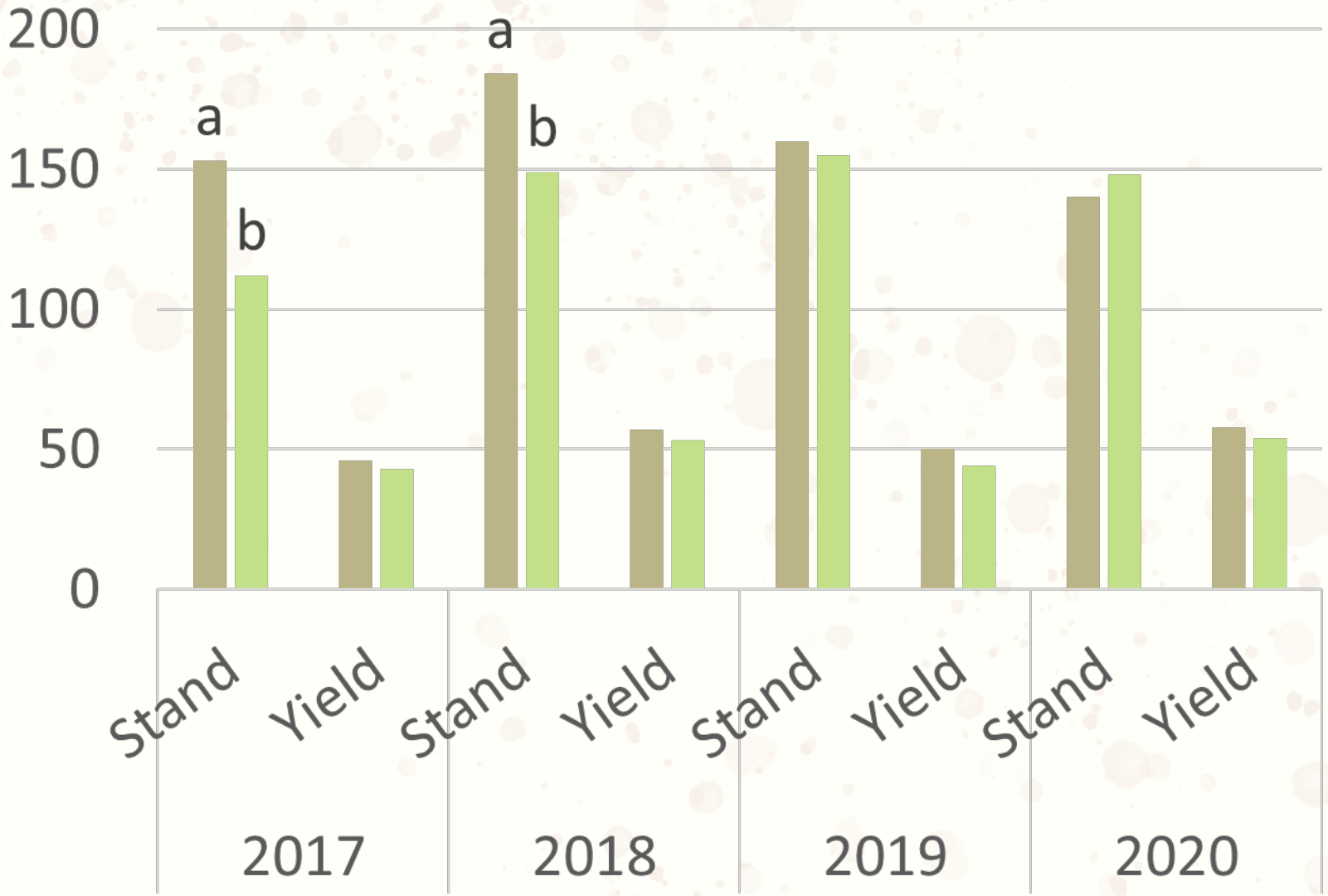
(2) Down pressure – High - 300 lbs vs. Low – 150 lbs

(3) Coulter – fluted coulter vs. no coulter

Plan B, C, D etc.

- Plow down, preferably at or before 12-15” high, late April
- Harvest for ryelage and till
- Keep for rye seed/ grain
- High residue cultivator
- Weed zapper
- Etc.

Wisconsin results 2017-2020



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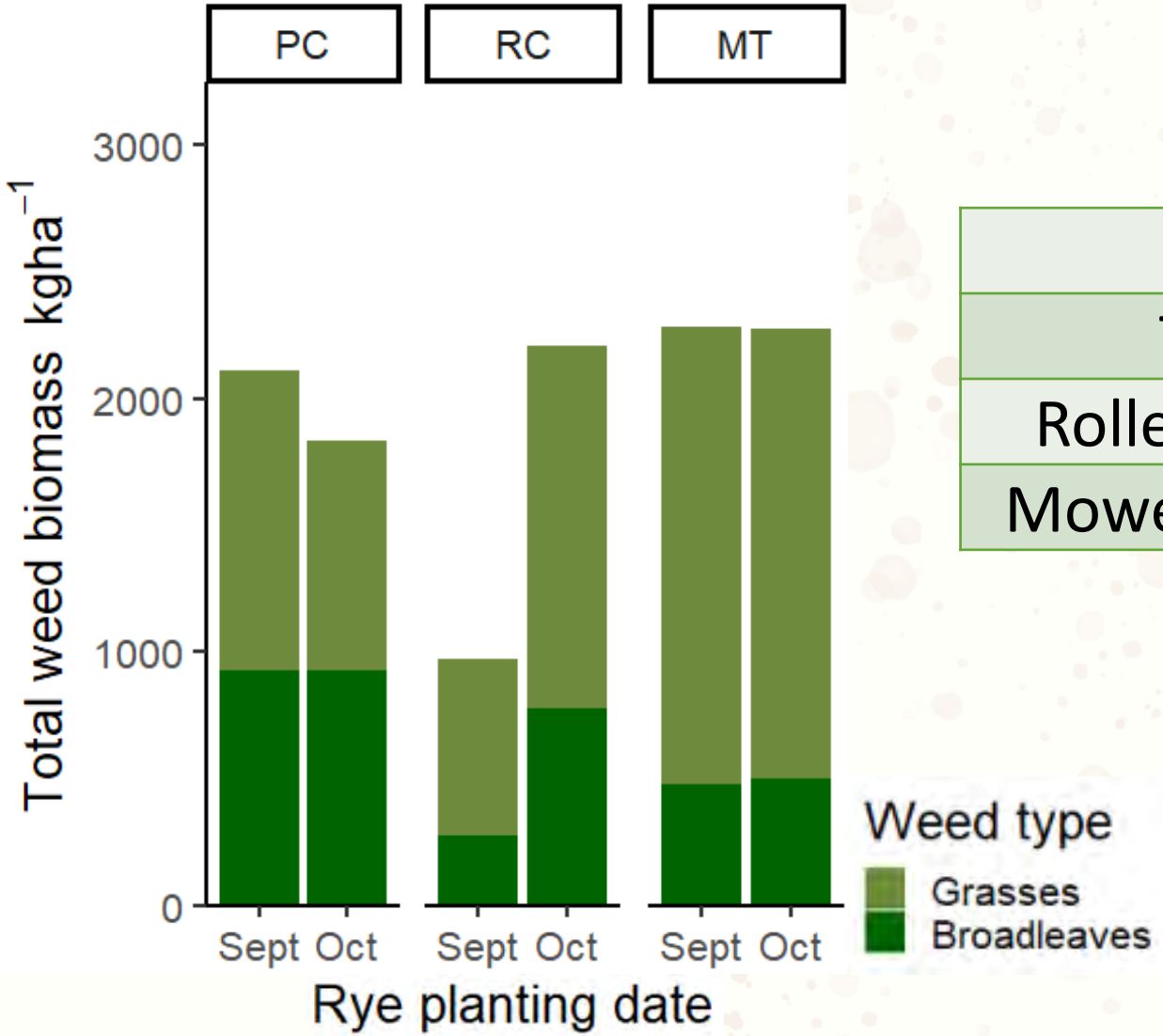
Tilled

No-tilled

What about mowing?



	2019	2020	2021
Tilled	51 a	23 b	35 b
Roller crimper	29 b	48 a	51 a
Mower + tedder	25 b	37 a	42 ab

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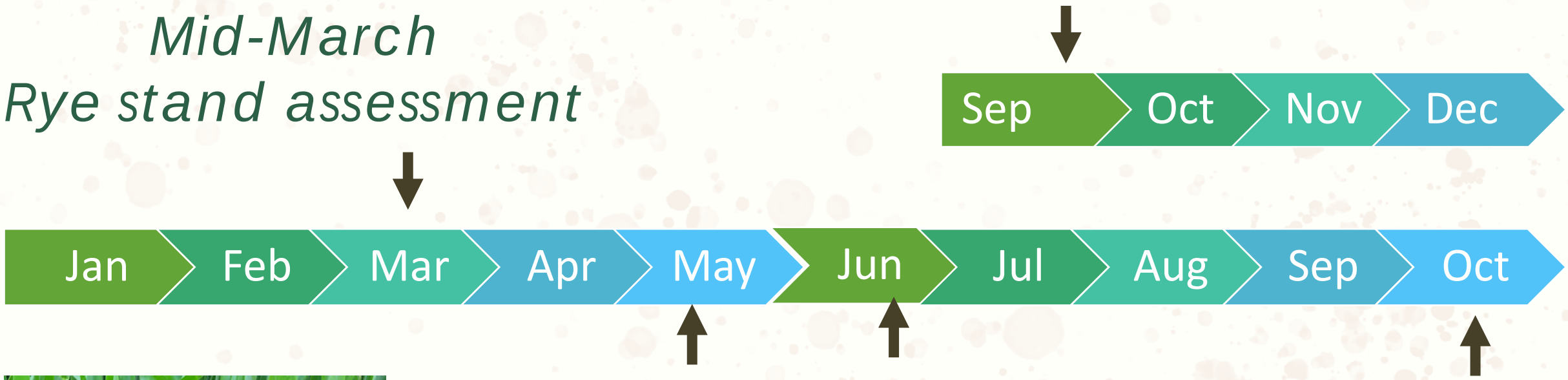
July 6

July 13

Planting green

Sept 20 – Oct 1
Rye planting

Mid-March
Rye stand assessment

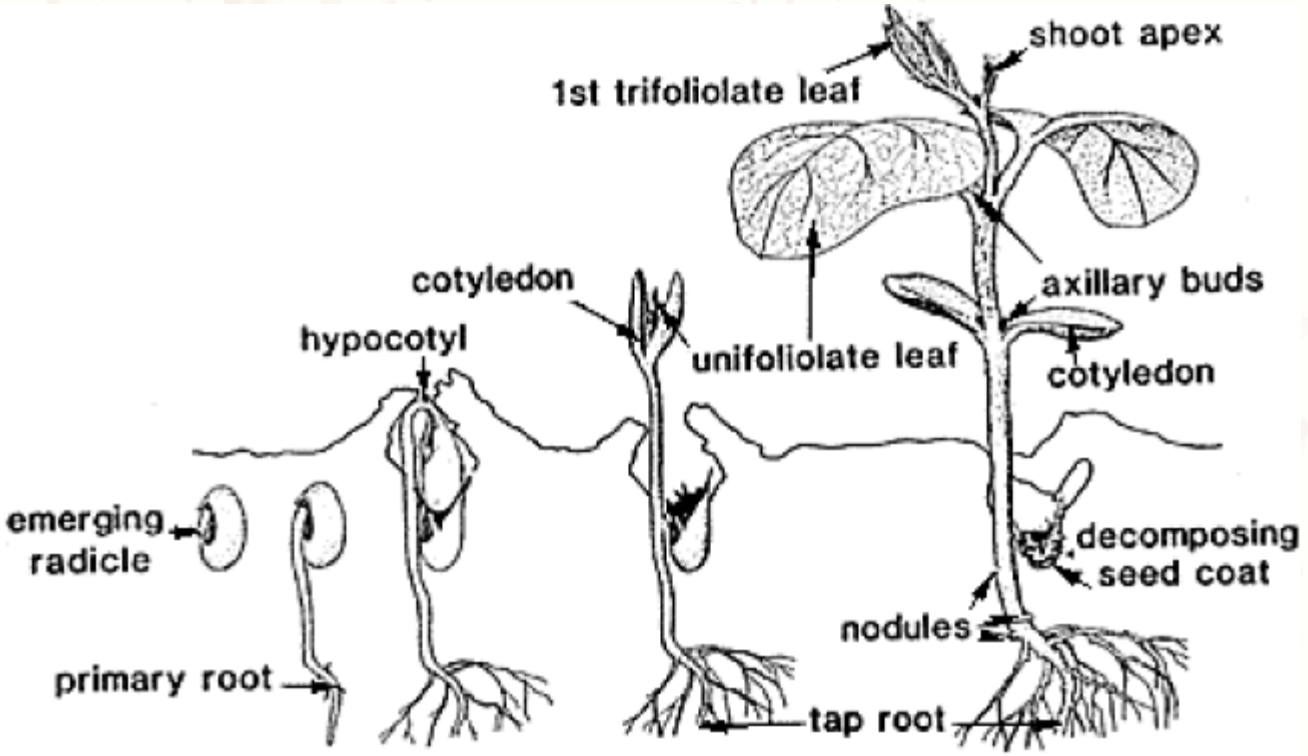


May 10 – 25
Plant
soybeans

May 30 –
June 5
Crimp rye

Mid-Late October
Harvest

Unifoliate unfolded or VC stage



Wisconsin results 2017-2020

	2017		2018		2019		2020	
	Stand	Yield	Stand	Yield	Stand	Yield	Stand	Yield
Boot stage	77 b	30 b	125	48	141	35 b	166	58
Anthesis	112 a	43 a	149	53	155	44 a	148 *	54
		-13		-5		-9		+4

203 before rolling

2017: May 12 – June 1

2018: May 24 – June 6

2019: May 15 – June 5

2020: May 15 – June 2

* Skip row

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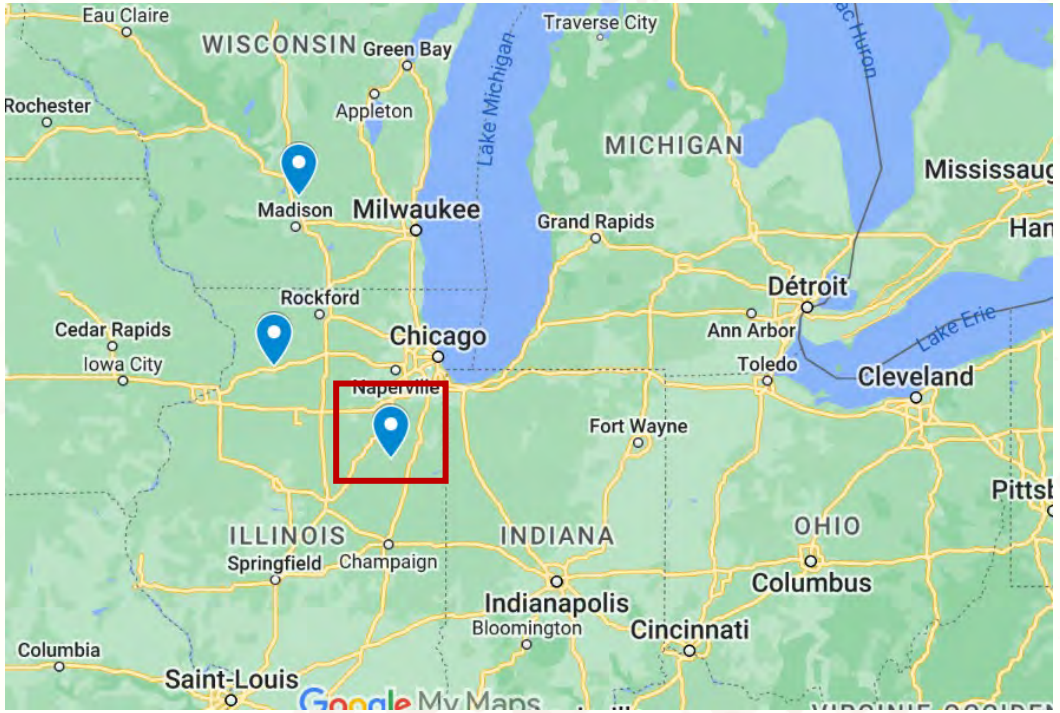
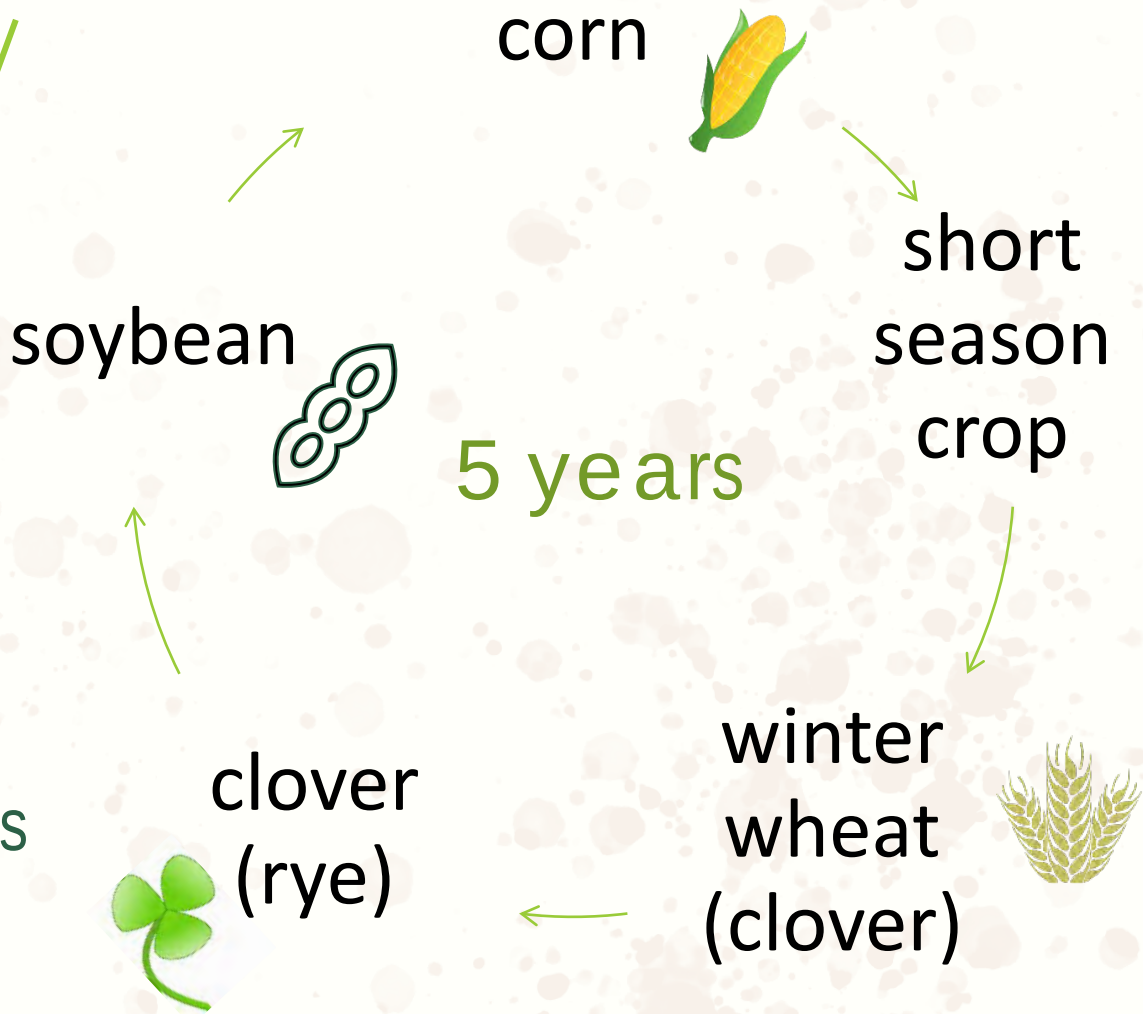
On farm trials 2022

Rye stage at soybean seeding	Rye seeding rate in million of seeds per acre			
	1.5	2.25		3.0
Anthesis	55	53 (plant)	57 (drill)	54
Boot		54 (full)	53 (skip row)	



Short season crops: peas, oats, sunflower, buckwheat, millet etc.



Avoid

- Corn before soybeans
- Winter wheat after soybeans
- Winter wheat after corn

Part 3

Organic no-till corn, food for thoughts

Cover Crops

- Biomass quantity and quality
- Flowering time
- Crop nutrient needs
- Pest and diseases
- “Crimpability”

Rye

Chickling Vetch

Peas

Crimson clover

Hairy vetch

Trials conducted in Wisconsin

Annual covers

Spring

- Peas
- Chickling vetch
- Buckwheat and clover

Fall

- Rye
- Winter peas
- Chickling vetch
- Crimson clover

Perennial covers

- Red clover

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Nutrients, pests and diseases

- Army worm (picture of the caterpillar and the moth)
- Cut worm

Couvert Culture

- Nitrogen needs of the crop and the cover
  - Legumes: low
  - Other dicots: medium
  - Grasses: high

Biomass quantity and quality

- 8,000 lbs of dry matter per acre for soybeans

Red clover, chickling vetch – 6,000lbs

Pea, chickling vetch – 4,000lbs

- Hard to find

Winter hardy cover crops

Spring covers which compete well against weeds

Vicia faba.
Fava bean

Mineralization: nitrogen is released for plant uptake

Immobilization: microbes utilize and tie up nitrogen

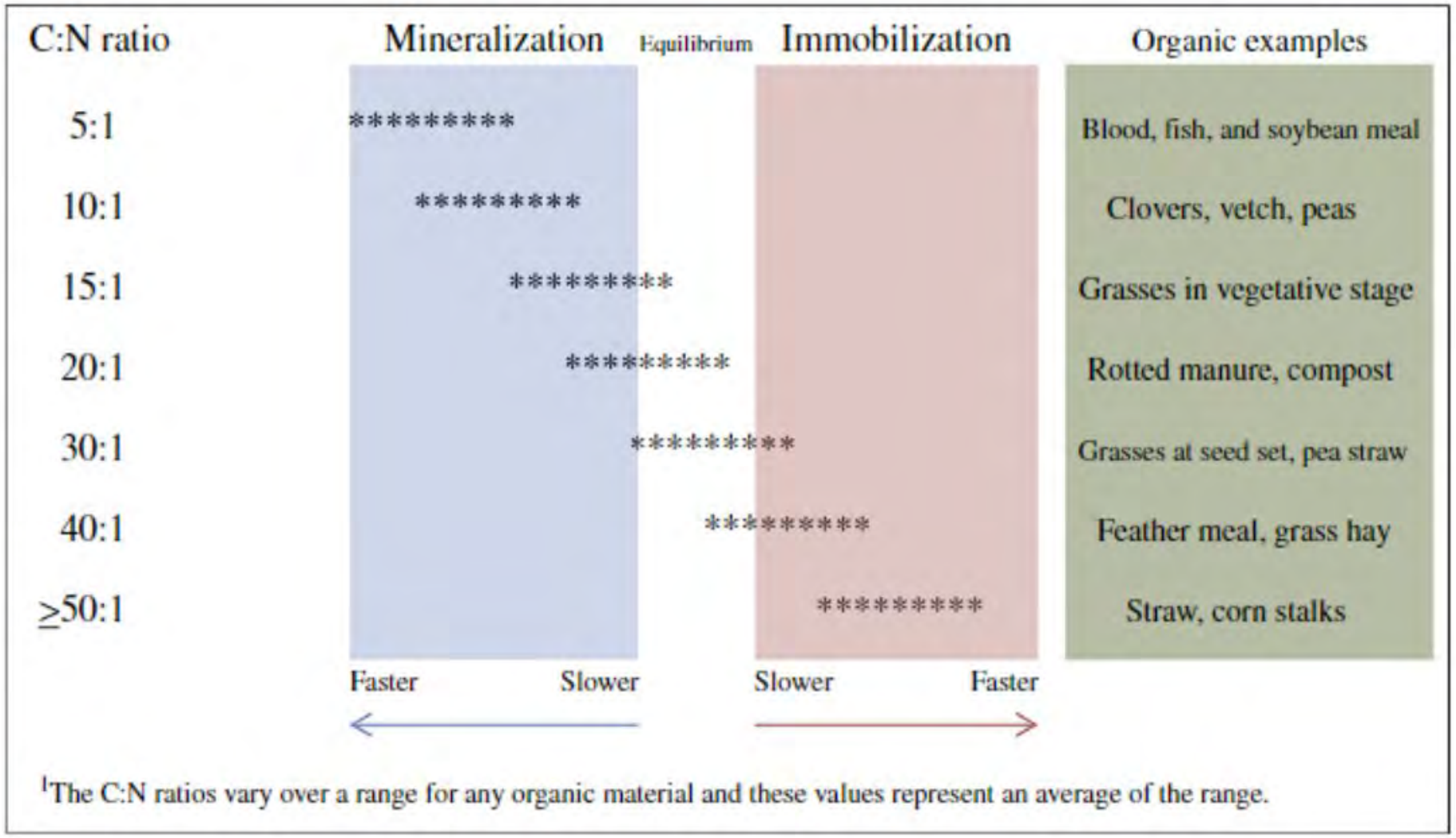

FIG. 1 The C:N ratio of some organic material and their mineralization and immobilization rates.

Source - Management Strategies for Organic Vegetable Fertility, Gerald E. Brust, 2019

Soybean: May 20 – June 5

Corn: May 15-30

Recommended planting dates in bare ground

May 15

May 30

June 15

June 30

Crimson clover

Rye

Buckwheat

Hairy vetch

Chickling vetch

Pea

Approximate flowering dates

“Crimpability”

- **Perennial covers**: will not be terminated with a roller crimper
- **Grasses**: rye and triticale are great candidates, wheat not as much
- **Legumes**:
  - Hairy vetch, most documented species
  - Crimson and Balansa clover, potential candidates, need more studies
  - Peas et chickling vetch, poor candidates
- **Other monocot.**: buckwheat, tillers under the break point

Perennial Covers

- Best place in the rotation is after small grain. Weediness of the field after grain harvest?
- No time constraint (flowering) except for soil temperature
- Need for cover management before and after crop seeding is unclear




Take away

- Rye + hairy vetch mix remains the highest success

- Corn stand, seeding rate 38k seed per acre

Min 0 – Av 22 – Max 36

- Corn yield (bu/ac)

Min 0 – Moy 55 – Max 77

Questions?

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