ORGANIC NO-TILL ROW CROP PRODUCTION

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A CATALYST FOR CHANGE

Rodale Institute is a **501(C)(3) nonprofit** which has been dedicated to advancing **regenerative organic agriculture** for over 75 years through **research, education and outreach.**

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RESEARCH

2

EDUCATION

3

CONSULTING

RODALE INSTITUTE RESEARCH

THE FARMING SYSTEM TRIAL KUTZTOWN, PA

ORGANIC MANURE

Represents an **organic dairy or beef operation**. Featuring long rotation including both annual feed grain crops and perennial forage crops. Fertility is provided by leguminous cover crops and composed manure.

ORGANIC LEGUME

Represents an **organic cash grain farming**. Featuring a mid-length rotation of annual grain crops and cover crops. Fertility is provided by leguminous cash and cover crops. Rotations provide defense against pests.

CONVENTIONAL SYNTHETICS

Represents the **majority of grain farms in the U.S**. Relies on synthetic nitrogen for fertility, weeds are controlled by synthetic herbicides applied at rates recommended by Penn State Univ. Cooperative Extension.

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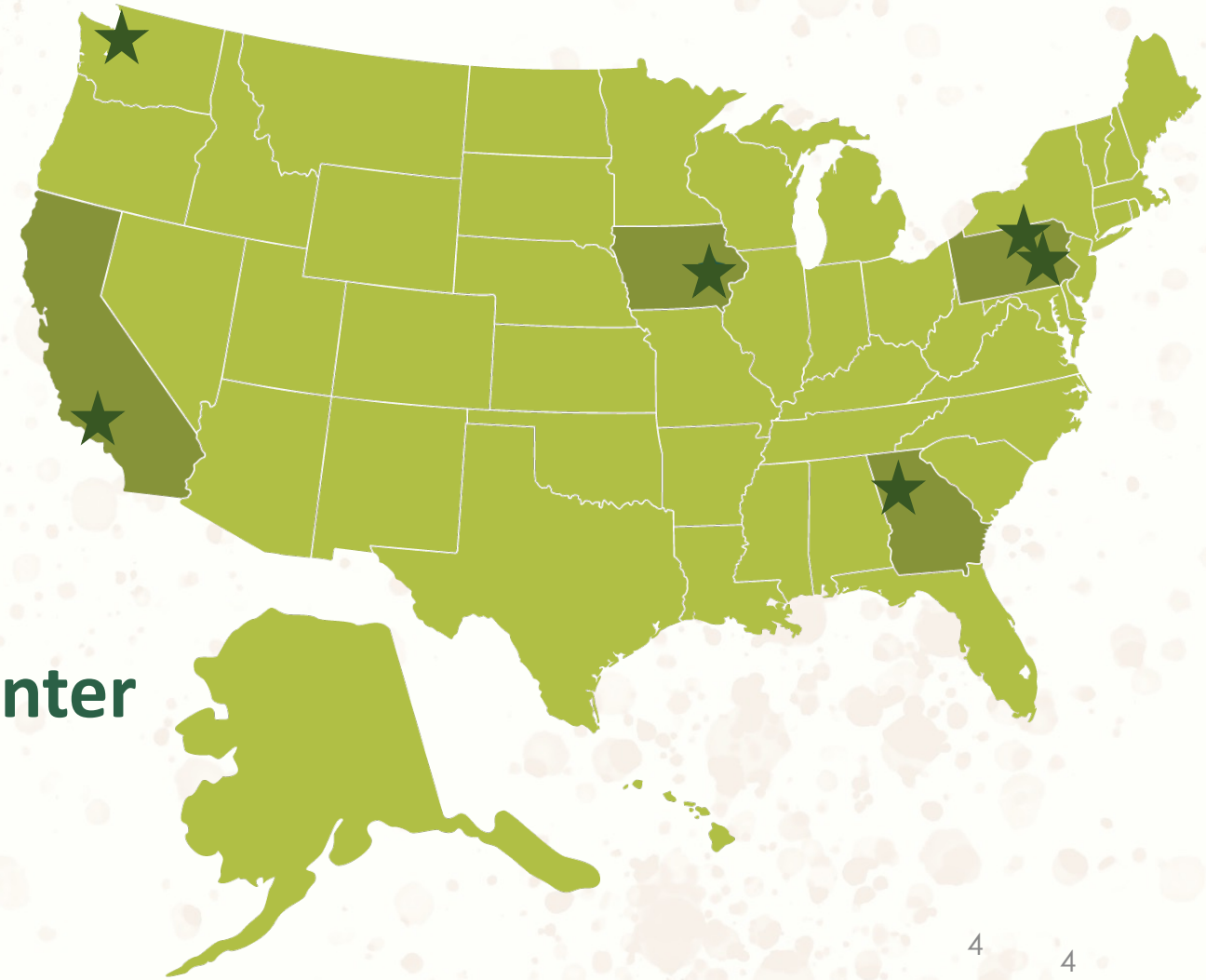

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Webinars from Rodale Institute give you firsthand access to our staff and research, no matter where you're located.

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Receive hands-on & classroom education through one of our training programs – specializing in organic vegetable production, livestock, beekeeping, and more.

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Attend an event at one of our campuses to learn about regenerative organic agriculture & meet our expert scientists/farmers.

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Let the Rodale Institute be your teacher — wherever you are in the world! Join us for virtual farm and garden trainings with our expert staff.

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Looking for more info to jumpstart your regenerative organic journey? Whether you need farm funding resources or composting basics, our website has you covered.

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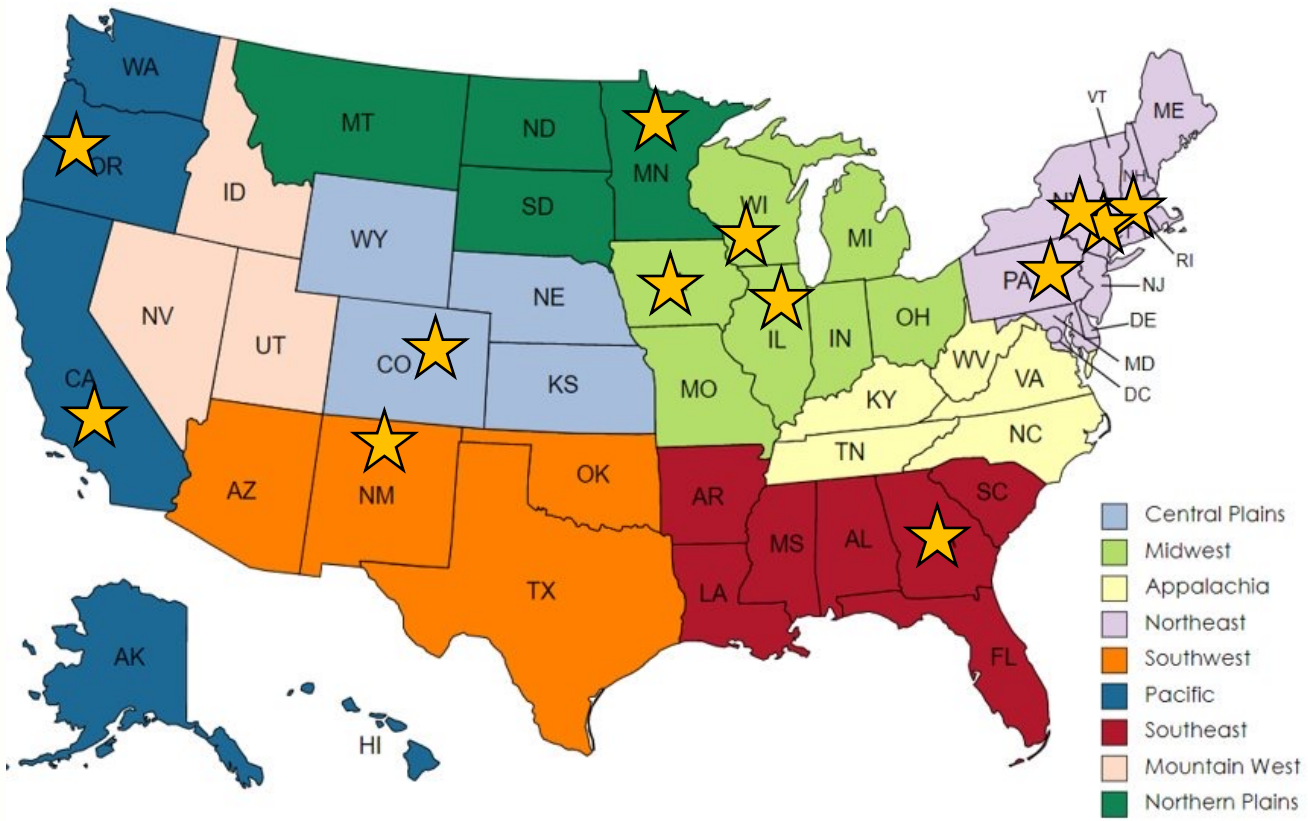

Our consultants have experience with **different crops, soils and climates** throughout the U.S. and are here to work with you **wherever** you are located.

When you contact us, we'll discuss your needs and find a solution that is **right for you.**

RODALE INSTITUTE CONSULTING SERVICES

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Weed-management

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Farmer-led-research

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Inputs-and-fertility

Networking

EACH FARM IS UNIQUE

There is **no one-size-fits-all** in farming. What works for others may not work for you. The **trial-and-error learning curve** can be smoothed out by collecting relevant information but can not be erased completely.

Keeps it fun, doesn't it?

ORGANIC NO-TILL SYSTEM
KEY COMPONENTS

(1) COVER CROPS

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

Rye

Chickling Vetch

Peas

Crimson clover

Hairy vetch

ORGANIC NO-TILL SYSTEM
KEY COMPONENTS

(2) ROLLER CRIMPER

DAWN

I & J mfg.

McFARLANE AG MANUFACTURING

This is not an endorsement by Rodale Institute; nor is this list exhaustive

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 *

GET PDF

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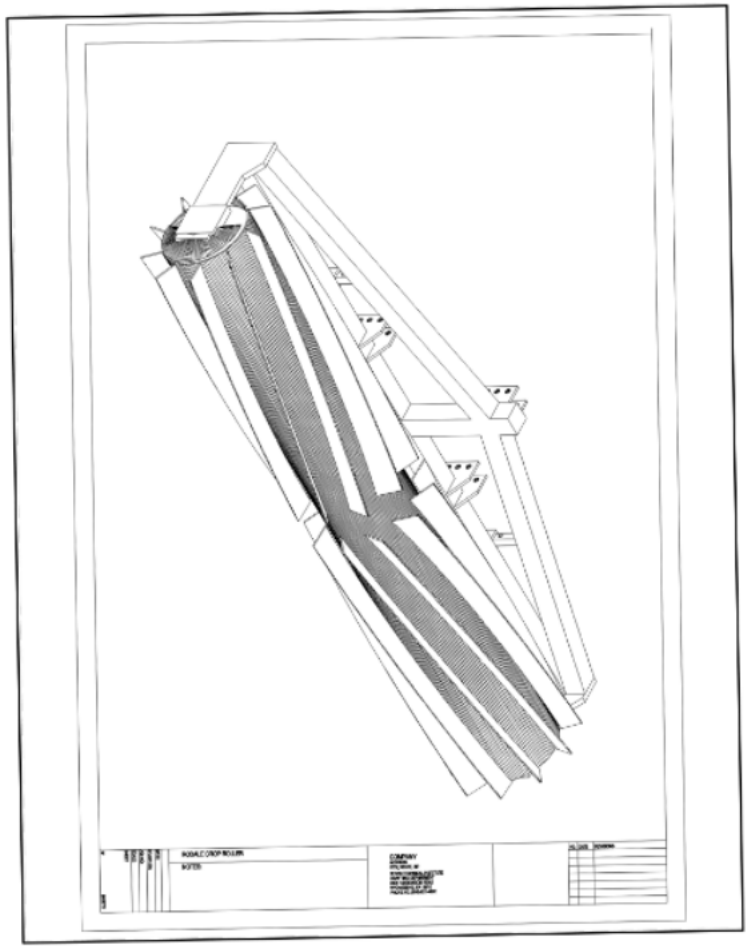
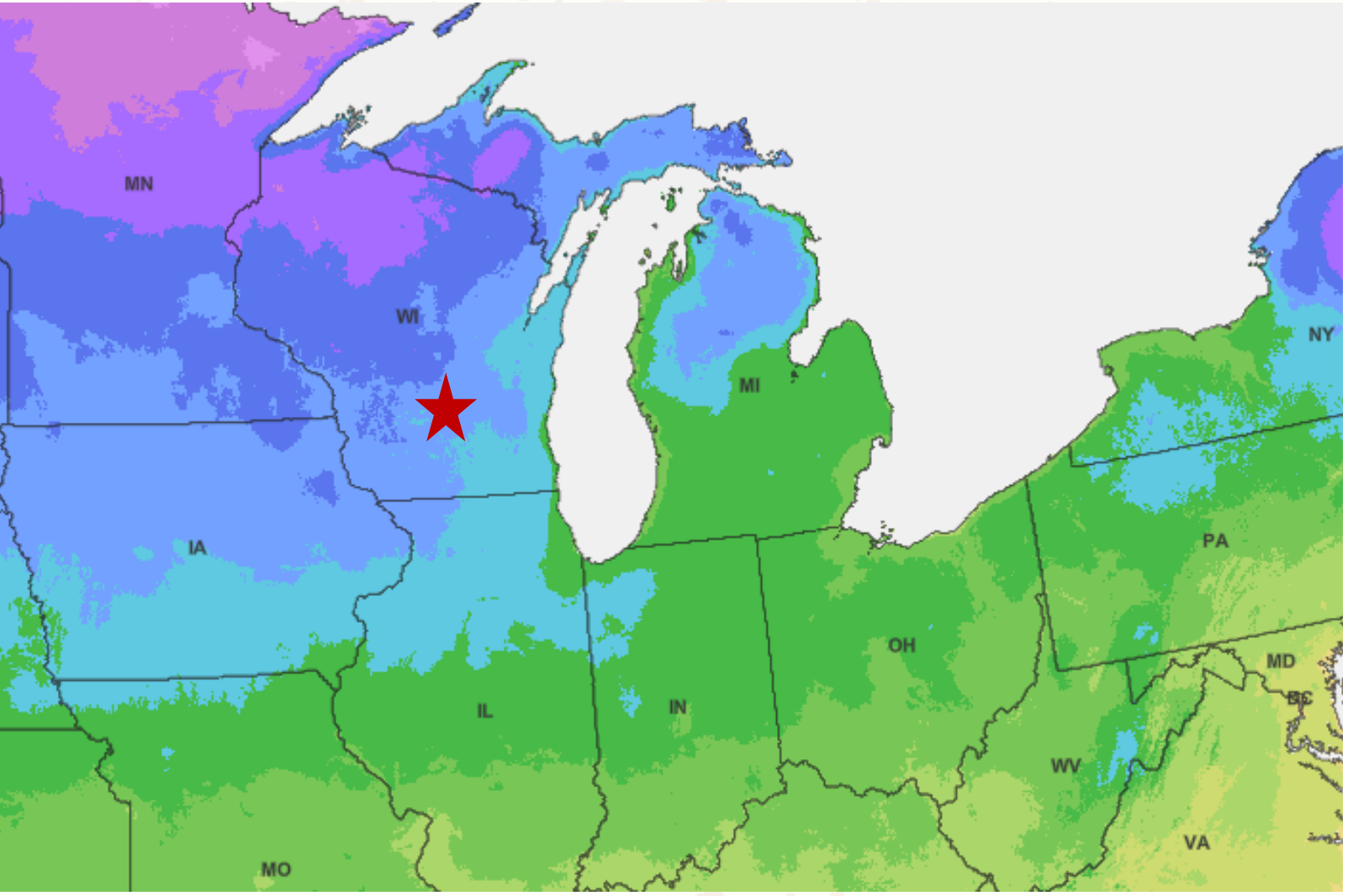



NEW HOLLAND

2023 USDA PLANT HARDINESS ZONES

(average annual extreme minimum winter temperature)



- 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)

ORGANIC NO-TILL SOYBEANS

Mid-March
Rye stand
assessment

Sept 20 – Oct 1
Plant rye

Sep | Oct | Nov | Dec

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

~ June 1
Crimp rye
and plant soybeans

Mid-Late
October
Harvest

RYE SEEDING RATE X VARIETY TRIAL

A comparison of **4 rye varieties** planted at **3 different seeding rates** on rye biomass production potential and lodging.

Rye Varieties	**Rye Seeding Rates**
1. Aroostook	1. 1,500,000 seeds/ac
2. ND Gardener	2. 2,250,000 seeds/ac
3. Spooner	3. 3,000,000 seeds/ac
4. Danko	

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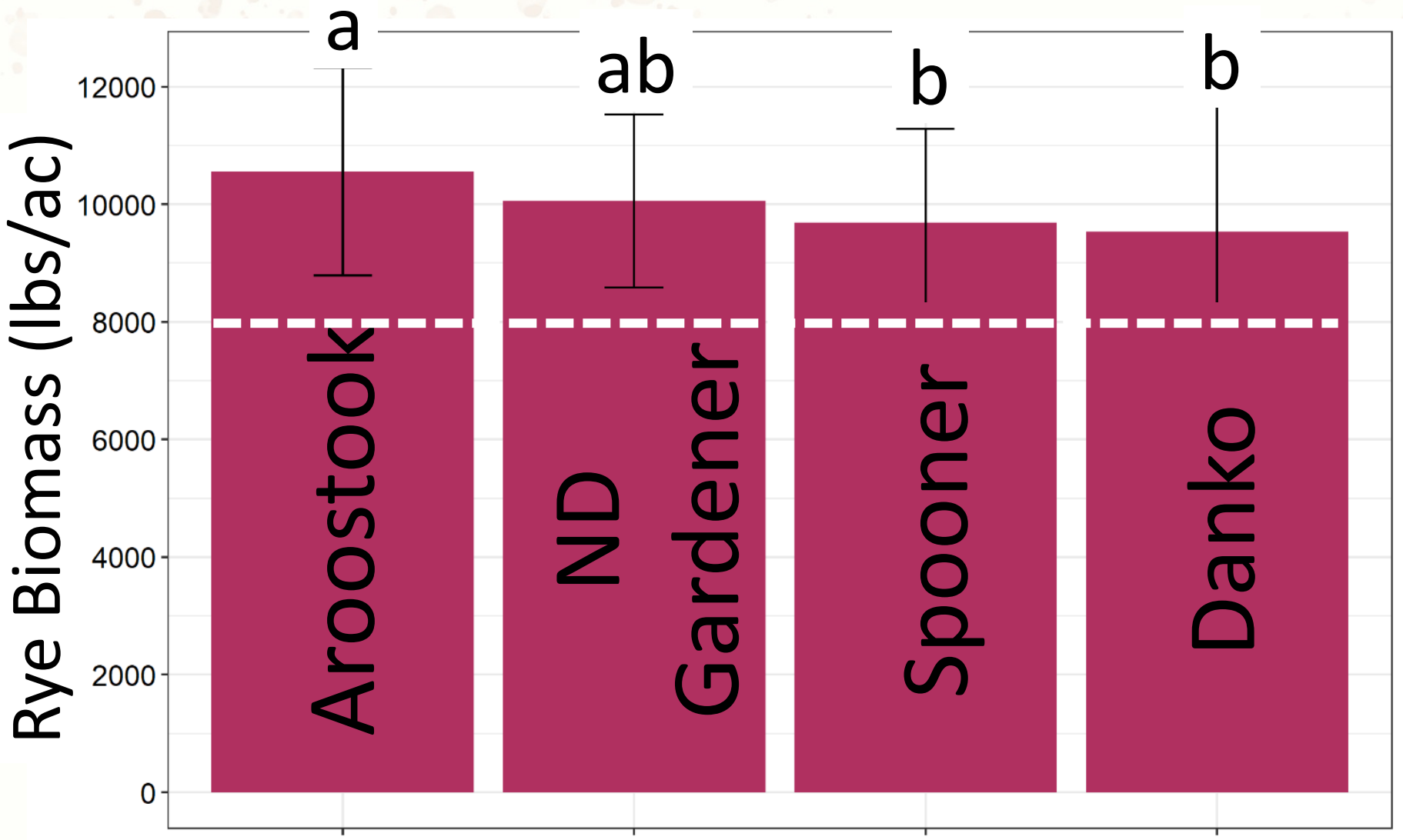
RYE: SEEDS VS. POUNDS PER ACRE

Seeds/lb	Seeds/ac: 1,500,000	2,250,000	3,000,000	lbs/ac
14,510	103	155	207	
14,982	100	150	200	
15,345	98	147	196	
18,508	81	122	162	
20,500	73	110	146	
22,102	68	102	136	

Rye biomass production at anthesis for 4 rye varieties measured at Arlington, WI, 2021-2022



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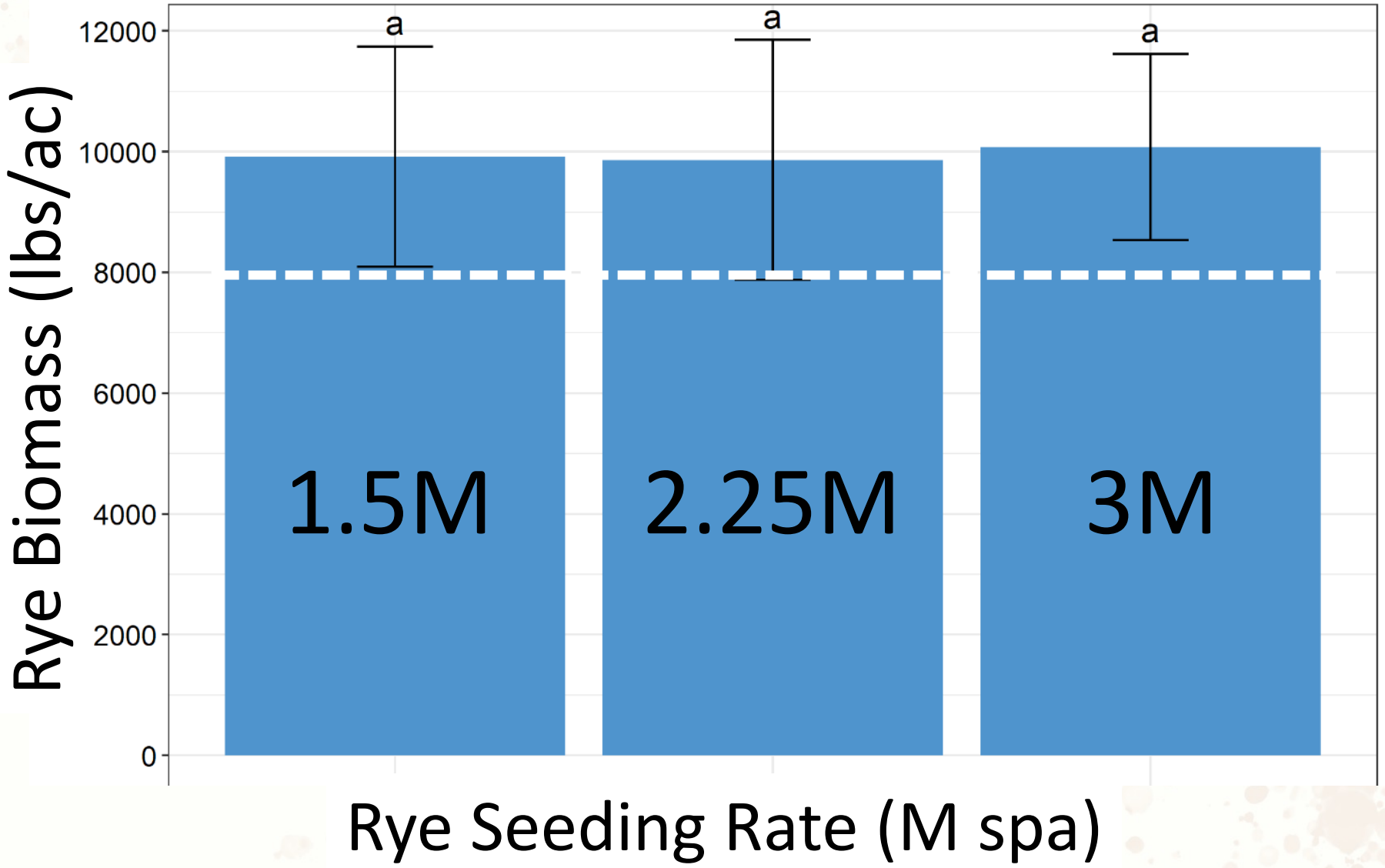
Rye biomass production at anthesis for 3 rye seeding rates measured at Arlington, WI, 2021-2022



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OPTIMIZE RYE BIOMASS PRODUCTION

- ✓ **Seed early -** no later than October 1st.
- ✓ **Seed heavy -** at least 1.5M seed/ac.
- ✓ **Provide fertility -** nitrogen deficiency in the fall will result in poor tillering = less biomass.
- ✓ **Prepare seed bed –** no-till seeding of the rye can lead to uneven stands.
- ✓ **Use proper equipment –** drill, or broadcast followed by shallow incorporation (e.g. VT tool).

RYE STAND ASSESSMENT
LATE MARCH TO EARLY APRIL

Chris Wilson's rule of thumb, Wilson Organic Dairy, Platteville, WI

- **80% or more** canopy cover is a go even if there is a few weeds.
- **50-80%** is only a go if there are no weeds.
- **below 50%** is a no-go.

CEREAL RYE BIOLOGY

Dual induction requirement for flowering

- **primary induction = vernalization =** requirement for low temperature initiate inflorescence primordia (**required** but **invisible** to the naked eye)

- **secondary induction** requirement for **long-day** allowing for stem elongation, inflorescence development and anthesis.

Illustration:
Katja Koehler-Cole, UNL

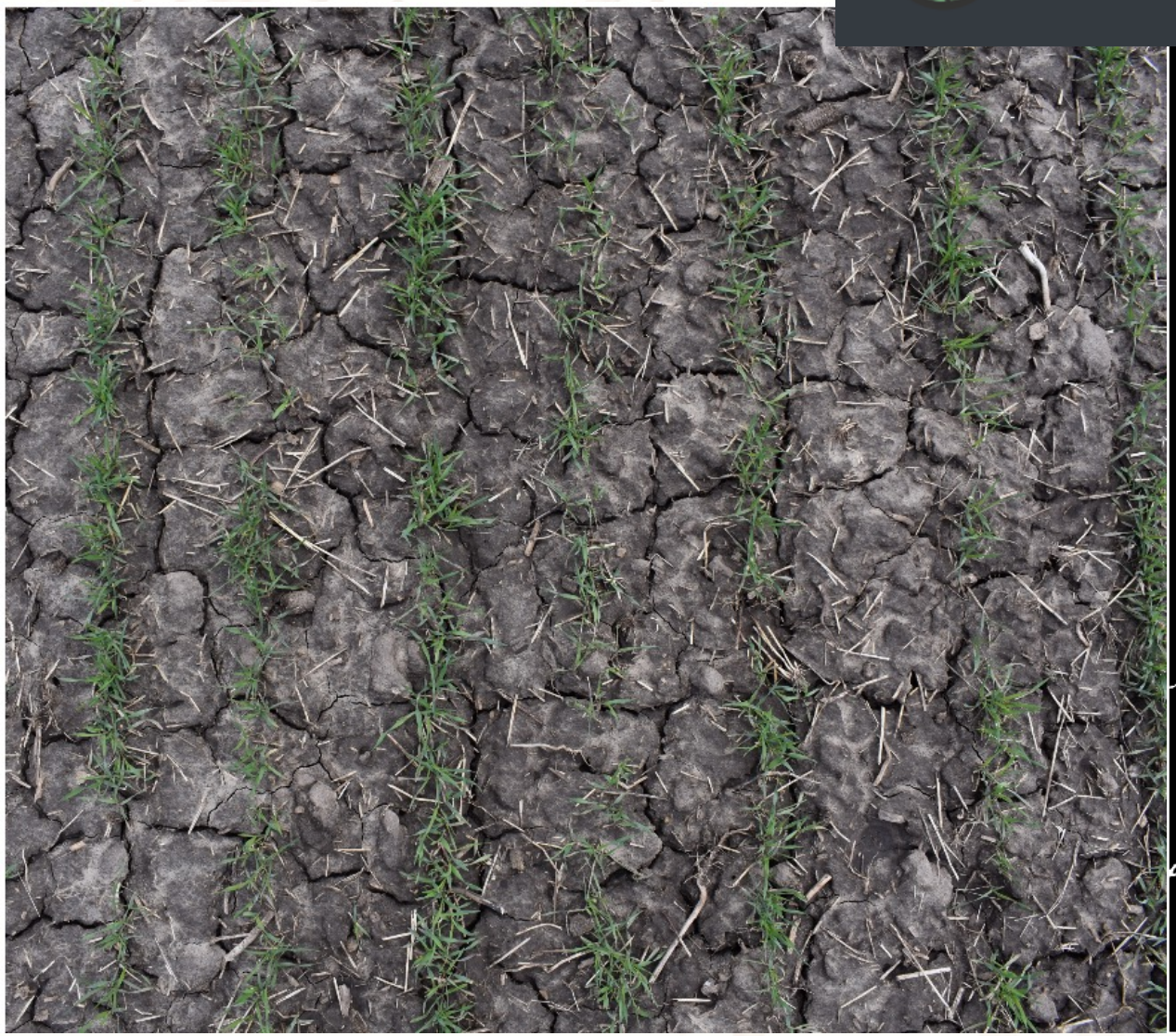
CEREAL RYE BIOLOGY

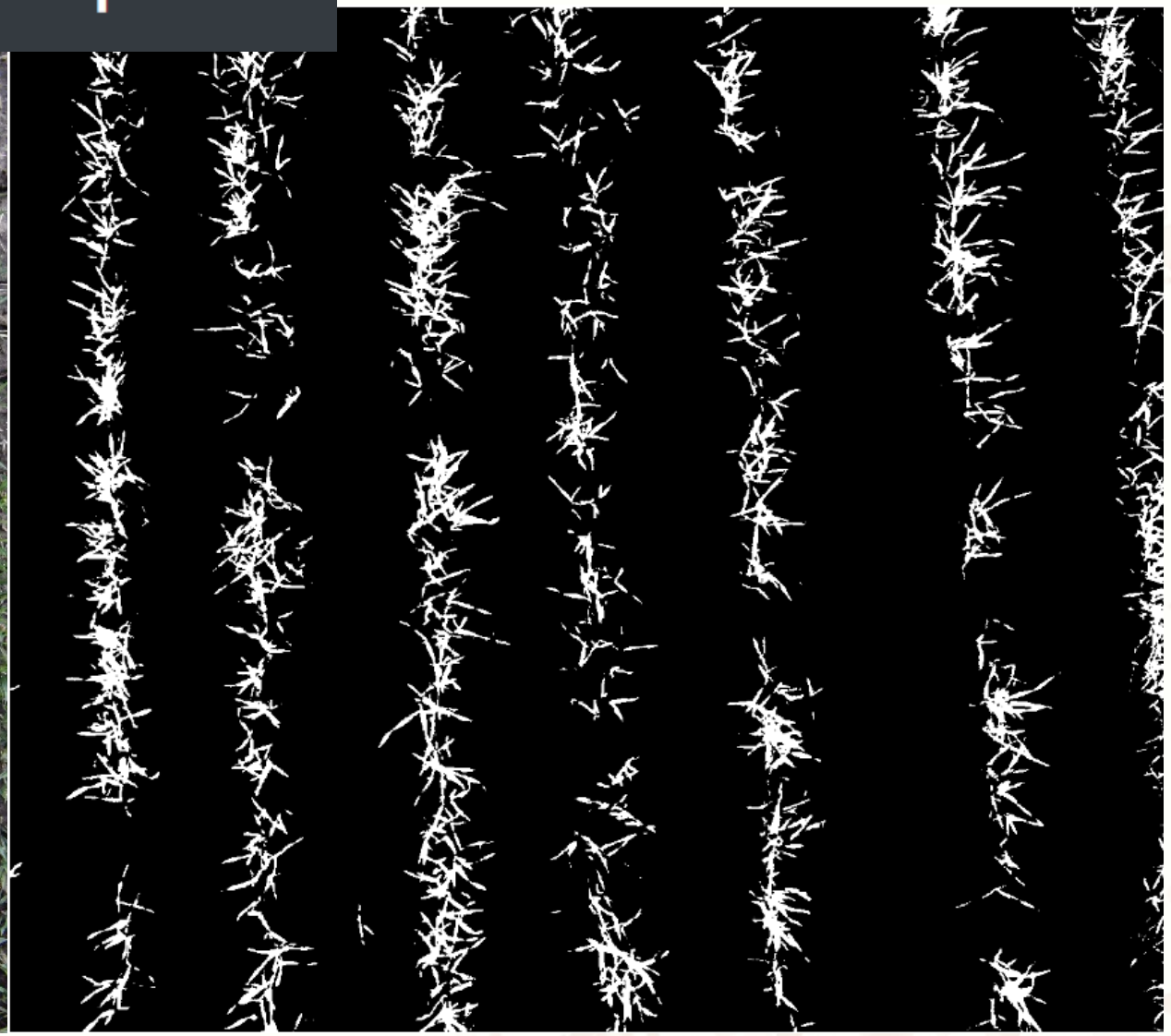
Indianapolis, IN		Madison, WI	
May 1	13h 56m	April 25	13h 55m
May 2	13h 59m	April 26	13h 58m
May 3	14h 1m	April 27	14h 0m

Average low above 40F and average high above 60F.

Secondary induction requires “14 hours of daylight accompanied by temperatures of 40 to 50 degrees F (Stoskopf, 1985)”

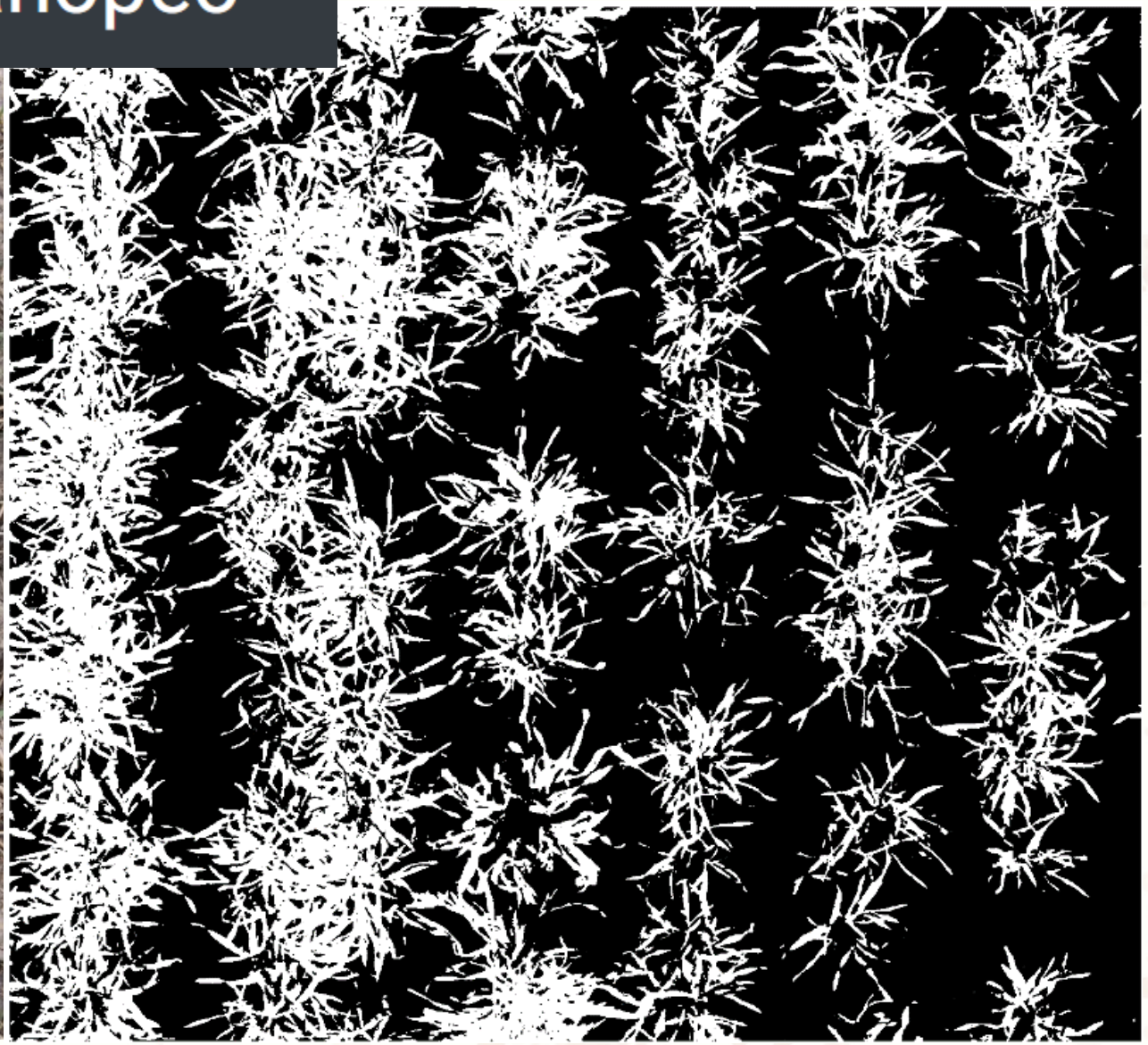
Canopeo





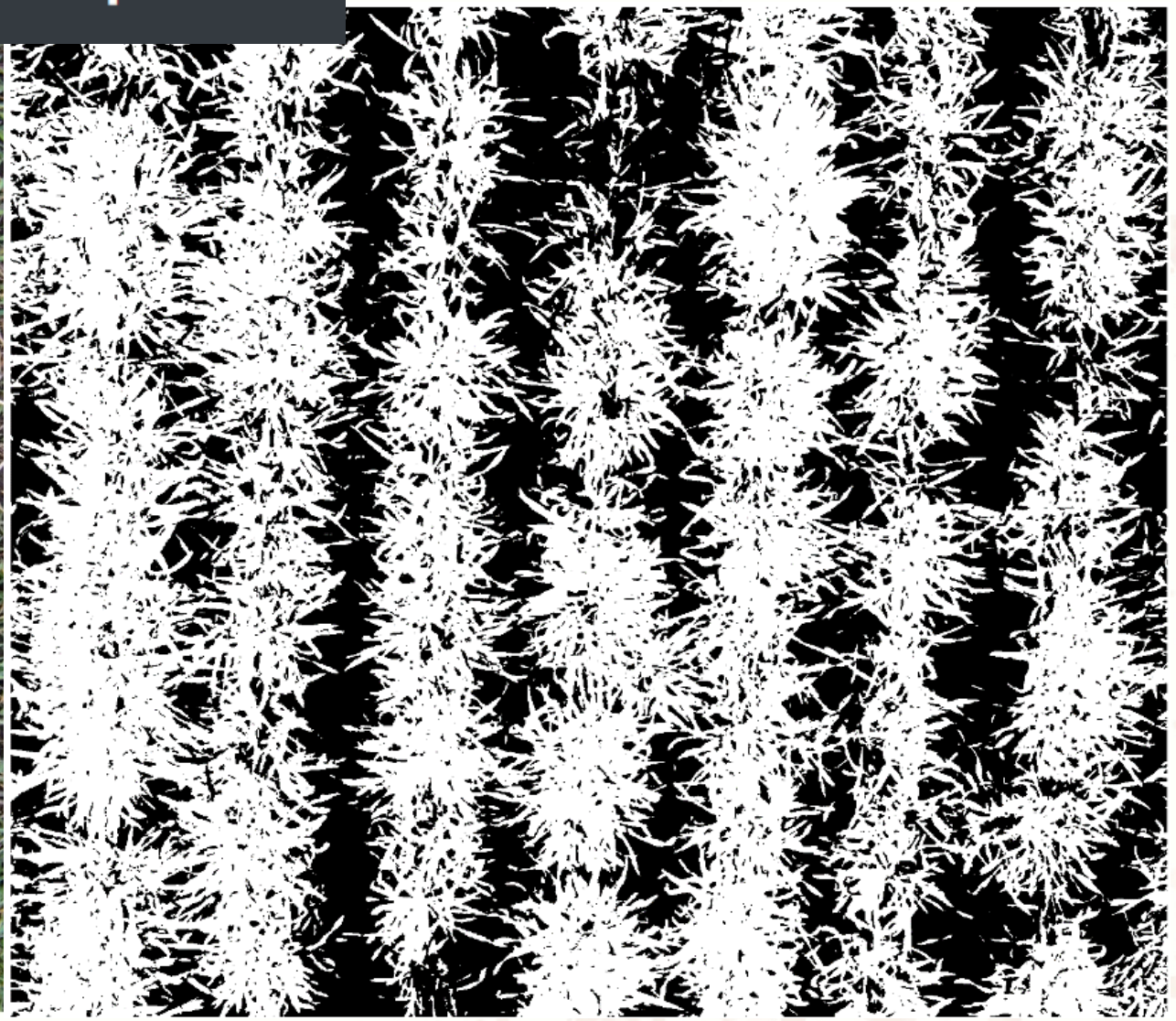
April 2, 10%. Aroostook planted Oct 8 @ 155lbs/ac (3M spa).

Canopeo



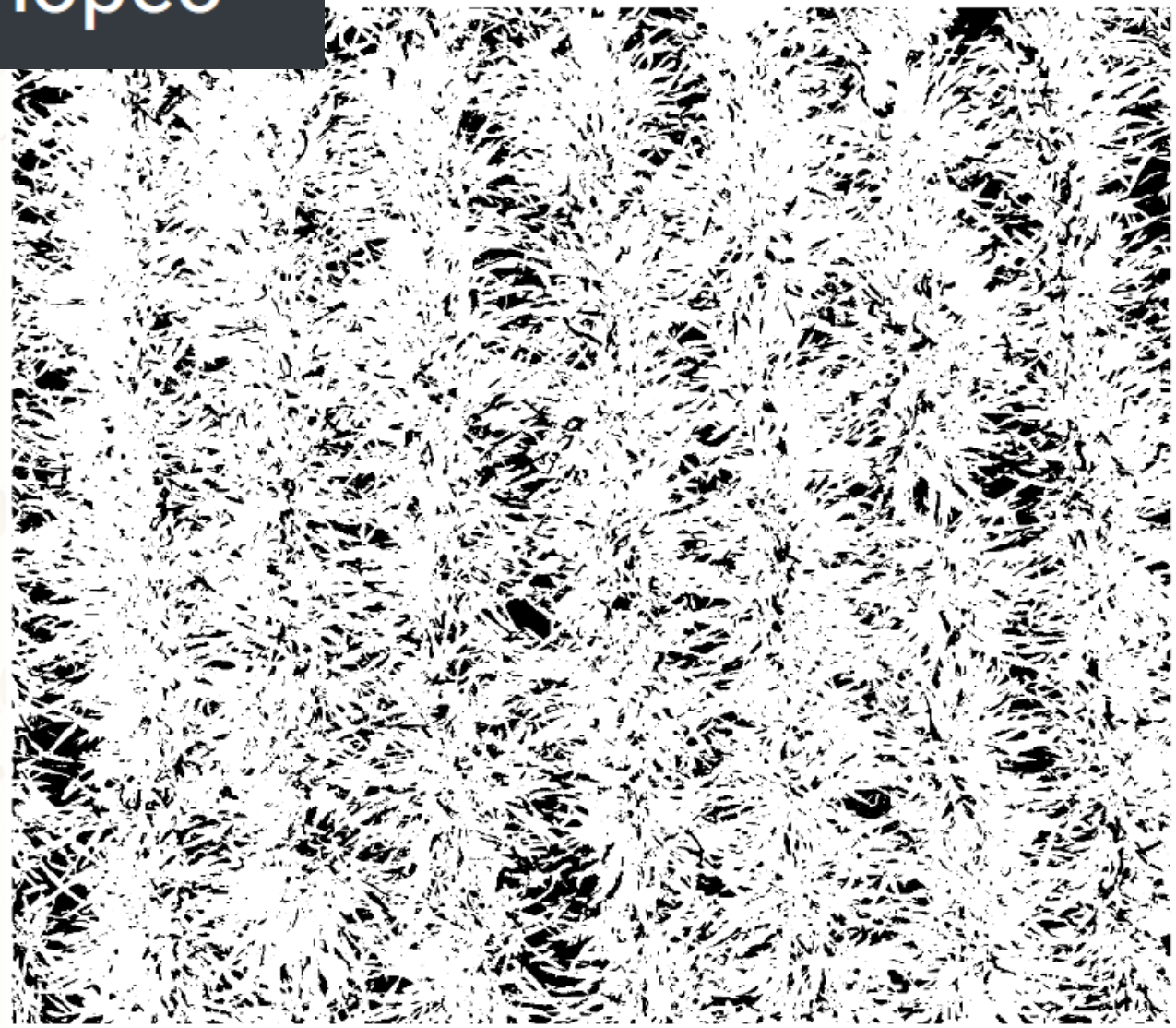
April 2, 34%. Spooner planted Sept 20 @ 160lbs/ac (3M spa).

Canopeo



April 2, 58%. Danko planted Sept 20 @ 190lbs/ac (3M spa).

Canopeo



April 2, 80%.* Aroostook planted Sept 17 @ 155lbs/ac (3M spa).

!!Camera Angle!!

Same field, same day

ADEQUATE RYE TERMINATION

Wait for **100% anthesis** or "anthesis complete"

RYE ANTHESIS DATES

Visual observation of the **frequency at which rye plots reached 50% anthesis** grouped by rye varieties and seeding rates at the Arlington Ag Research Station, 2022.

Treatment	Frequency of rye plots reaching 50% anthesis, %			
	May 31st	June 1st	June 2nd	June 3rd
Variety				
Aroostook	0.00	91.7	8.33	0.00
ND Gardener	8.33	91.7	0.00	0.00
Spooner	0.00	50.0	41.7	8.33
Danko	0.00	66.7	25.0	8.33

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SOYBEAN PLANTING

- **Seeding rate**: at least 185k seeds/ac.
- **Seeding depth**: in moisture, no deeper than 2.5”.
- **Variety**: needs research.

OGRAIN

DAWN EQUIPMENT COMPANY

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USDA NRCS

Conservation Innovation Grant

Effect of soybean seeding method on soybean emergence, stand, and yield averaged across the study, 2019-2021.

Treatment		Soybean Emergence (%)	Soybean Stand (k plant/ac)	Soybean Yield (bu/ac)
Seeding Rate	185k seeds/ac	67 a	124 b	35 b
	225k seeds/ac	66 b	148 a	36 a
Down Pressure	Low (150 lb)	65 b	134 b	40
	High (300 lb)	67 a	138 a	41
Coulter	No Coulter	66	135 b	35
	Coulter	67	138 a	35
Closing wheel	Standard Rubber	67	136	35
	Dawn RCX	66	136	35

STARTER FERTILIZER TRIAL

Fertilizer was banded at planting to achieve a rate of 25 lbs N/ac.

Treatment	Weed Biomass (lbs DM/ac)	Soybean Biomass (lbs DM/ac)	Soybean Stand (k plant/ac)	Soybean Yield (bu/ac)
No Fertilizer	175	3,398	103	38
Pelletized Poultry Manure	315	3,515	110	39
Feathermeal	442	3,075	114	35
Chilean Nitrate	164	3,716	113	37

None of the differences observed were statistically significant.

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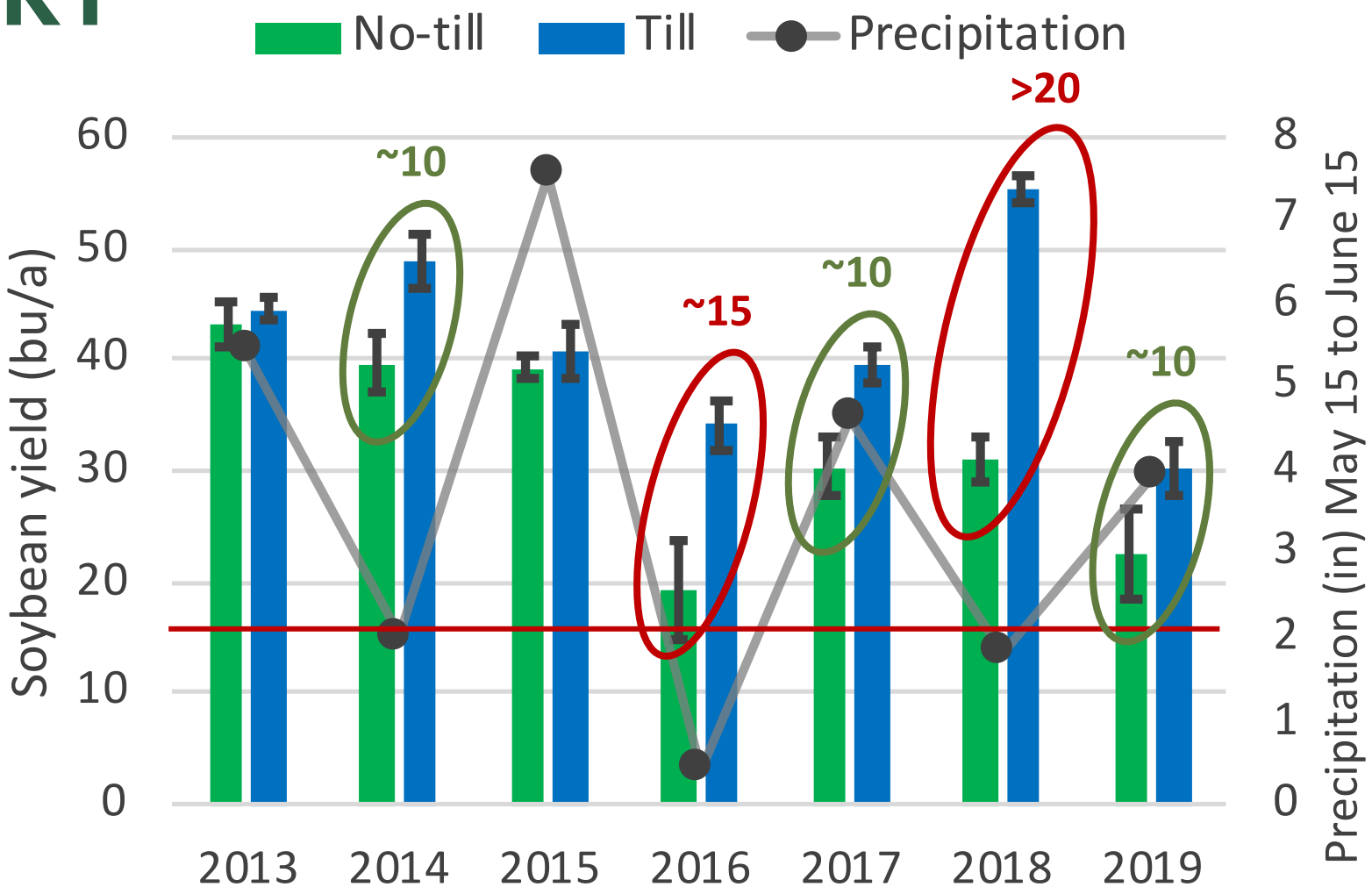
LOWER SOYBEAN YIELDS WHEN SPRING IS DRY

Data from paired plots in Aurora and Geneva, NY

Emily McFadden, Kristen Loria, Ben Brockmueller, Erin Silva, and Matthew Ryan



WHAT ABOUT PLANTING GREEN?

~ May 15
Rye at boot stage
Plant soybeans

Sept 20 – Oct 1
Plant rye

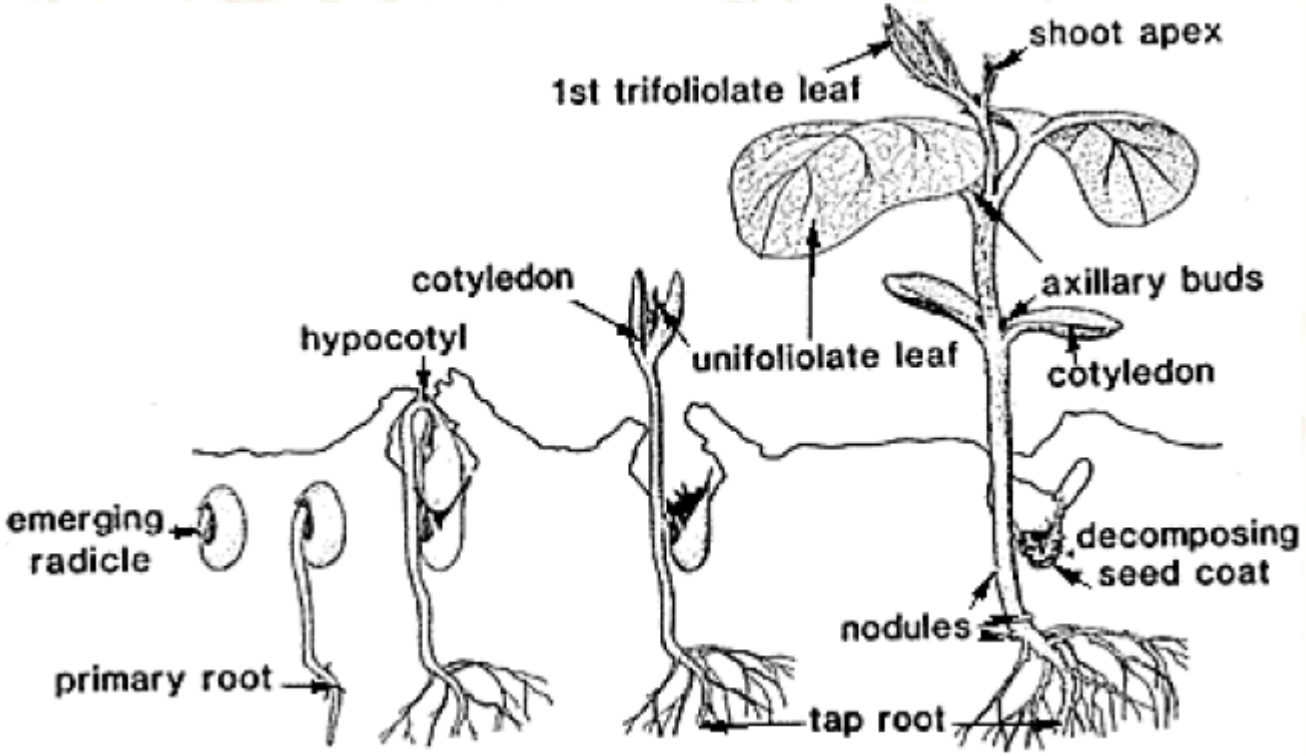
Sep | Oct | Nov | Dec

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

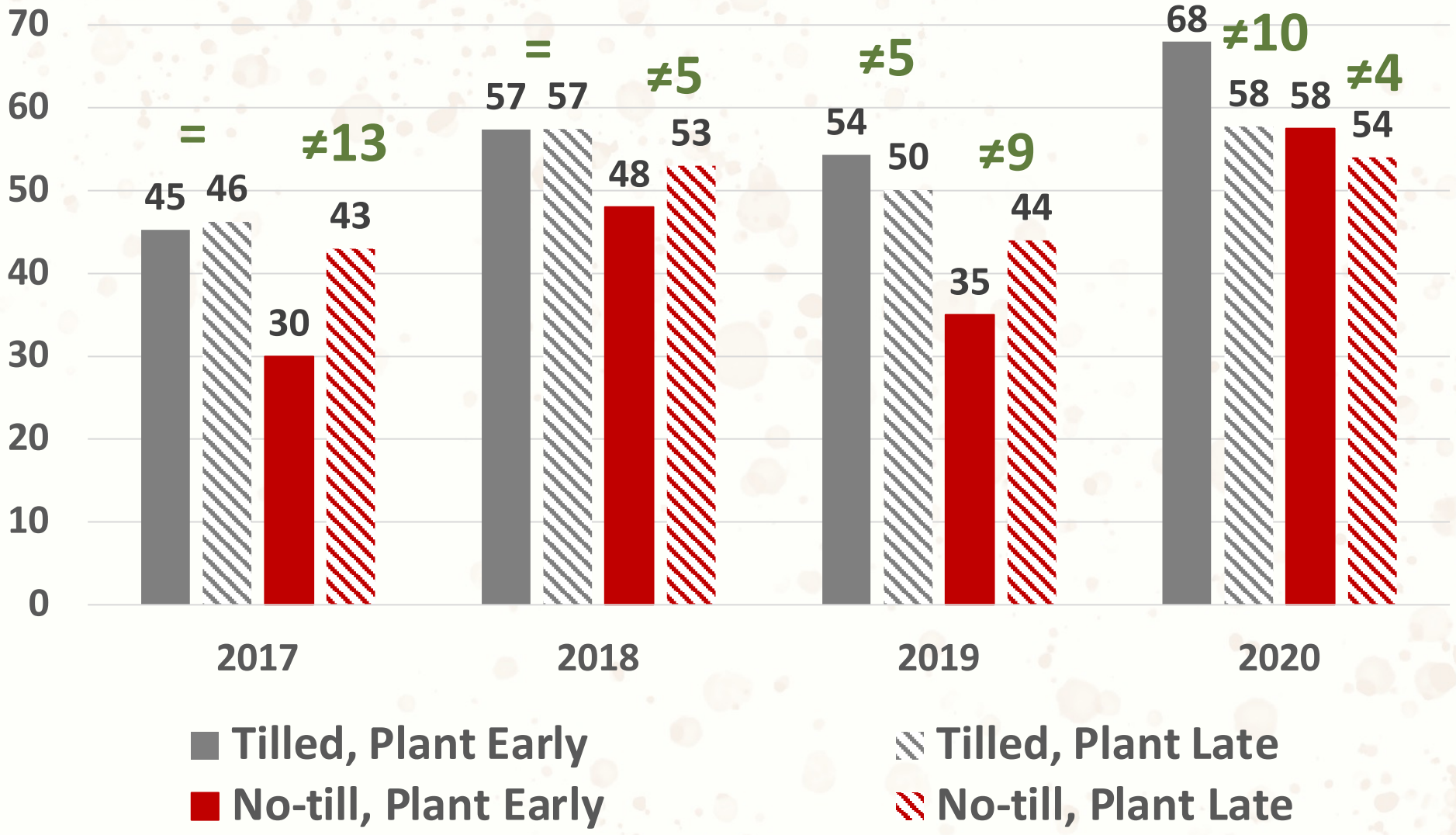
~ June 1
Crimp rye

Mid-Late October Harvest

SOYBEAN STAGE AND CRIMPING



ARLINGTON AGRICULTURAL RESEARCH STATION, WI 2017-2020



With **early plant**: **tilled** averaged **3.75bu/ac increase**; **no-till** averaged **5.75bu/ac decrease**.

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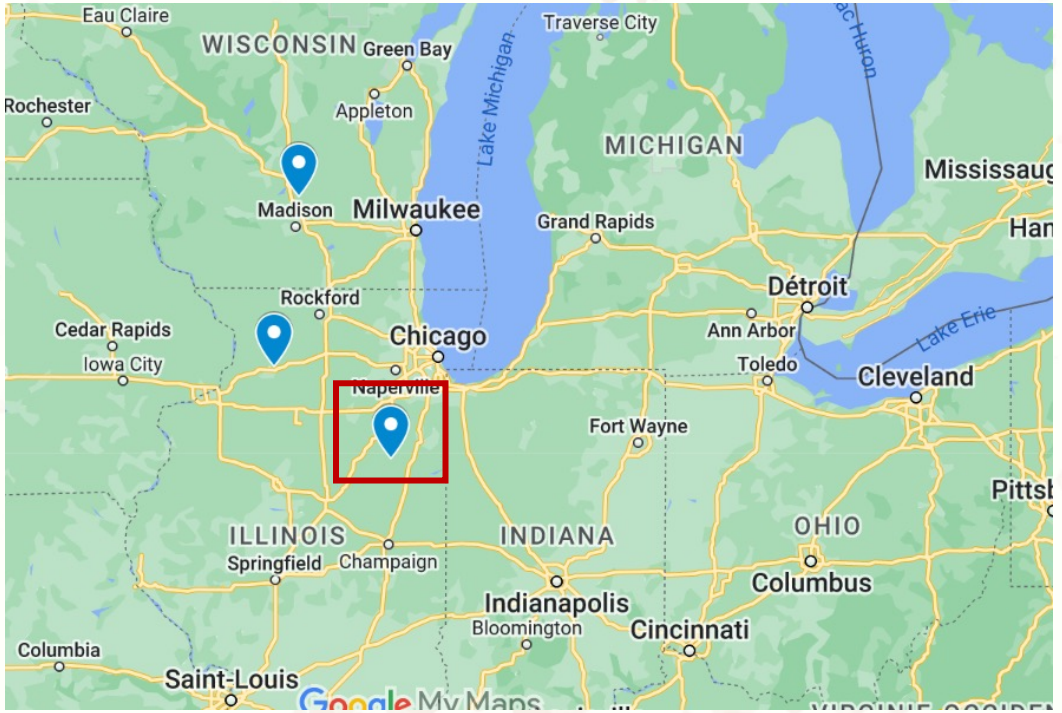
Léa Vereecke,
Erin Silva

PLANTING GREEN
ON FARM TRIAL 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)	



ORGANIC NO-TILL SOYBEAN ECONOMICS

- Use of **custom rates** for field operations provides for standardization of 1) return on investment of the equipment fleet and 2) fair 'hired labor' values as they relate to equipment operations.
- This analysis assumes that **Owner's Labor & Management rates** are the same for each system.

Organic No-Till (/ac)

Fall	High-Speed Disk	$	24.70
	Rye Seeding (drill)	$	21.20
	CC Rye Seed (150 lb/ac rate)	$	75.00
Spring	Roller-Crimper (Rotary Hoe rate)	$	9.50
	NT Soybean Plant 30"	$	23.40
	Soybean Seed 200,000 sds/ac	$	107.20
	Weed Zap 1x	$	50.00
	Harvest Soybeans	$	37.10

Total Variable Costs	$	348.10
Revenue (50bu/ac @$20/bu)	$	1,000.00
Return above Variable Costs	**$**	**651.90**

Organic Till (/ac)

Fall	High-Speed Disk	$	24.70
	Rye Seeding (drill)	$	21.20
	CC Rye Seed (50 lb/ac rate)	$	25.00
Spring	High-Speed Disk	$	24.70
	Field Cultivator	$	17.40
	CT Soybean Plant 30"	$	22.40
	Soybean Seed 200,000 sds/ac	$	107.20
	RH or TW 2 x	$	19.00
	Cultivate 3 x	$	40.20
	Weed Zap 1x	$	50.00
	Harvest Soybeans	$	37.10

Total Variable Costs	$	388.90
Revenue (55bu/ac @$20/bu)	$	1,100.00
Return above Variable Costs	**$**	**711.10**

ORGANIC NO-TILL SOYBEAN ECONOMICS

	Total Variable Costs /ac	Revenue /ac	Return above Variable Costs /ac
Organic till	$388	$1,100	$711
Organic no-till	$348	$1,000	$651

NO-TILL SOYBEAN IN ROLLED RYE ECONOMICS

Crimper	Cost /ac
Roller crimper	$9.5
Roundup + AMS*	$20
Total	**$29.50**

Potential savings
$20.50- $48.50/ac

No crimper	Cost /ac
Roundup, 24D, Metribuzin, Sulfentrazone*	$50
Glufosinate + AMS*	$28
Total	**$78**

*includes application cost

Credit: Greg McGlinch, Darke County, Ohio

ORGANIC NO-TILL CORN TRIALS CONDUCTED IN WI

Annual covers		Perennial covers
Spring	**Fall**	
Peas	Rye	Red clover
Chickling vetch	Winter peas	
Buckwheat and clover	Hairy vetch	
	Crimson clover	

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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

Pea

Chickling vetch

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 specie.
  - **Crimson** and **Balansa clover**, potential candidates, need more studies.
  - **Peas** and **chickling vetch**, poor candidates.
- **Non-legume broadleaves**: **buckwheat**, insufficient biomass; winter **canola**, needs two crimping? volunteer issues; etc.

PERENNIAL COVERS

- Not constrained by **flowering** time for termination and crop plant, only **soil temperature**.
- Need for cover **management** before and after crop seeding is unclear.
- Monitor **weediness** of the stand prior to planting crop.




ORGANIC NO-TILL CORN
MOST TRIALED SYSTEMS

Average yield (bu/ac),
Arlington WI, 2019-2022.

Year	Rye/Hairy Vetch	Red Clover
2019	52	NA
2020	116	52
2021	111	108
2022	90	37

ORGANIC NO-TILL CORN
PLANTER SETUP

Effect of planter set-up on corn stand, emergence, and yield. Arlington, WI, 2020-2022.

Treatment		Corn stand (plant/ac)	Emergence (%)	Yield (bu/ac)
Coulter	**Yes**	**27,405 a**	**72.9 a**	84.0 ^{NS}
	No	**23,777 b**	**63.2 b**	80.6
Closing wheel	**Dawn RCX**	25,381 ^{NS}	67.5 ^{NS}	**78.4 b**
	Standard Rubber	25,800	68.6	**86.2 a**
Down Pressure	**Low (150 lb)**	25,546 ^{NS}	68.1 ^{NS}	84.5 ^{NS}
	High (300 lb)	25,636	68.0	80.2

ORGANIC NO-TILL CORN
RED CLOVER MANAGEMENT

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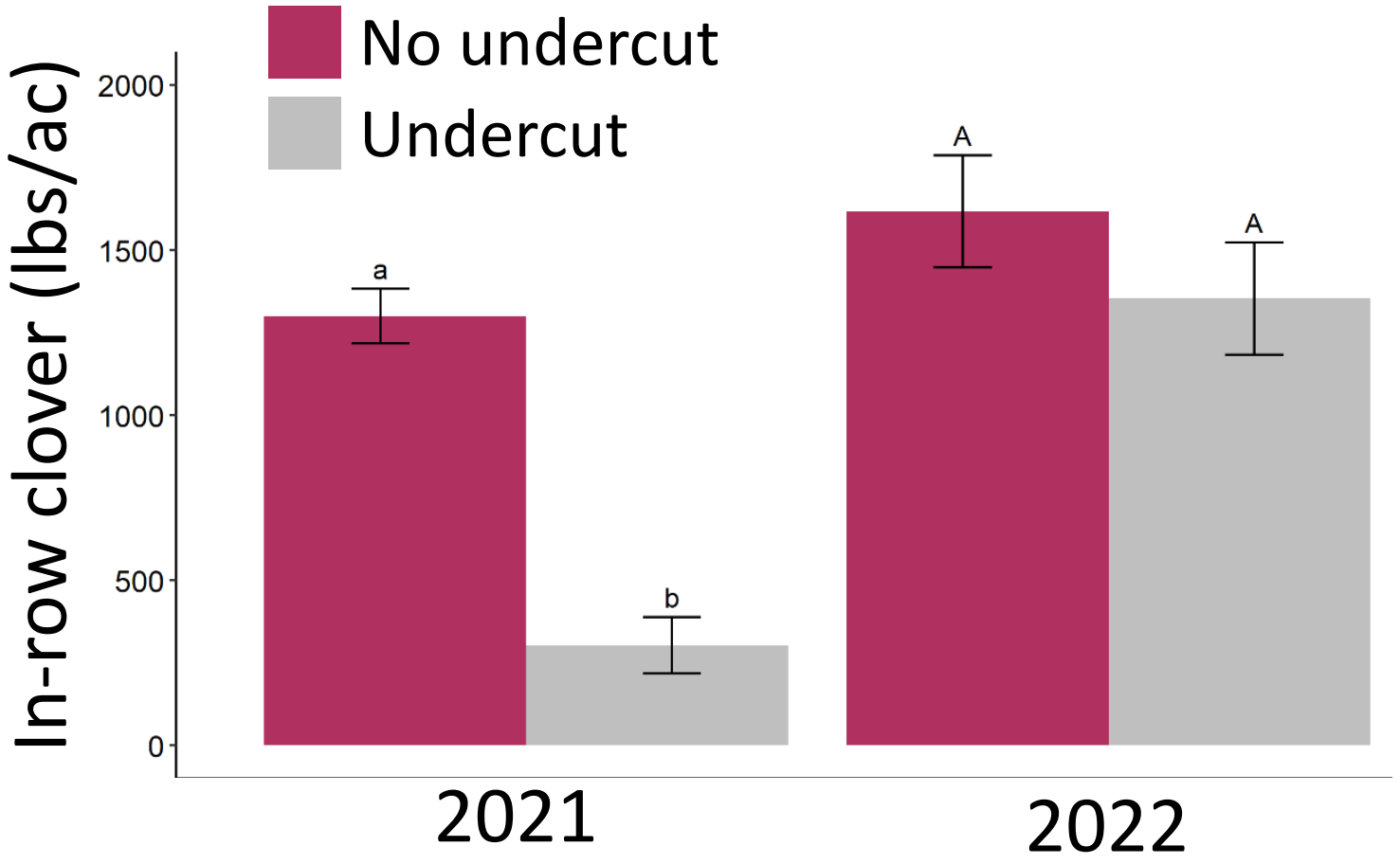
Plant stand and grain yield for 2021 corn planted into red clover.

Treatment		Corn stand (plants/ac)	Yield (bu/ac)
Before corn planting			
Undercut	Yes	**32,278 a**	**134 a**
	No	**28,674 b**	**83.5 b**
Flame	Yes	30,421 NS	112 NS
	No	30,341	106 NS
After corn emergence			
Interrow Crimper (IC)		**32,469 a**	109 NS
High Residue Cultivator (HRC)		**29,458 b**	109
IC + HRC		**29,038 b**	109

CHALLENGES IN REPRODUCIBILITY

Maintaining consistent results with the clover system has remained a challenge



Successfully terminating clover with undercut can depend on **soil conditions**: dry soil conditions are better to terminate clover.

Drewry, Luck, Brockmueller, Vereecke, Silva

CHALLENGES IN REPRODUCIBILITY

Maintaining consistent results with the clover system has remained a challenge

In-season management increases risk: damage occurs if equipment is not perfectly aligned, or corn rows not perfectly straight.

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QUESTIONS?

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