Environmental Impacts on Soybean Production

Seth Naeve –
naeve002@umn.edu

UNIVERSITY OF MINNESOTA
EXTENSION
Driven to Discover℠

Advanced Crop Advisers Workshop – Fargo – February 13, 2019

Outline

- Interactions between…
  - SCN and IDC
  - Management and Drainage
  - Management and Weed Control
  - Weed Control and FM in Grain
  - Environment and Soybean Quality

© 2015 Regents of the University of Minnesota. All rights reserved.

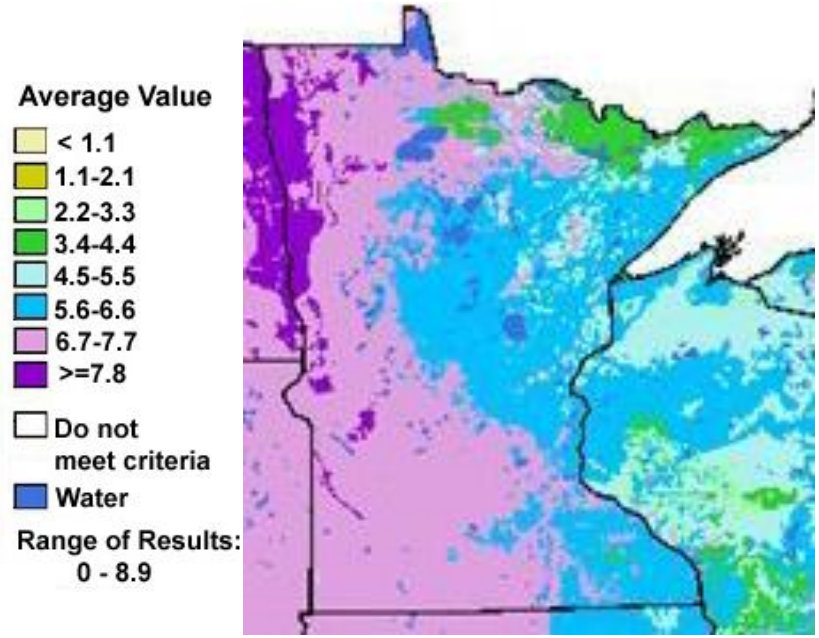
What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

The Minnesota Challenge: Interactions between IDC and SCN

IDC and SCN are major problems in MN

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

- Hard to manage
- Difficult to research
- Likely acting together in the field



Management issues and solutions

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

IDC

- Susceptible variety
- High soil pH
- Calcium carbonates
- Soil Nitrates
- Wet soil

- Tolerant Variety
- Fe chelates-Soygreen
- Companion Crops
- Drainage (-) Salts
- Reduce other stress

SCN

- Susceptible variety
- Presence of nematodes
- High soil pH
- Hot and dry

- Tolerant Variety
- Nonhost crops
- Seed treatments
- Cover crops?
- Reduce other stress

Challenge accepted!
Teasing apart IDC and SCN

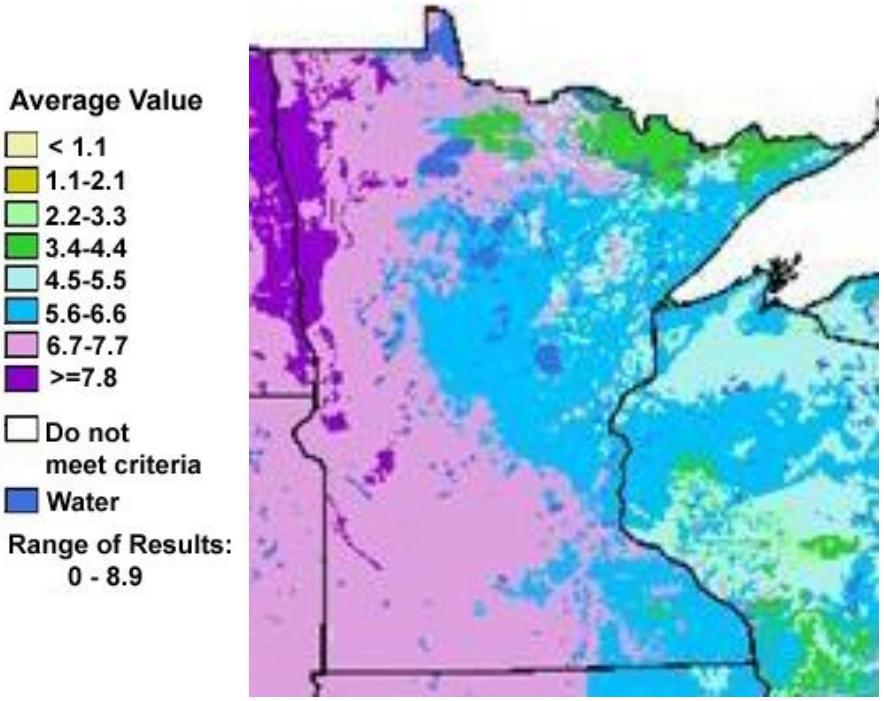
What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

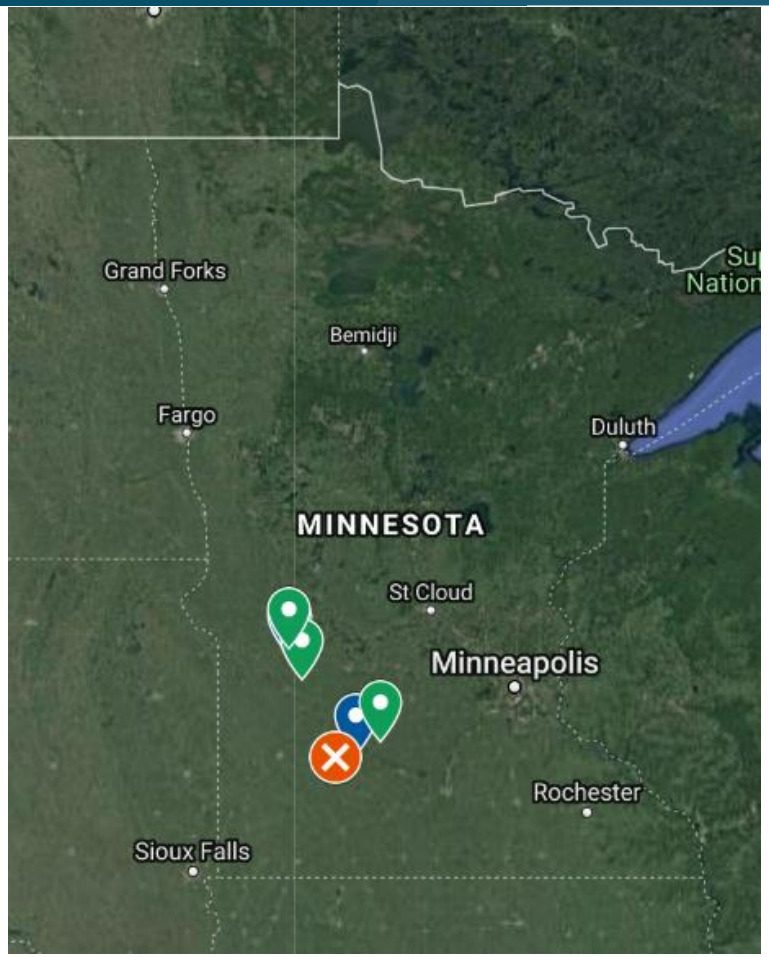
Project Goals:

- Identify in-field treatments that differentially affect IDC and SCN
- Investigate how IDC and SCN stress affects yield losses and SCN reproduction
  - Individually and together
- Quantify stress using remote sensing tools

Field Locations target high pH soils

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff





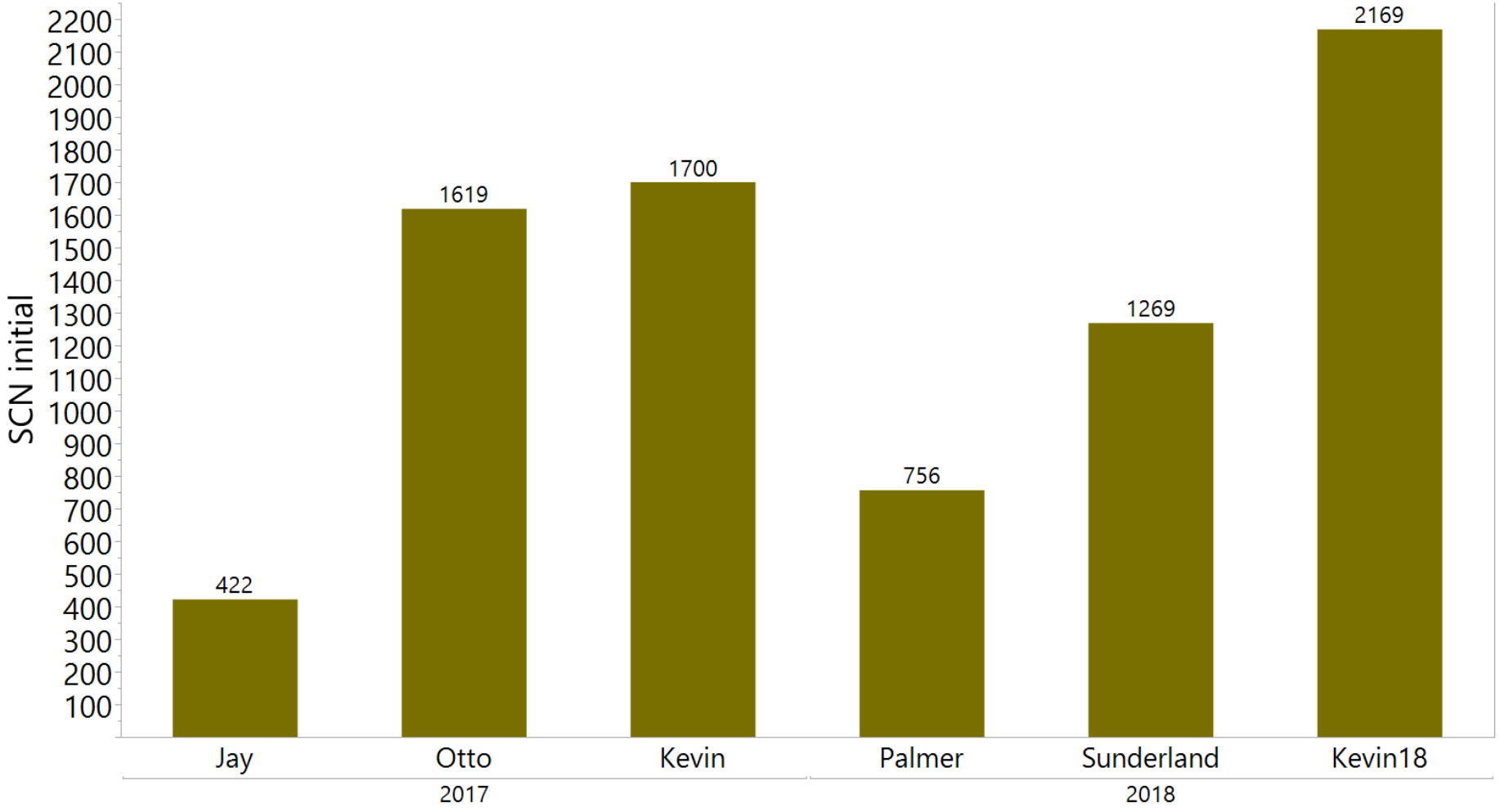
2017

2018

Lost from flooding

Field locations target nematode presence

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



Treatments we can introduce

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

IDC

- **Susceptible variety**
- High soil pH
- Calcium carbonates
- **Soil Nitrates**
- Wet soil

- **Tolerant Variety**
- **Soygreen**
- Companion Crops
- Calcium carbonates
- Reduce other stress

SCN

- **Susceptible variety**
- Presence of nematodes
- High soil pH
- Hot and dry

- **Tolerant Variety**
- Nonhost crops
- Seed treatments
- Cover crops?
- Reduce other stress

Treatments arranged to study interactions

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

SCN

Susceptible - PI 88788 - Peking

IDC

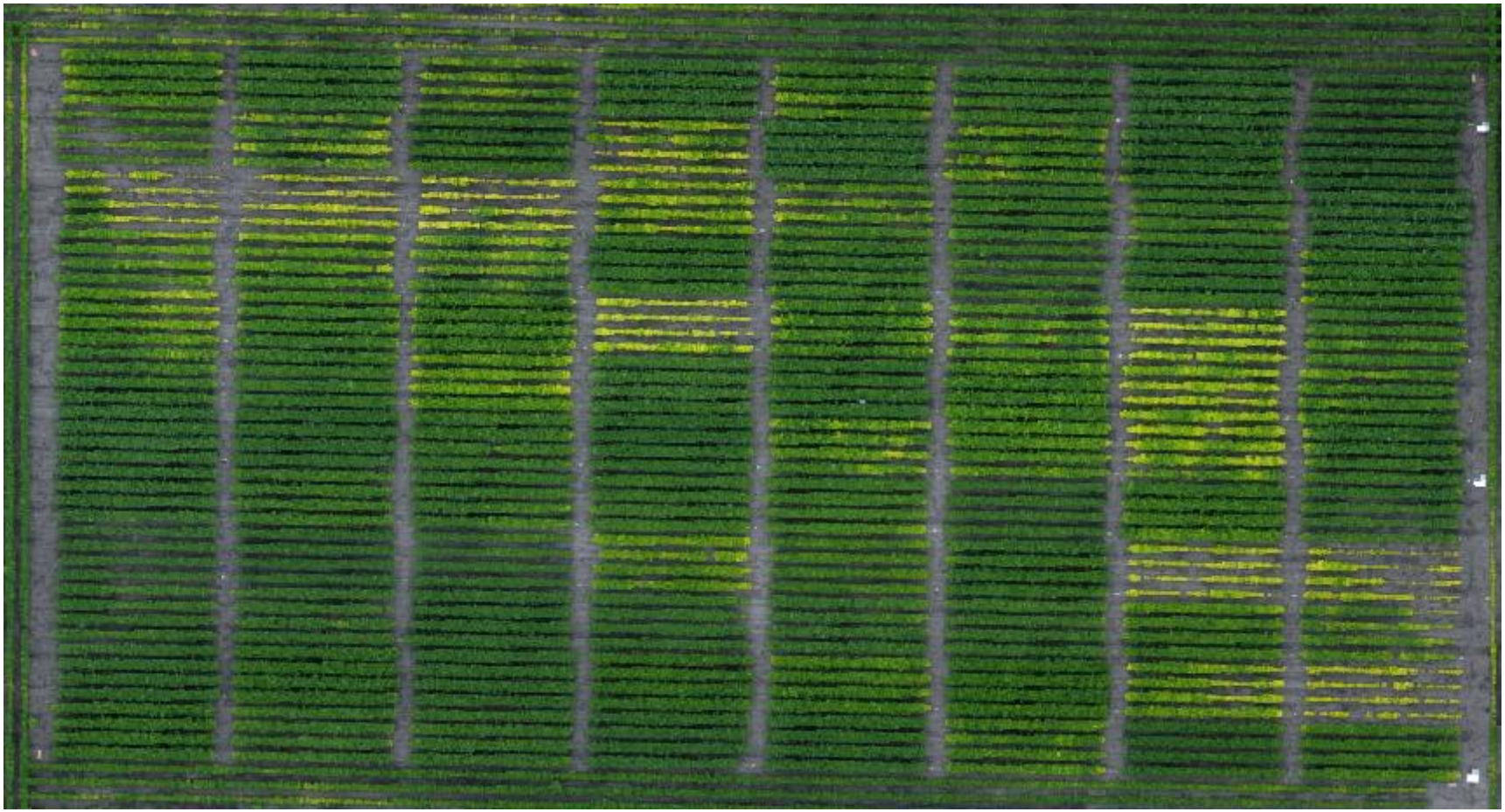
i. Nitrogen

ii. No treatment

iii. Soygreen

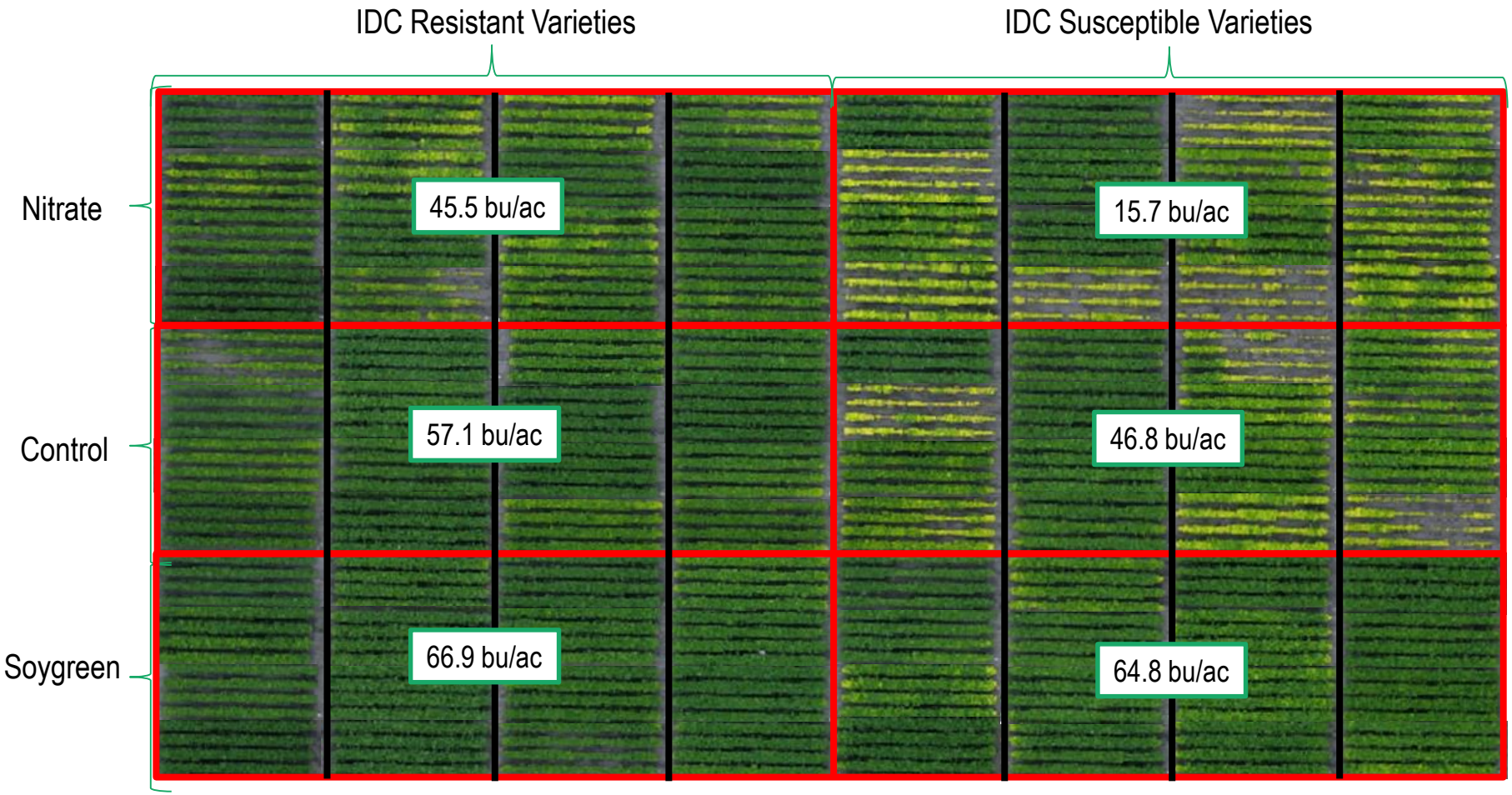
Drone view of experimental design

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



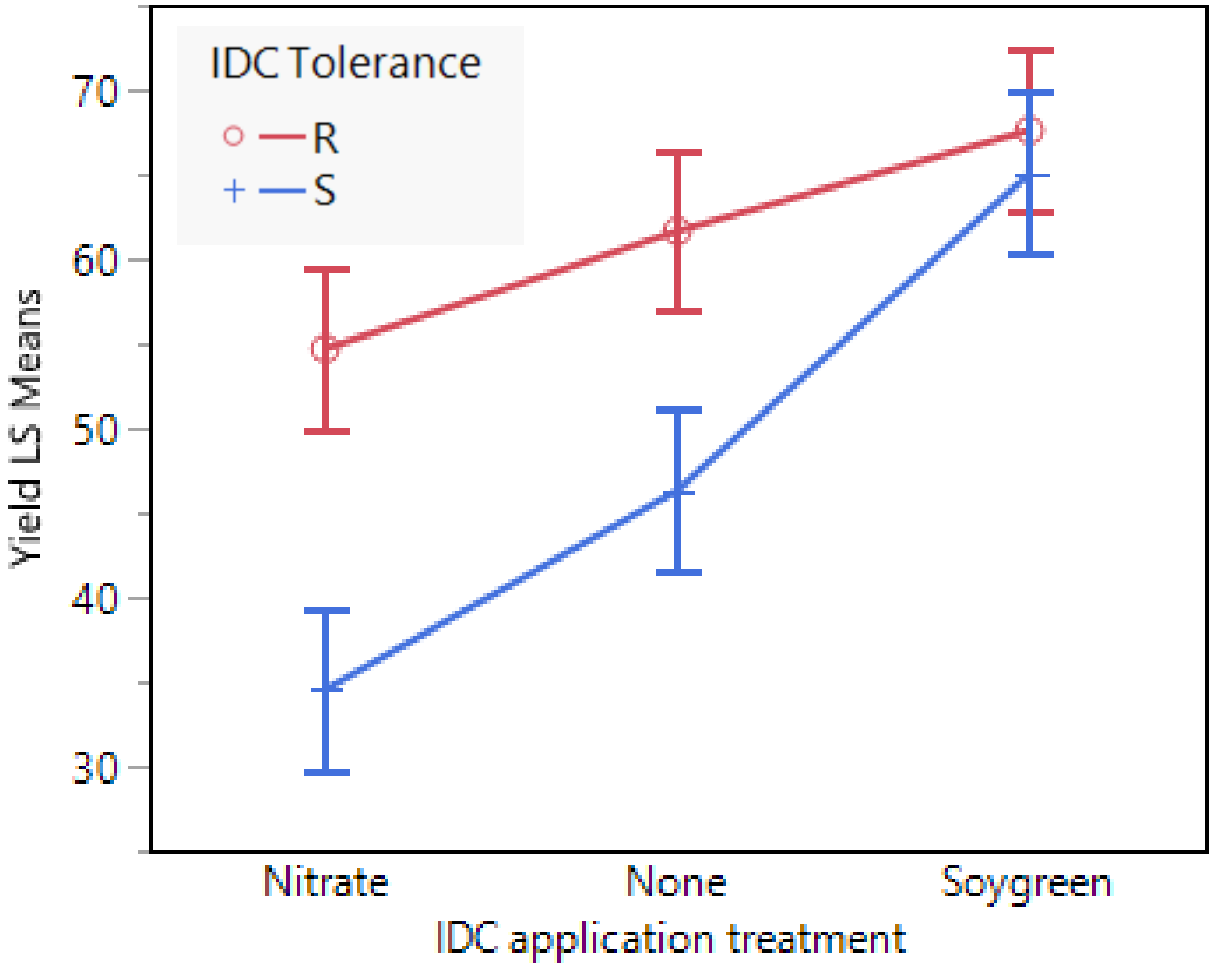
Affect of IDC treatments on yield

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



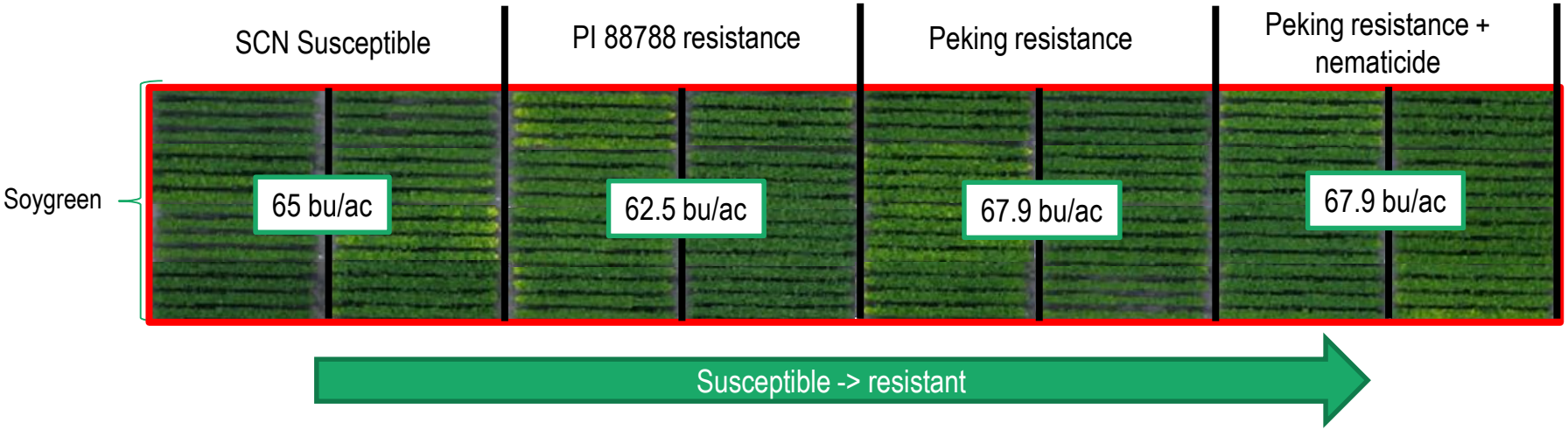
IDC resistant varieties out-yield susceptible under all treatments (Averaged across locations)

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



Affect of SCN treatments on yield

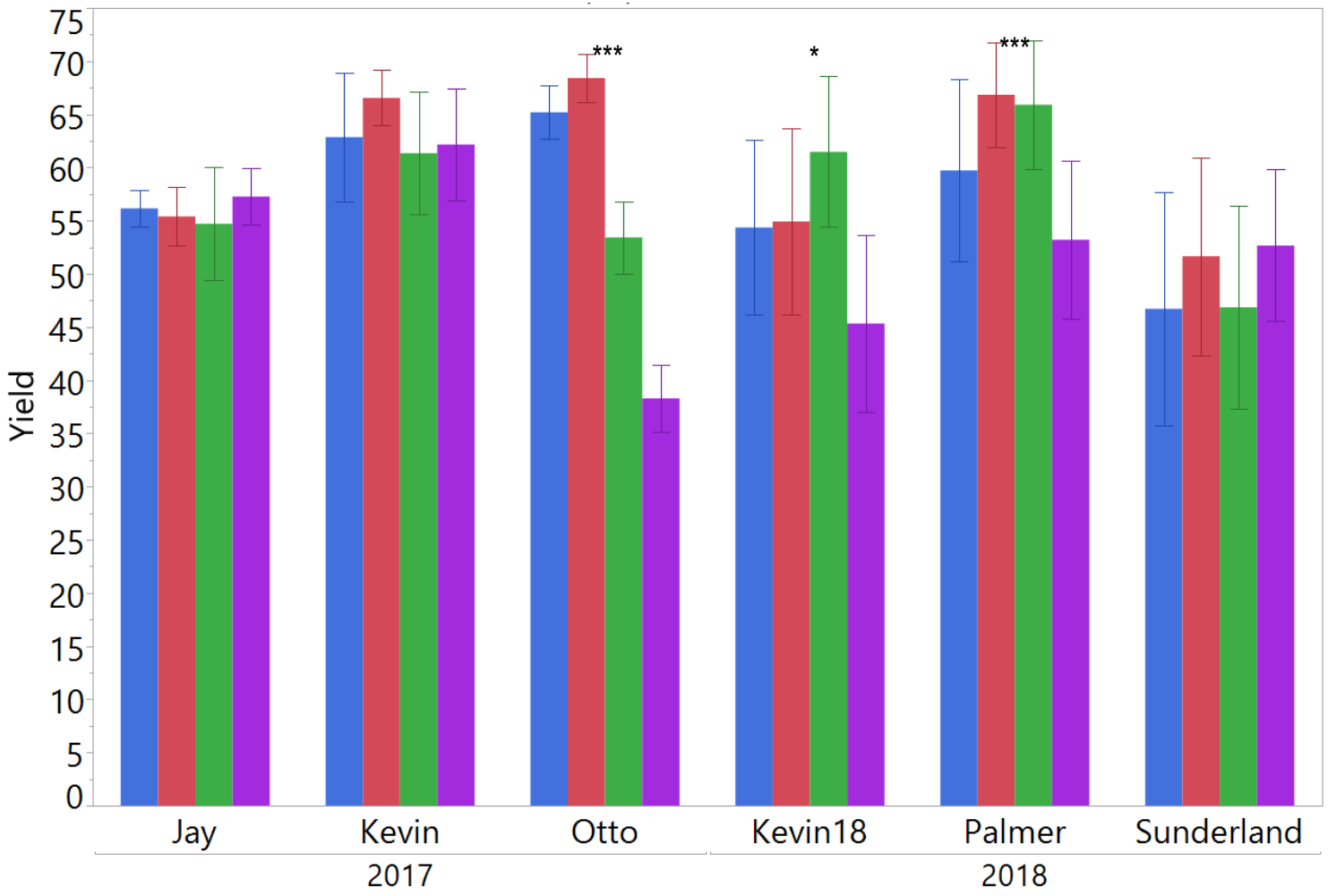
What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



Significant yield differences only found in 3/6 locations

SCN variety impacted yield at 3 of 6 locations

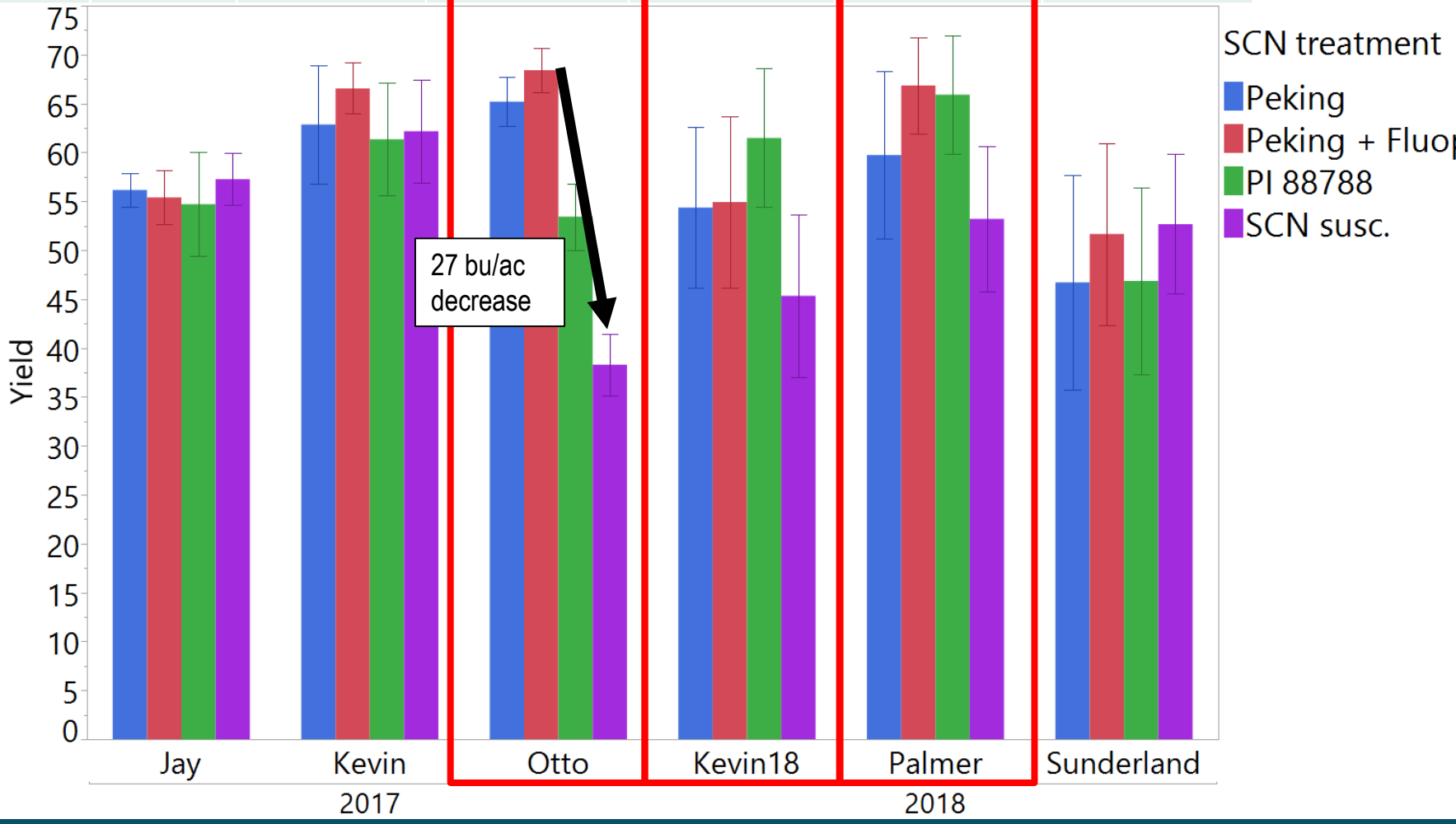
What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



* = significant at .05

*** = significant at .001

	Jay	Kevin	Otto	Kevin18	Palmer	Sunderland
Initial counts	421	1,700	1,619	2,169	2,169	1,269
Peking FI	1.7	3.9	14.8	3.9	.6	2.1
PI 88788 FI	18.7	6.3	13.6	10.9	8.4	22.7
HG Type	2	-	1, 2	2	-	2



Reproduction Factor

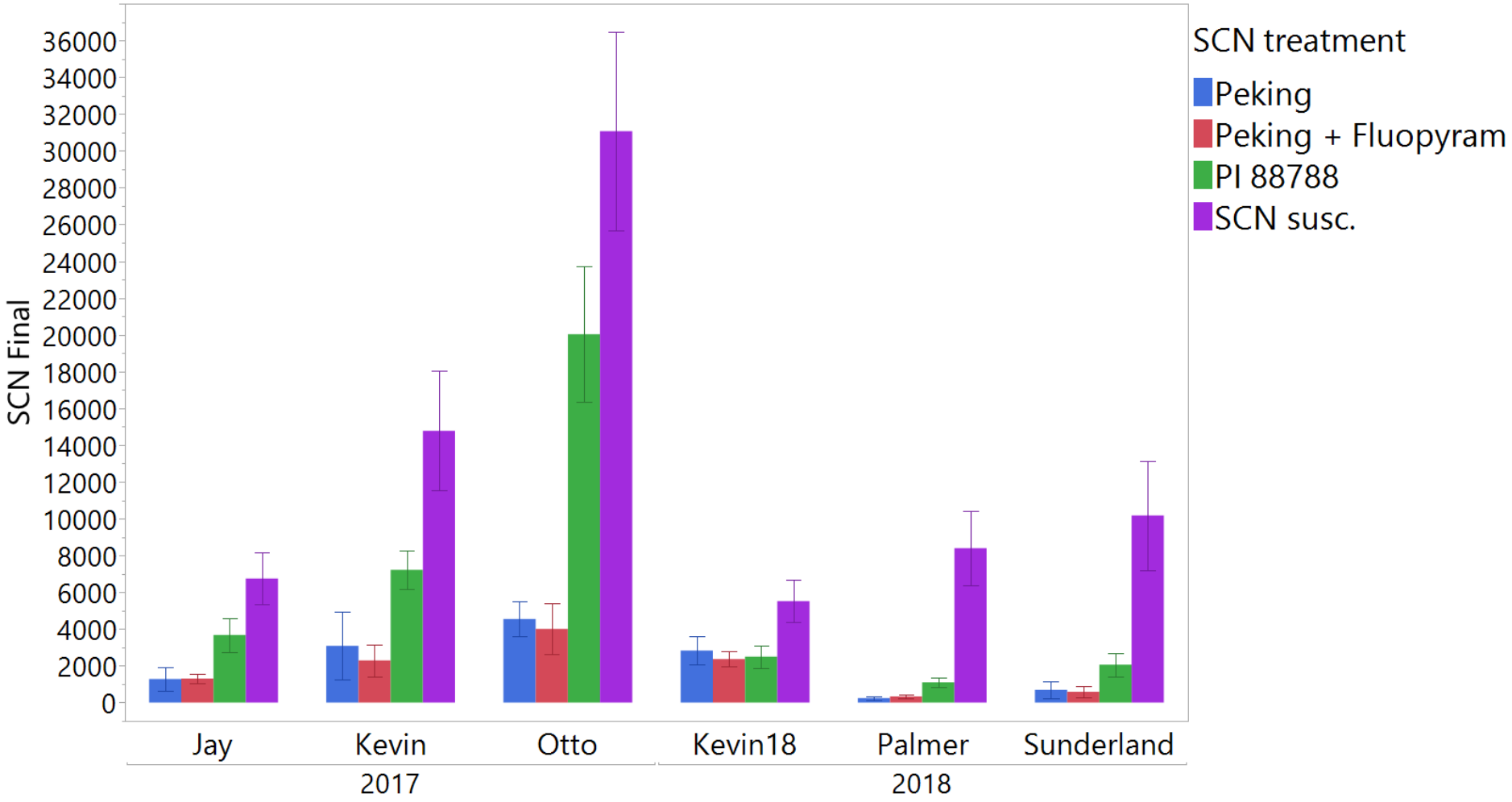
What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

$$Reproduction\ Factor\ (RF) = \frac{Beginning\ of\ season\ egg\ counts}{end\ of\ season\ egg\ counts}$$

↑ RF = ↑ Nematodes reproducing

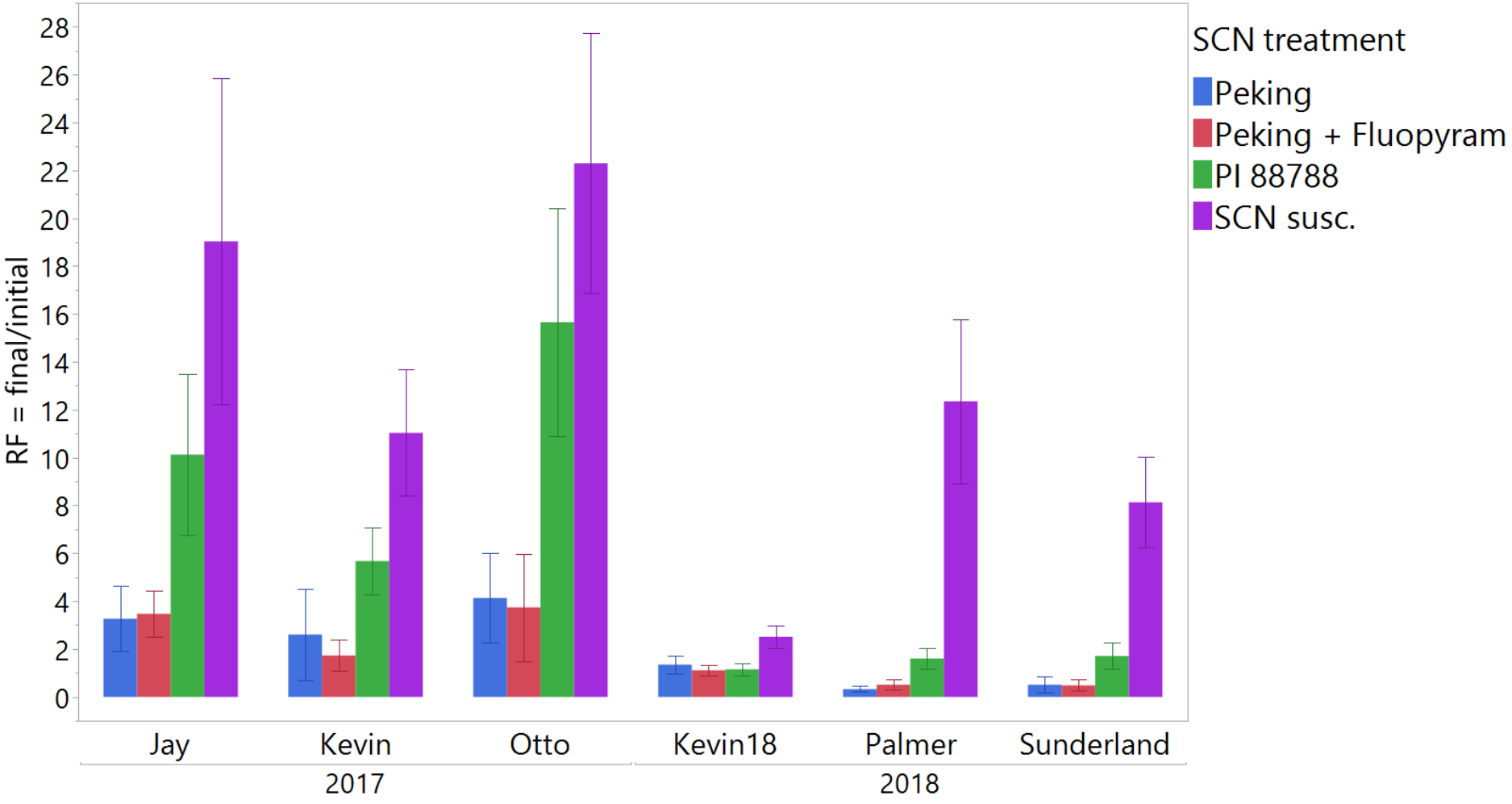
Nematodes are reproducing on susceptible soybean varieties.

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



Reproduction Factor (RF)

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff



Yield data did not show an interaction

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

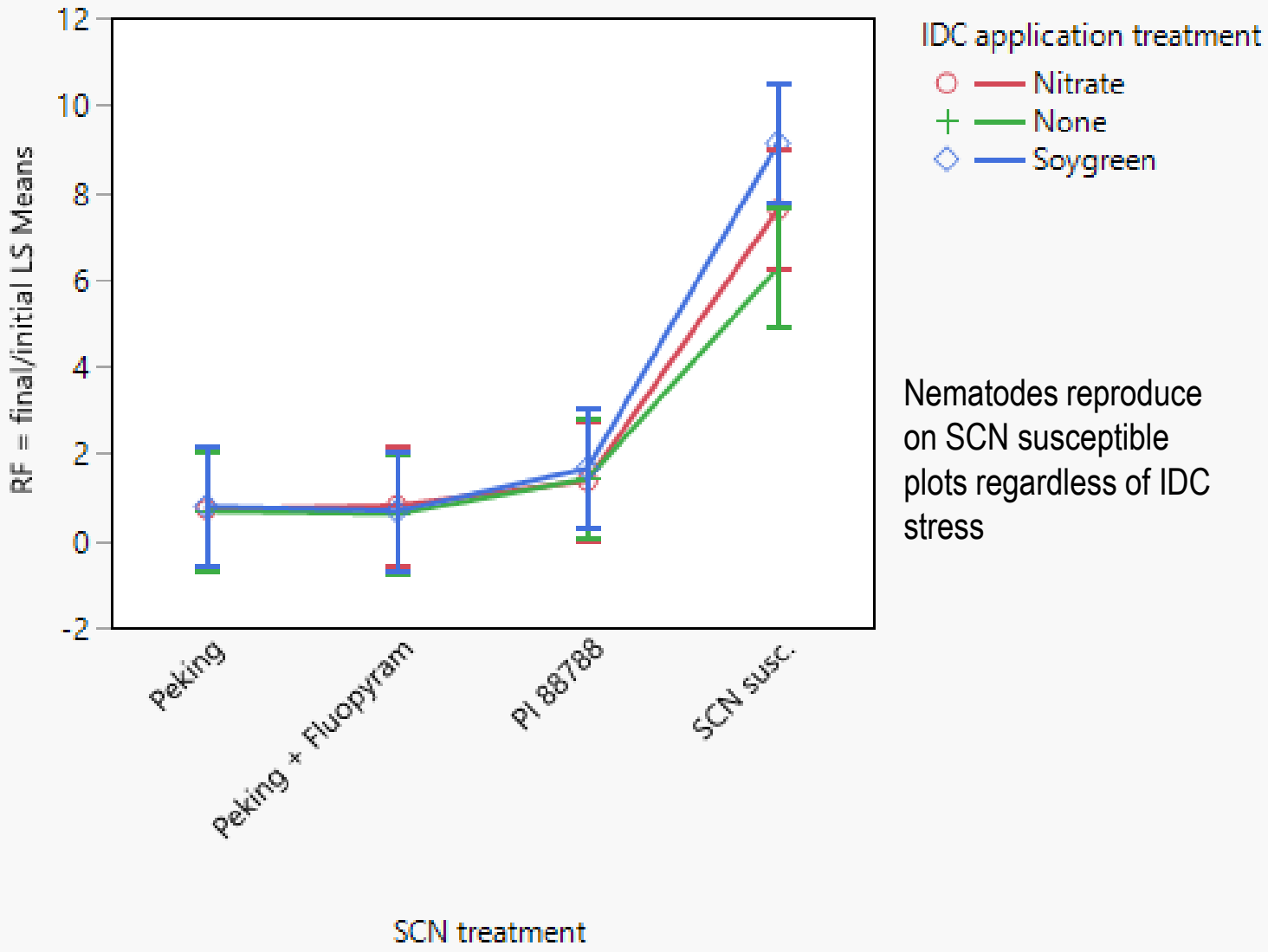
SCN

Susceptible - PI 88788 - Peking

IDC

i. Nitrogen	40.8	46.7	40.0
ii. No treatment	48.3	59.9	53.0
iii. Soygreen	62.1	67.7	67.9

No interaction between IDC and SCN



Nematodes reproduce on SCN susceptible plots regardless of IDC stress

Summary

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

- The good news is that it appears that we can manage IDC and SCN independently
- Start by identifying the problem
  - IDC will be obvious - but understand that many other issues can cause yellowing in soybean
    - SCN
    - Aphids
    - Other fertility issues
  - Soil sampling for SCN is a required first step.
    - Be certain of very low SCN numbers before planting a susceptible line
    - Medium to high populations (2000-10,000 eggs) require significant action
    - Beyond 10,000 one should consider more corn (or other crops)

Summary

What's your number?
Take the test. Beat the pest.
The SCN Coalition™
Funded by the soybean checkoff

- Manage IDC with genetic tolerance first, then add iron chelates
  - Variable Rate iron chelates if available
- Identify good SCN resistant varieties
  - Public Variety Trial reports
  - Seed company advise
  - Evaluate varieties on your own farm
  - It's nearly impossible to ID varieties that allow low reproduction, on-farm
  - The best that you can do is continually monitor SCN levels

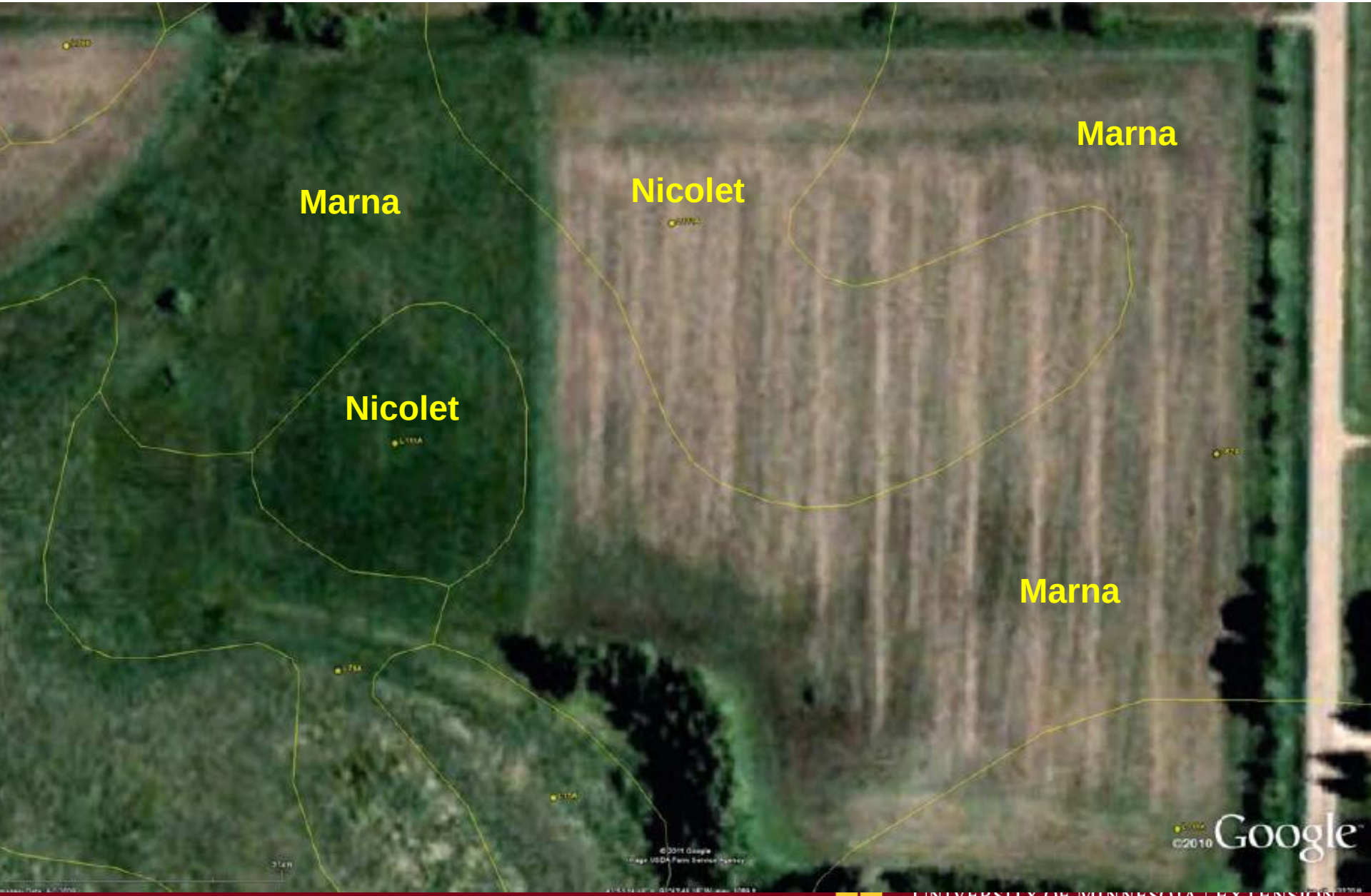

QUESTIONS?

Effects of Tile Drainage on Soybean Yields and the Interaction between Drainage and Soybean Management

Objectives

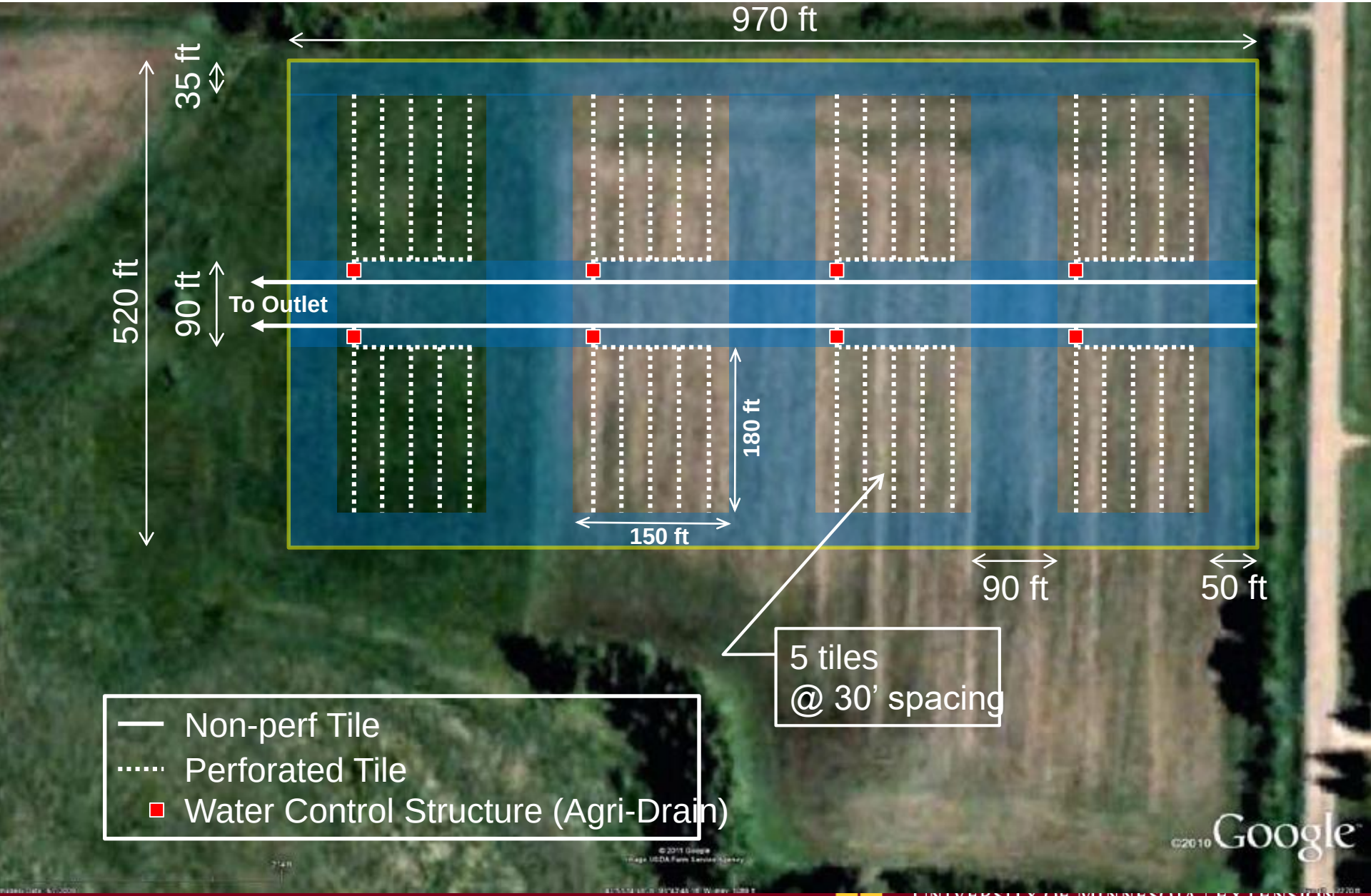
- To investigate of the overall benefits of tile drainage on corn and soybean yields in southern Minnesota.
- To investigate the interactions between drainage and a wide range of current soybean production practices, including high input treatments.
- Additional interactive studies with allied disciplines.

© 2015 Regents of the University of Minnesota. All rights reserved.



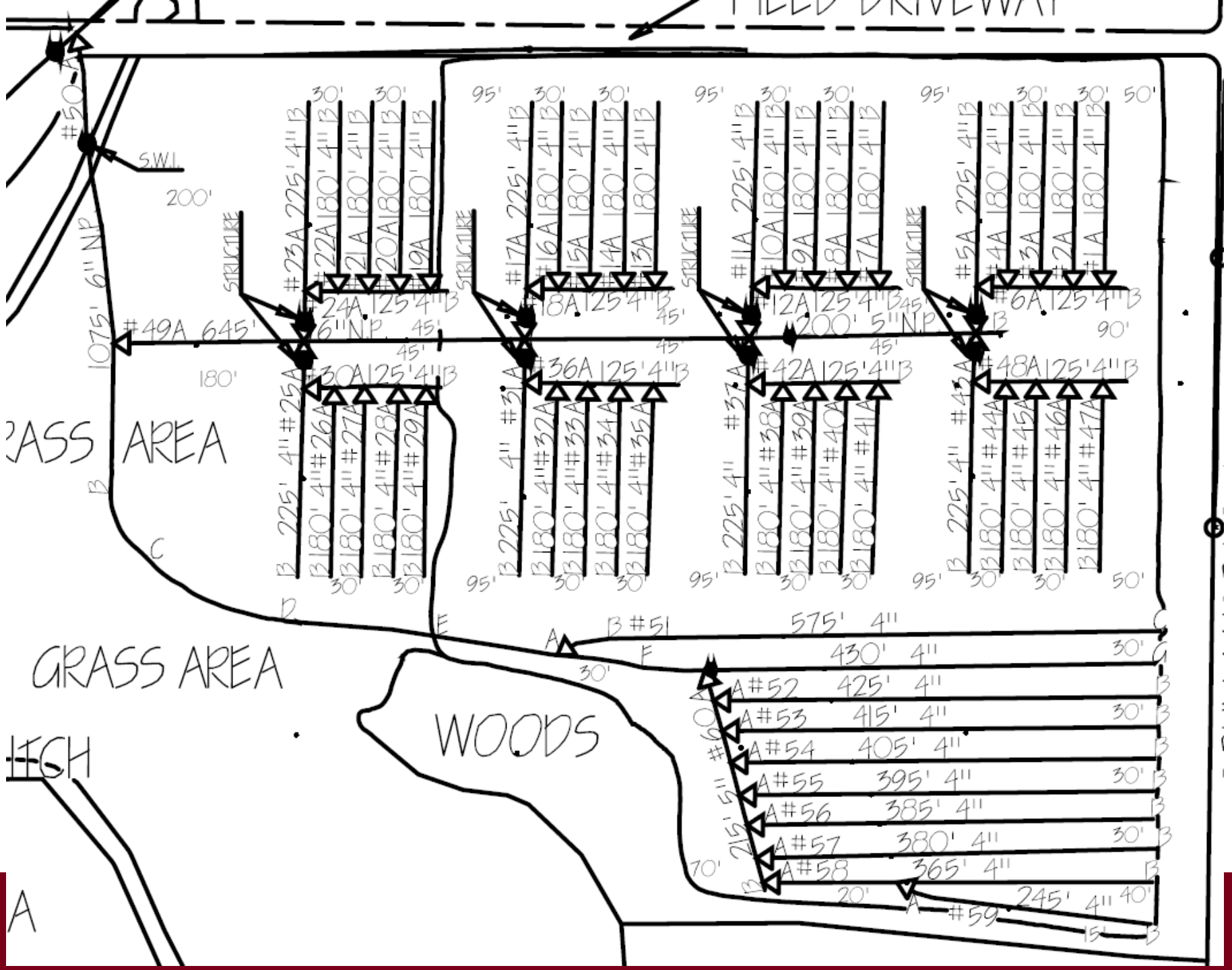
© 2015 Regents of the University of Minnesota. All rights reserved.

2011 Tiling Plan

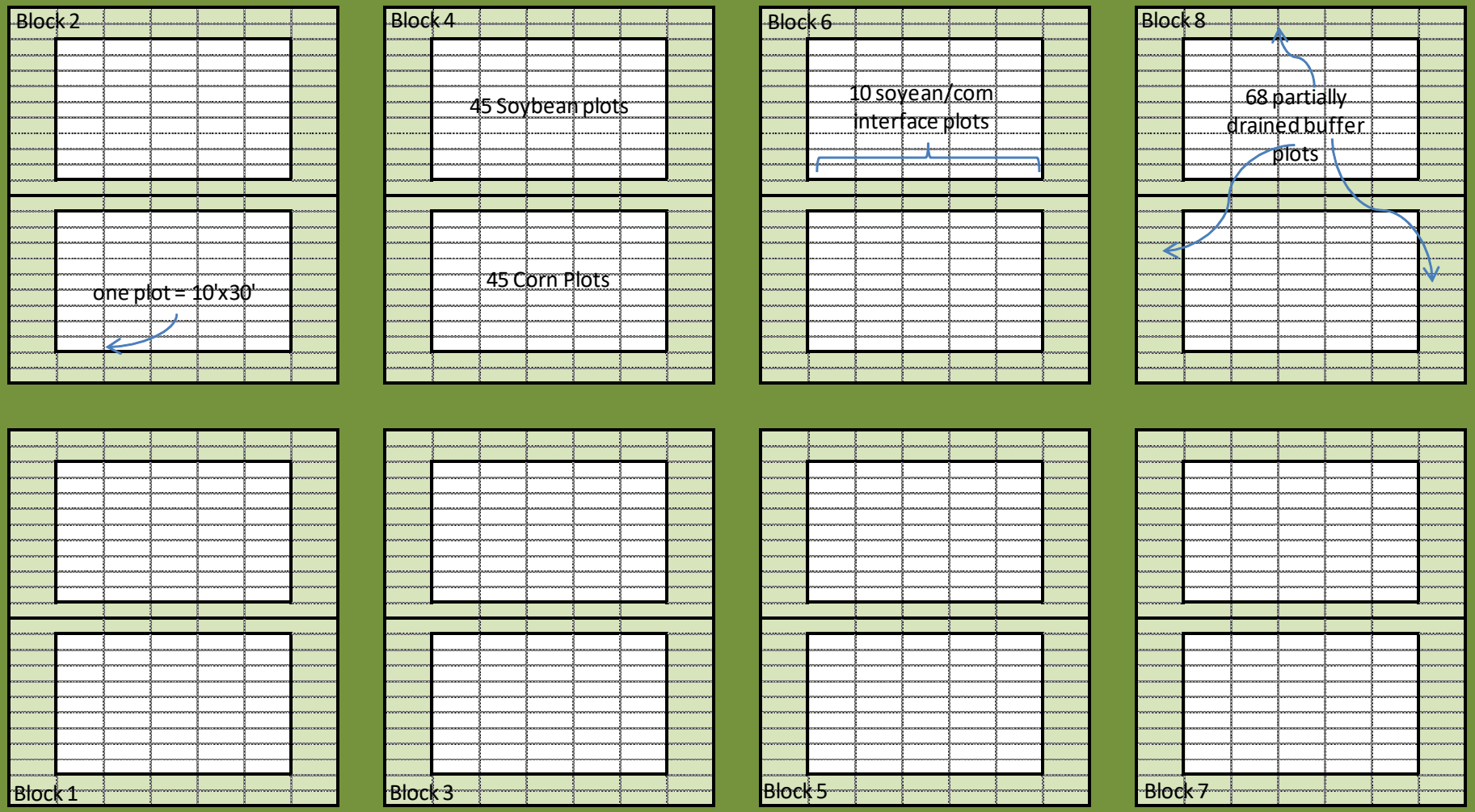


© 2015 Regents of the University of Minnesota. All rights reserved.


GREGOR TILING CO.
Inter-Drain
2050 GP
GREGOR TILING CO.

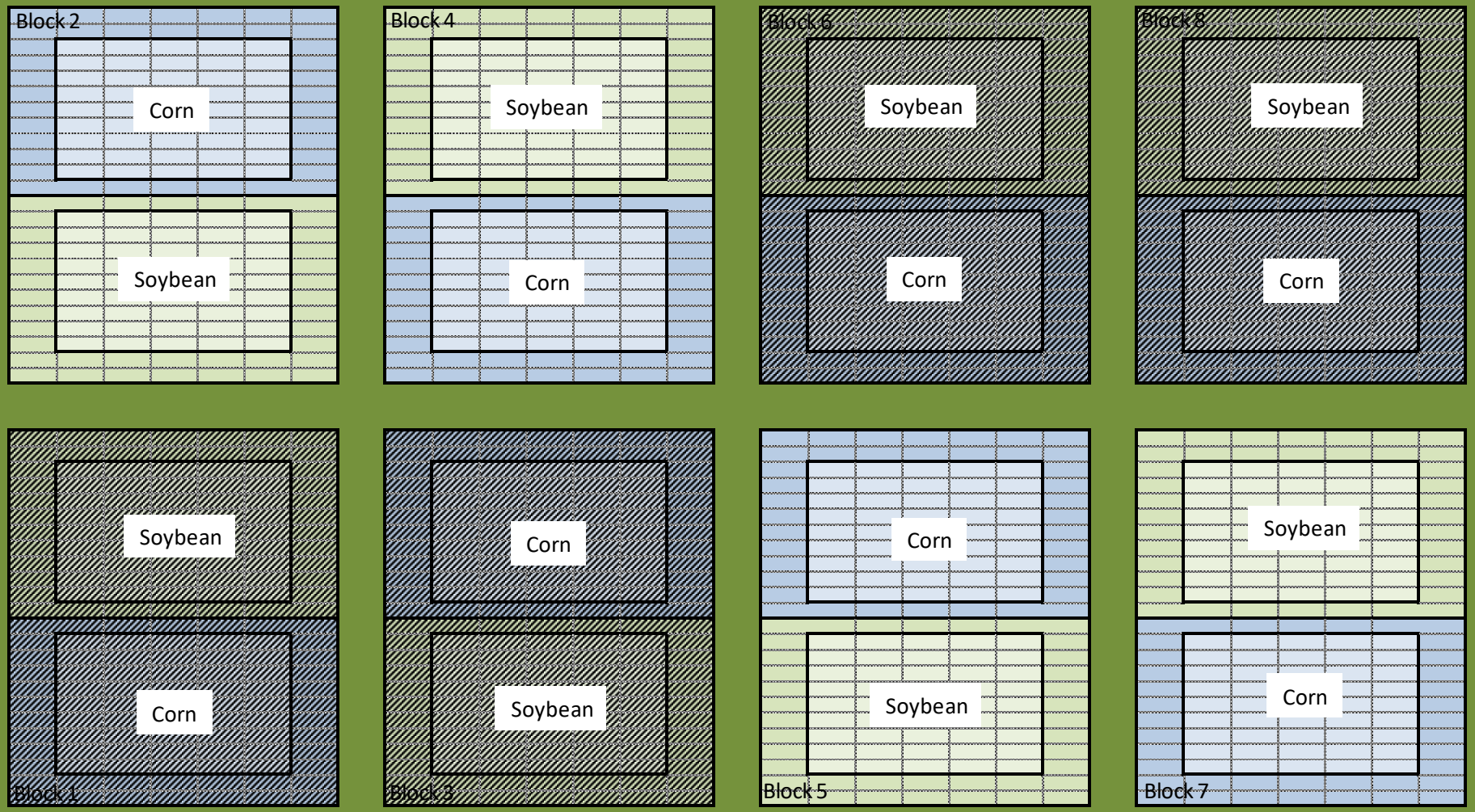

GRASS AREA
WOODS
SWL
STRUCTURE
#49A 645' 6" NP
#50A
#23A 225' 4" B
#22A 180' 4" B
#21A 180' 4" B
#20A 180' 4" B
#19A 180' 4" B
#24A 125' 4" B
#17A 225' 4" B
#16A 180' 4" B
#15A 180' 4" B
#14A 180' 4" B
#13A 180' 4" B
#18A 125' 4" B
#11A 225' 4" B
#10A 180' 4" B
#9A 180' 4" B
#8A 180' 4" B
#7A 180' 4" B
#12A 125' 4" B
200' 5" NP
#5A 225' 4" B
#4A 180' 4" B
#3A 180' 4" B
#2A 180' 4" B
#1A 180' 4" B
#6A 125' 4" B
#25A
#26A
#27A
#28A
#29A
#30A 125' 4" B
#31A
#32A
#33A
#34A
#35A
#36A 125' 4" B
#37A
#38A
#39A
#40A
#41A
#42A 125' 4" B
#43A
#44A
#45A
#46A
#47A
#48A 125' 4" B
B #51 575' 4"
430' 4"
A #52 425' 4"
A #53 415' 4"
A #54 405' 4"
A #55 395' 4"
A #56 385' 4"
A #57 380' 4"
A #58 365' 4"
A #59 245' 4"

Plot layout and buffers



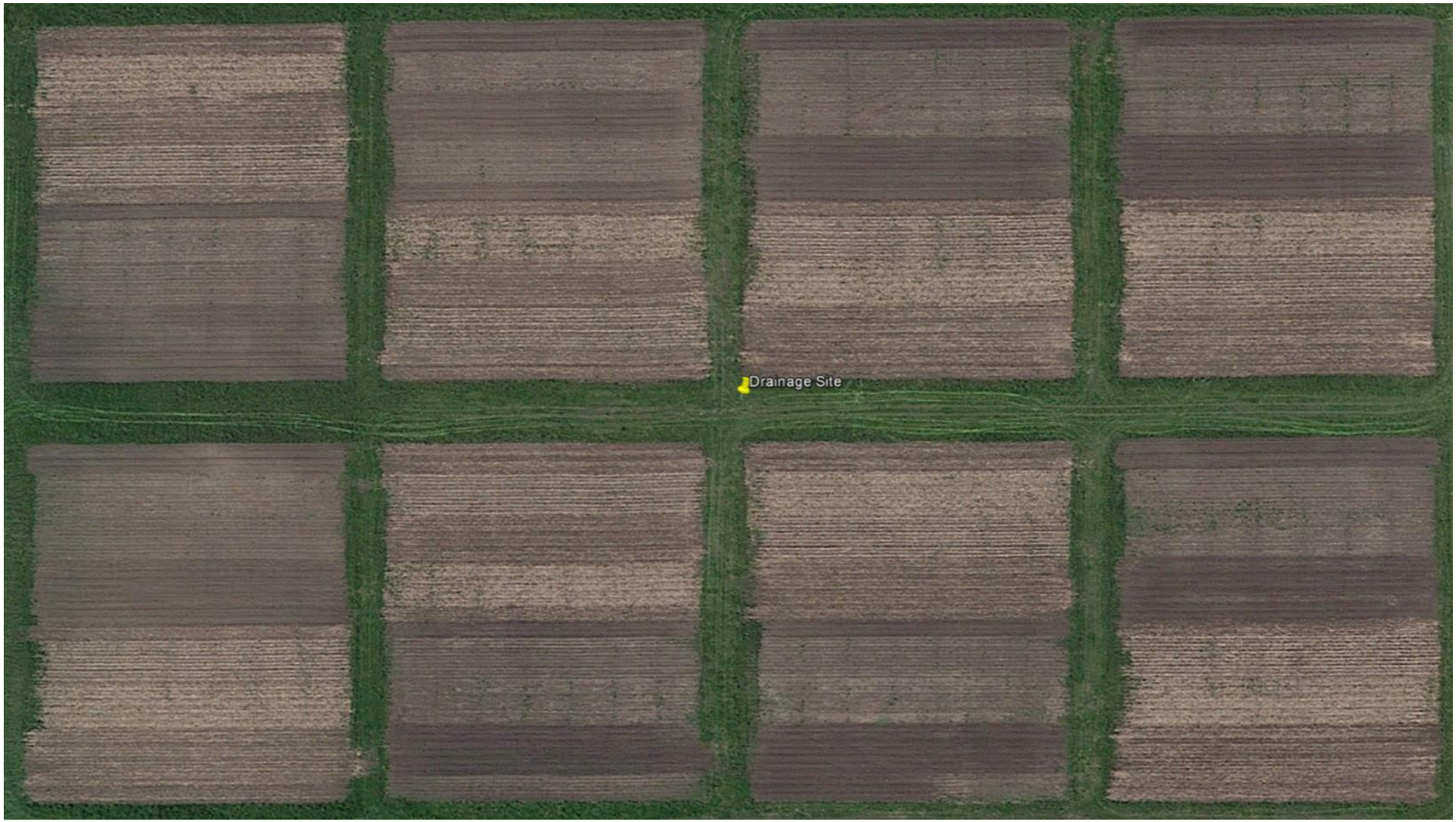
© 2015 Regents of the University of Minnesota. All rights reserved.

2018 plot plan



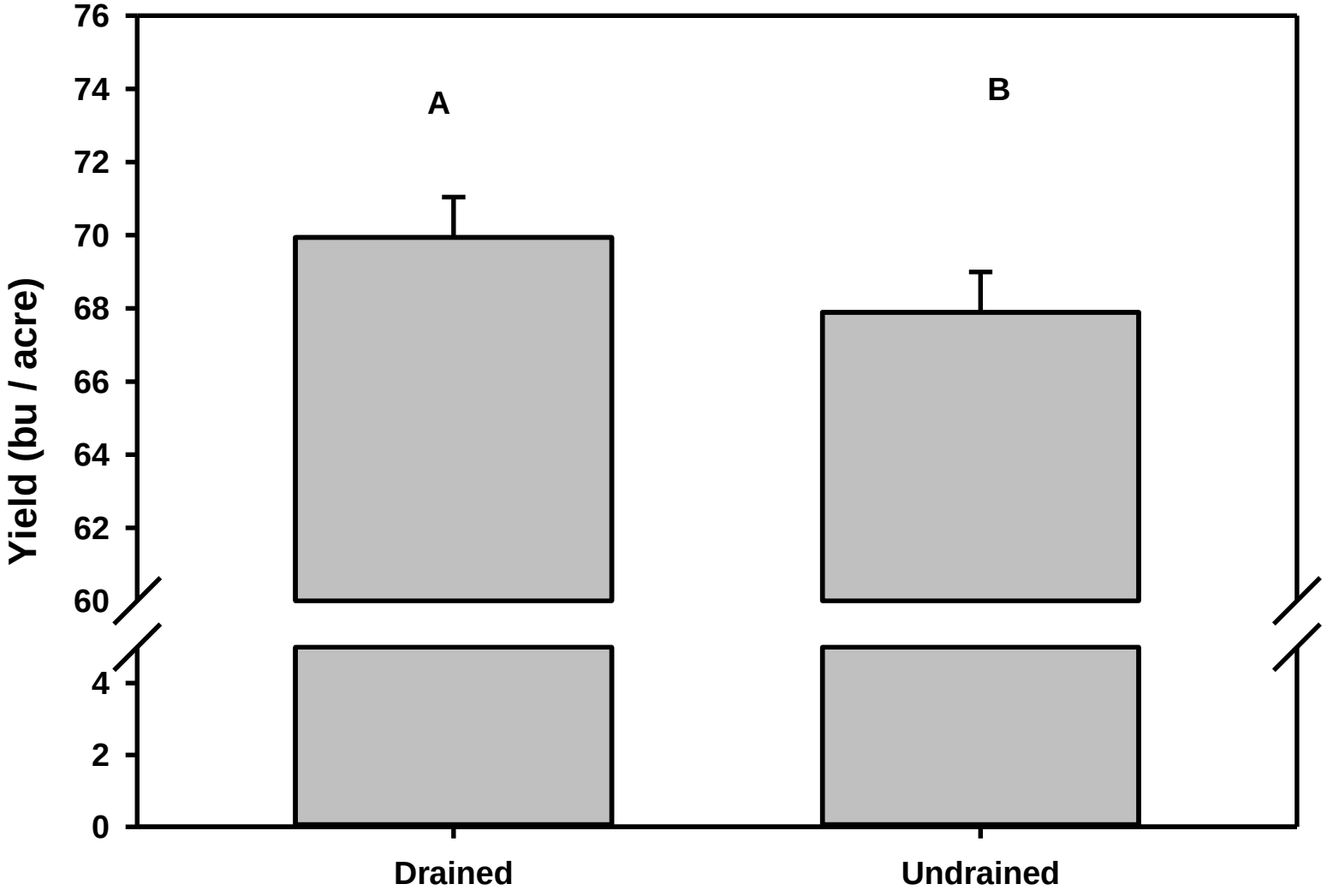
© 2015 Regents of the University of Minnesota. All rights reserved.

© 2015 Regents of the University of Minnesota. All rights reserved.



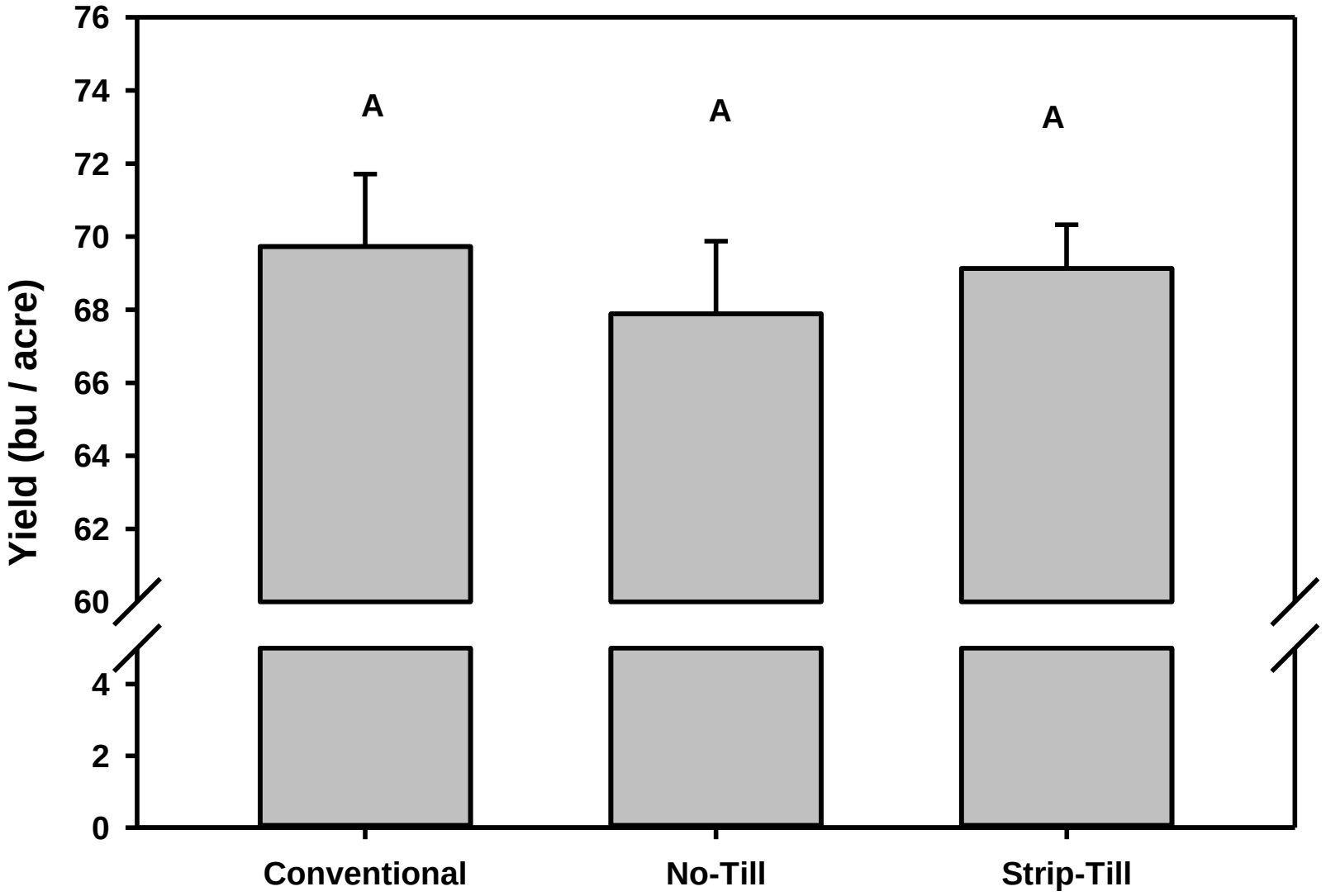
© 2015 Regents of the University of Minnesota. All rights reserved.

2017 Effects of Drainage on Soybean Yields



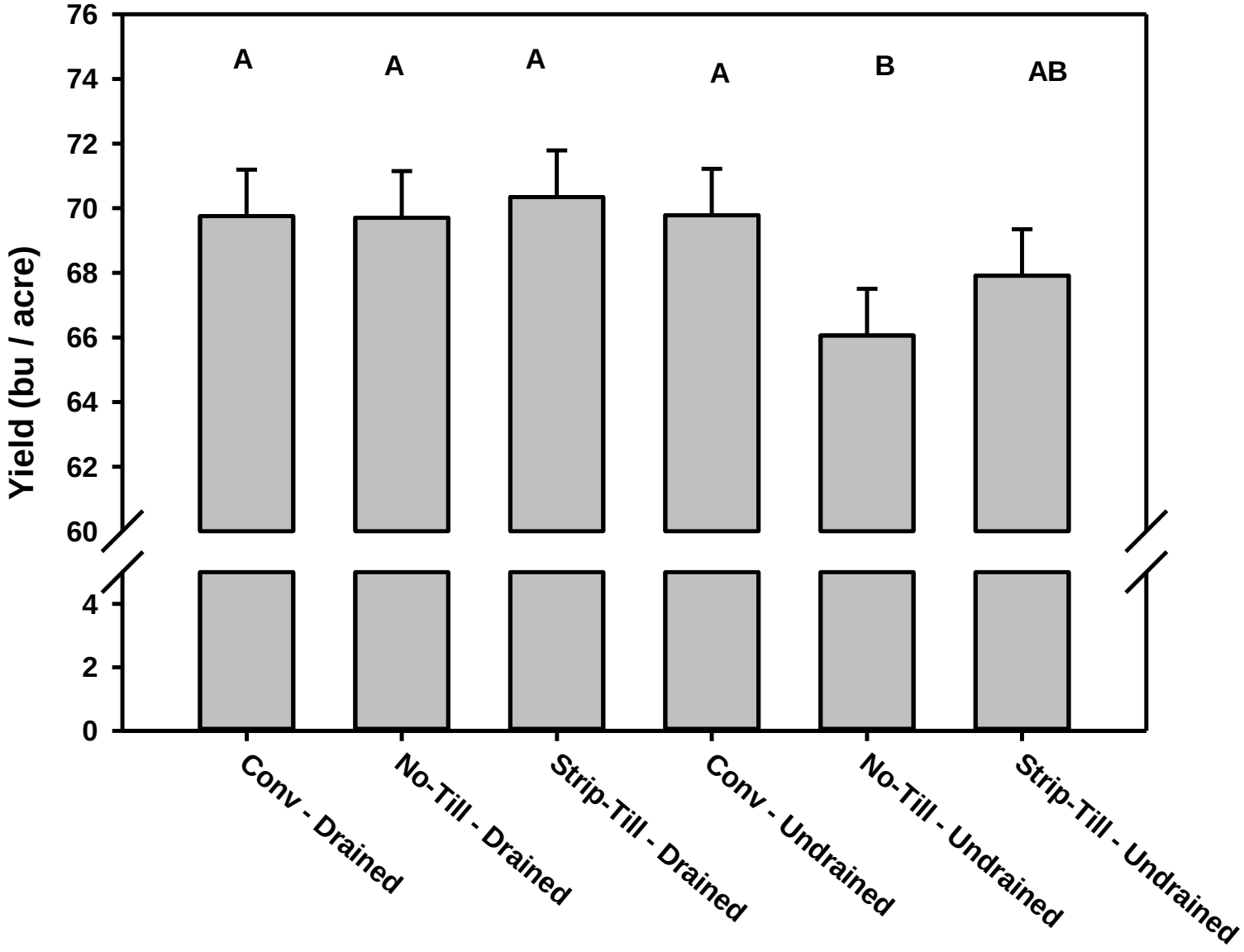
© 2015 Regents of the University of Minnesota. All rights reserved.

2017 -- Effects of Tillage on Soybean Yields



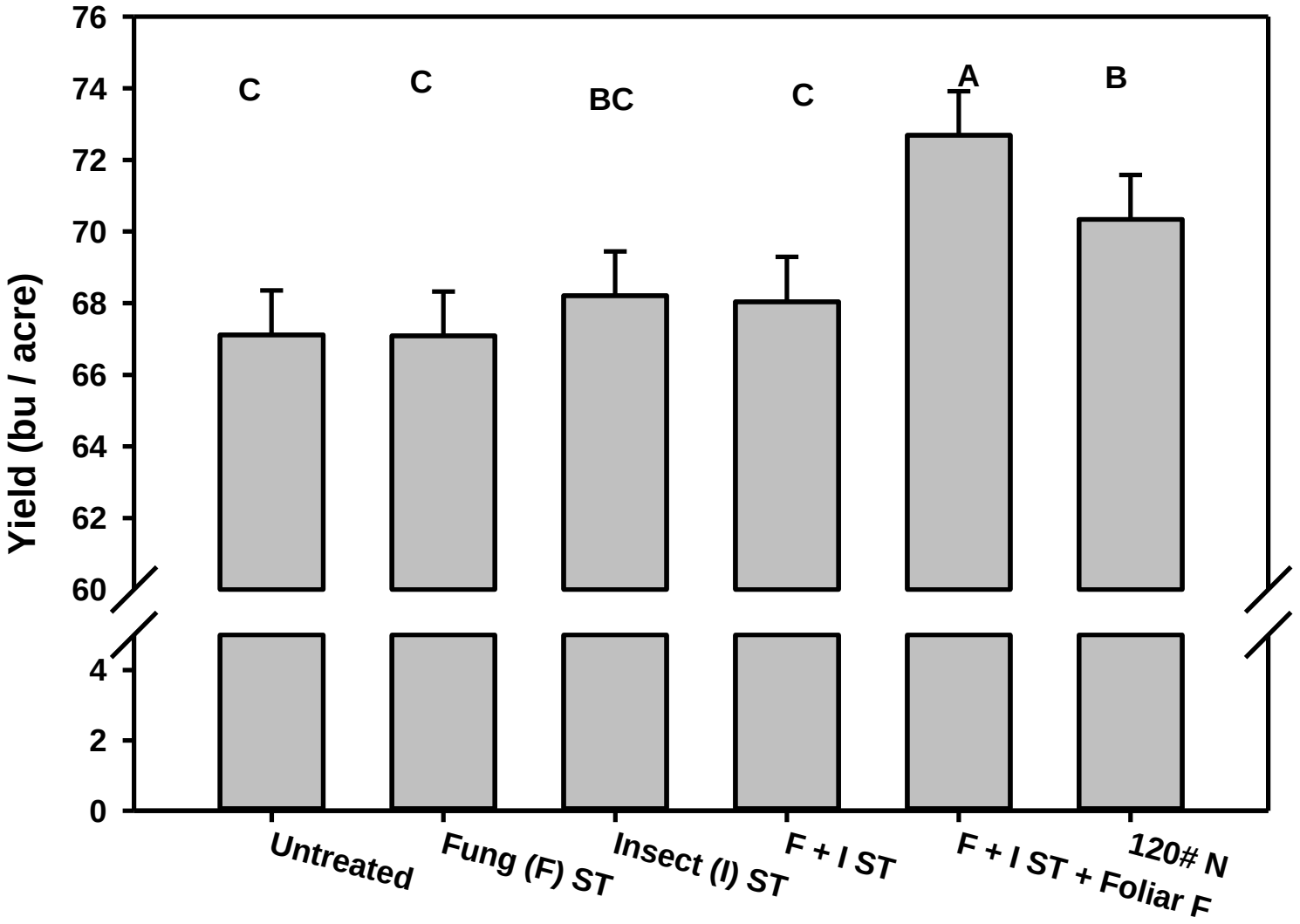
© 2015 Regents of the University of Minnesota. All rights reserved.

2017 -- Effects of Tillage and Drainage on Soybean Yields



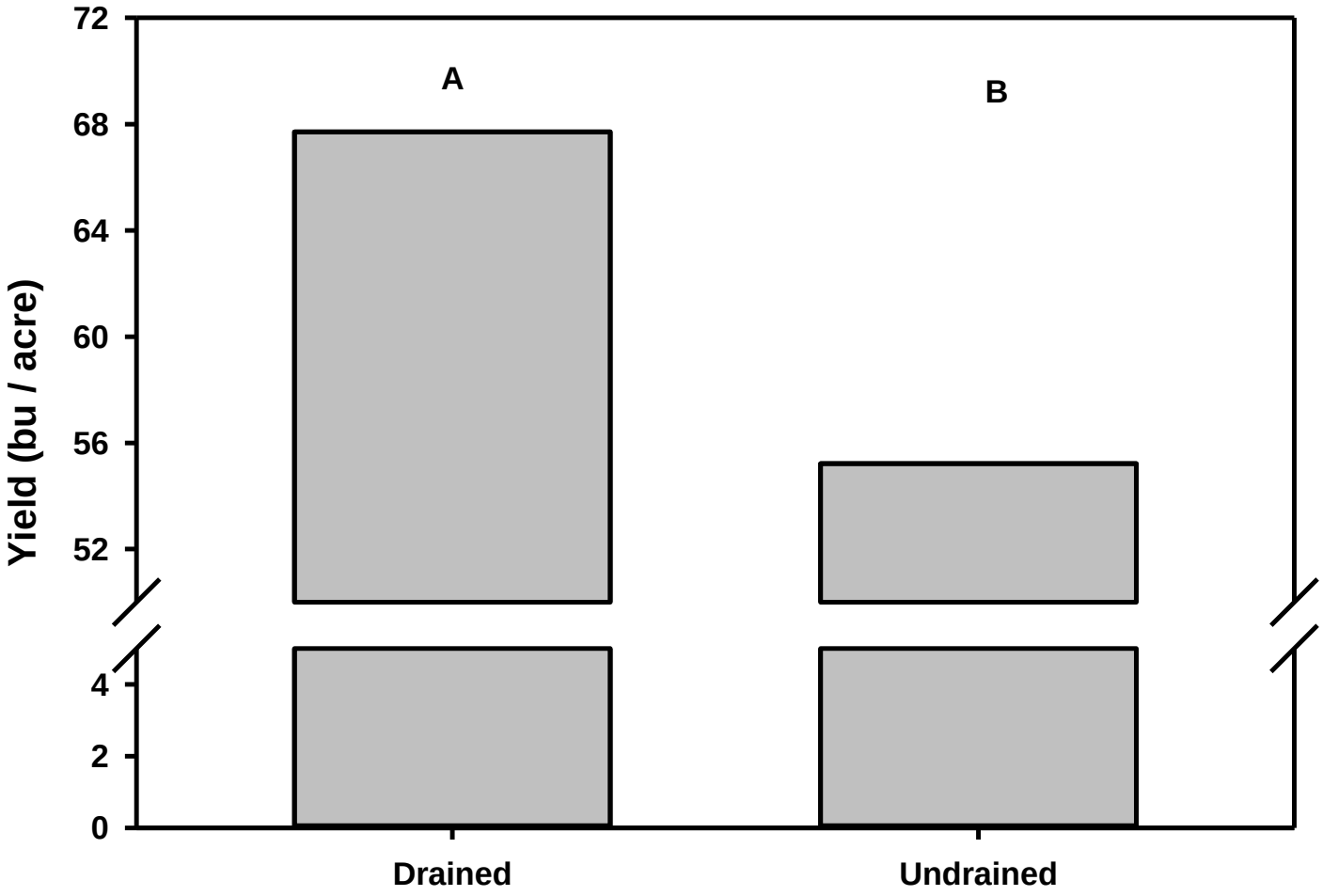
© 2015 Regents of the University of Minnesota. All rights reserved.

2017 -- Effects of Management on Soybean Yields



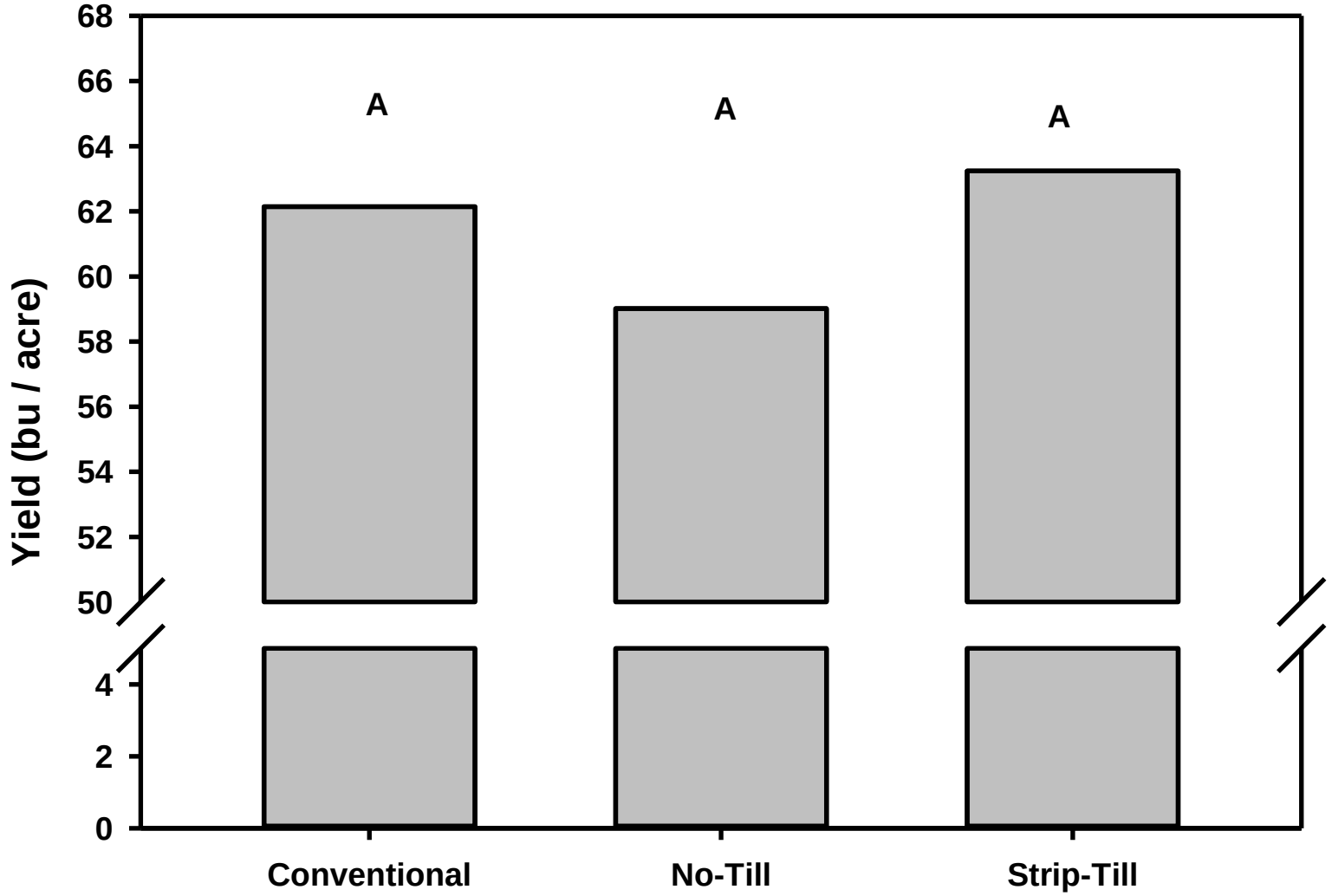
© 2015 Regents of the University of Minnesota. All rights reserved.

2018 Effects of Drainage on Soybean Yields



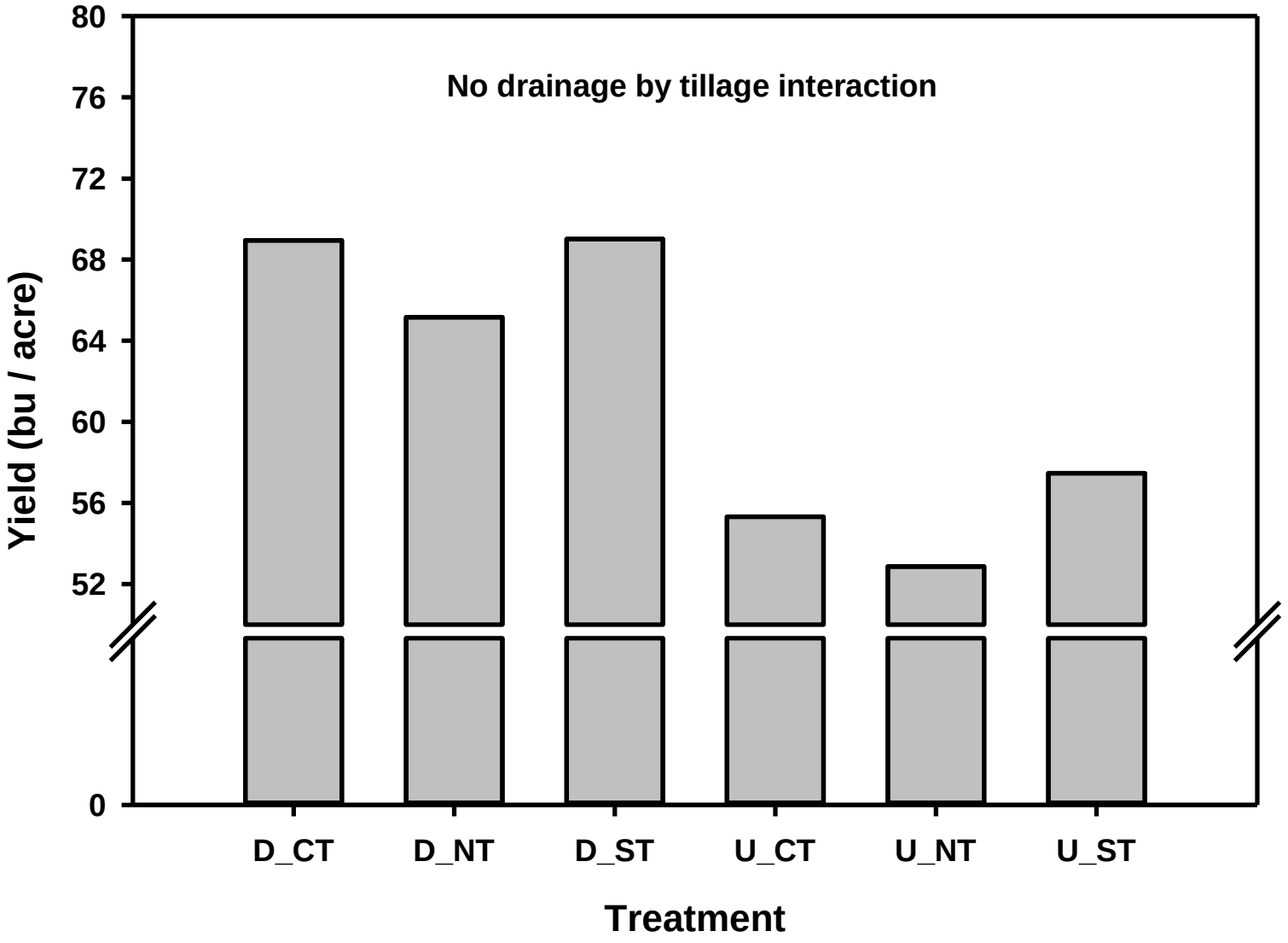
© 2015 Regents of the University of Minnesota. All rights reserved.

2018 -- Effects of Tillage on Soybean Yields



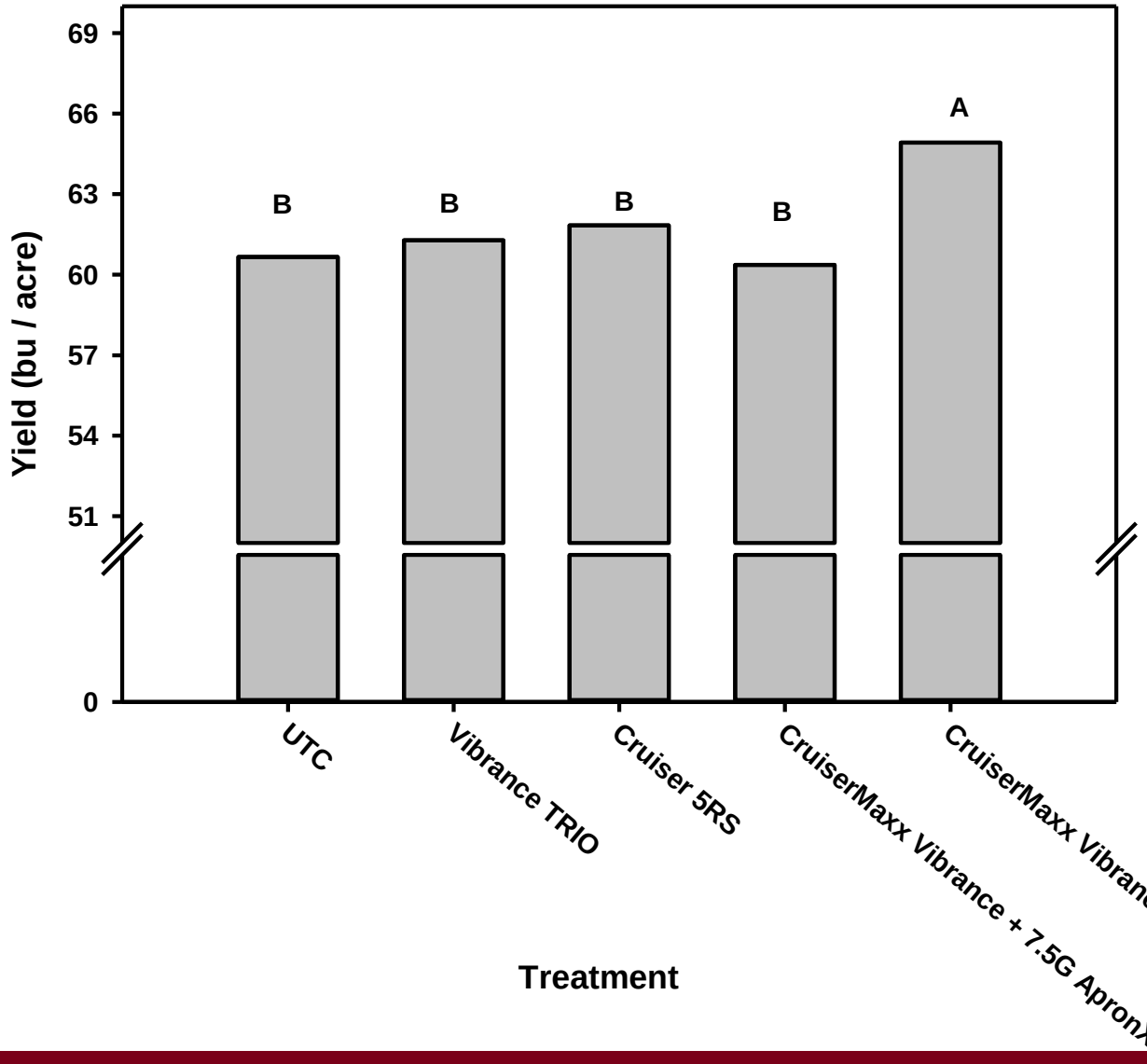
© 2015 Regents of the University of Minnesota. All rights reserved.

2018 -- Effects of Drainage and Tillage on Soybean Yields



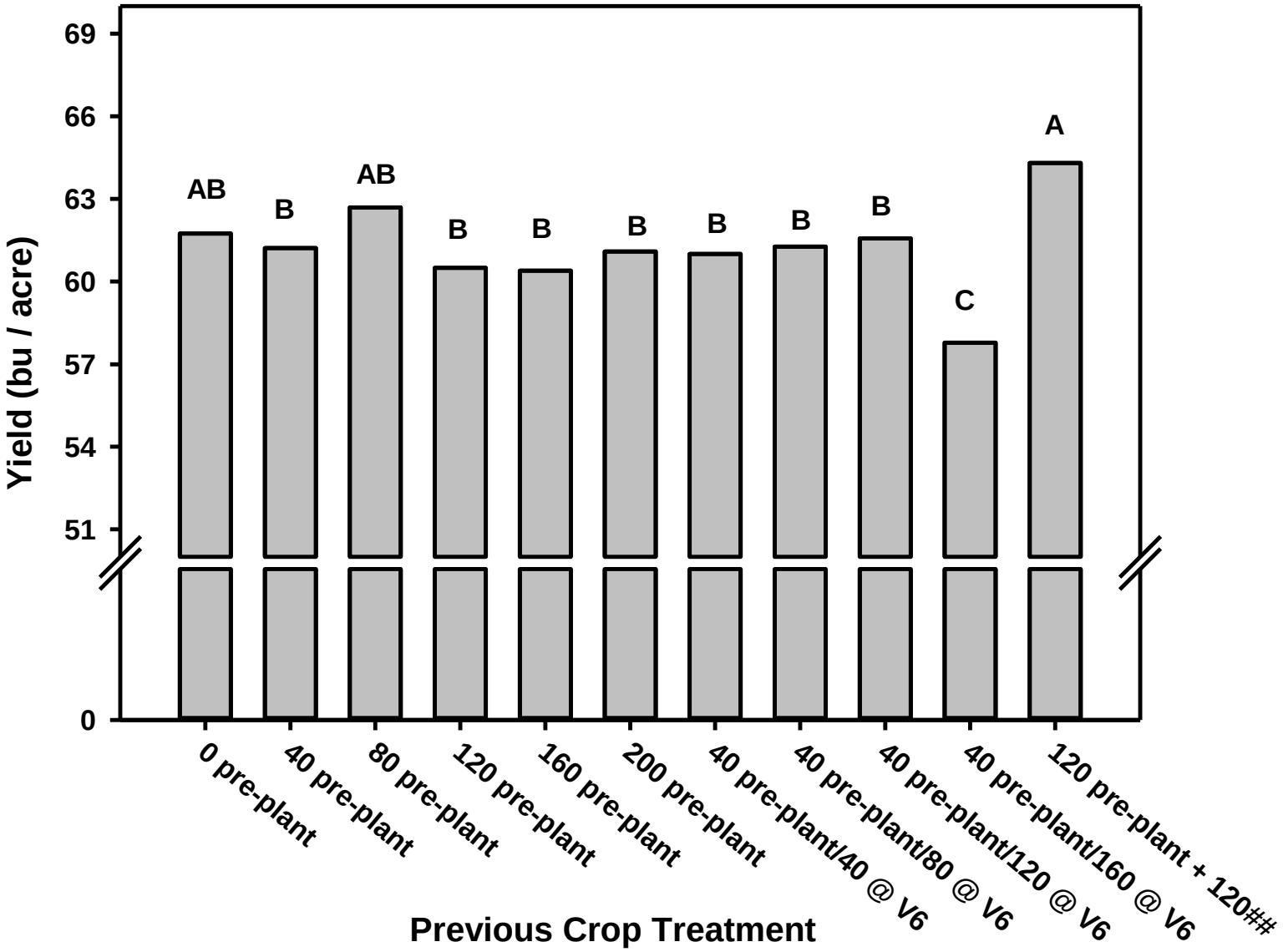
© 2015 Regents of the University of Minnesota. All rights reserved.

2018 -- Effects of Management on Soybean Yields



© 2015 Regents of the University of Minnesota. All rights reserved.

2018 -- Effects of Management on Soybean Yields



© 2015 Regents of the University of Minnesota. All rights reserved.

Growing Soybeans that Out-Compete Weeds

Crop Competition

- Ability to compete with weeds to reduce biomass and seed production

- Ability to tolerate weeds with reduced yield effects

© 2015 Regents of the University of Minnesota. All rights reserved.

Competition Depends on:

- The **weed** side
  - Relative time of emergence
  - Species of weeds
    - Broadleaves tend to me more competitive
  - Weed density
  - Environmental factors
    - Water
    - Light
    - Nutrients
    - Temperature

© 2015 Regents of the University of Minnesota. All rights reserved.

Competition Depends on:

- The **crop** side
  - Soybean genetics and architecture
  - Row spacing
  - Population
  - Date of planting
  - Soybean maturity
  - Diseases, stresses, hazards, and crop injury
    - IDC
    - SCN

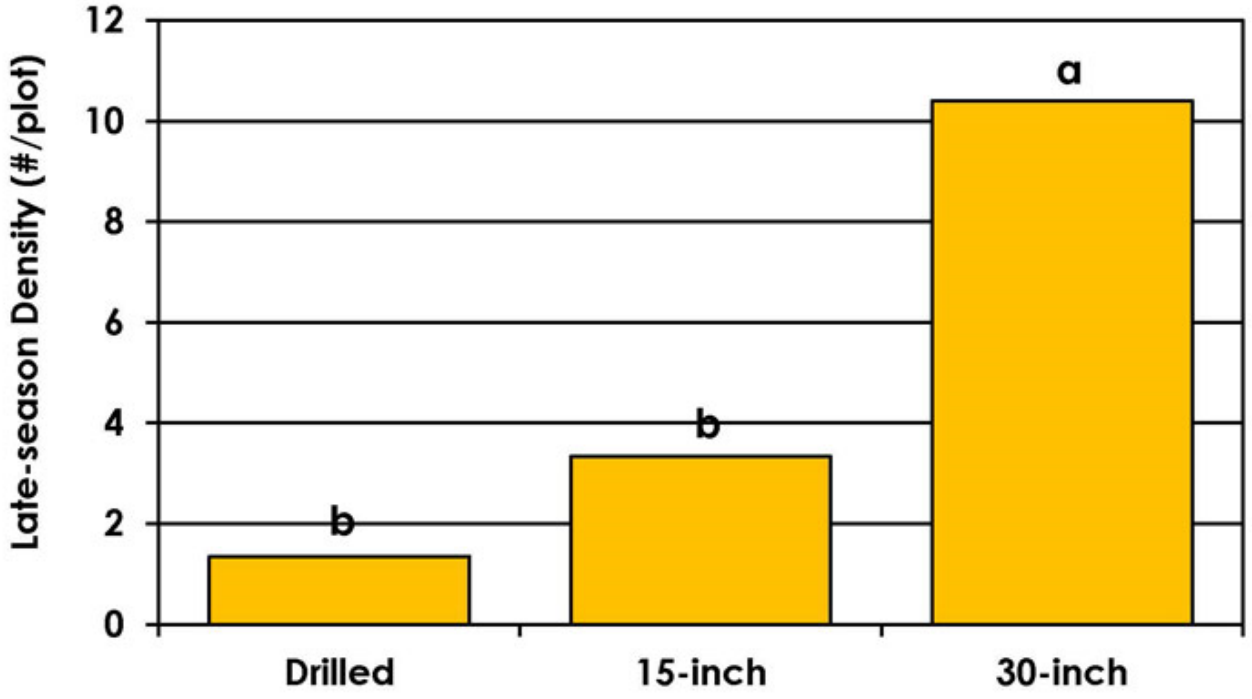
© 2015 Regents of the University of Minnesota. All rights reserved.

Row Spacing

- Narrow rows impact weed competition by
  - Reduction in amount of light that reaches the soil surface
  - Reduction in the time that is required for the crop to reach full canopy closure
- The result is that narrow rows suppress mid-season weed growth and have less “weed resurgence” (late emerging weeds)

© 2015 Regents of the University of Minnesota. All rights reserved.

What effect does soybean row spacing have on pigweed control?



*Results summarized across herbicide programs, tillage types, and planting populations.
**Means followed by the same letter are not different, P≤0.05

© Dr. Kevin Bradley, University of Missouri

© 2015 Regents of the University of Minnesota. All rights reserved.

Row Spacing

- Narrow rows increase crop competition, but there are interactions with weed species
  - Growth habits of cocklebur and giant ragweed can grow at lower light levels, continue to grow within the crop canopy (partially through branching) and will grow taller than the soybean crop later in the season
    - Less affected by row spacing
  - Broadleaves like velvetleaf grow to overtake the soybean canopy early
    - More affected by row spacing

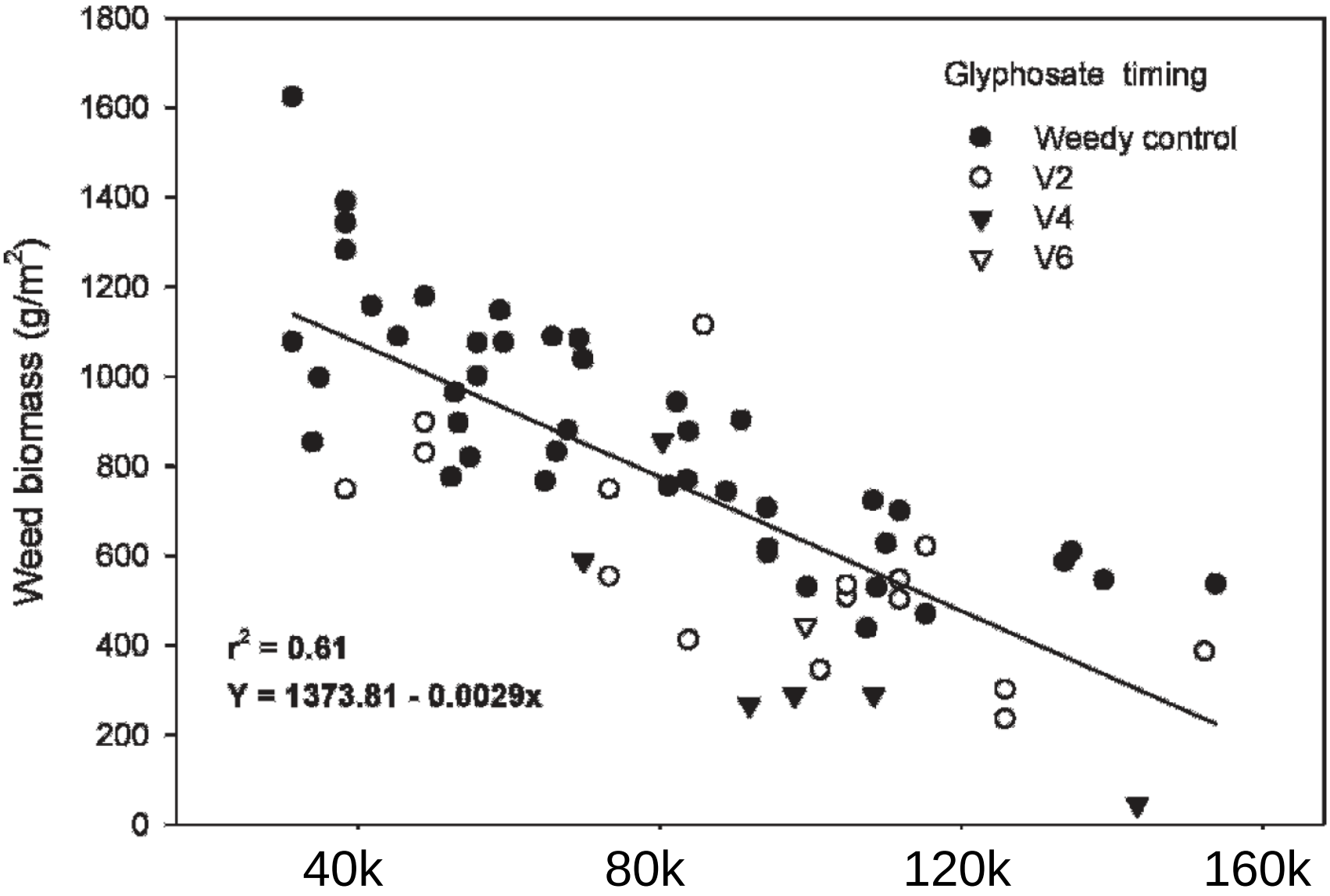
© 2015 Regents of the University of Minnesota. All rights reserved.

In general

- Weeds in narrow rows
  - Have lower total biomass
  - Reduced soybean yields less than those in wide rows
  - Were less likely to emerge late in the season
- However, delaying emergence of weeds (by other means) will likely have a larger effect than row spacing alone

© 2015 Regents of the University of Minnesota. All rights reserved.

Soybean Populations



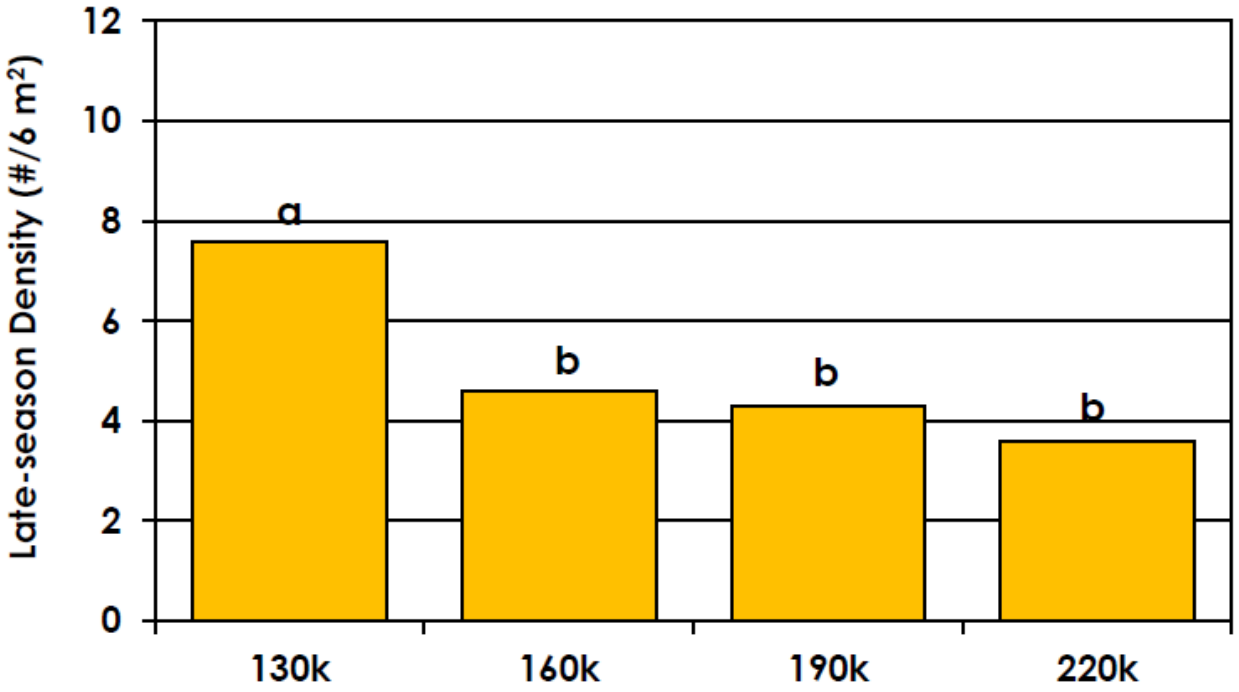
Arce and Hartzler(2009)

Soybean Populations (continued)

- DeWerff et al (2014) examined effect of PRE herbicides and soybean populations on weed competition.
- The use of a PRE had a large effect on weeds, weed competition, and soybean yields.
- Soybean populations had a relatively small impact on weed competition, but affect soybean yields
- Interestingly, the use of a PRE helped the crop to develop leaf area sooner and faster.
  - CIPAR (V1-R1) was 22% higher in the PRE treatments

© 2015 Regents of the University of Minnesota. All rights reserved.

What effect does soybean planting population have on pigweed control?



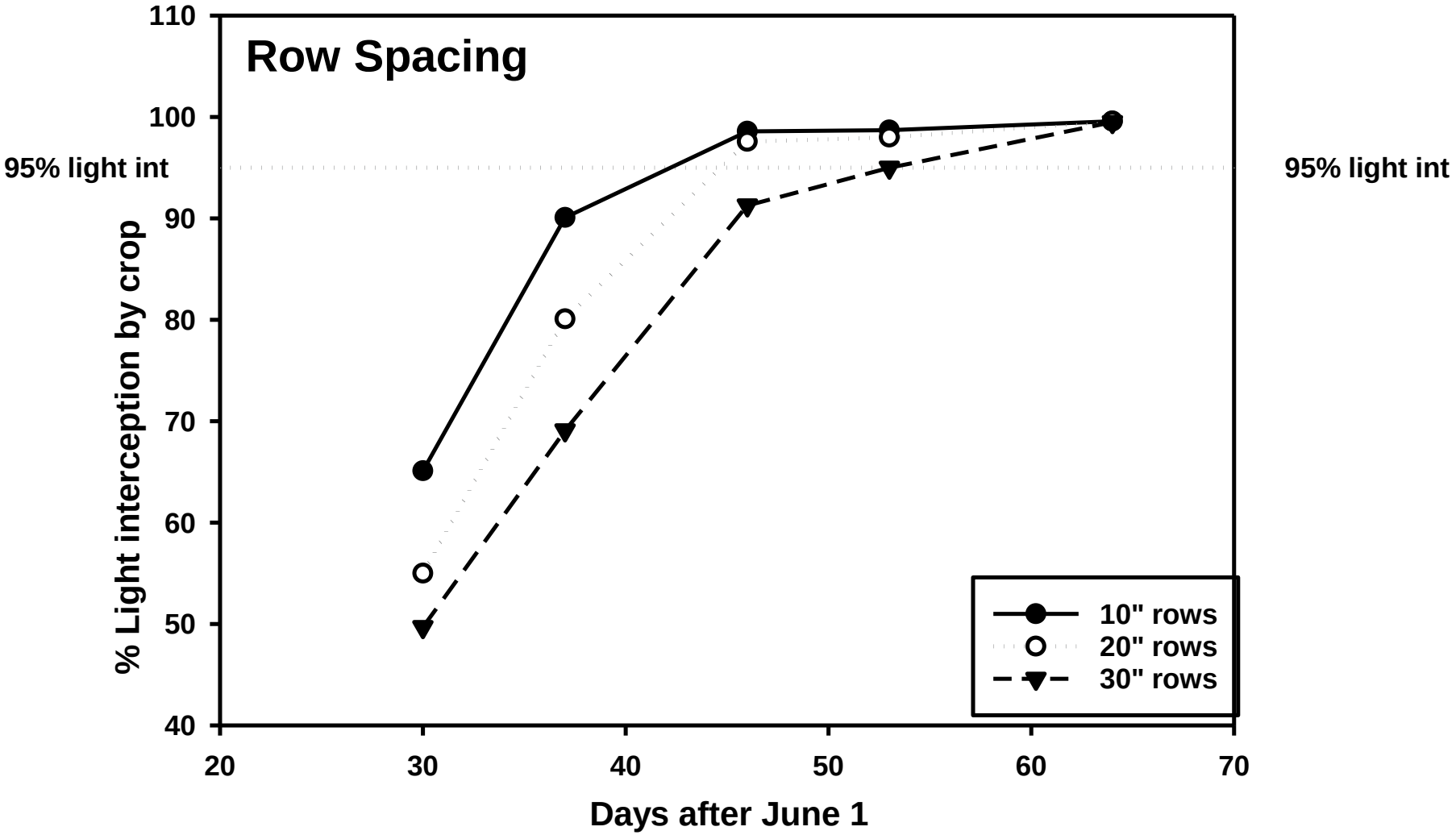
*Results summarized across herbicide programs, tillage types, and row spacings.

**Means followed by the same letter are not different, P≤0.05

© Dr. Kevin Bradley, University of Missouri

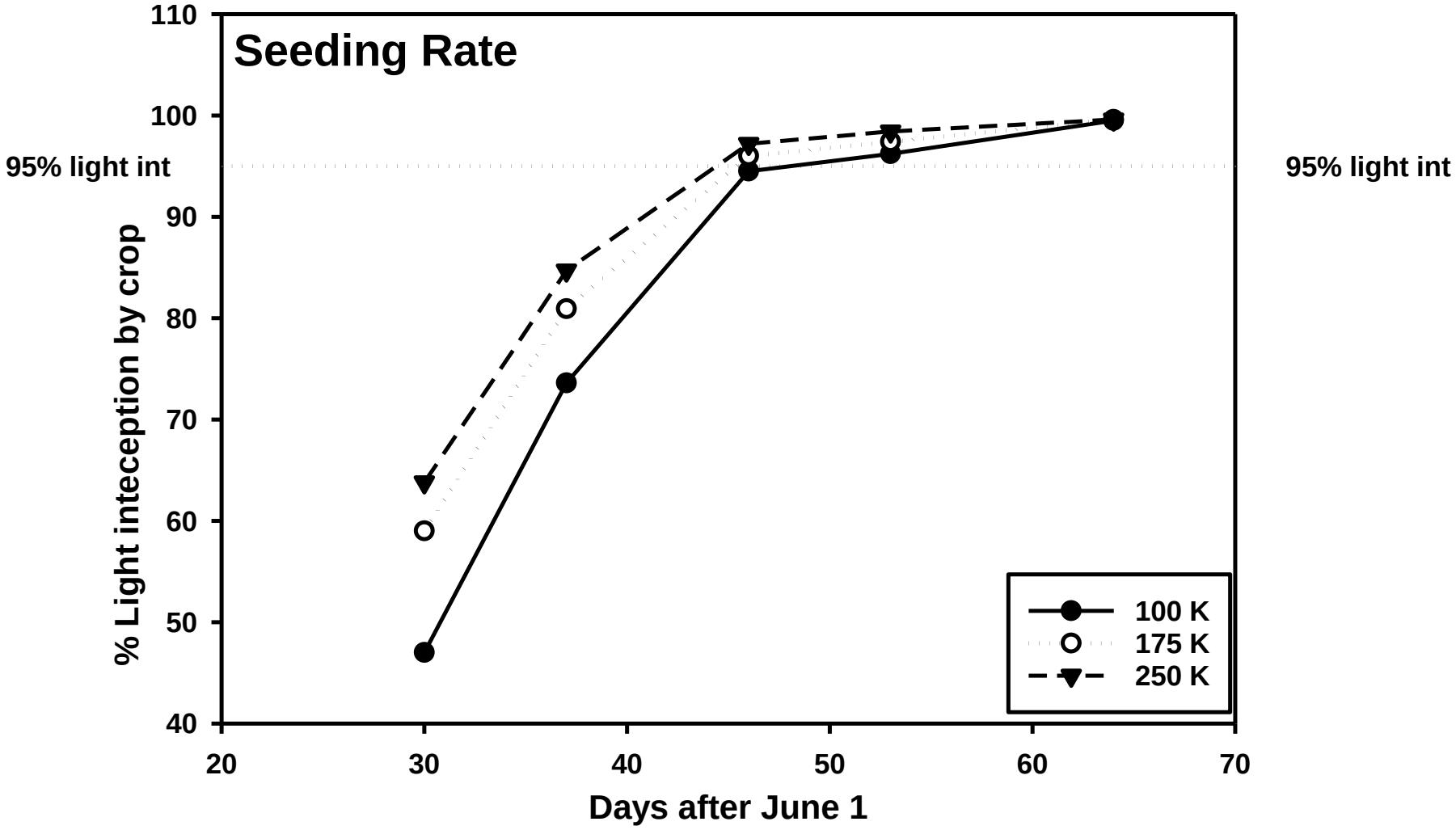
© 2015 Regents of the University of Minnesota. All rights reserved.

Soybean Light Interception
Lamberton - 2000



© 2015 Regents of the University of Minnesota. All rights reserved.

Soybean Light Interception
Lamberton - 2000



© 2015 Regents of the University of Minnesota. All rights reserved.

Date of planting

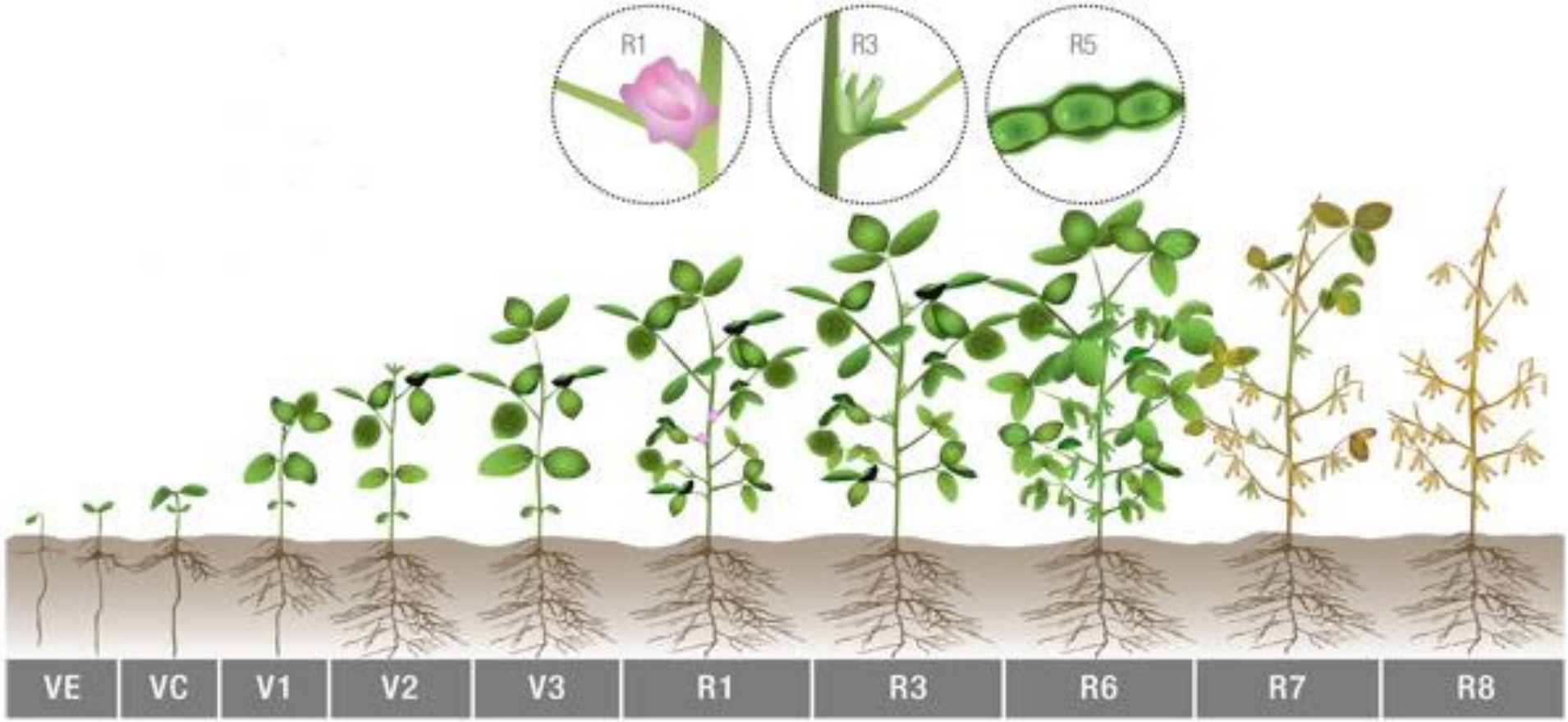
- Theoretically - early planting will lead to earlier canopy closure and greater LAI, and therefore earlier crop competition.
- However, early planting will favor weeds that emerge and thrive at cooler temperatures than soybeans.
  - Planting date effects are really about managing the environment to favor the crop over the weed
- And, due to cool early conditions, 1 day earlier planting does not equal 1 day earlier canopy closure

© 2015 Regents of the University of Minnesota. All rights reserved.

Soybean maturity

- Soybean maturity may affect late season weed emergence
- Maturity primarily affects the overlap in vegetative growth and seed filling and the timing of maturity
- Soybean maturity will not affect days to row closure or any early season weed competitive effects

© 2015 Regents of the University of Minnesota. All rights reserved.



© 2015 Regents of the University of Minnesota. All rights reserved.

Soybean maturity (continued)

- Longer season soybeans will continue vegetative development longer and will form denser canopies in late summer.
- On the other hand, short-season soybeans will end vegetative growth earlier and have less dense canopies in late summer.
- So, soybean maturity had the potential to affect late-season weeds

© 2015 Regents of the University of Minnesota. All rights reserved.

Summary

- Narrow rows, higher populations, earlier planting, and longer maturities all increase soybean's ability to compete with weeds.
- However, there are many caveats

- What about other effects?
  - Yield - *per se*
  - Other hazards (IDC, SCN, risk of white mold, etc)

© 2015 Regents of the University of Minnesota. All rights reserved.

Summary

- We are living in a whole new world
- Weed management will require a holistic approach to soybean production.
  - No matter how effective, no single tool will be enough
  - Layering tools will be essential
- Weed management should be a core part of every management decision made on the farm

© 2015 Regents of the University of Minnesota. All rights reserved.

Costs and Benefits of a 1% Cap on Foreign Material in US Soybean Exports

Seth Naeve
naeve002@umn.edu

Shawn Conley
spconley@wisc.edu

UNIVERSITY OF MINNESOTA
EXTENSION
Driven to Discover℠

Weed Science Society of America – February 12, 2019

Outline

- Grain Grading and Chinese Imports
- FM in the US Soybean Quality Survey
- FM Education in the NW Corn belt

© 2015 Regents of the University of Minnesota. All rights reserved.

Grain Grading Standards

- As with most commodities, soybean are primarily traded – globally – based on U.S. grain grading standards codified by USDA-FGIS.
  - Soybean standards were established in 1940 and were last amended in 2007
- Quality standards are focused around easily measurable parameters
  - Some argue that these standards may be antiquated

© 2015 Regents of the University of Minnesota. All rights reserved.

Anecdotally

- Naeve regularly meets with international customers regarding soybean quality

- *“When buyers complain about FM in US Soybean imports, this usually indicates that there are no other quality related issues to complain about.”*

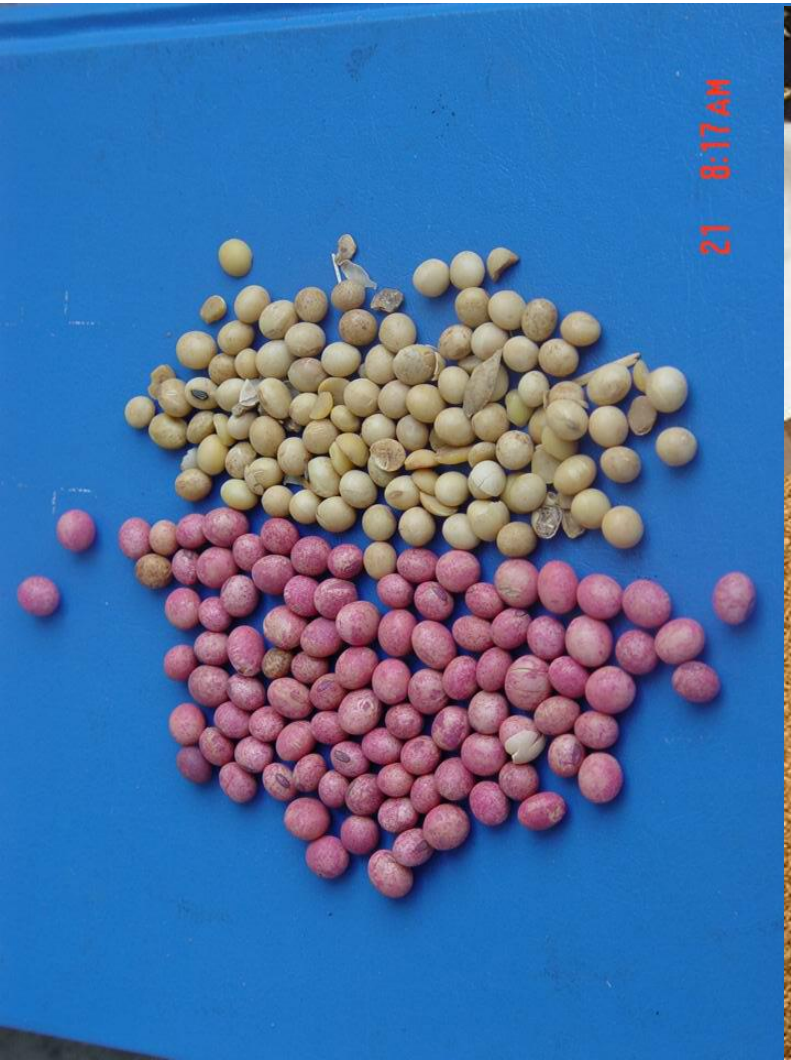
© 2015 Regents of the University of Minnesota. All rights reserved.

In fact

- Because Chinese purchase soybeans on the spot market, some feel that extra scrutiny is placed on vessels during periods of declining prices

© 2015 Regents of the University of Minnesota. All rights reserved.

On the ground in China



On the ground in China (cont.)

- You CAN find FM in soybean in soybean imports throughout Asia

© 2015 Regents of the University of Minnesota. All rights reserved.

© 2015 Regents of the University of Minnesota. All rights reserved.

Cockleburs and corn are not hard to find

© 2015 Regents of the University of Minnesota. All rights reserved.

Corn can be especially problematic

- Identification of unapproved traits in corn can lead to rejections of entire vessels

© 2015 Regents of the University of Minnesota. All rights reserved.

FM Survey

- Naeve has conducted a survey of the quality of the US Soybean crop since 2006
- His lab receives 2,000-3,000 samples annually
- Quality measures include total FM in each sample

© 2015 Regents of the University of Minnesota. All rights reserved.

In 2018

- Of 1,683 samples, FM averaged 0.2%
- Only 5 samples had FM levels of greater than 2%
- 27 had FM levels between 1-2%.

- More than 98% of samples had FM levels below 1%.

© 2015 Regents of the University of Minnesota. All rights reserved.

Results

- Of the 693 samples with measurable FM, we have analyzed 334 for weed seed contamination
- Of these, 37% had no weed seed within the FM

- So, although 98% of all samples had less than 1% FM. Approximately 25% of all samples contained weed seed.
  - 41% x 63% = 25%
    - 41% of all soybean samples had measurable FM
    - 63% of these contained weed seed

© 2015 Regents of the University of Minnesota. All rights reserved.

Nationwide

Ranking	Weed Genus/Species (common name)	# Samples	% of 334	% of 210
1	*Ambrosia* spp. (ragweed)	53	15.9	25.2
2	*Zea mays* (corn)	49	14.7	23.3
3	*Ipomoea* spp. (morning glory)	39	11.7	18.6
4	*Amaranthus* spp. (pigweed)	33	9.9	15.7
5	*Sida* spp. (mallow, wireweed)	32	9.6	15.2
6	*Setaria* spp. (foxtail)	29	8.7	13.8
7	*Echinochloa* spp. (barnyard grass)	22	6.6	10.5
8	*Triticum aestivum* (common wheat)	19	5.7	9.0
9	*Chenopodium* spp. (lambsquarters)	12	3.6	5.7
10	*Abutilon theophrasti* (velvetleaf)	9	2.7	4.3
	Brassica spp. (wild mustards)	9	2.7	4.3
	Panicum spp. (witchgrass, switchgrass)	9	2.7	4.3
	Sinapsis arvensis (field mustard)	9	2.7	4.3

© 2015 Regents of the University of Minnesota. All rights reserved.

Minnesota, N Dakota, and S Dakota

Ranking	Weed Genus/Species (common name)	# Samples	Percent of 71	
1	*Triticum aestivum* (common wheat)	13	18.3	
2	*Zea mays* (corn)	12	16.9	
3	*Ambrosia* spp. (ragweed)	10	14.1	
4	*Amaranthus* spp. (pigweed)	8	11.3	
5	*Echinochloa* spp. (barnyard grass)	7	9.9	
6	*Chenopodium* spp. (lambsquarters)	5	7.0	
7	*Setaria* spp. (foxtail)	5	7.0	
8	*Brassica* spp. (wild mustards)	3	4.2	
9	*Sinapsis arvensis* (field mustard)	3	4.2	
10	*Abutilon theophrasti* (velvetleaf)	2	2.8	
	Avena spp. (oats, wild oats)	2	2.8	
	Bassia scoparia (kocia)	2	2.8	
	Panicum spp. (witchgrass, switchgrass)	2	2.8	

© 2015 Regents of the University of Minnesota. All rights reserved.

The Full List

- Abutilon theophrasti
- Amaranthus spp.
- Ambrosia spp.
- Ambrosia artemisiifolia
- Ambrosia trifida
- Argemone sp.
- Asteraceae spp.
- Asteraceae spp. (mostly immature)
- Avena fatua
- Avena sativa
- Bassia scoparia
- Brassica spp.
- Brassica napus
- Bupleurum rotundifolia
- Carex sp.
- Chenopodium album
- Chenopodium spp.
- Commelina spp.
- Digitaria ciliaris
- Digitaria sanguinalis
- Echinochloa colona
- Echinochloa crus-galli
- Eleusine indica
- Eriochloa sp.
- Eriochloa villosa
- Euphorbia davidii
- Fallopia convolvulus
- Hordeum vulgare
- Ipomoea spp.
- Linum spp.
- Malva sp. (possibly Malvella sp.)
- Medicago sativa
- Melilotus sp.
- Mercurialis annua
- Mollugo verticillata
- Oryza sativa
- Panicum capillare
- Panicum miliaceum
- Panicum miliaceum subsp. ruderale
- Panicum spp.
- Persicaria lapathifolia
- Phaseolus vulgaris
- Physalis spp.
- Phytolacca americana
- Plantago lanceolata
- Plantago major
- Poaceae sp. (small caryopsis)
- Secale cereale
- Senna spp.
- Sesbania exalta
- Setaria faberi
- Setaria parviflora
- Setaria pumila
- Setaria viridis
- Sida spp.
- Sida rhombifolia
- Sida spinosa
- Sinapis arvensis
- Solanum rostratum
- Solanum spp.
- Solidago spp.
- Sonchus arvensis
- Sorghum bicolor
- Sorghum halepense
- Sorghum spp. (Broomcorn?)
- Triticum aestivum
- Typha sp.
- Urochloa platyphylla
- Urochloa texana
- Vicia villosa subsp. villosa
- Xanthium sp. (1 seed unit)
- Zea mays

© 2015 Regents of the University of Minnesota. All rights reserved.

FM Education project

- In light of new Chinese requirements
  - Naeve has initiated a project to educate farmers about the importance of weed control and minimizing additions to the weed-seed bank with the added bonus of maintaining markets through producing clean seed.
- Funded by MN, ND, and SD Soybean
- The primary deliverable is a series (10+) of 2 min videos

© 2015 Regents of the University of Minnesota. All rights reserved.

Insert FM overview video here

© 2015 Regents of the University of Minnesota. All rights reserved.

Summary – A 1% FM Threshold…

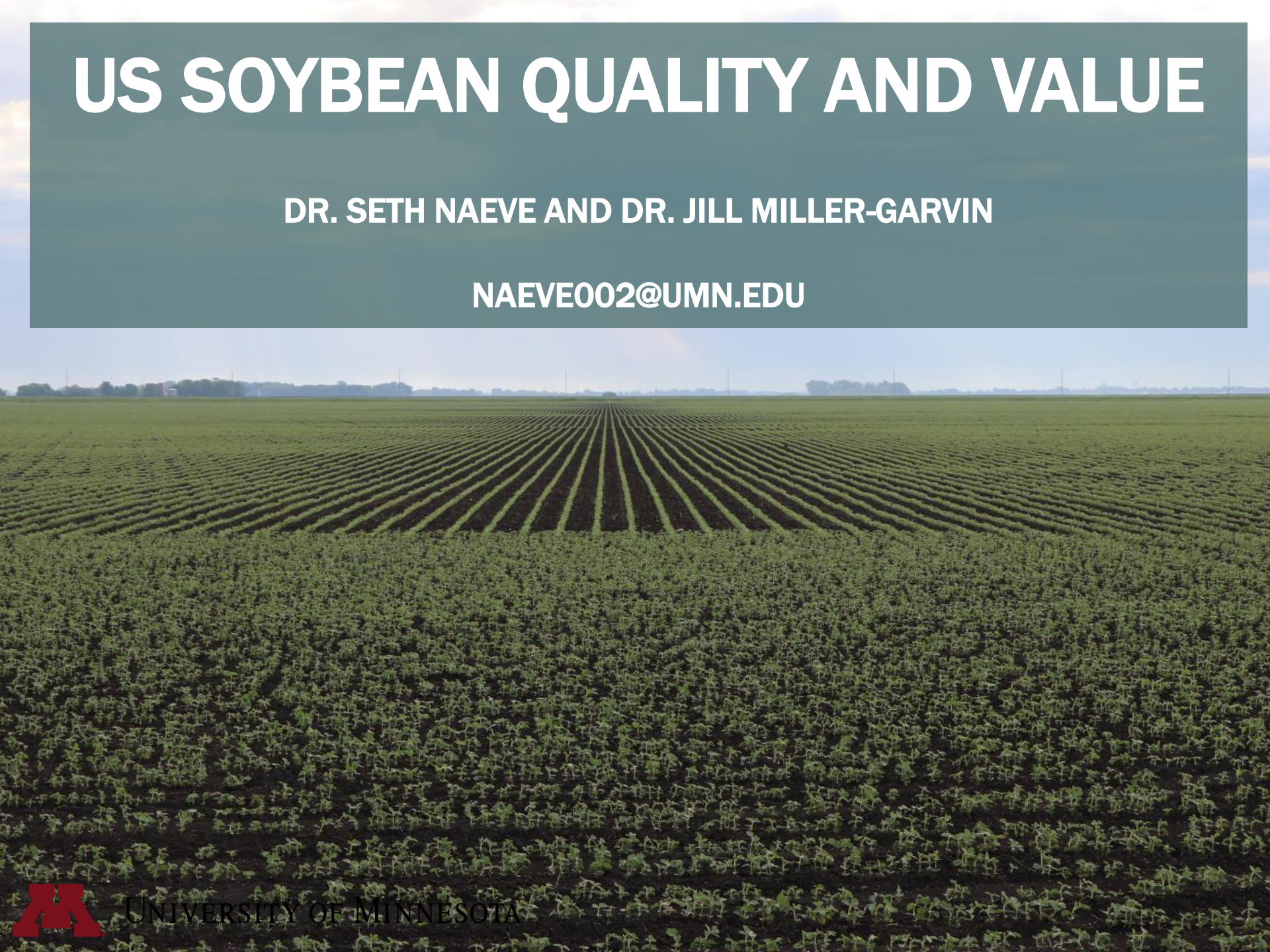
- Provides parity with Brazilian exports into China
- Requires the trade to maintain the purity of soybeans that farmers deliver to their local elevators
- Increases the value of US shipments into other destinations as the majority of soybeans available for export *should* be maintained at FM <1%
- Farmers should do all in their power to reduce weed seed contamination

© 2015 Regents of the University of Minnesota. All rights reserved.

US SOYBEAN QUALITY AND VALUE

DR. SETH NAEVE AND DR. JILL MILLER-GARVIN

NAEVE002@UMN.EDU



UNIVERSITY OF MINNESOTA

MY GENERAL PHILOSOPHY

- Soybean is a complex and variable product/commodity.
- Traditional grading systems do not correlate well with actual value.
- Most soybean quality traits extend into meal
- The first purchasers who are able to find hidden value will capture additional profit.

OUTLINE

- ~~2018 Growing season~~
- Historical protein and oil variation
- ~~2018 survey results~~
- Better measures of soybean value

SOYBEAN COMPOSITION

36% PROTEIN

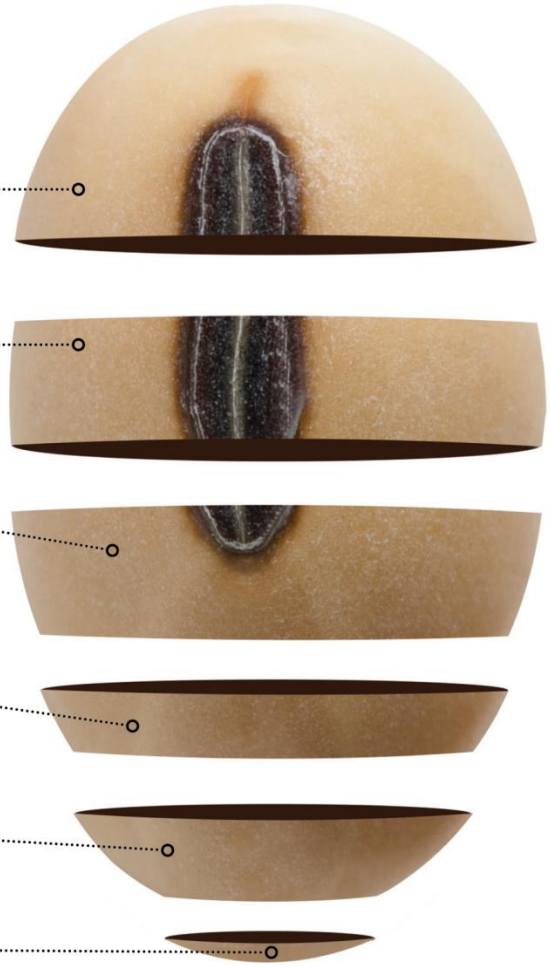
19% OIL

19% INSOLUBLE CARBOHYDRATE (FIBER)

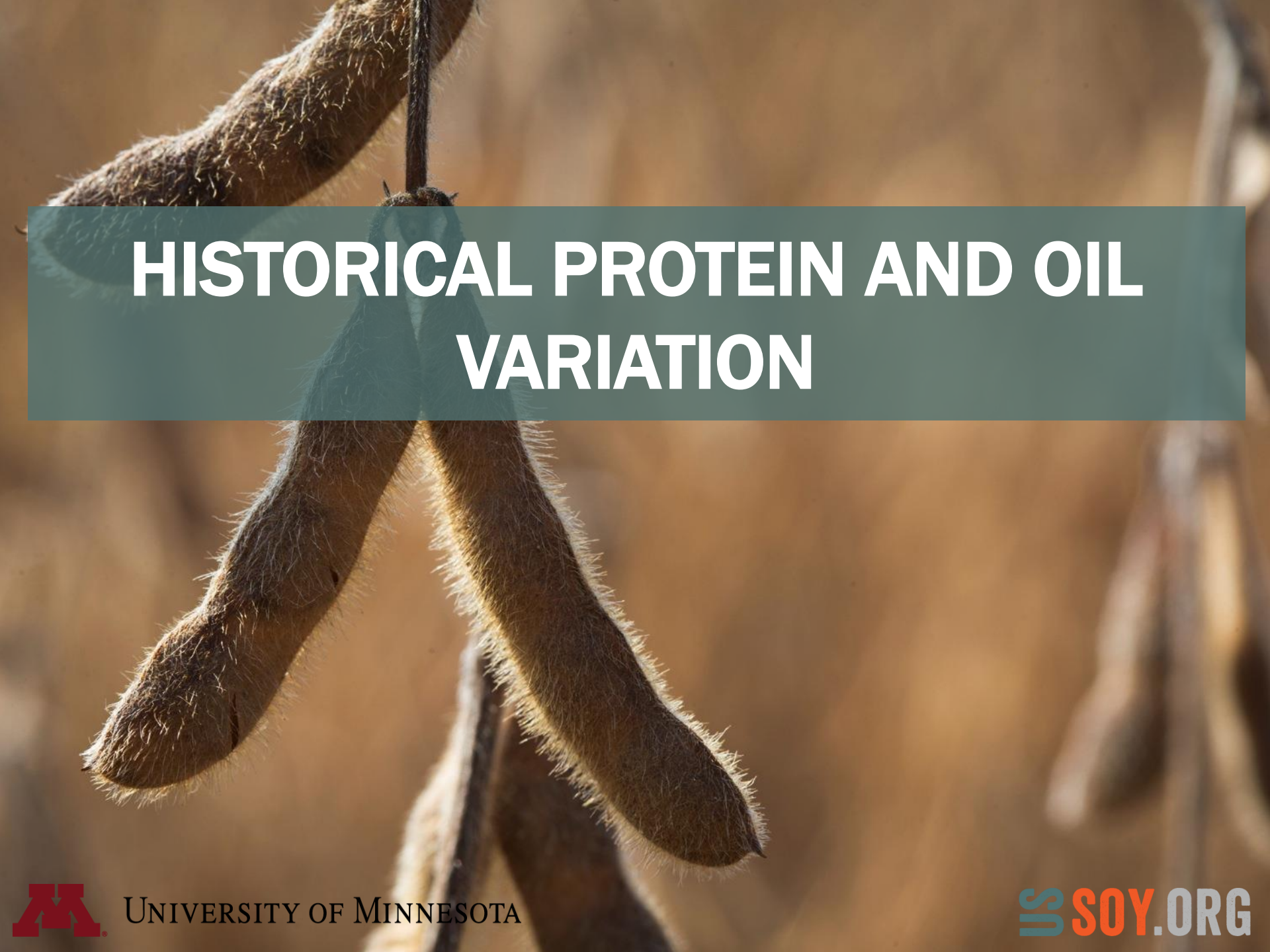
9% SOLUBLE CARBOHYDRATE

13% MOISTURE

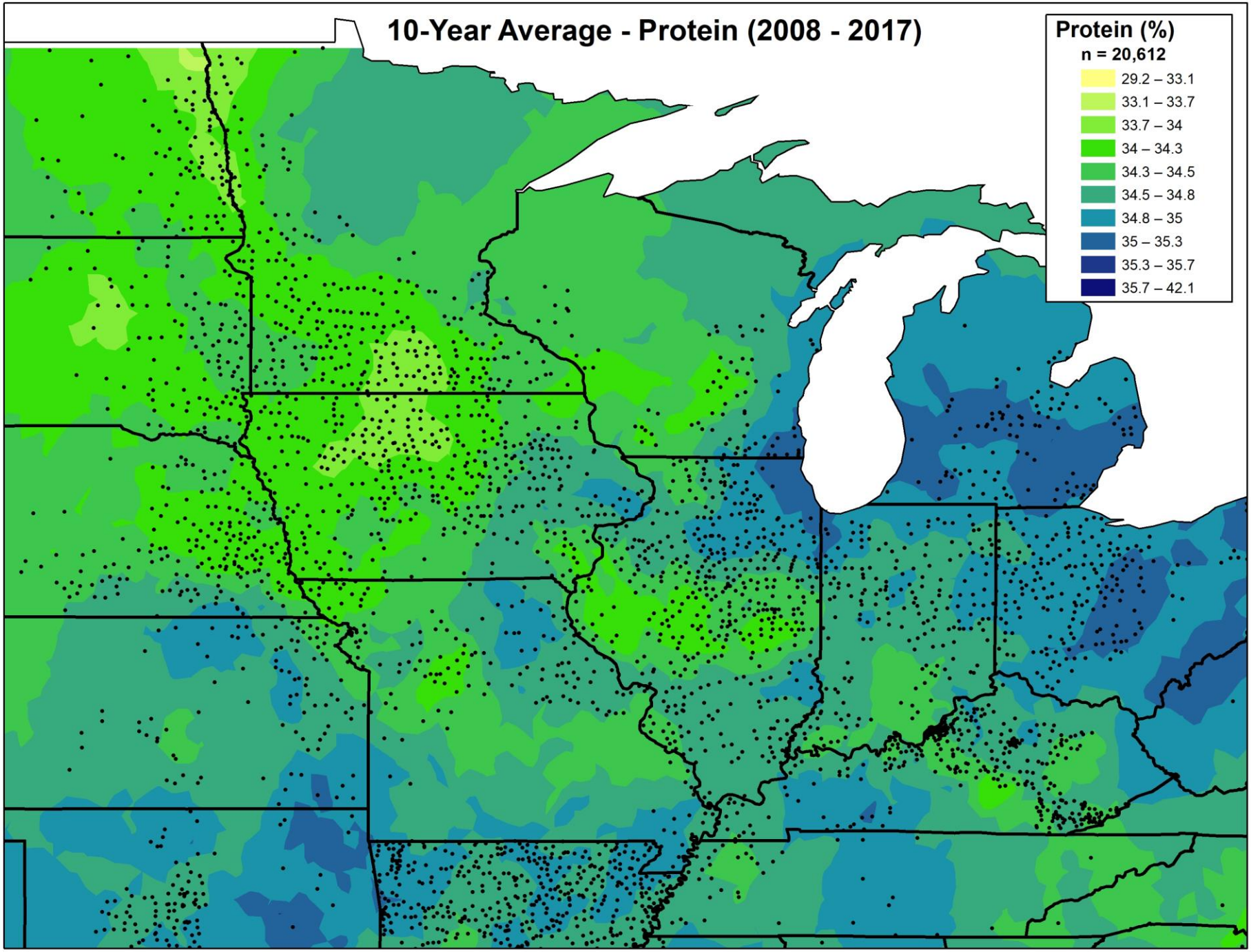
4% ASH (MINERALS)

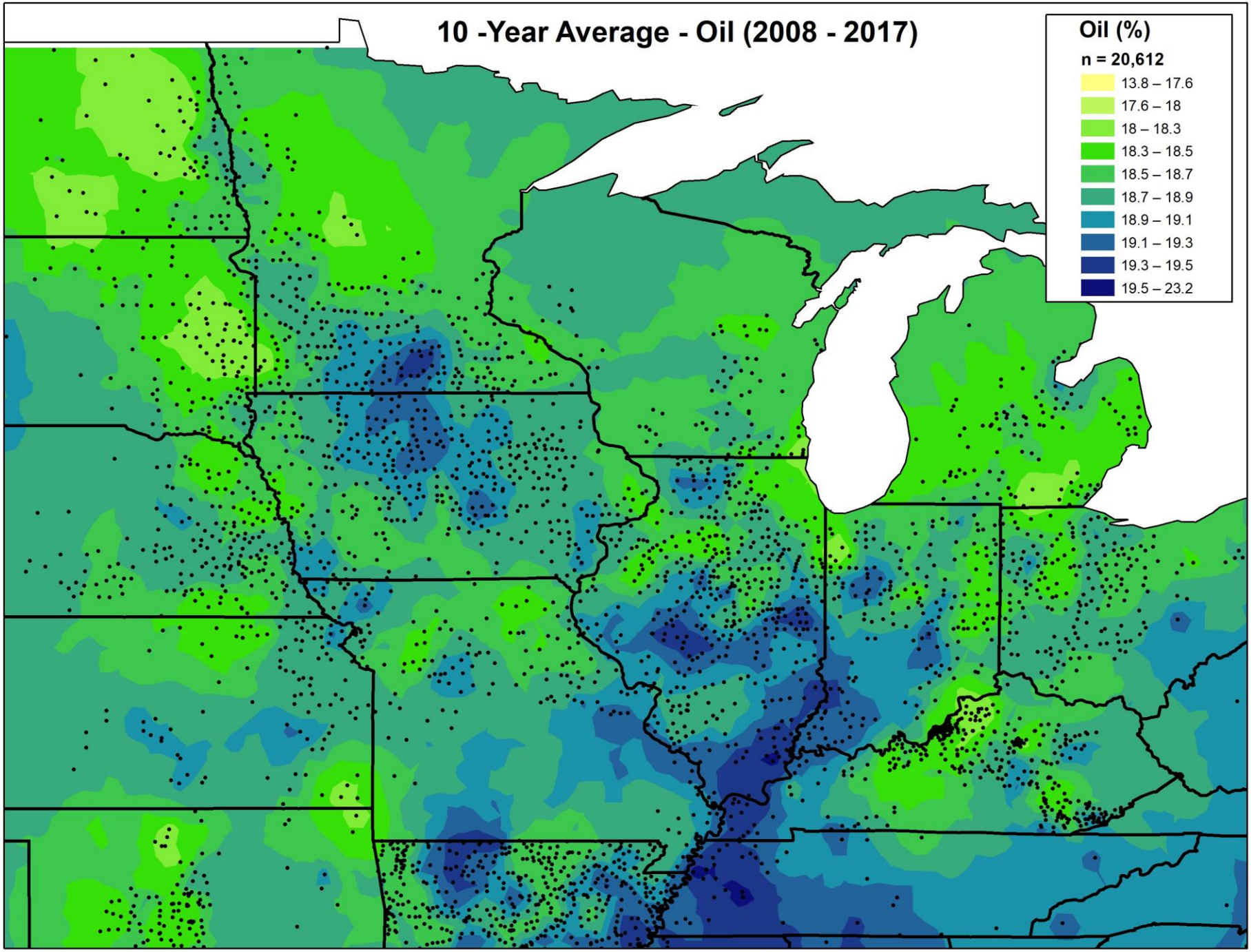


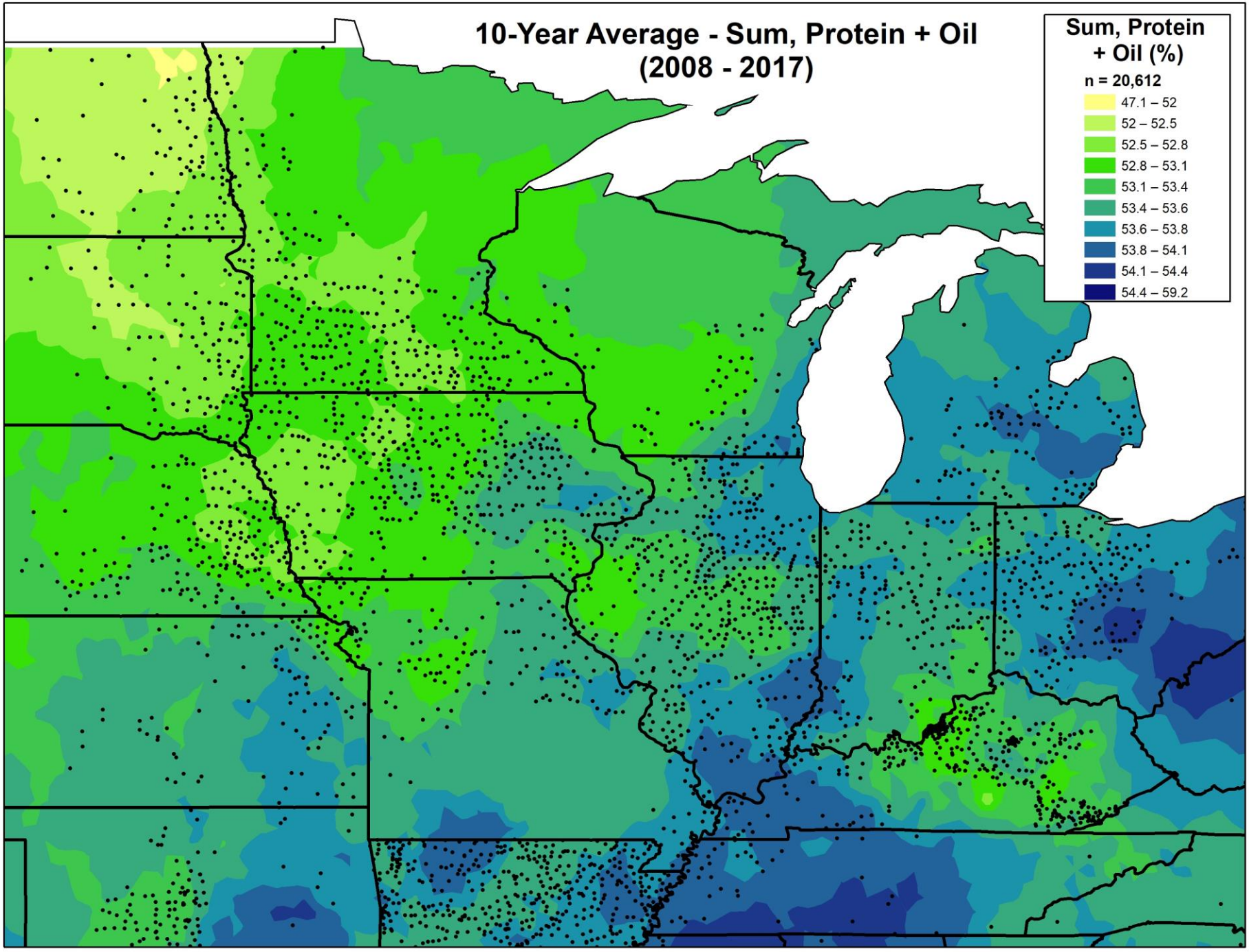
Source: United Soybean Board

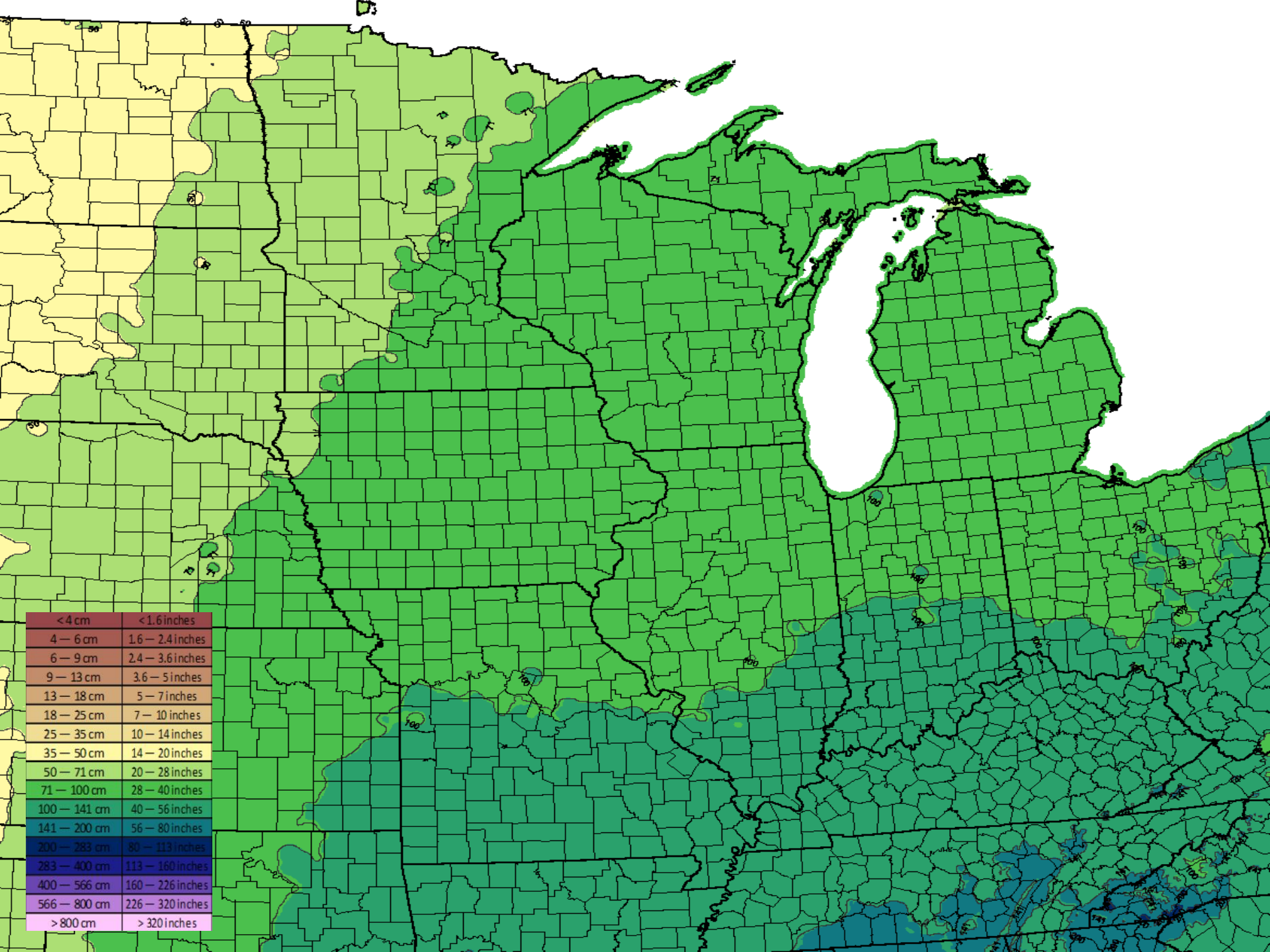


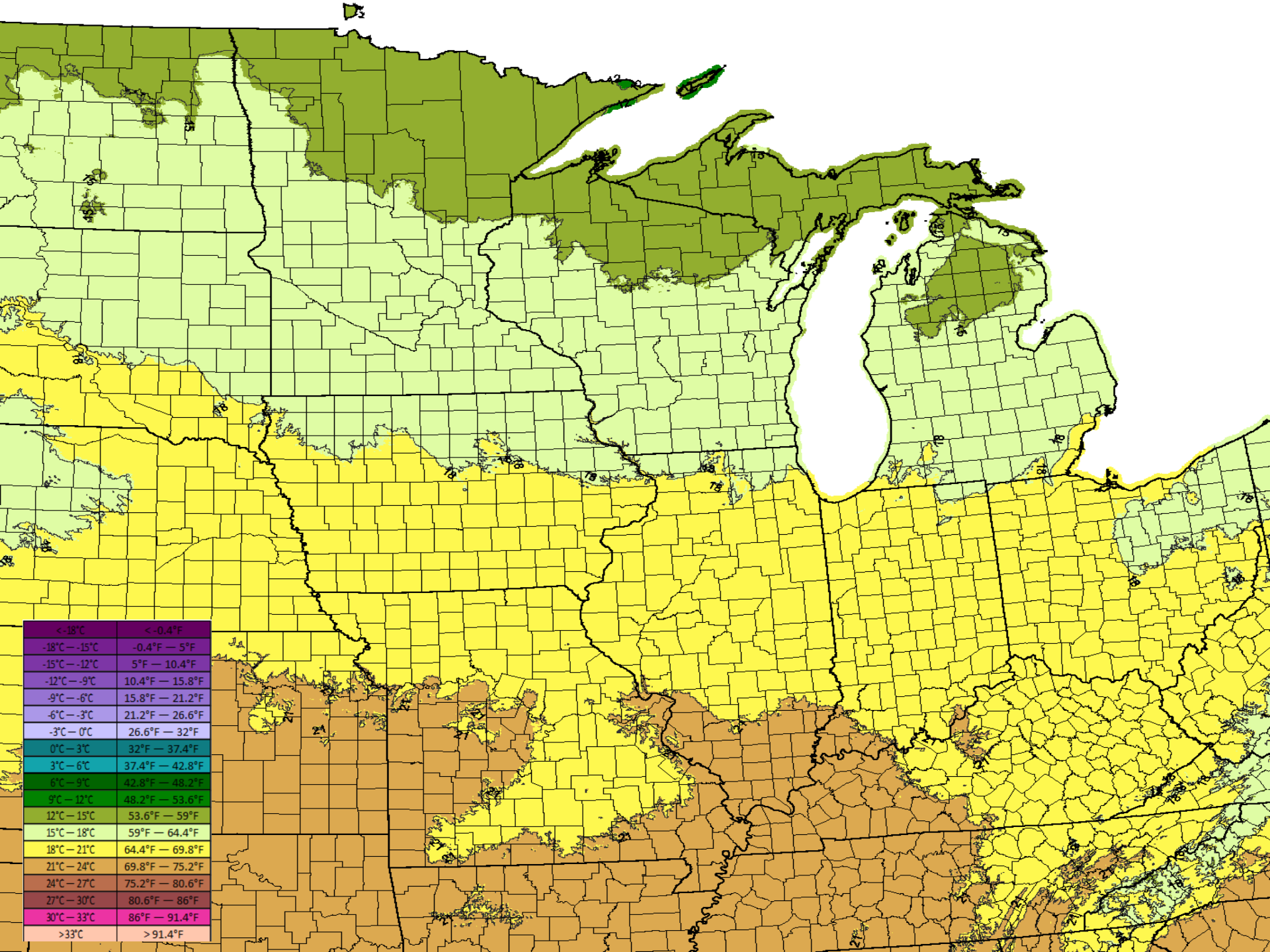
HISTORICAL PROTEIN AND OIL VARIATION

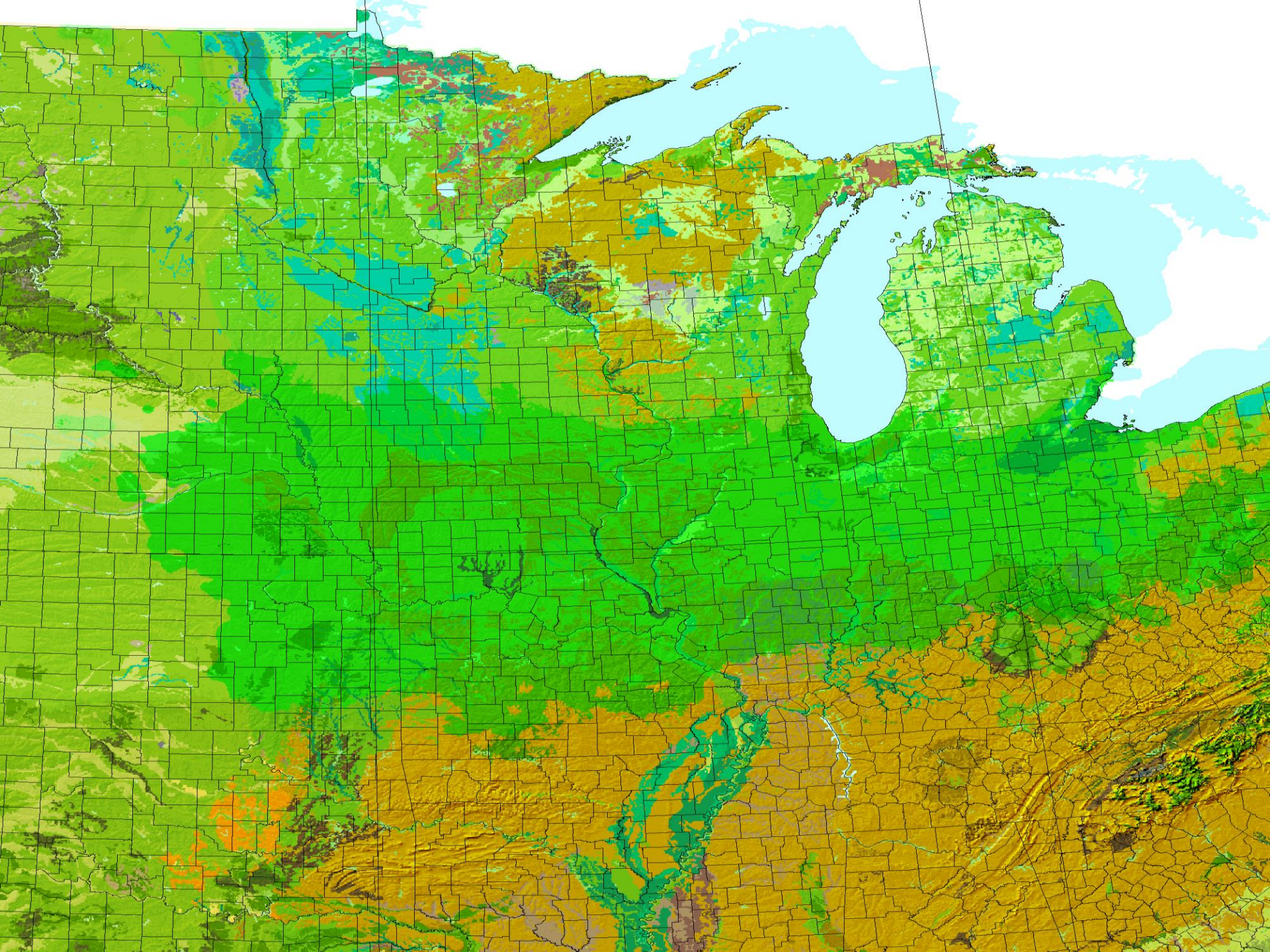

10-Year Average - Protein (2008 - 2017)
Protein (%)
n = 20,612
29.2 – 33.1
33.1 – 33.7
33.7 – 34
34 – 34.3
34.3 – 34.5
34.5 – 34.8
34.8 – 35
35 – 35.3
35.3 – 35.7
35.7 – 42.1


10 -Year Average - Oil (2008 - 2017)
Oil (%)
n = 20,612
13.8 – 17.6
17.6 – 18
18 – 18.3
18.3 – 18.5
18.5 – 18.7
18.7 – 18.9
18.9 – 19.1
19.1 – 19.3
19.3 – 19.5
19.5 – 23.2


10-Year Average - Sum, Protein + Oil
(2008 - 2017)
Sum, Protein + Oil (%)
n = 20,612
47.1 – 52
52 – 52.5
52.5 – 52.8
52.8 – 53.1
53.1 – 53.4
53.4 – 53.6
53.6 – 53.8
53.8 – 54.1
54.1 – 54.4
54.4 – 59.2


< 4 cm
< 1.6 inches
4 — 6 cm
1.6 — 2.4 inches
6 — 9 cm
2.4 — 3.6 inches
9 — 13 cm
3.6 — 5 inches
13 — 18 cm
5 — 7 inches
18 — 25 cm
7 — 10 inches
25 — 35 cm
10 — 14 inches
35 — 50 cm
14 — 20 inches
50 — 71 cm
20 — 28 inches
71 — 100 cm
28 — 40 inches
100 — 141 cm
40 — 56 inches
141 — 200 cm
56 — 80 inches
200 — 283 cm
80 — 113 inches
283 — 400 cm
113 — 160 inches
400 — 566 cm
160 — 226 inches
566 — 800 cm
226 — 320 inches
> 800 cm
> 320 inches


< -18°C | < -0.4°F
-18°C — -15°C | -0.4°F — 5°F
-15°C — -12°C | 5°F — 10.4°F
-12°C — -9°C | 10.4°F — 15.8°F
-9°C — -6°C | 15.8°F — 21.2°F
-6°C — -3°C | 21.2°F — 26.6°F
-3°C — 0°C | 26.6°F — 32°F
0°C — 3°C | 32°F — 37.4°F
3°C — 6°C | 37.4°F — 42.8°F
6°C — 9°C | 42.8°F — 48.2°F
9°C — 12°C | 48.2°F — 53.6°F
12°C — 15°C | 53.6°F — 59°F
15°C — 18°C | 59°F — 64.4°F
18°C — 21°C | 64.4°F — 69.8°F
21°C — 24°C | 69.8°F — 75.2°F
24°C — 27°C | 75.2°F — 80.6°F
27°C — 30°C | 80.6°F — 86°F
30°C — 33°C | 86°F — 91.4°F
>33°C | >91.4°F



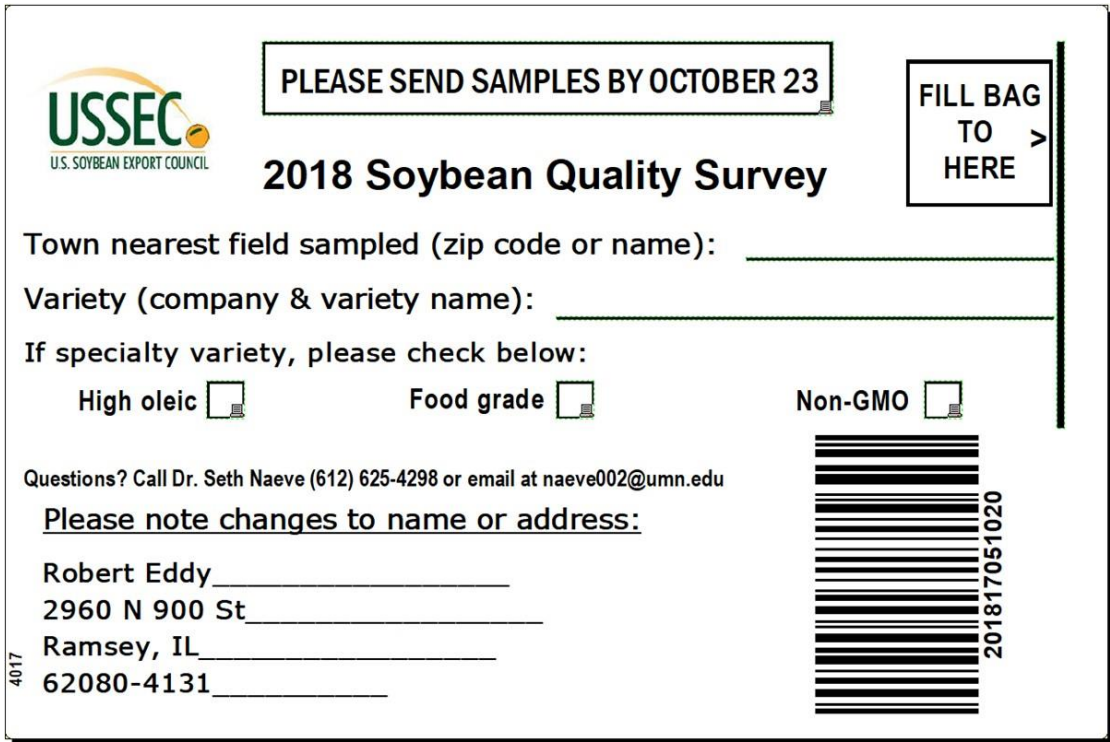
ENVIRONMENTAL IMPACTS ON SOYBEAN PROTEIN AND OIL

- Location-specific environmental impacts (latitude, climate, and soil type) affect long-term quality trends
- However, annual variation in weather patterns affects year-over-year variation in soybean quality
- Rainfall patterns appear to have the greatest impact on soybean quality
  - Excessive rainfall early in the season appears to reduce protein deposition in the seed
  - Drought conditions during the seed-filling stages exacerbate this condition


2018 SURVEY RESULTS
Voyager Pro
WEIGHING
UNITS
2nd UNITS
CALIBRATE
11/30/64 20:43:40
1.29835 lb
588.92 g
4100g
OHAUS
USSEC
2008 Food Soybean
Quality Survey
Variety (name/number and company):
Intended use:
Tofu
Natto
Miso
Other
Additional characteristics:
Special oil
Non-GMO
Organic
Field location (zip code or town, state):
Charlotte, MI
Producer name or specific field identifier:
Contracting company:
Citizens LLC
0.6086/0
12%
Questions? Call Dr. Seth Naeve at (612) 625-4288
UNIVERSITY OF MINNESOTA
SOY.ORG

2018 SURVEY METHODS

- In August, sample kits were mailed to 5,702 soybean producers based on soybean production by state
- By October 26, 2018, 1,004 samples were returned for analysis
- 1,518 were returned by November 2
- By December 7, 1,683 samples were returned


PLEASE SEND SAMPLES BY OCTOBER 23

USSEC
U.S. SOYBEAN EXPORT COUNCIL

FILL BAG TO HERE >

2018 Soybean Quality Survey

Town nearest field sampled (zip code or name): _____

Variety (company & variety name): _____

If specialty variety, please check below:

High oleic ☐ Food grade ☐ Non-GMO ☐

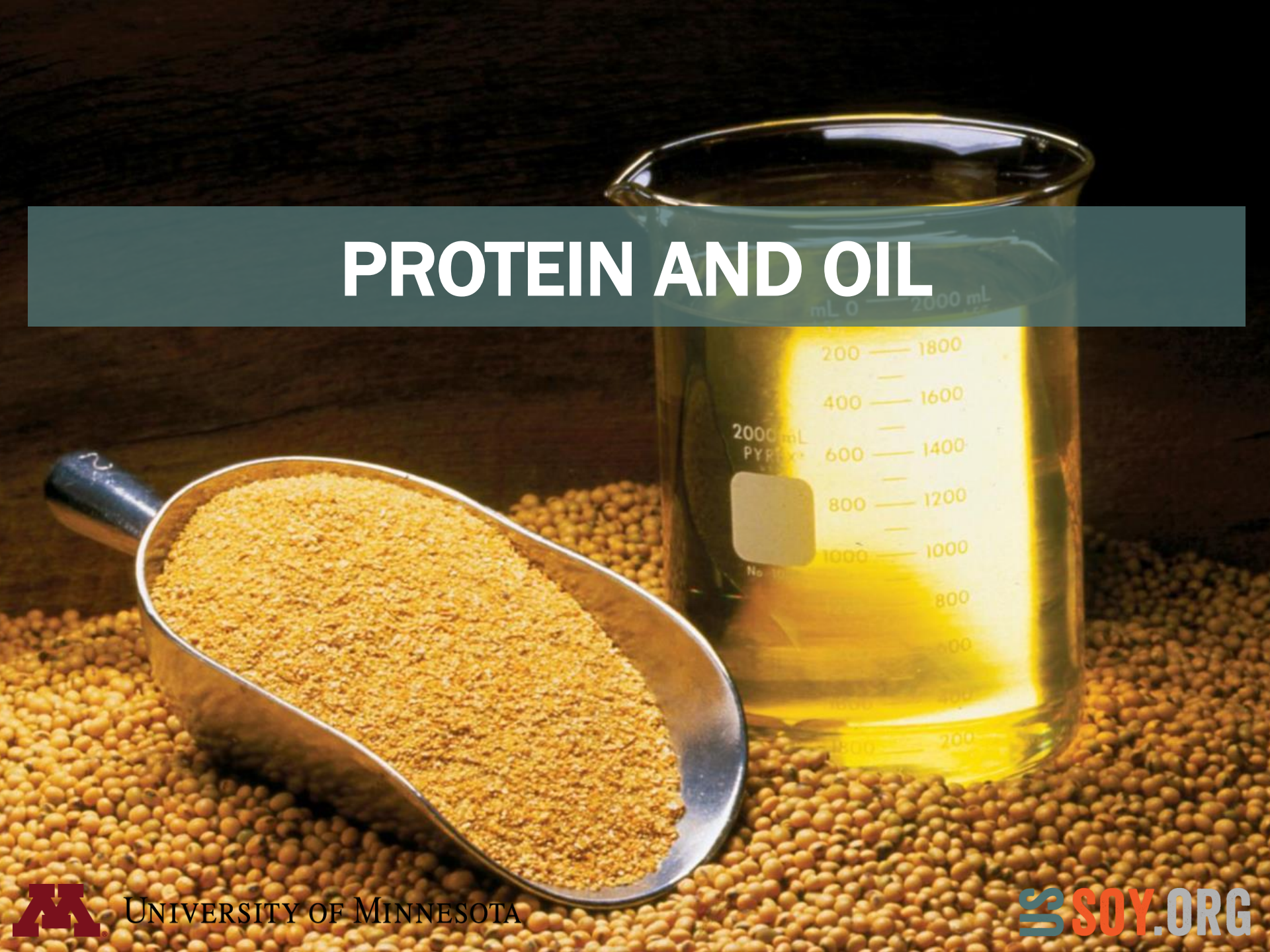
Questions? Call Dr. Seth Naeve (612) 625-4298 or email at naeve002@umn.edu

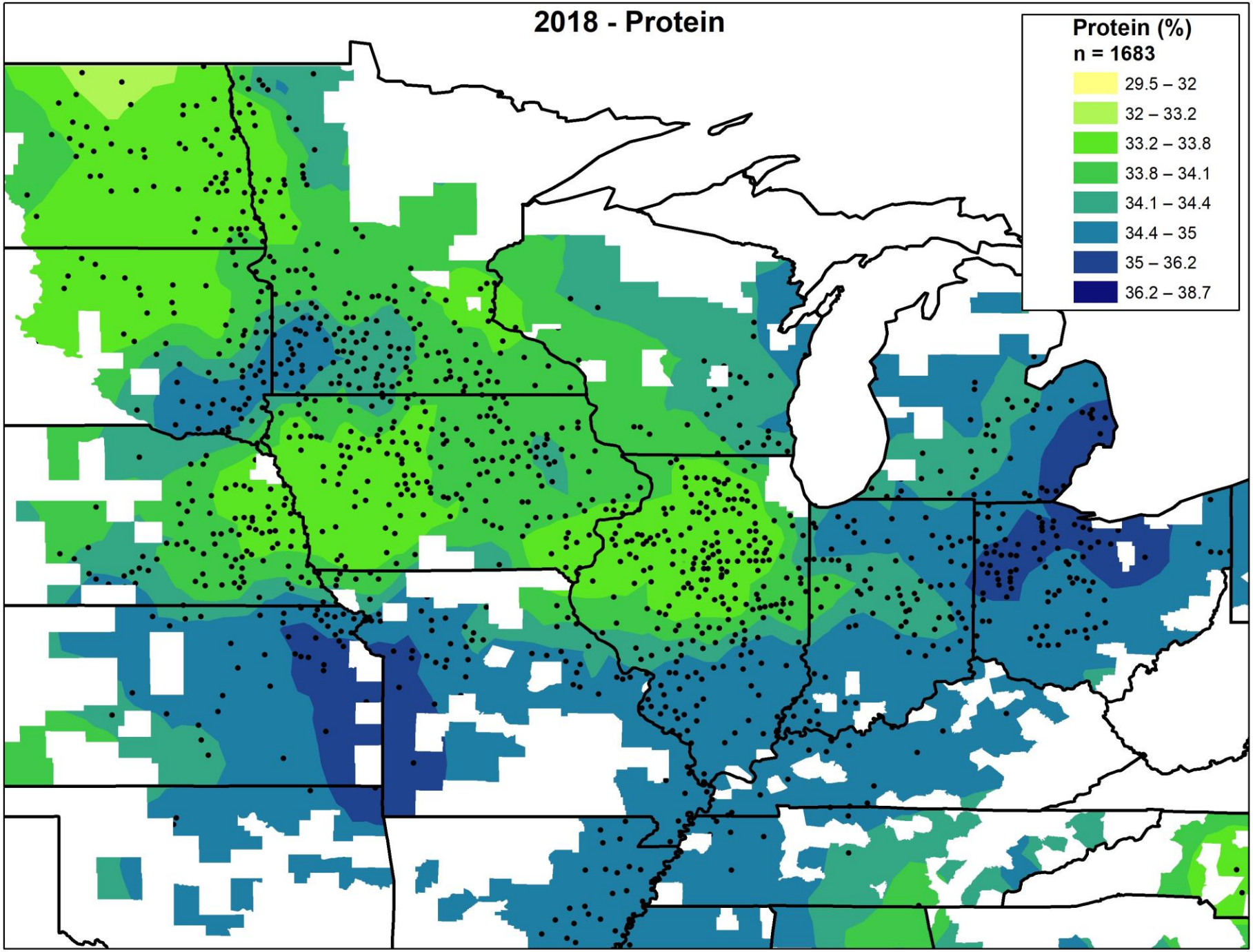
Please note changes to name or address:

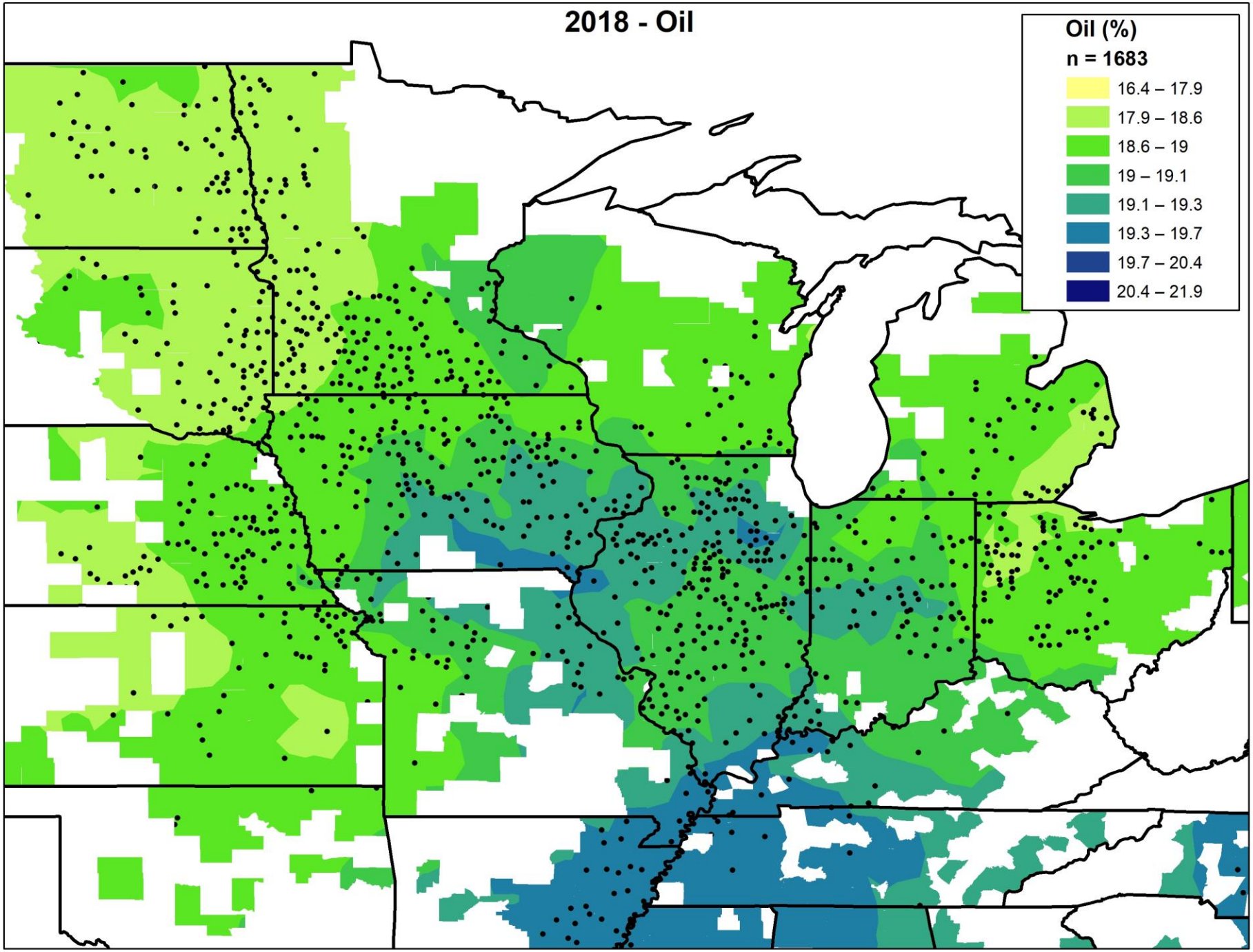
Robert Eddy_____
2960 N 900 St_____
Ramsey, IL_____
62080-4131_____

4017

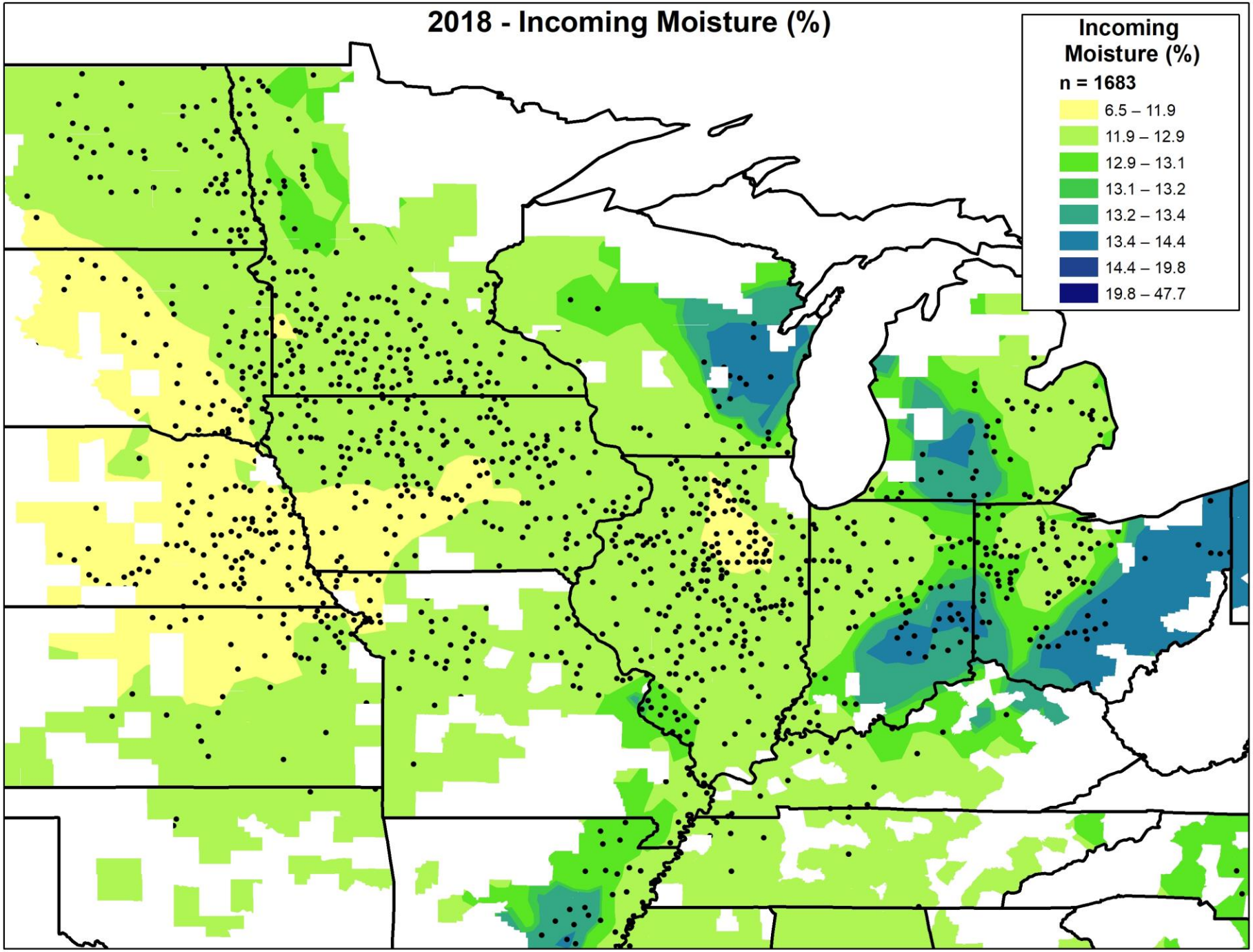
201817051020

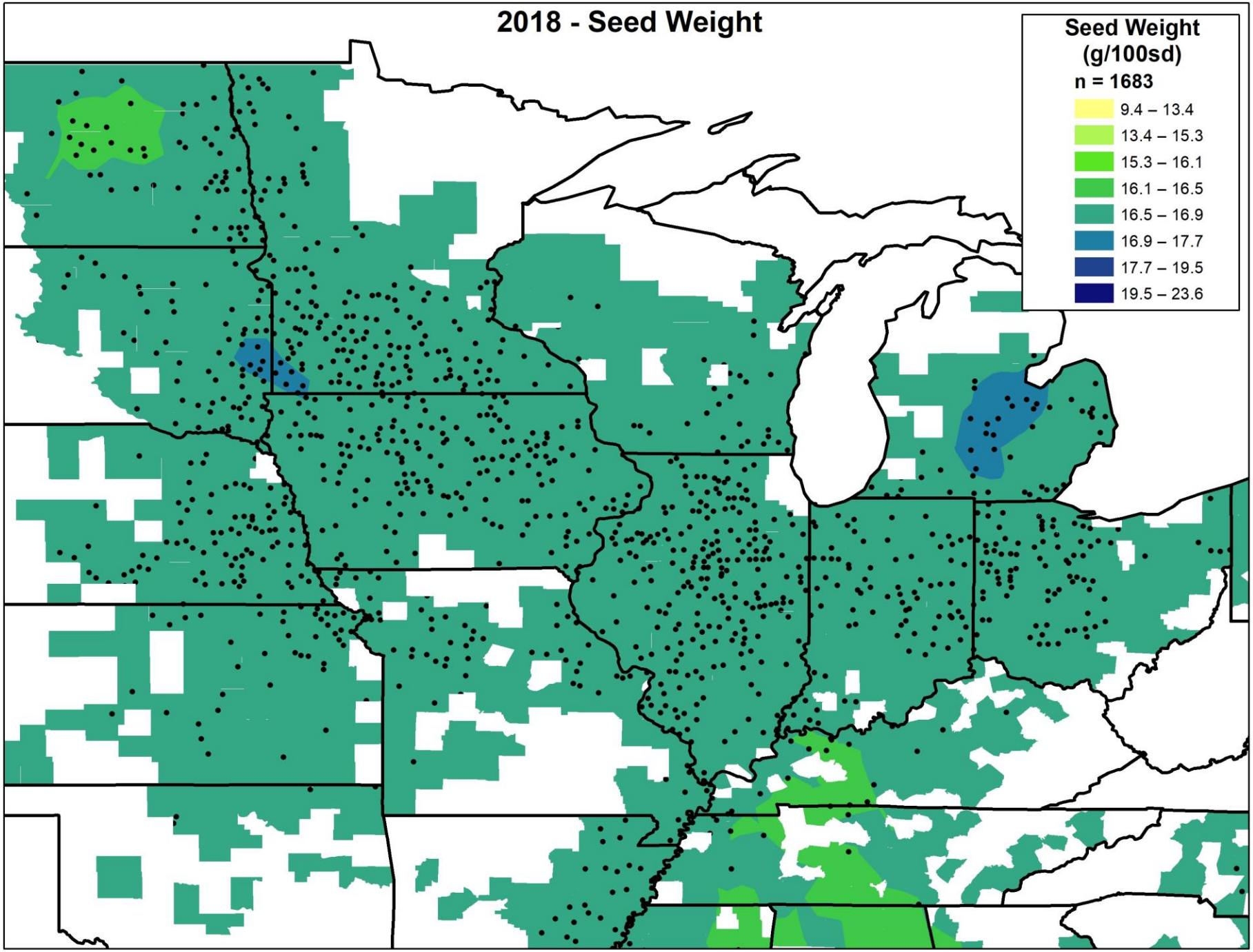

PROTEIN AND OIL
UNIVERSITY OF MINNESOTA
USSOY.ORG

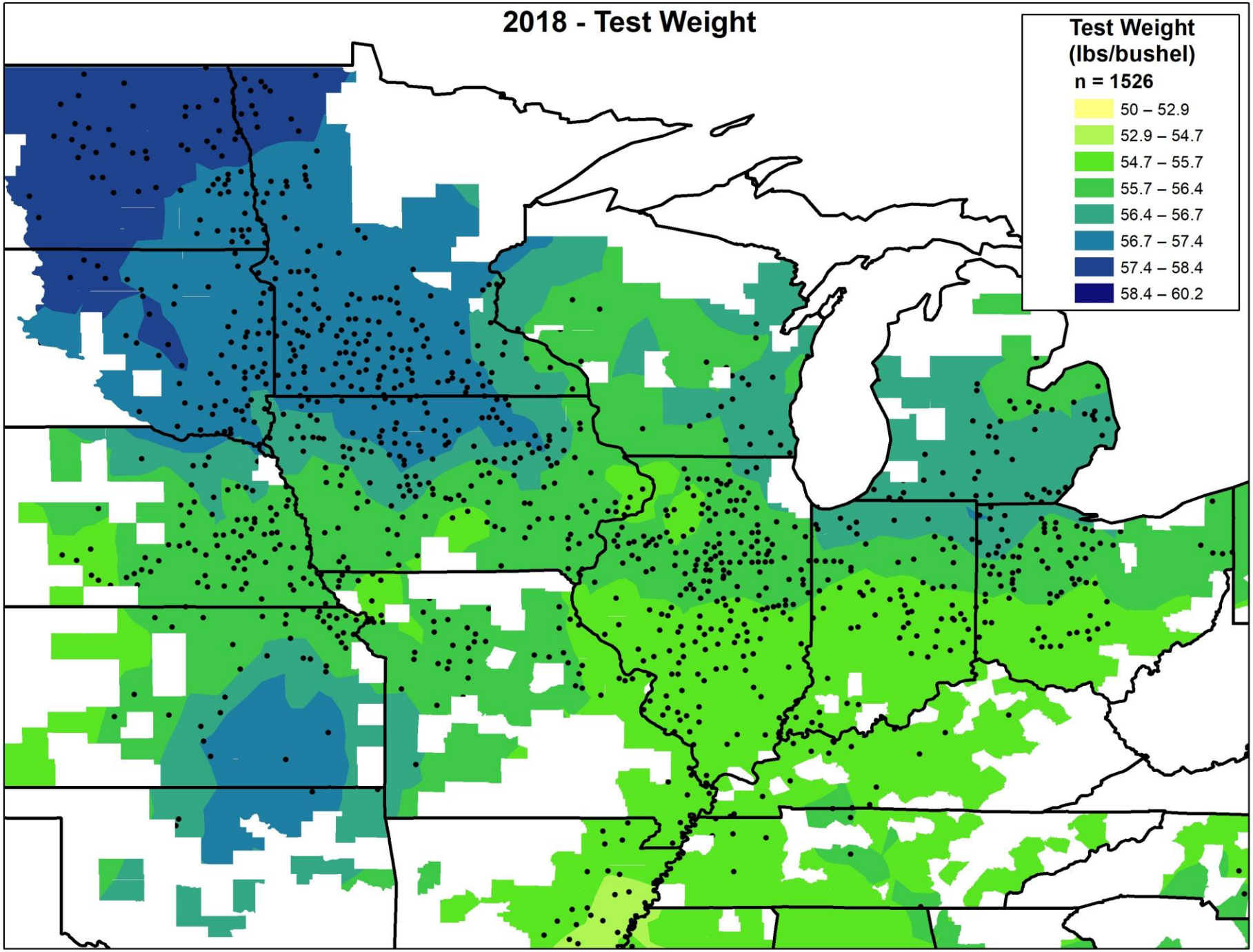

2018 - Protein
Protein (%)
n = 1683
29.5 – 32
32 – 33.2
33.2 – 33.8
33.8 – 34.1
34.1 – 34.4
34.4 – 35
35 – 36.2
36.2 – 38.7

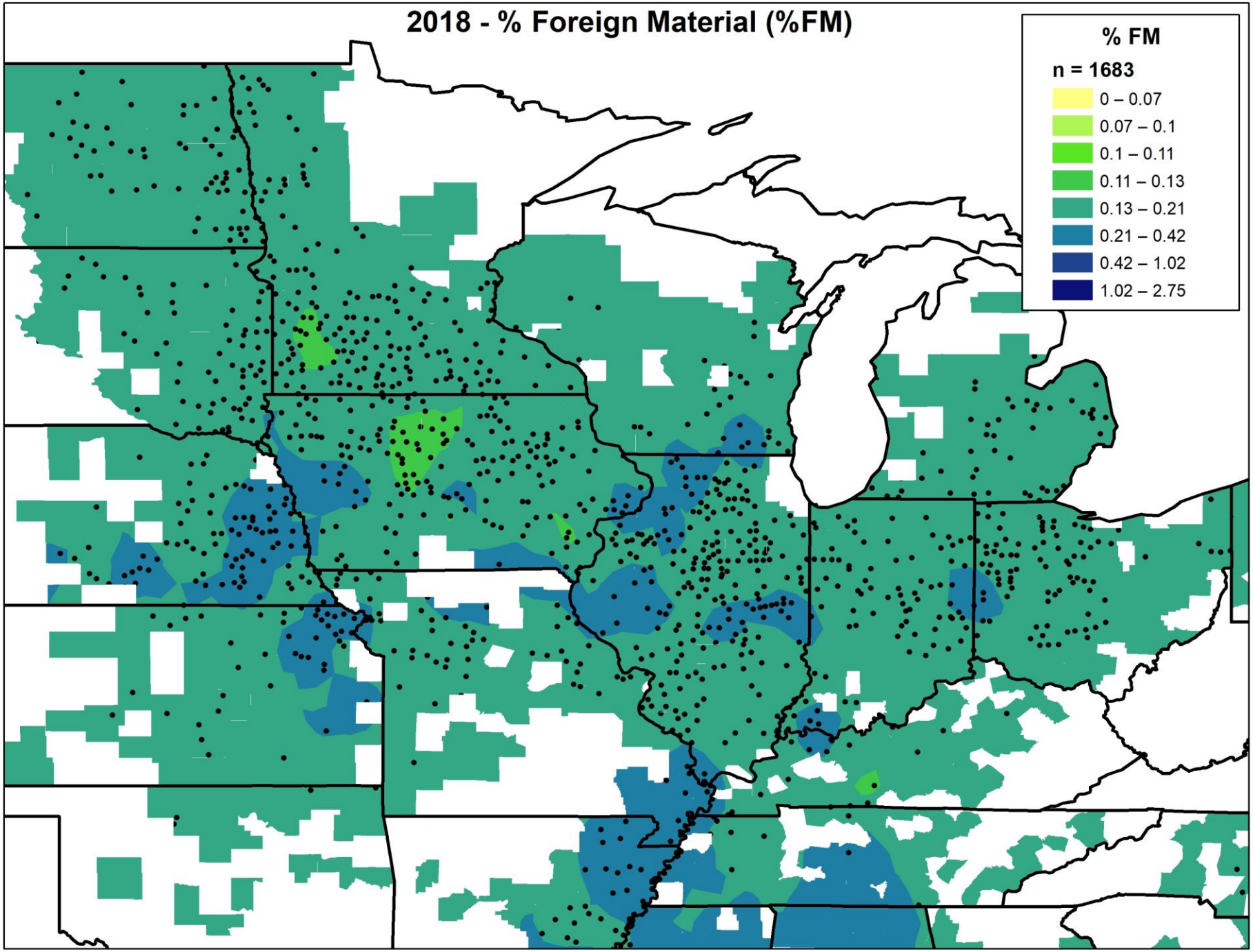

2018 - Oil
Oil (%)
n = 1683
16.4 – 17.9
17.9 – 18.6
18.6 – 19
19 – 19.1
19.1 – 19.3
19.3 – 19.7
19.7 – 20.4
20.4 – 21.9

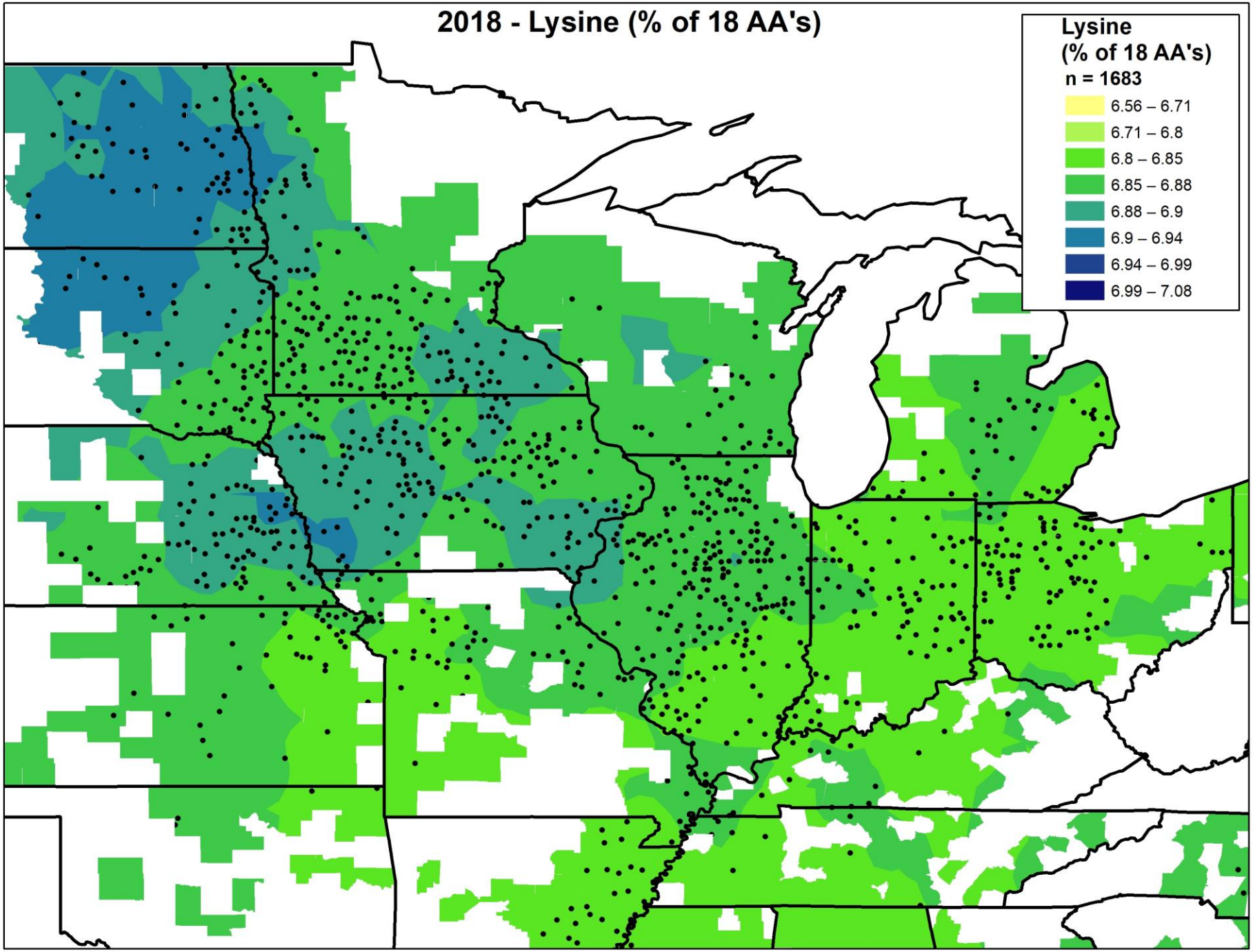
PHYSICAL CHARACTERISTICS

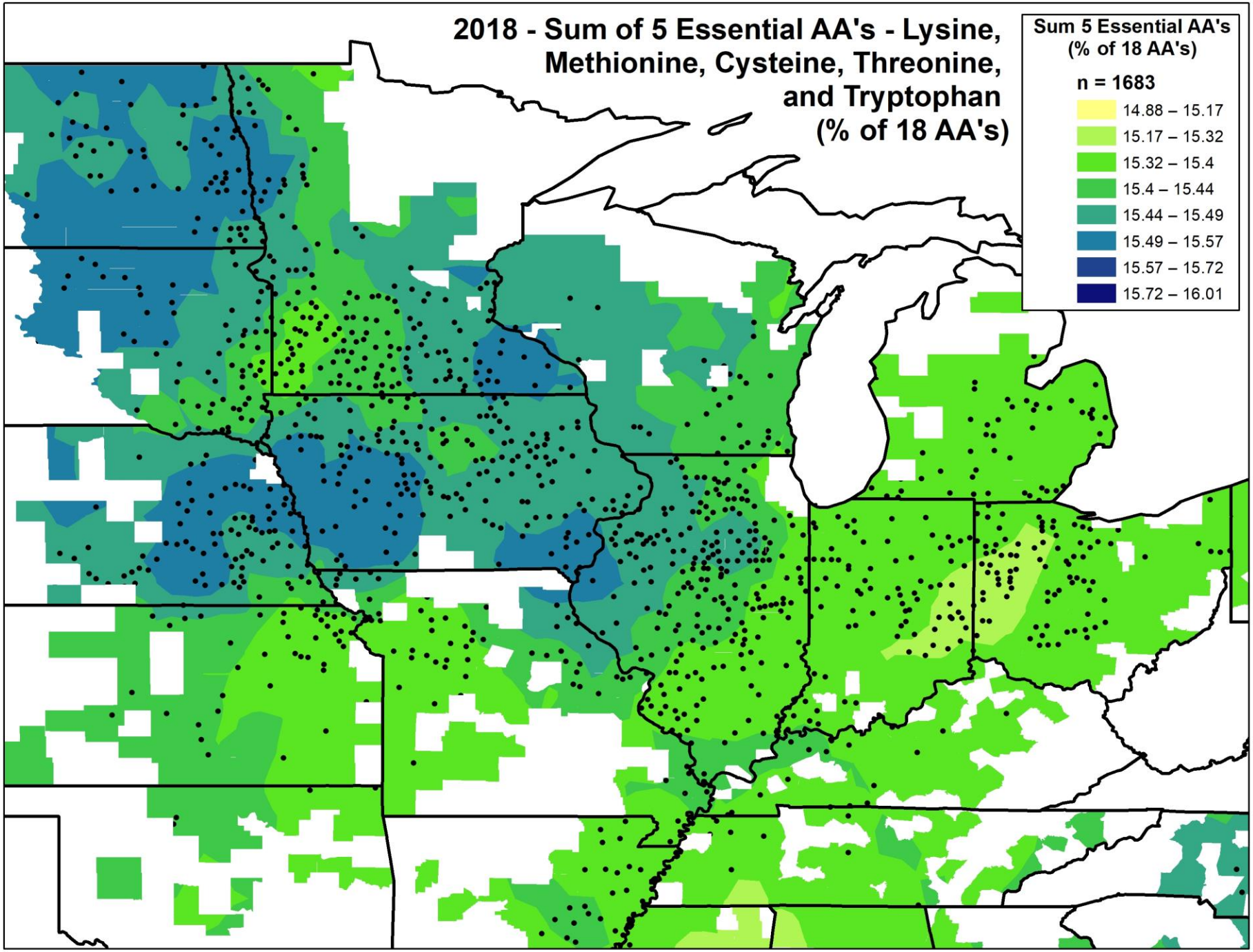

2018 - Incoming Moisture (%)
Incoming Moisture (%)
n = 1683
6.5 – 11.9
11.9 – 12.9
12.9 – 13.1
13.1 – 13.2
13.2 – 13.4
13.4 – 14.4
14.4 – 19.8
19.8 – 47.7

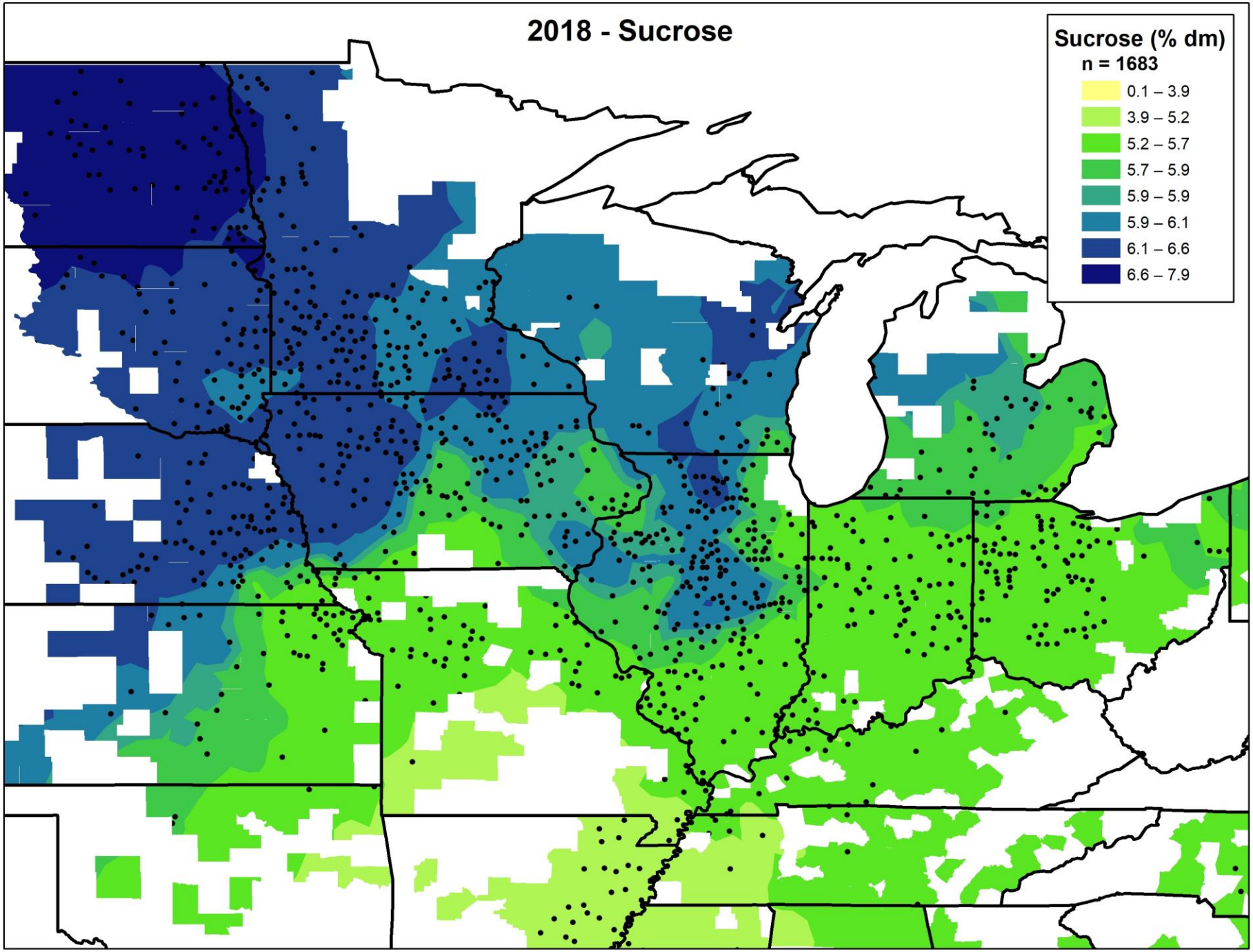

2018 - Seed Weight
Seed Weight (g/100sd)
n = 1683
9.4 – 13.4
13.4 – 15.3
15.3 – 16.1
16.1 – 16.5
16.5 – 16.9
16.9 – 17.7
17.7 – 19.5
19.5 – 23.6


2018 - Test Weight
Test Weight (lbs/bushel)
n = 1526
50 – 52.9
52.9 – 54.7
54.7 – 55.7
55.7 – 56.4
56.4 – 56.7
56.7 – 57.4
57.4 – 58.4
58.4 – 60.2


2018 - % Foreign Material (%FM)
% FM
n = 1683
0 – 0.07
0.07 – 0.1
0.1 – 0.11
0.11 – 0.13
0.13 – 0.21
0.21 – 0.42
0.42 – 1.02
1.02 – 2.75


2018 - Lysine (% of 18 AA's)
Lysine
(% of 18 AA's)
n = 1683
6.56 – 6.71
6.71 – 6.8
6.8 – 6.85
6.85 – 6.88
6.88 – 6.9
6.9 – 6.94
6.94 – 6.99
6.99 – 7.08


2018 - Sum of 5 Essential AA's - Lysine, Methionine, Cysteine, Threonine, and Tryptophan (% of 18 AA's)
Sum 5 Essential AA's (% of 18 AA's)
n = 1683
14.88 – 15.17
15.17 – 15.32
15.32 – 15.4
15.4 – 15.44
15.44 – 15.49
15.49 – 15.57
15.57 – 15.72
15.72 – 16.01


2018 - Sucrose
Sucrose (% dm)
n = 1683
0.1 – 3.9
3.9 – 5.2
5.2 – 5.7
5.7 – 5.9
5.9 – 5.9
5.9 – 6.1
6.1 – 6.6
6.6 – 7.9

THANK YOU

Seth Naeve – naeve002@umn.edu

USSEC U.S. SOYBEAN EXPORT COUNCIL

USB UNITED SOYBEAN BOARD

ASA American Soybean Association International Marketing®

UNIVERSITY OF MINNESOTA

USSOY.ORG

Thank you!

naeve002@umn.edu

UNIVERSITY OF MINNESOTA
EXTENSION
Driven to Discover℠