Quality of the United States Soybean Crop: 2023

2023 U.S. Soy Buyers Outlook Conference

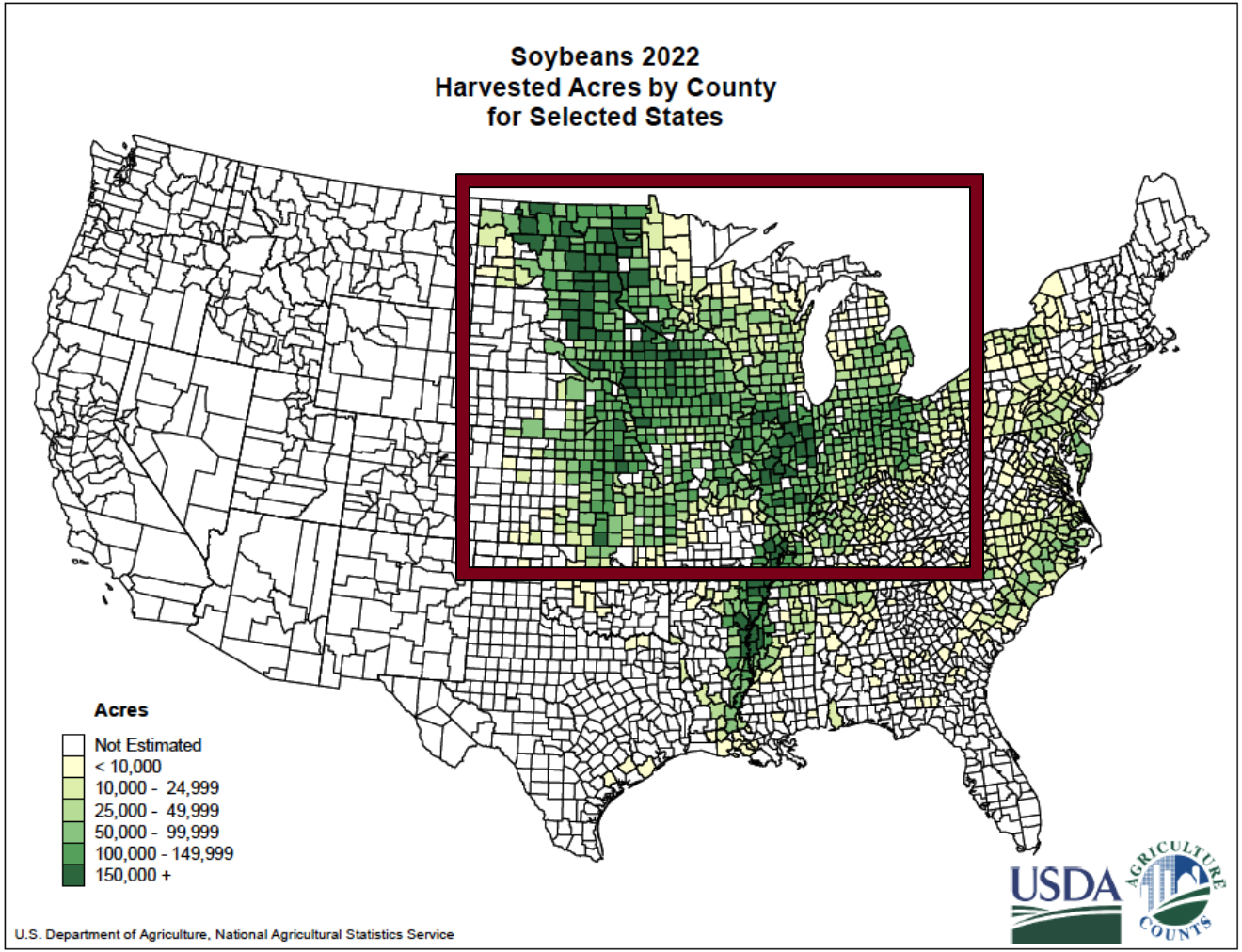
14 and 16 November 2023

Tokyo Japan and Seoul Korea

Seth Naeve and Jesse Christenson

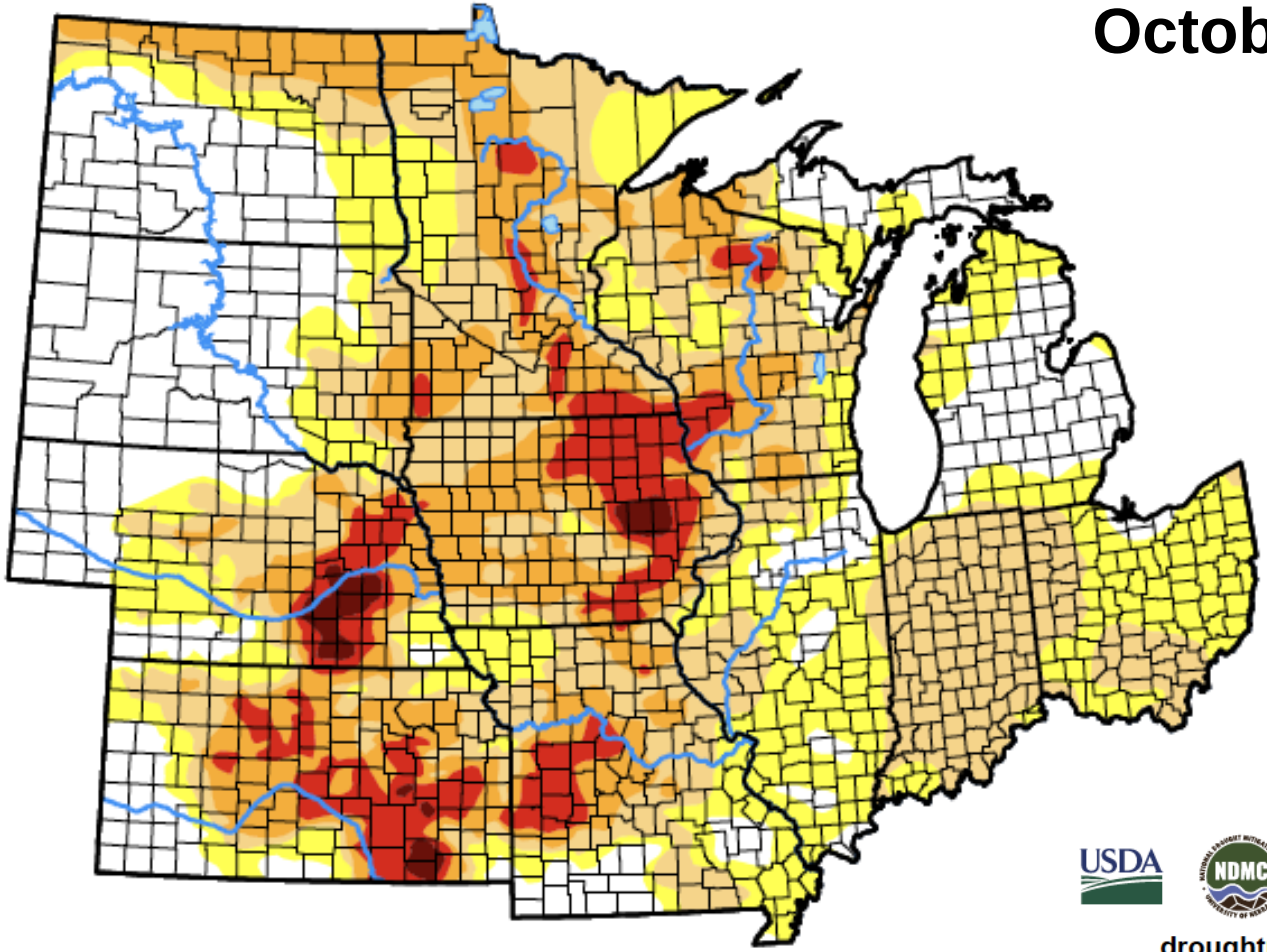
UNIVERSITY OF MINNESOTA
Driven to Discover®

CRITICAL WEATHER EVENTS

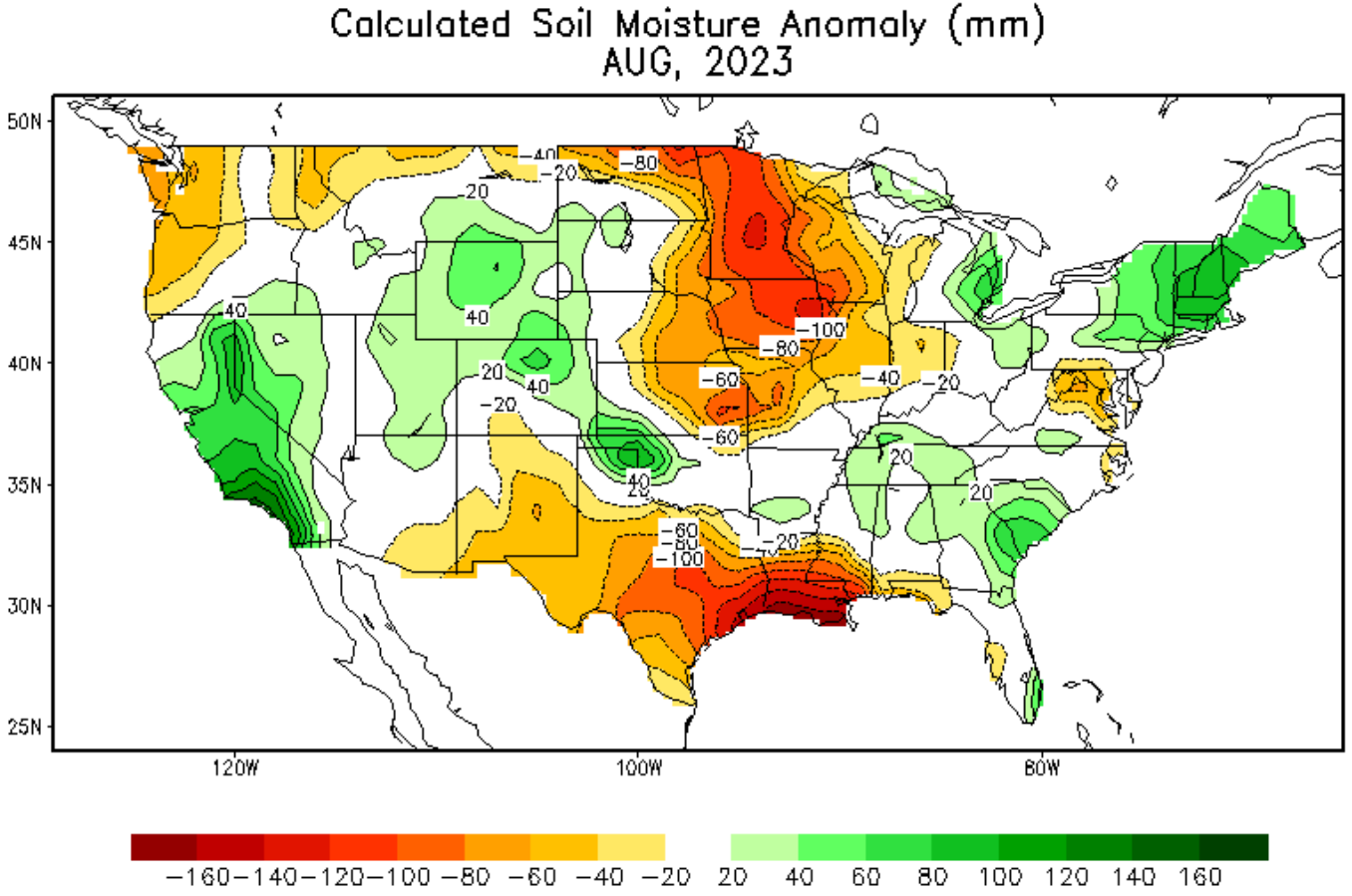


https://www.nass.usda.gov/Charts_and_Maps/Crops_County/index.php#sb

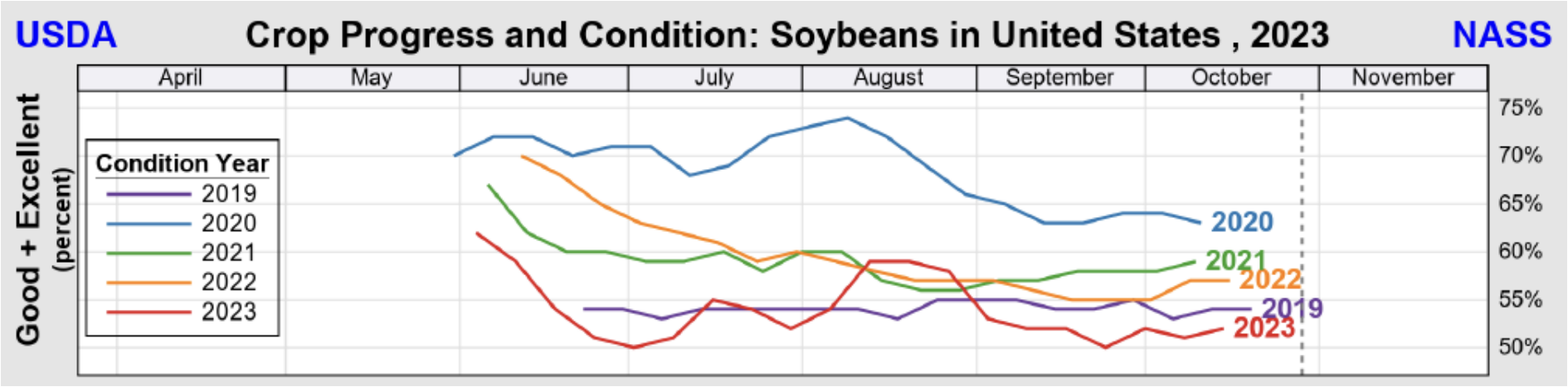
October 3, 2023

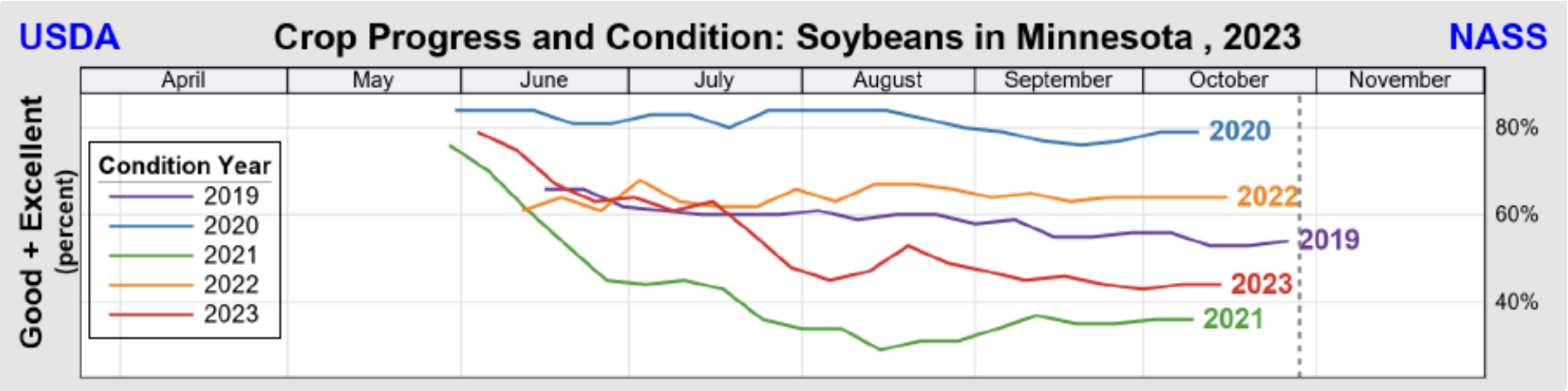


droughtmonitor.unl.edu



https://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/US_Soil-Moisture-Monthly.php

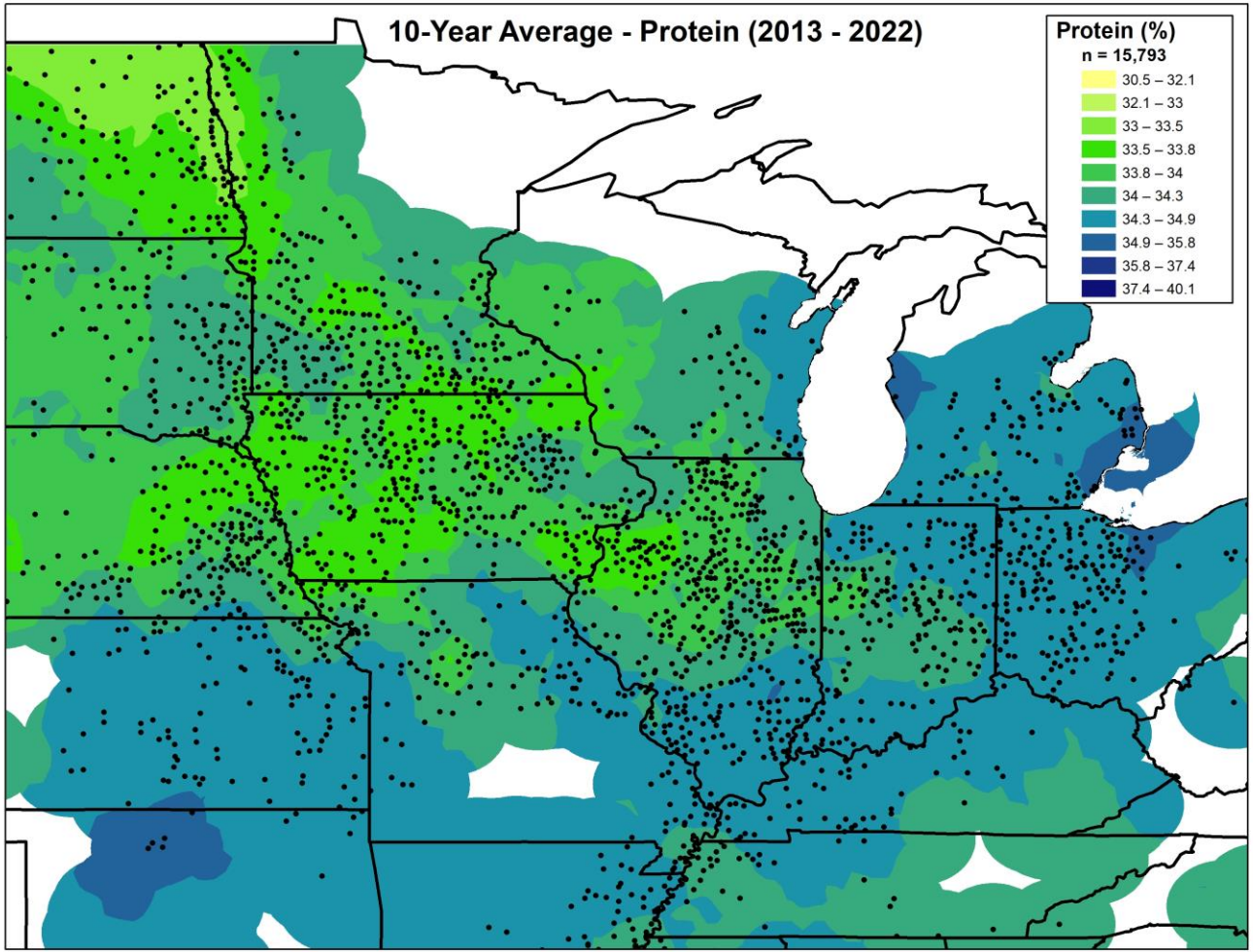

USDA
Crop Progress and Condition: Soybeans in United States , 2023
NASS
April
May
June
July
August
September
October
November
Good + Excellent
(percent)
Condition Year
2019
2020
2021
2022
2023
75%
70%
65%
60%
55%
50%
2020
2021
2022
2019
2023

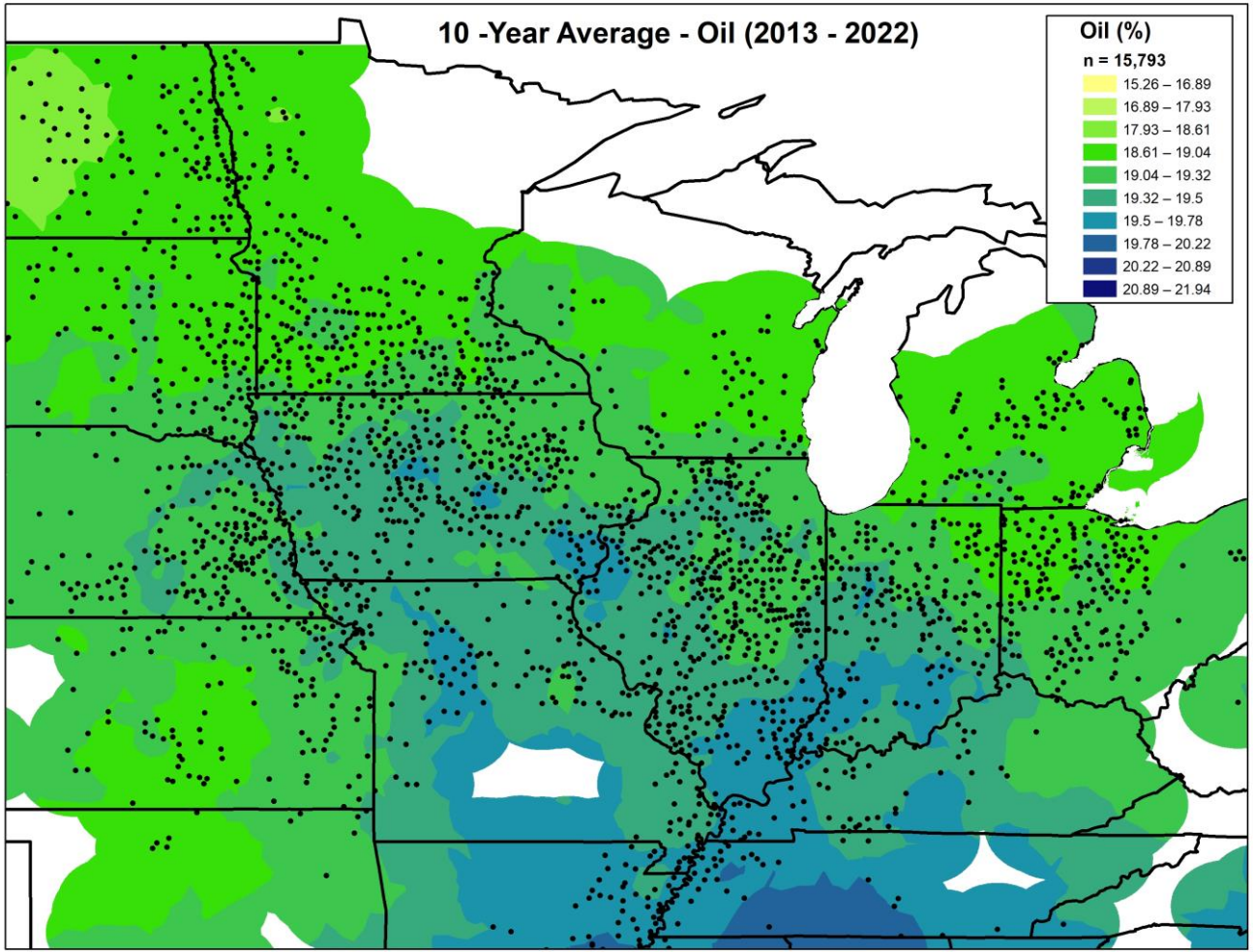

USDA
Crop Progress and Condition: Soybeans in Minnesota , 2023
NASS
April
May
June
July
August
September
October
November
Good + Excellent
(percent)
Condition Year
2019
2020
2021
2022
2023
80%
60%
40%
2020
2022
2019
2023
2021

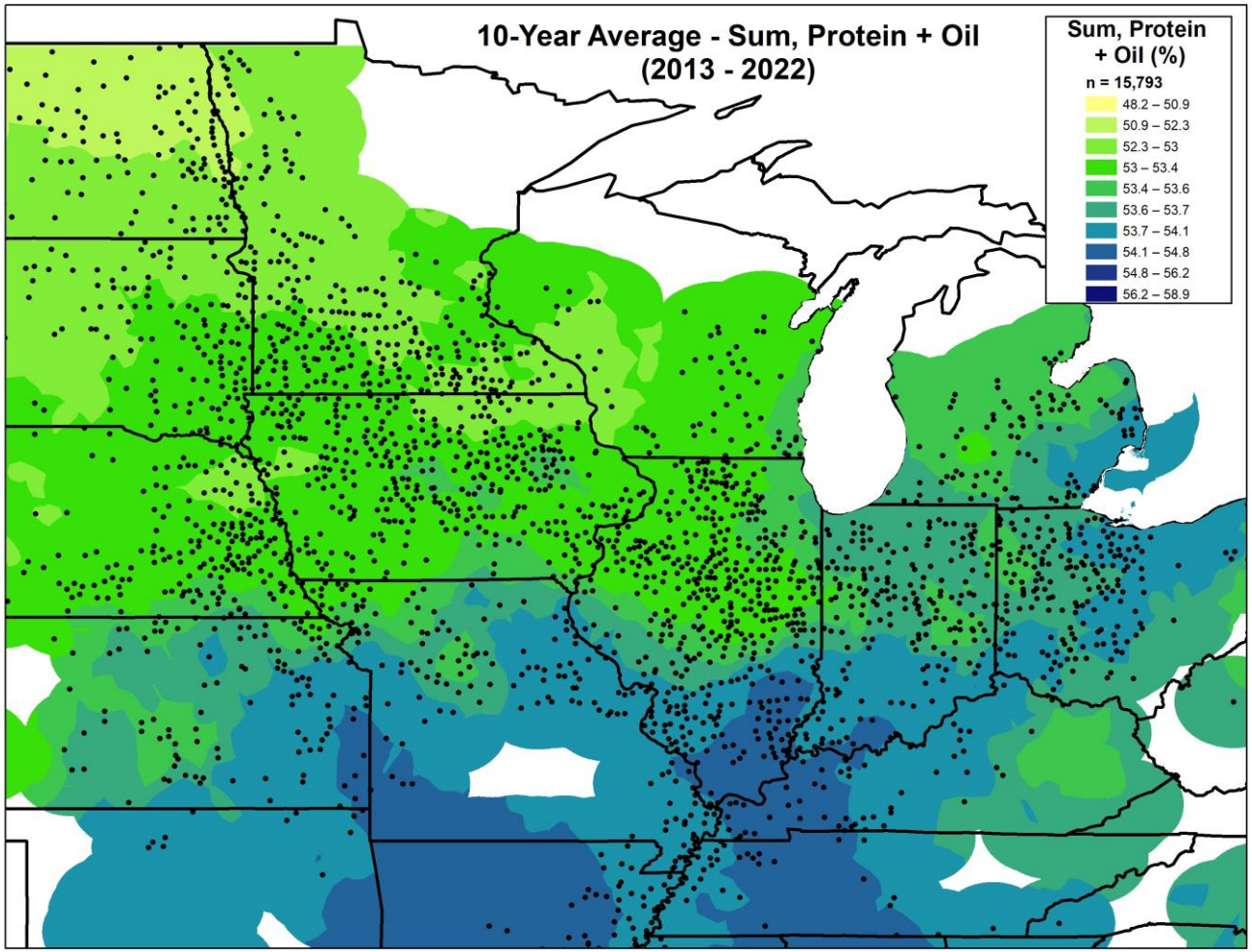
QUALITY OF THE UNITED STATES SOYBEAN CROP: 2023

University of Minnesota


HISTORICAL PROTEIN AND
OIL VARIATION


10-Year Average - Protein (2013 - 2022)
Protein (%)
n = 15,793
30.5 – 32.1
32.1 – 33
33 – 33.5
33.5 – 33.8
33.8 – 34
34 – 34.3
34.3 – 34.9
34.9 – 35.8
35.8 – 37.4
37.4 – 40.1

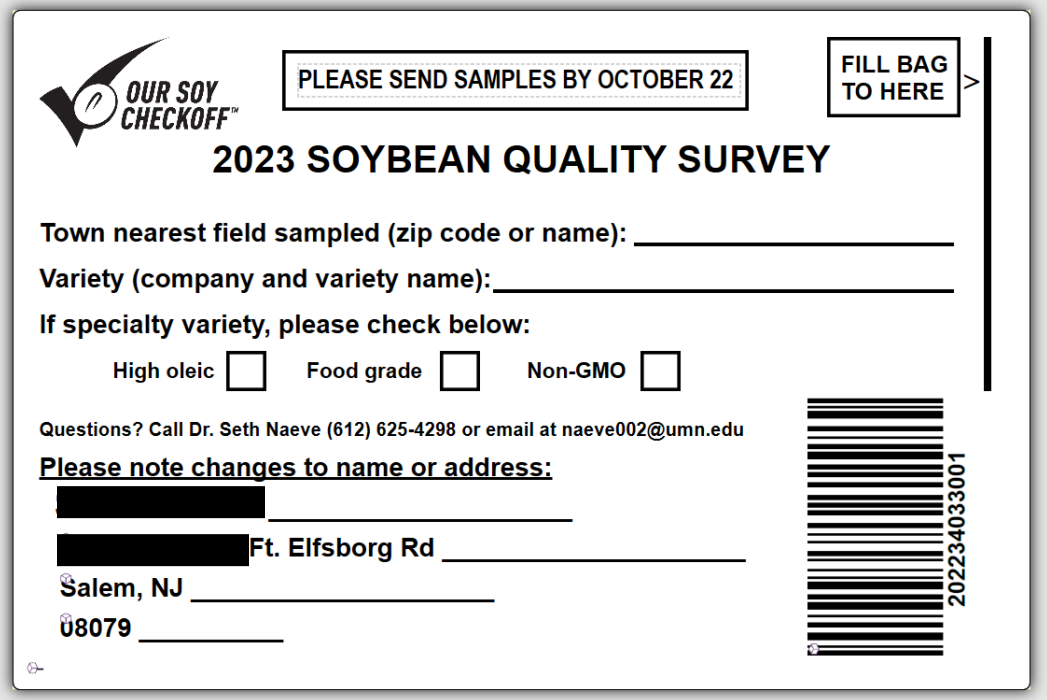

10 -Year Average - Oil (2013 - 2022)
Oil (%)
n = 15,793
15.26 – 16.89
16.89 – 17.93
17.93 – 18.61
18.61 – 19.04
19.04 – 19.32
19.32 – 19.5
19.5 – 19.78
19.78 – 20.22
20.22 – 20.89
20.89 – 21.94


10-Year Average - Sum, Protein + Oil
(2013 - 2022)
Sum, Protein
+ Oil (%)
n = 15,793
48.2 – 50.9
50.9 – 52.3
52.3 – 53
53 – 53.4
53.4 – 53.6
53.6 – 53.7
53.7 – 54.1
54.1 – 54.8
54.8 – 56.2
56.2 – 58.9


2023 SURVEY RESULTS
Voyager Pro
1.29835 lb
588.92 g
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):
Producer name or specific field identifier:
Contracting company:
Questions? Call Dr. Seth Naeve at (612) 625-4298

2023 Survey Methods

- In August, sample kits were mailed to 3,886 soybean producers based on soybean production by state
- By 2 November, 2023, 1,169 samples were returned for analysis



OUR SOY CHECKOFF™

PLEASE SEND SAMPLES BY OCTOBER 22

FILL BAG TO HERE >

2023 SOYBEAN QUALITY SURVEY

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

Variety (company and 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:

[redacted] _____

[redacted]Ft. Elfsborg Rd _____

Salem, NJ _____

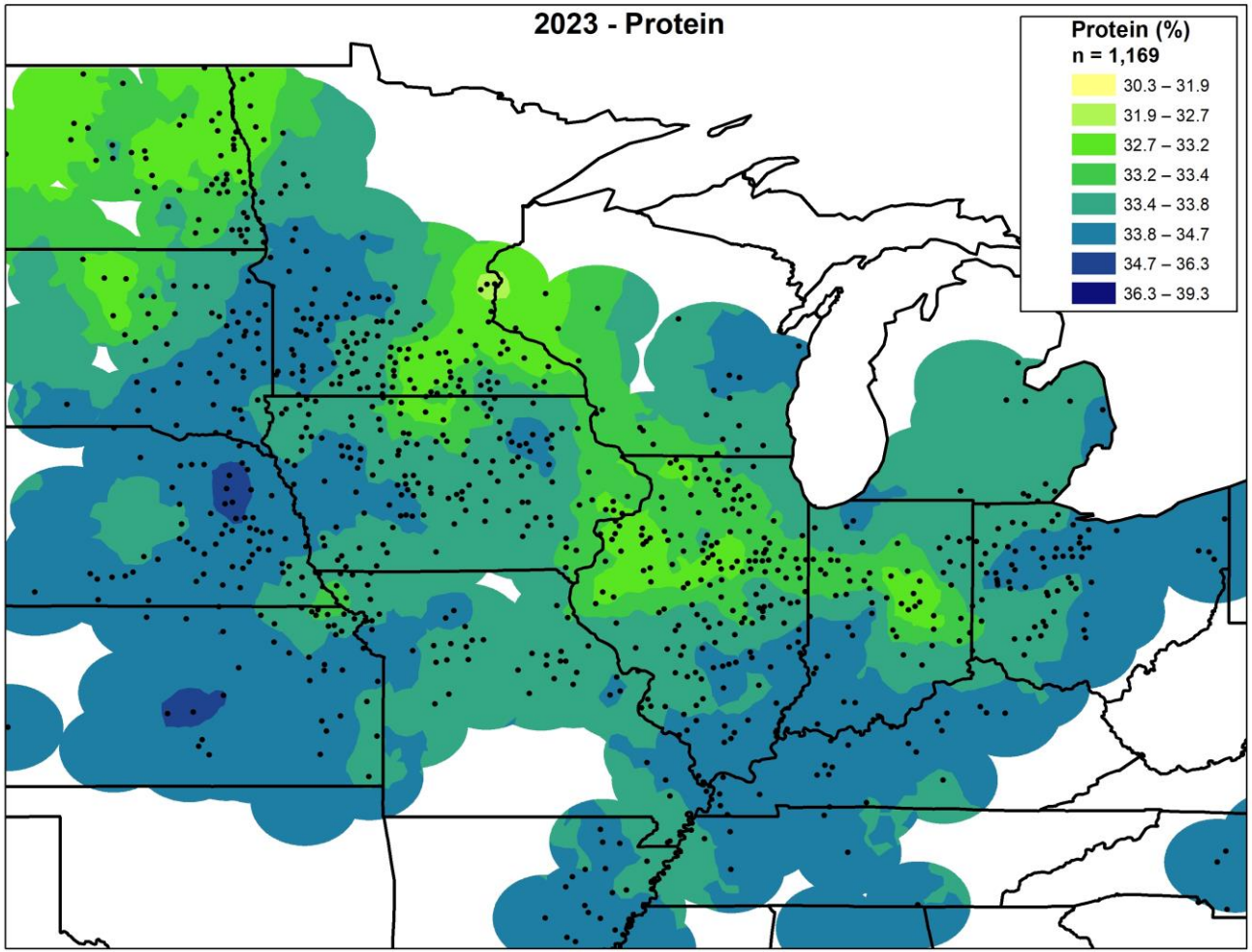
08079 _____

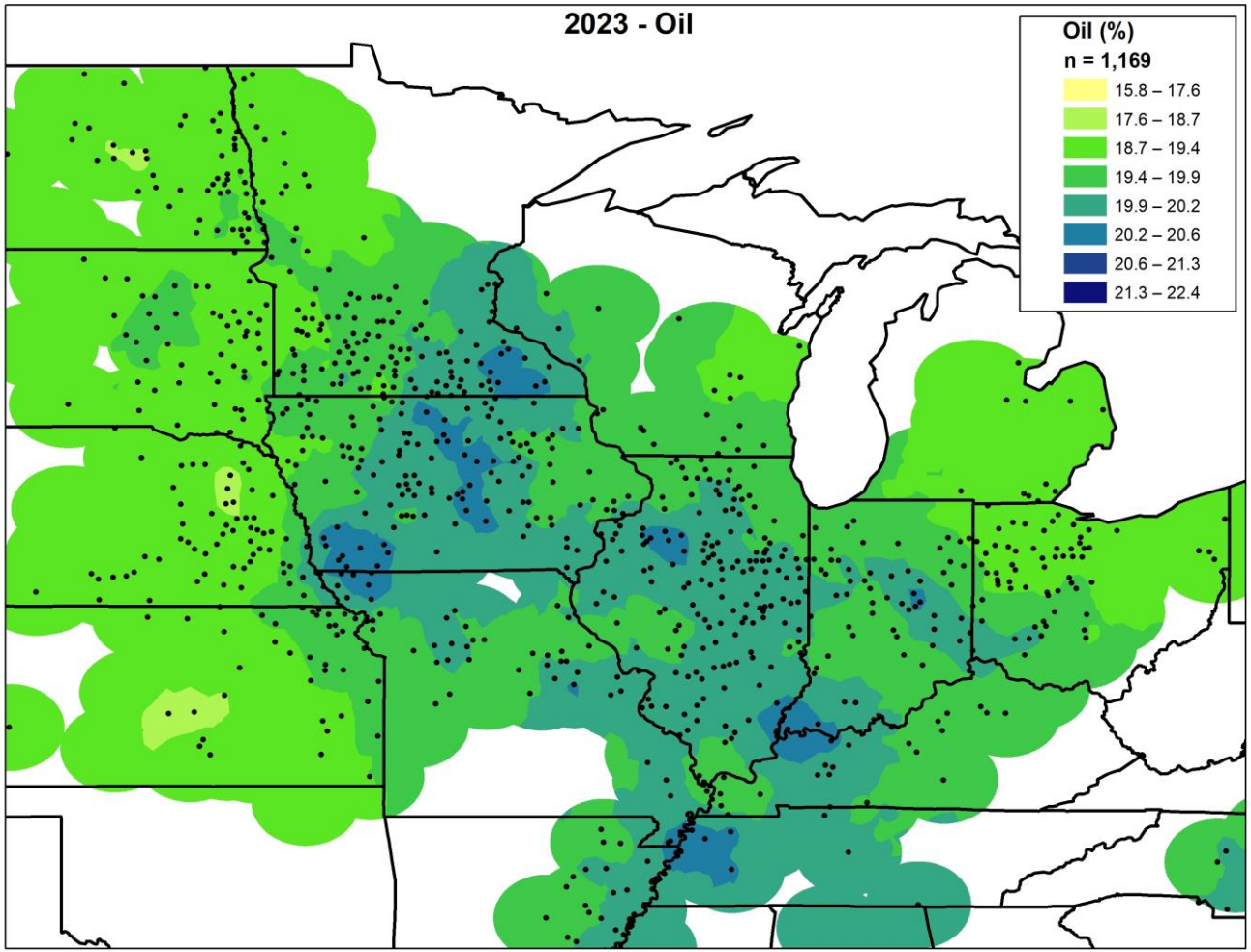
202234033001

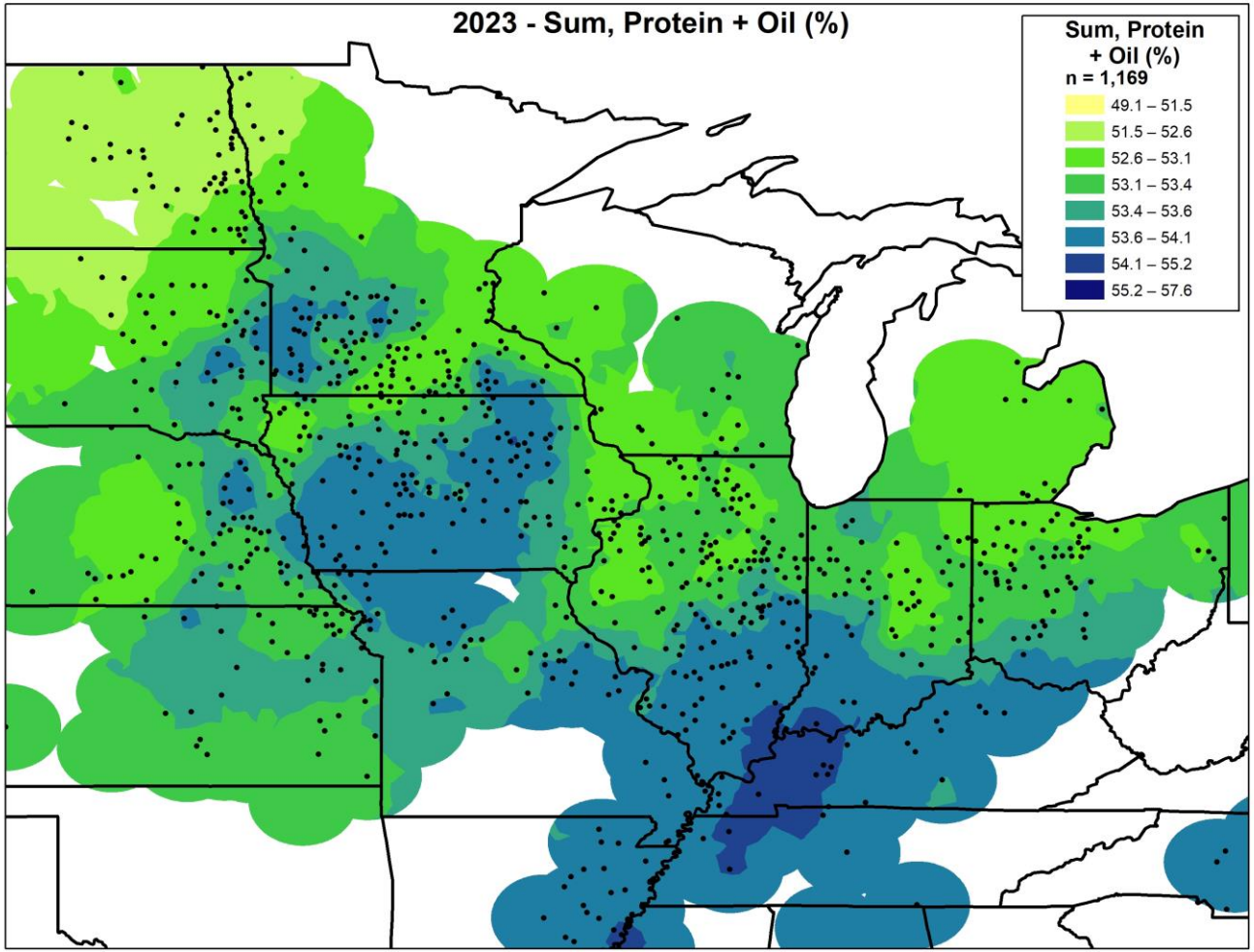
PROTEIN AND OIL

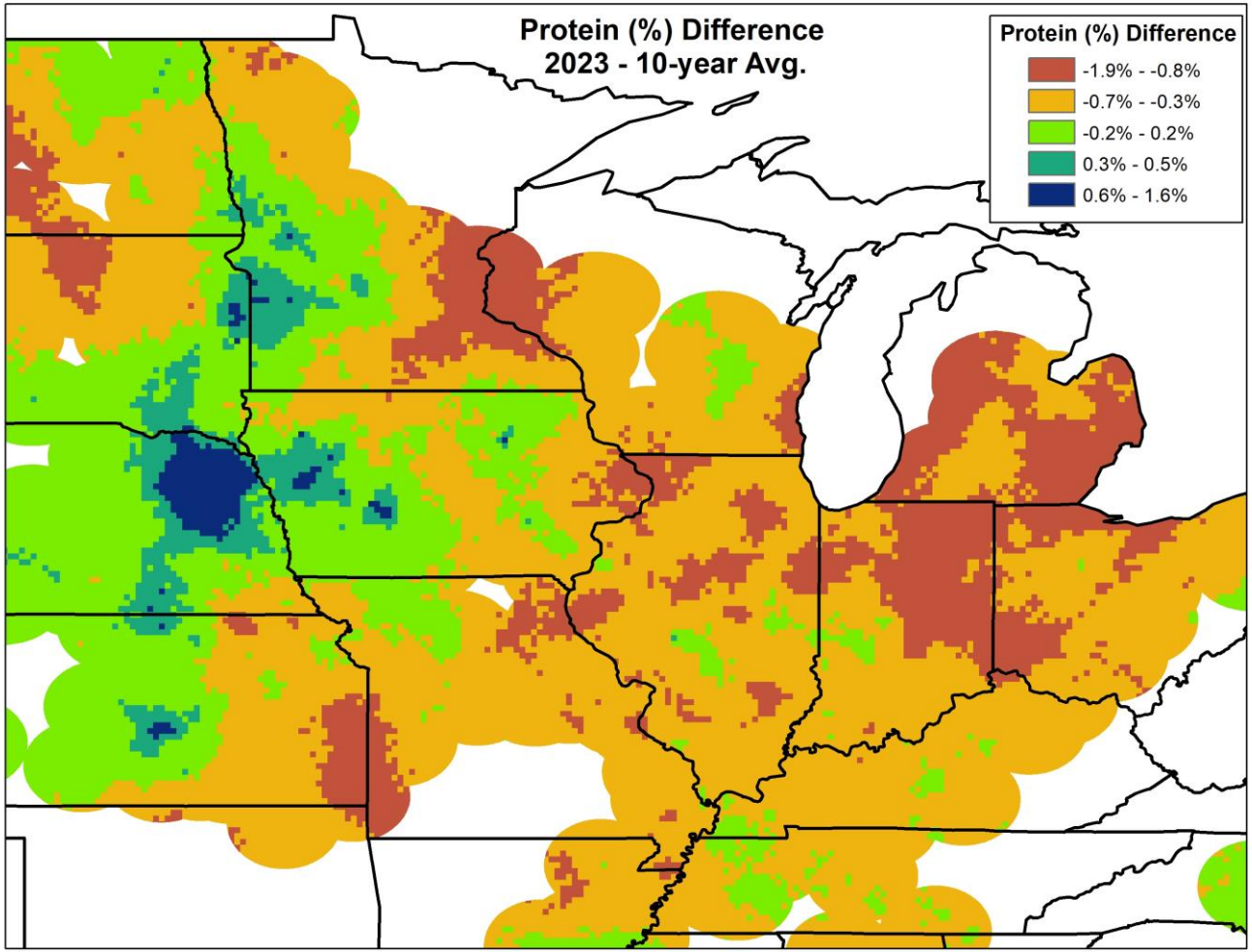
Region	Number of Samples	Protein (13%)	Change from 2022	Oil (13%)	Change from 2022	Seed Weight (g/100 seeds)
US Average	1,169	33.7		19.6		15.9
Average of 2023 Crop†		**33.7**	**-0.2**	**19.6**	**0.1**	**15.8**
US 2013-2022 Average†		34.2		19.3		

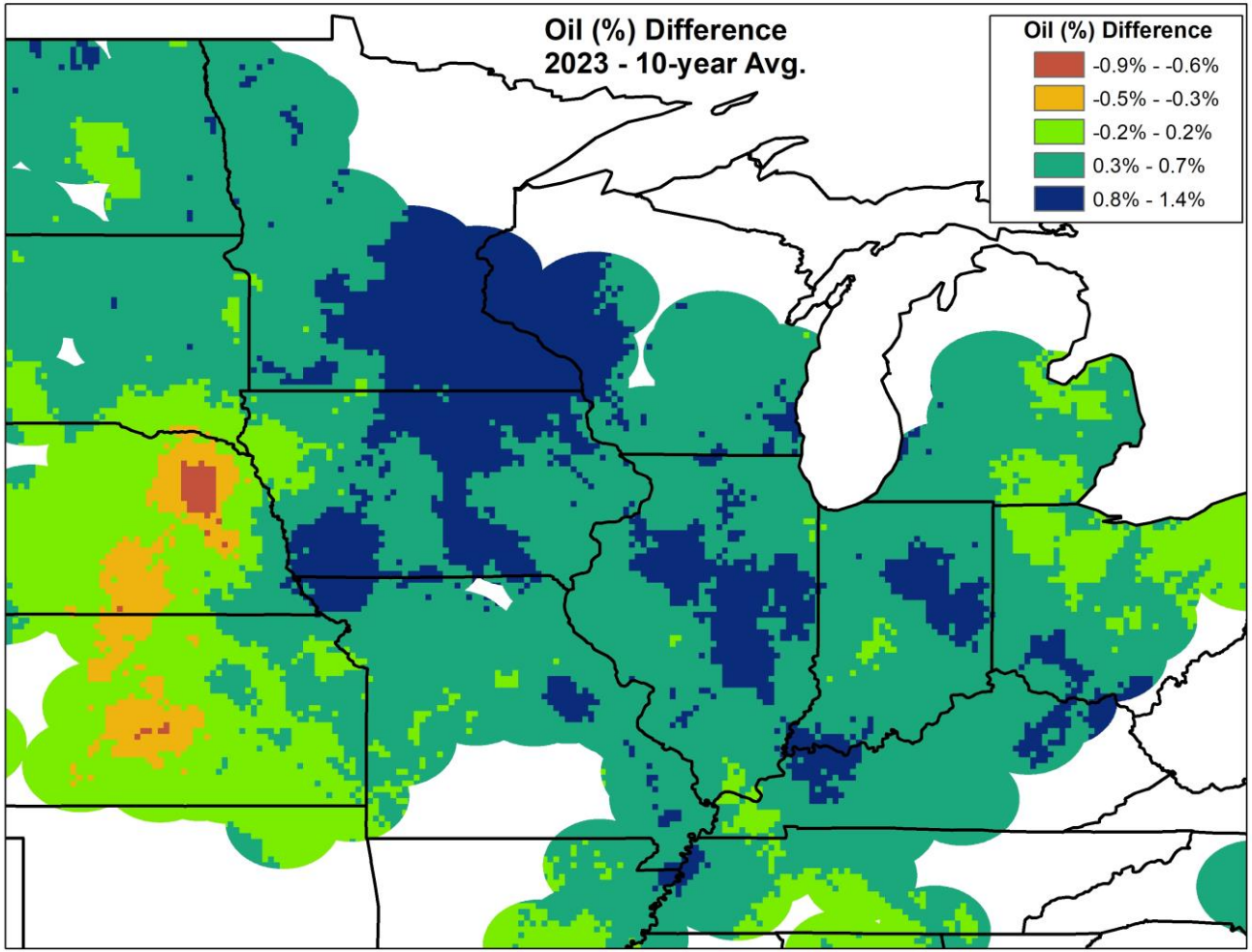
†US average values weighted based on estimated production by state, as estimated by USDA, NASS Crop Production Report (October, 2023)

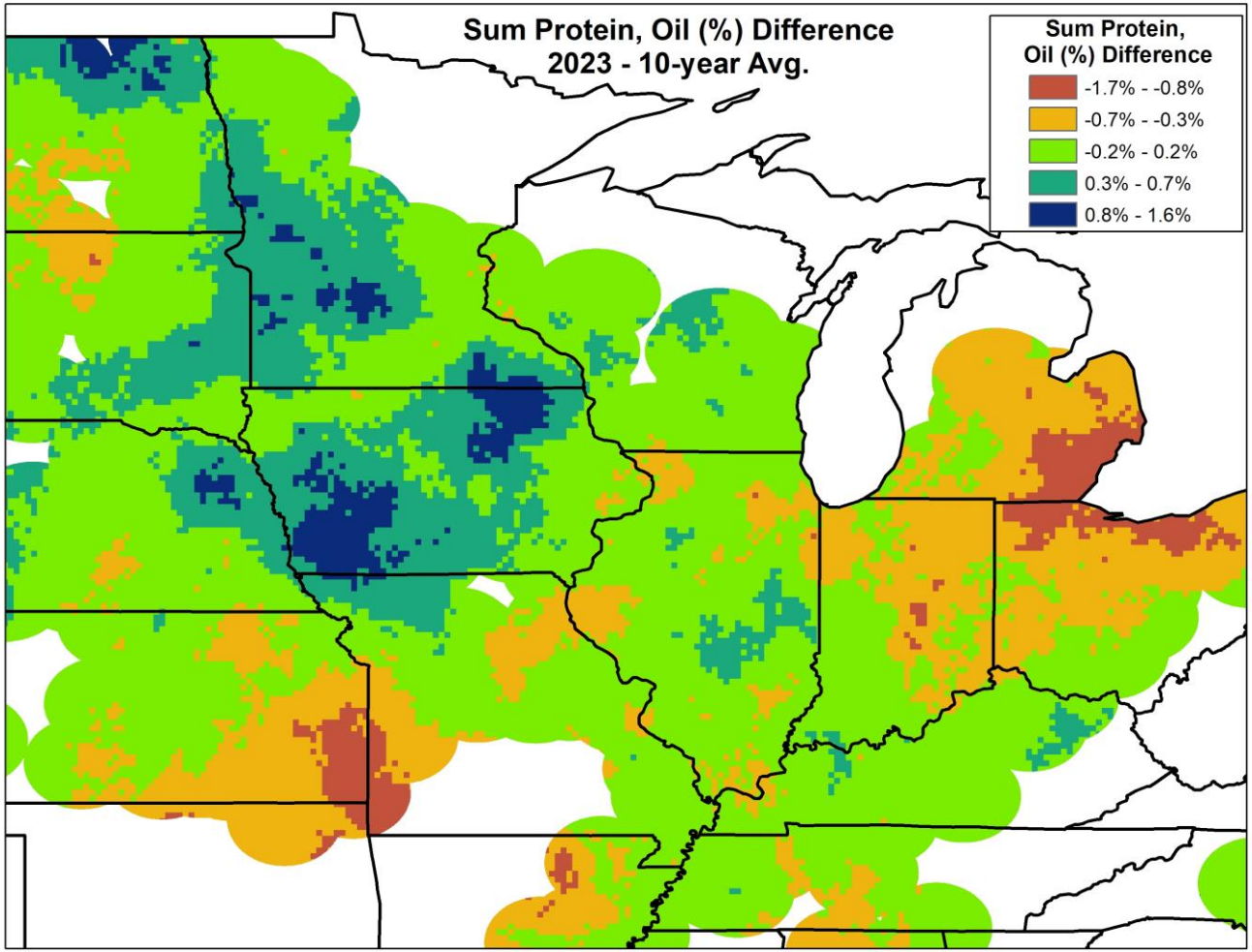

2023 - Protein
Protein (%)
n = 1,169
30.3 – 31.9
31.9 – 32.7
32.7 – 33.2
33.2 – 33.4
33.4 – 33.8
33.8 – 34.7
34.7 – 36.3
36.3 – 39.3

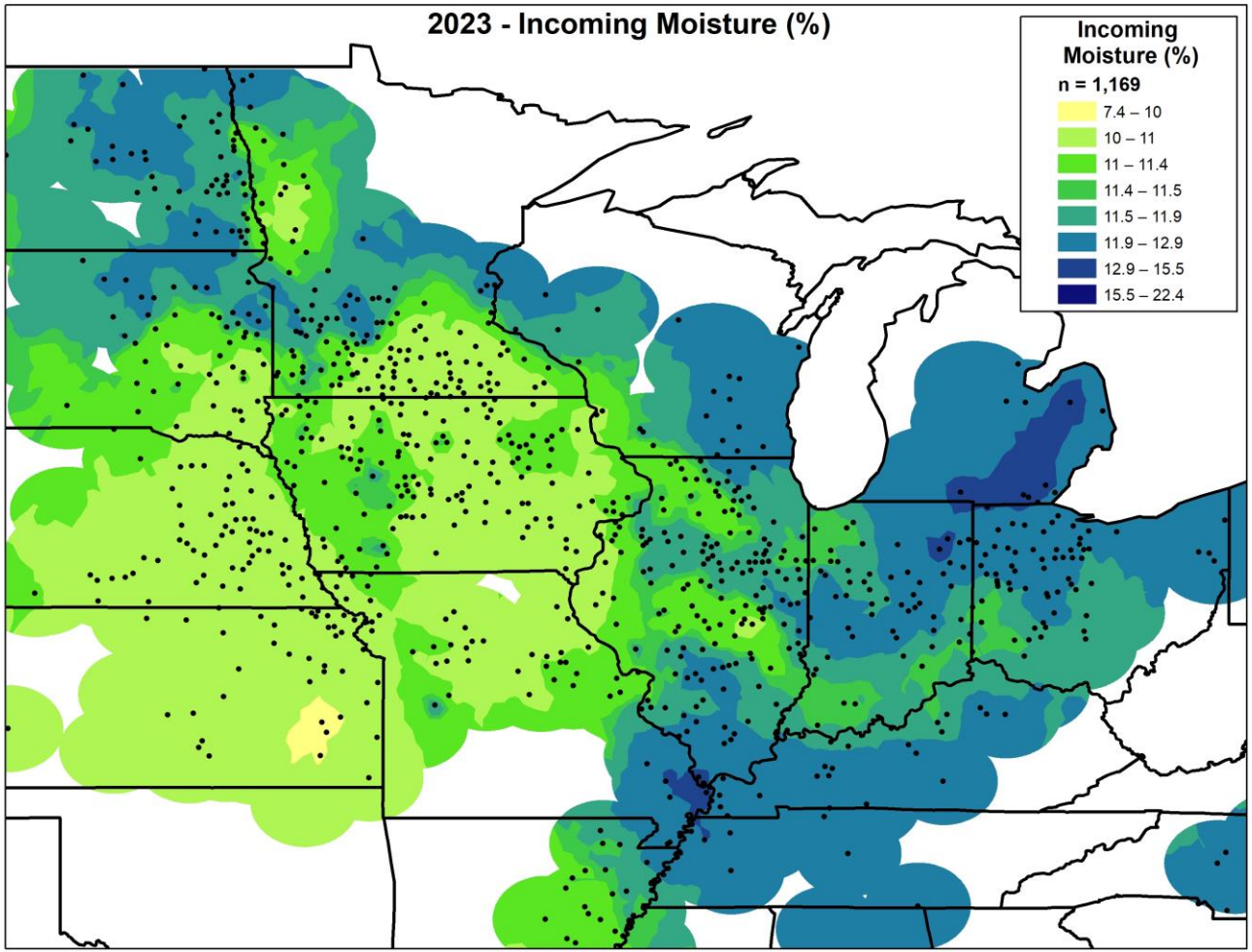

2023 - Oil
Oil (%)
n = 1,169
15.8 – 17.6
17.6 – 18.7
18.7 – 19.4
19.4 – 19.9
19.9 – 20.2
20.2 – 20.6
20.6 – 21.3
21.3 – 22.4


2023 - Sum, Protein + Oil (%)
Sum, Protein + Oil (%)
n = 1,169
49.1 – 51.5
51.5 – 52.6
52.6 – 53.1
53.1 – 53.4
53.4 – 53.6
53.6 – 54.1
54.1 – 55.2
55.2 – 57.6

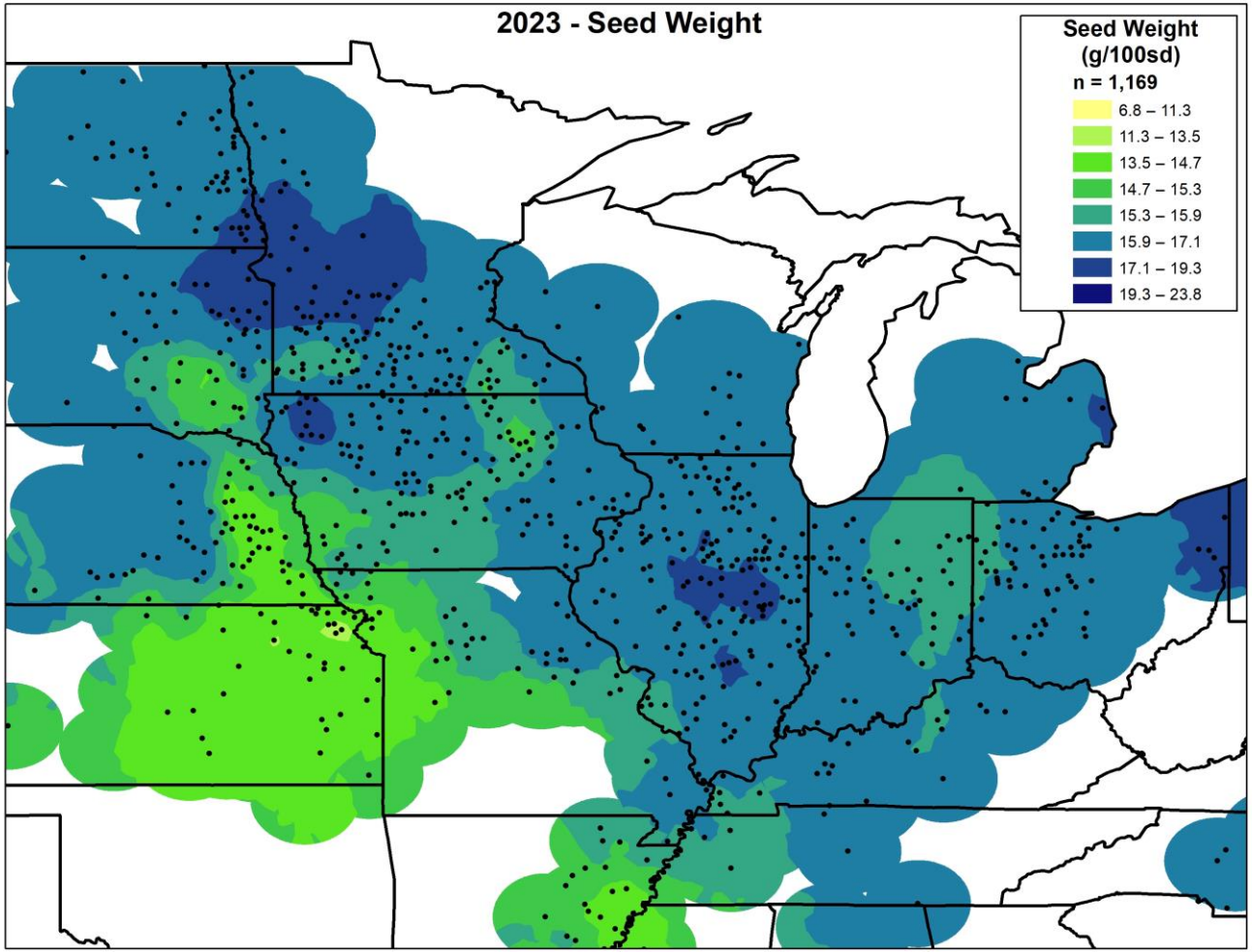

Protein (%) Difference
2023 - 10-year Avg.
Protein (%) Difference
-1.9% - -0.8%
-0.7% - -0.3%
-0.2% - 0.2%
0.3% - 0.5%
0.6% - 1.6%

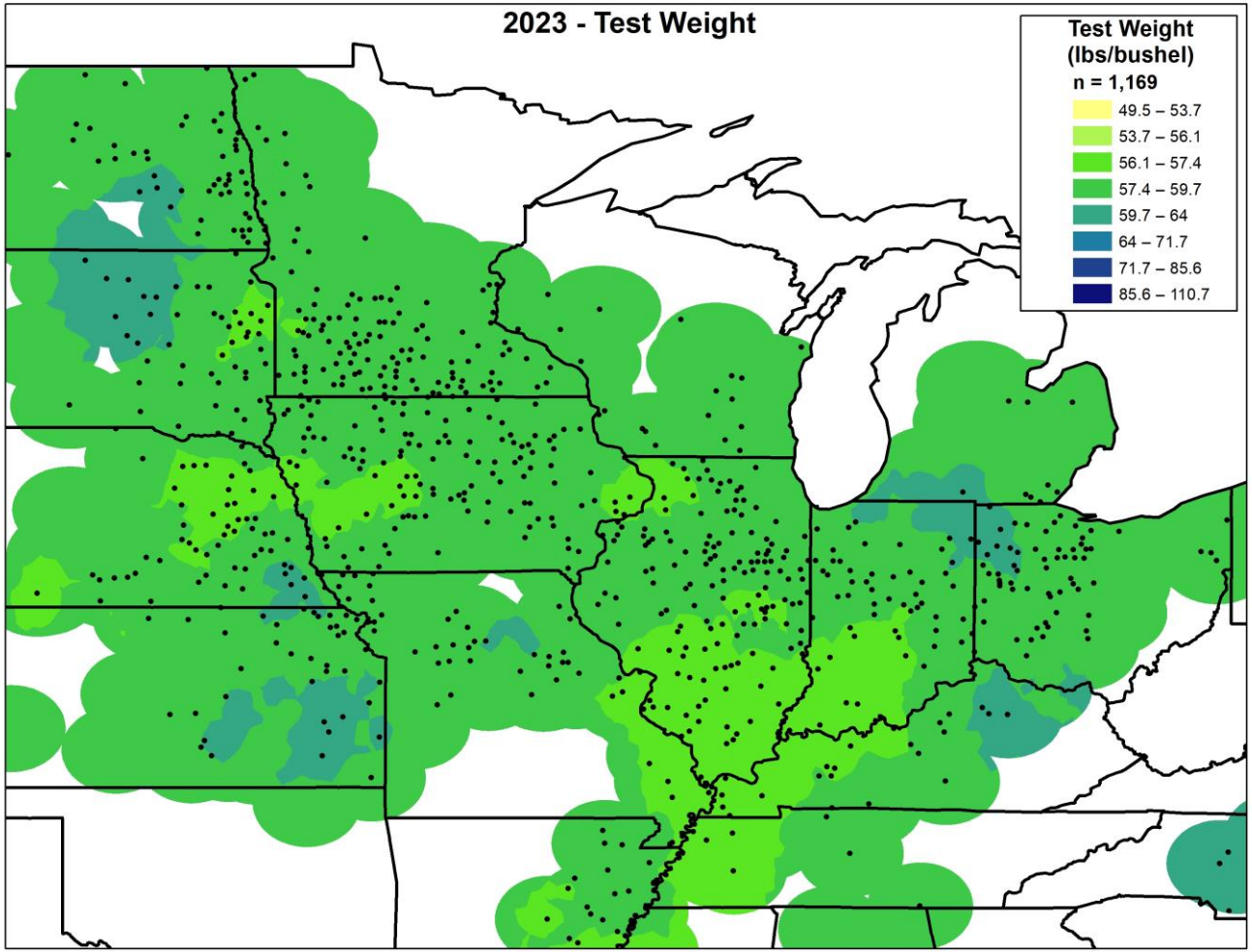

Oil (%) Difference
2023 - 10-year Avg.
Oil (%) Difference
-0.9% - -0.6%
-0.5% - -0.3%
-0.2% - 0.2%
0.3% - 0.7%
0.8% - 1.4%

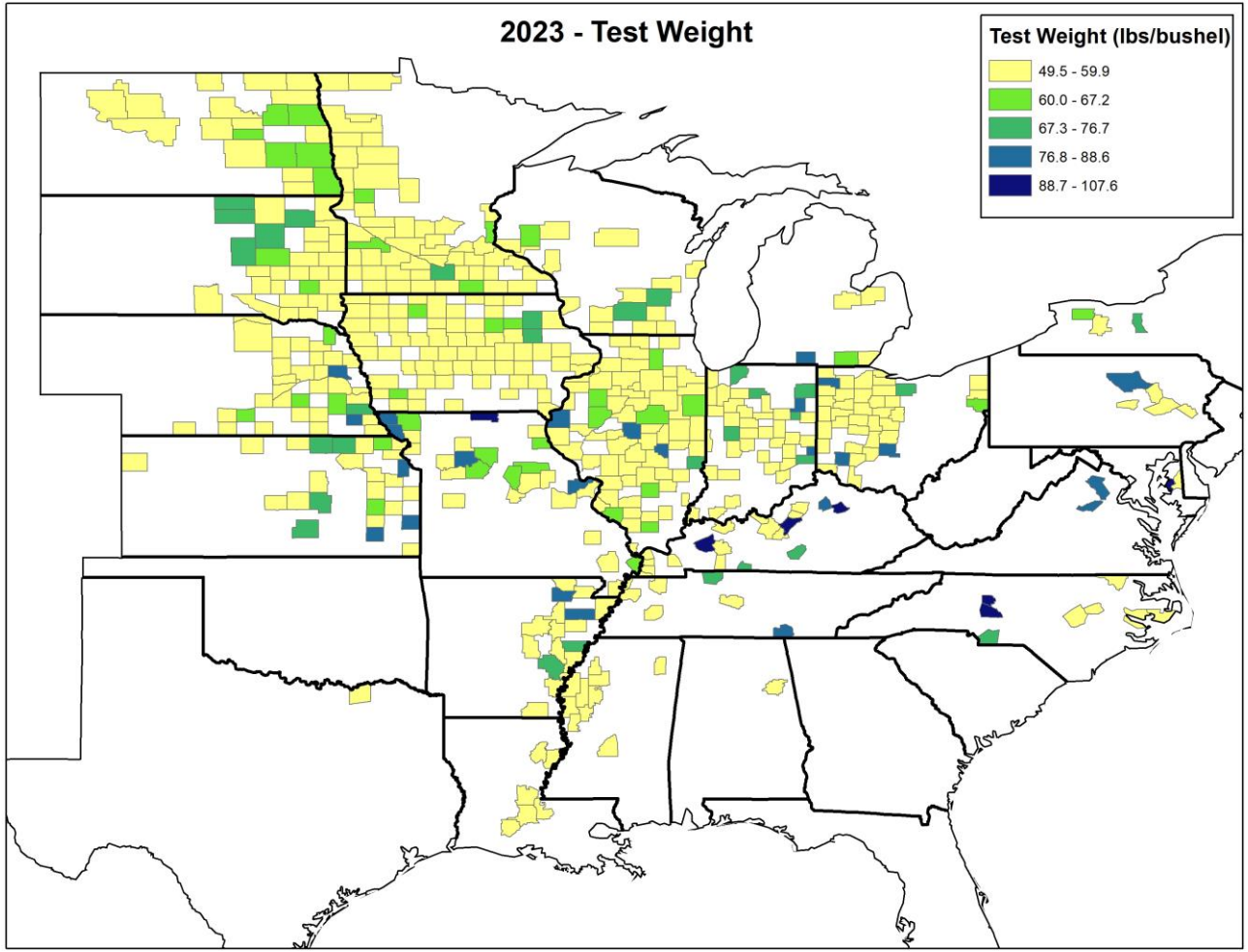

Sum Protein, Oil (%) Difference
2023 - 10-year Avg.
Sum Protein,
Oil (%) Difference
-1.7% - -0.8%
-0.7% - -0.3%
-0.2% - 0.2%
0.3% - 0.7%
0.8% - 1.6%

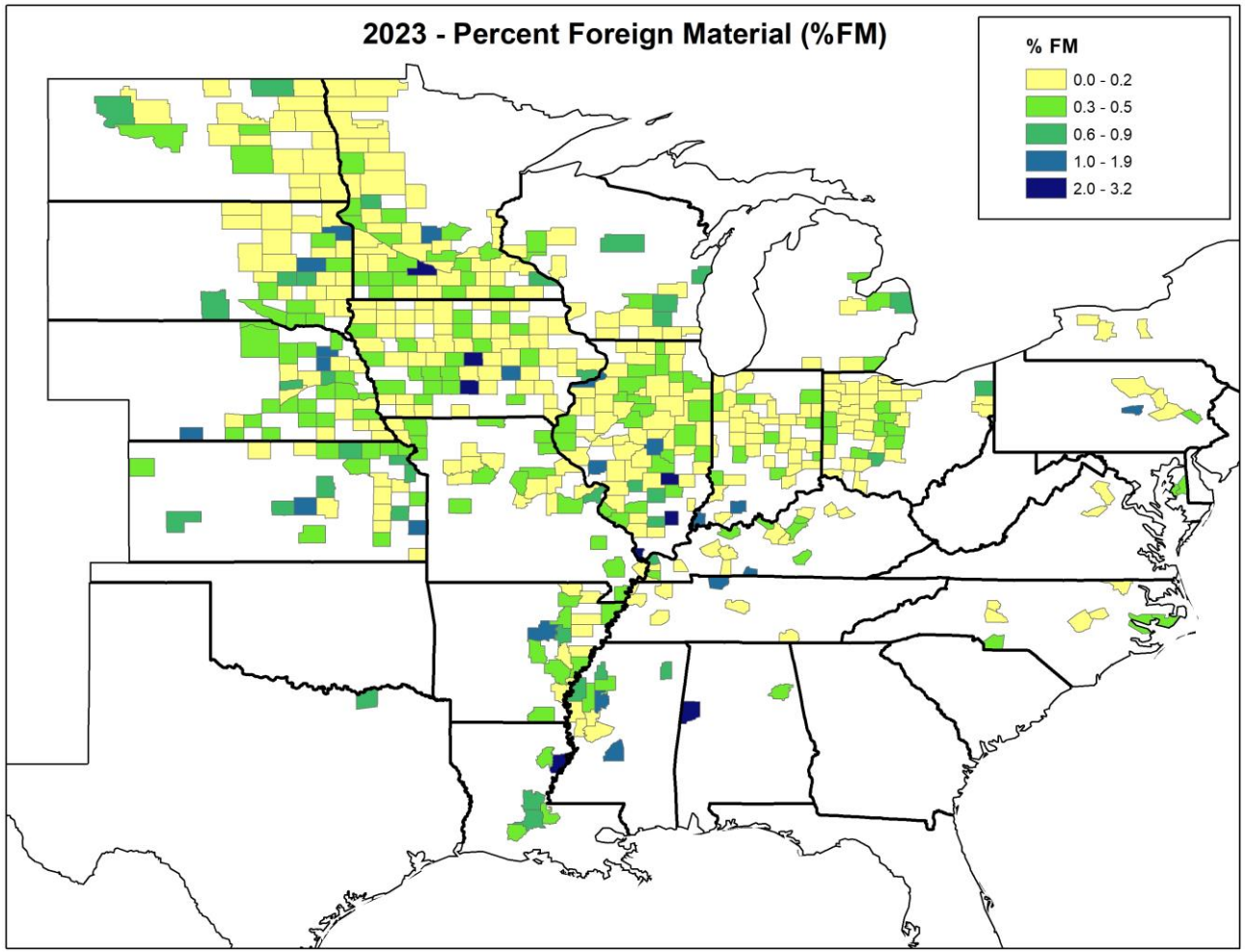

2023 - Incoming Moisture (%)
Incoming Moisture (%)
n = 1,169
7.4 – 10
10 – 11
11 – 11.4
11.4 – 11.5
11.5 – 11.9
11.9 – 12.9
12.9 – 15.5
15.5 – 22.4


PHYSICAL CHARACTERISTICS


2023 - Seed Weight
Seed Weight
(g/100sd)
n = 1,169
6.8 – 11.3
11.3 – 13.5
13.5 – 14.7
14.7 – 15.3
15.3 – 15.9
15.9 – 17.1
17.1 – 19.3
19.3 – 23.8


2023 - Test Weight
Test Weight (lbs/bushel)
n = 1,169
49.5 – 53.7
53.7 – 56.1
56.1 – 57.4
57.4 – 59.7
59.7 – 64
64 – 71.7
71.7 – 85.6
85.6 – 110.7


2023 - Test Weight
Test Weight (lbs/bushel)
49.5 - 59.9
60.0 - 67.2
67.3 - 76.7
76.8 - 88.6
88.7 - 107.6


2023 - Percent Foreign Material (%FM)
% FM
0.0 - 0.2
0.3 - 0.5
0.6 - 0.9
1.0 - 1.9
2.0 - 3.2

BETTER MEASURES OF QUALITY: AMINO ACIDS

AMINO ACIDS ARE THE BUILDING BLOCKS OF PROTEINS IN LIVING ORGANISMS. THERE ARE OVER 500 AMINO ACIDS FOUND IN NATURE - HOWEVER, THE HUMAN GENETIC CODE ONLY DIRECTLY ENCODES 20. 'ESSENTIAL' AMINO ACIDS MUST BE EATEN AS PART OF THE DIET. [illegible] ESSENTIAL AMINO ACIDS CAN BE SYNTHESISED IN THE BODY.

Chart Key: ALIPHATIC · AROMATIC · [illegible] · AMIDIC · NON-ESSENTIAL · ESSENTIAL

Chemical Structure — *single letter code*

NAME (A) — *three letter code* — DNA codons

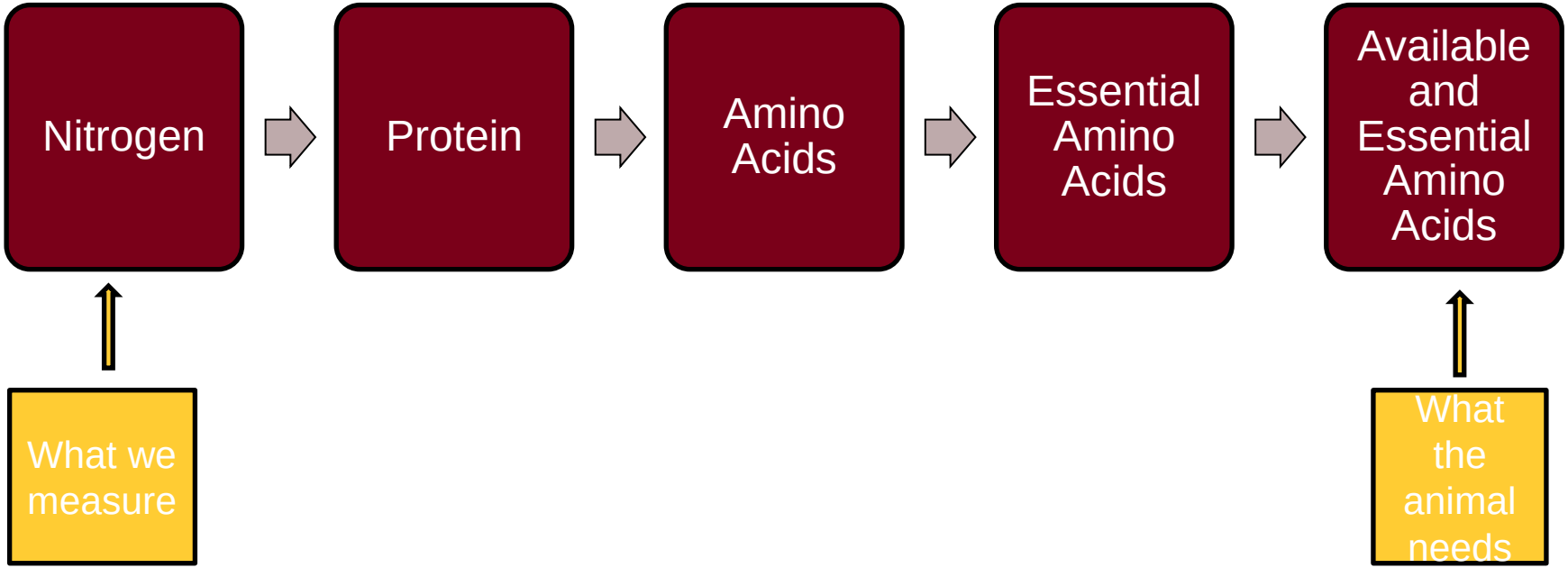
ALANINE (A) *Ala* GCT, GCC, GCA, GCG	GLYCINE (G) *Gly* GGT, GGC, GGA, GGG	ISOLEUCINE (I) *Ile* ATT, ATC, ATA	LEUCINE (L) *Leu* CTT, CTC, CTA, CTG, TTA, TTG	PROLINE (P) *Pro* CCT, CCC, CCA, CCG	VALINE (V) *Val* GTT, GTC, GTA, GTG	
PHENYLALANINE (F) *Phe* TTT, TTC	TRYPTOPHAN (W) *Trp* TGG	TYROSINE (Y) *Tyr* TAT, TAC	ASPARTIC ACID (D) *Asp* GAT, GAC	GLUTAMIC ACID (E) *Glu* GAA, GAG	ARGININE (R) *Arg* CGT, CGC, CGA, CGG, AGA, AGG	HISTIDINE (H) *His* CAT, CAC
LYSINE (K) *Lys* AAA, AAG	SERINE (S) *Ser* TCT, TCC, TCA, TCG, AGT, AGC	THREONINE (T) *Thr* ACT, ACC, ACA, ACG	CYSTEINE (C) *Cys* TGT, TGC	METHIONINE (M) *Met* ATG	ASPARAGINE (N) *Asn* AAT, AAC	GLUTAMINE (Q) *Gln* CAA, CAG

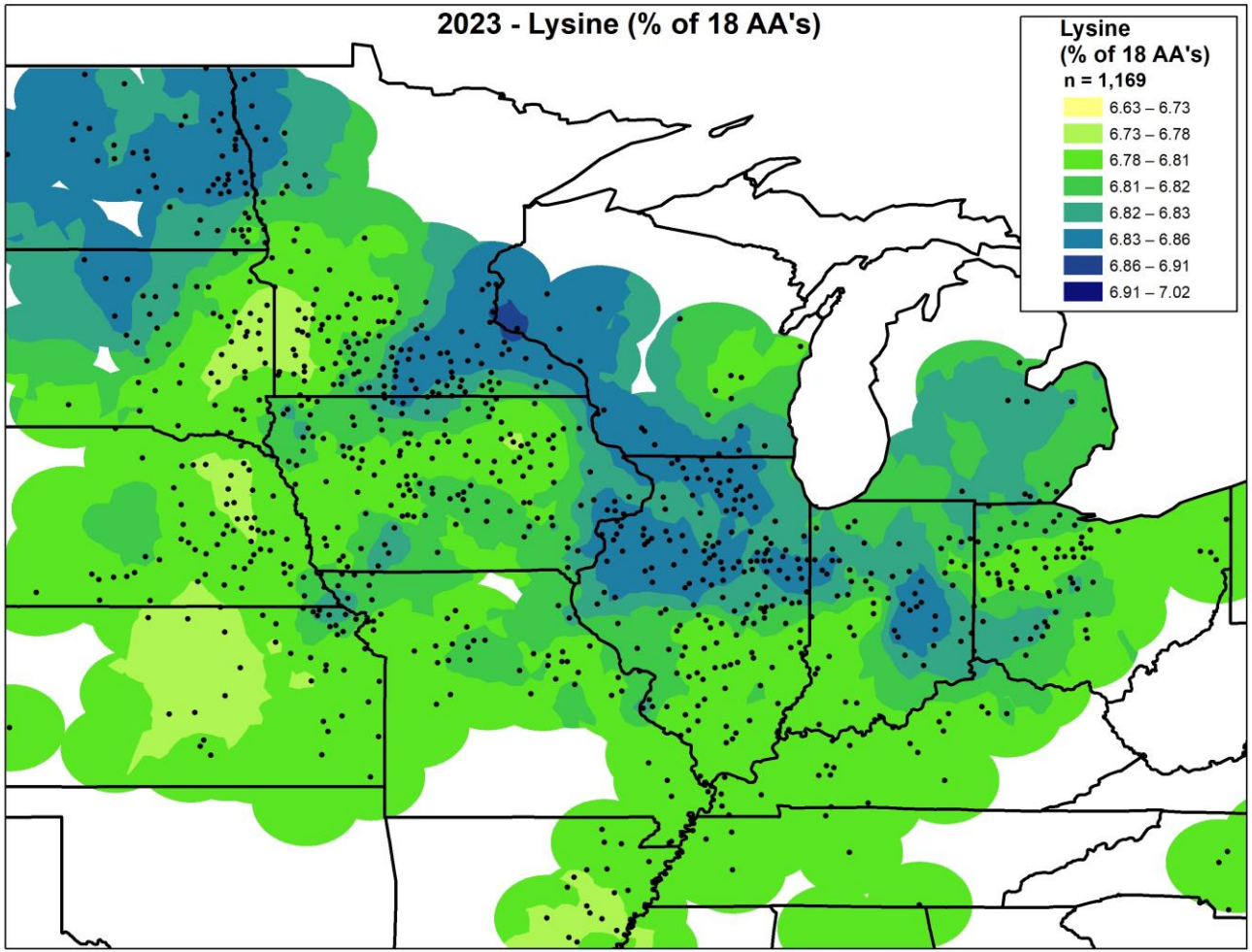
Note: This chart only shows those amino acids for which the human genetic code directly codes for. Selenocysteine is often referred to as the 21st amino acid, but is encoded in a special manner. In some cases, distinguishing between asparagine/aspartic acid and glutamine/glutamic acid is difficult. In these cases, the codes asx (B) and glx (Z) are respectively used.

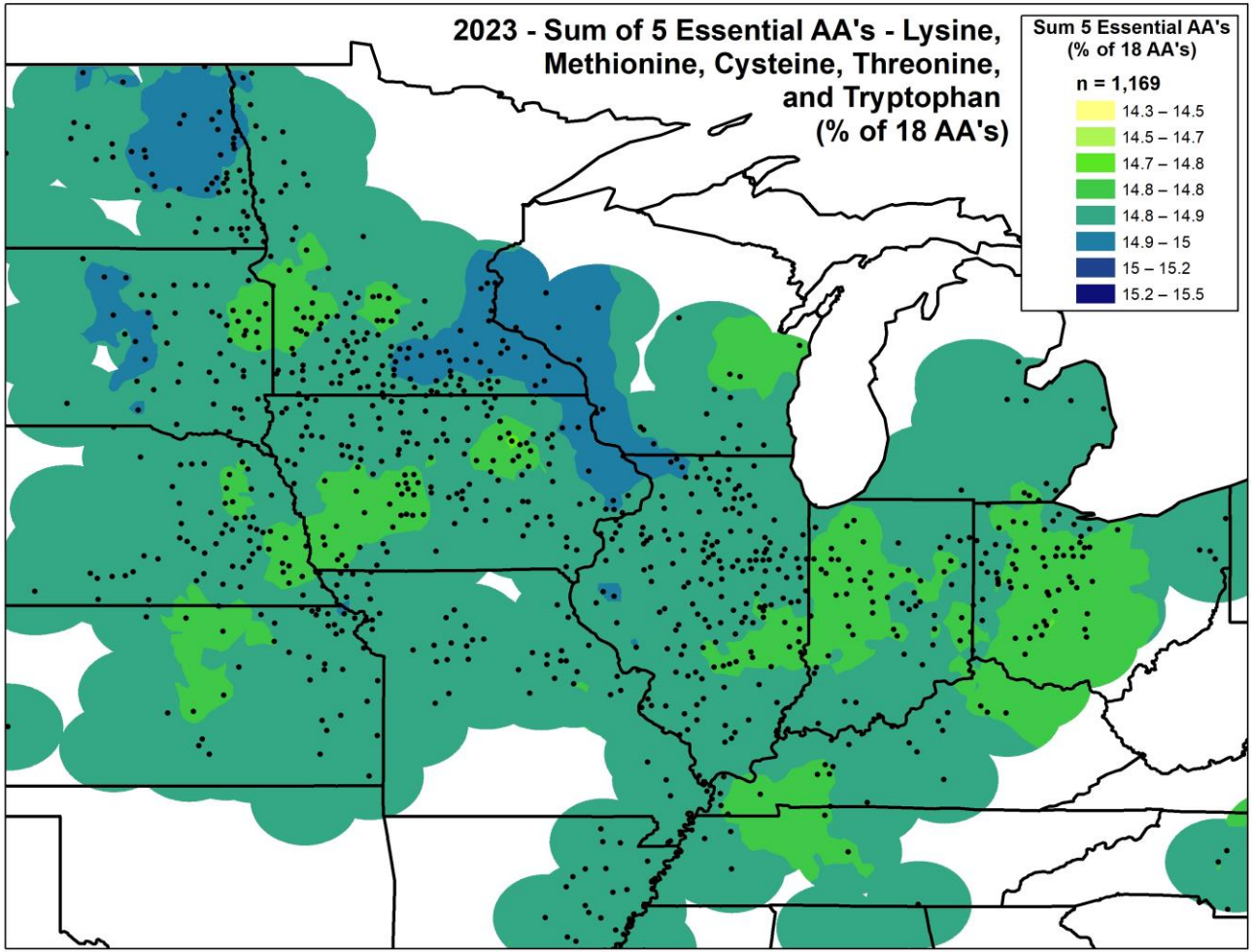
Better measures of the value of soybeans

- Soybean is a complex and variable product/commodity.
- Traditional grading systems do not correlate well with actual value.
- Soybeans & soybean meal have been valued primarily on an indirect measure of protein – ‘crude protein’
- Crude protein is probably not the best measure of a soybean (or a soybean meal’s) value
- The first purchasers who can find hidden value will capture additional profit.

CP (N) is an indirect measure of quality




2023 - Lysine (% of 18 AA's)
Lysine
(% of 18 AA's)
n = 1,169
6.63 – 6.73
6.73 – 6.78
6.78 – 6.81
6.81 – 6.82
6.82 – 6.83
6.83 – 6.86
6.86 – 6.91
6.91 – 7.02


2023 - 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 = 1,169
14.3 – 14.5
14.5 – 14.7
14.7 – 14.8
14.8 – 14.8
14.8 – 14.9
14.9 – 15
15 – 15.2
15.2 – 15.5

frontiers | Frontiers in Sustainable Food Systems

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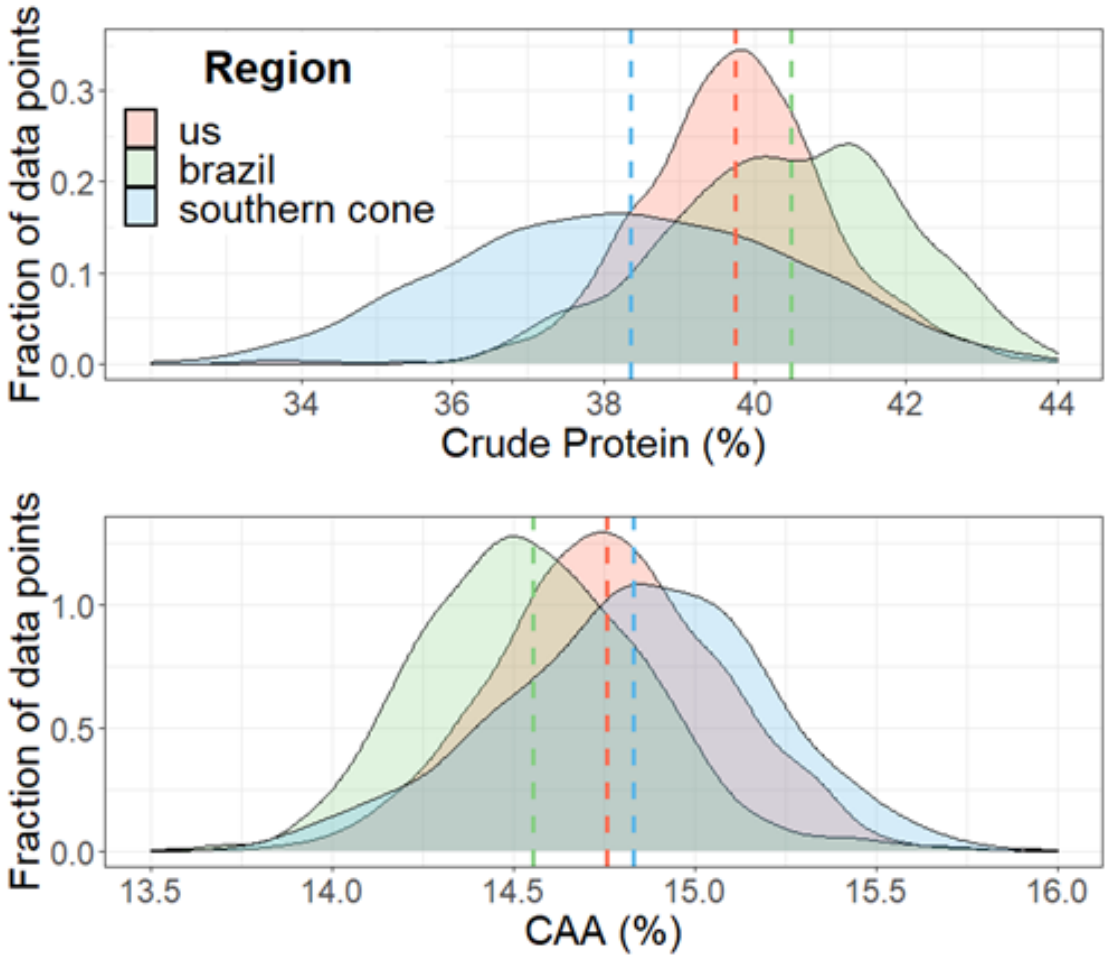
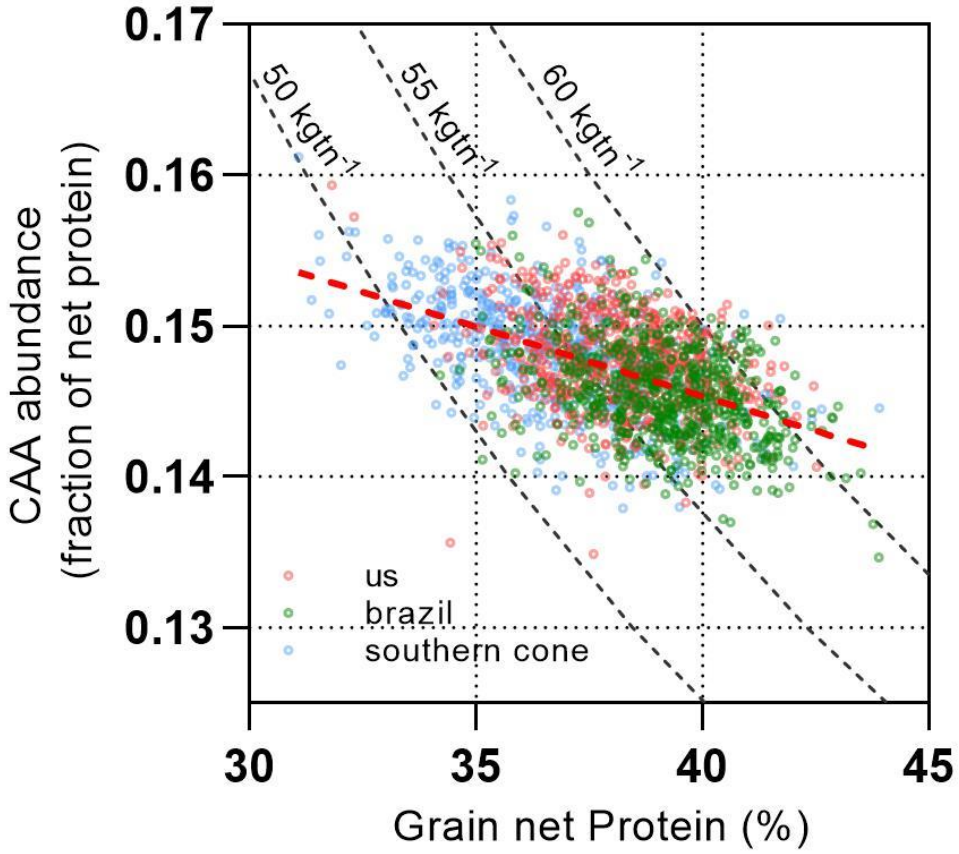
Western Hemisphere quality and production capacity of soybean protein

Anibal Cerrudo[1,2]*, Jill Miller-Garvin[1] and Seth L. Naeve[1]

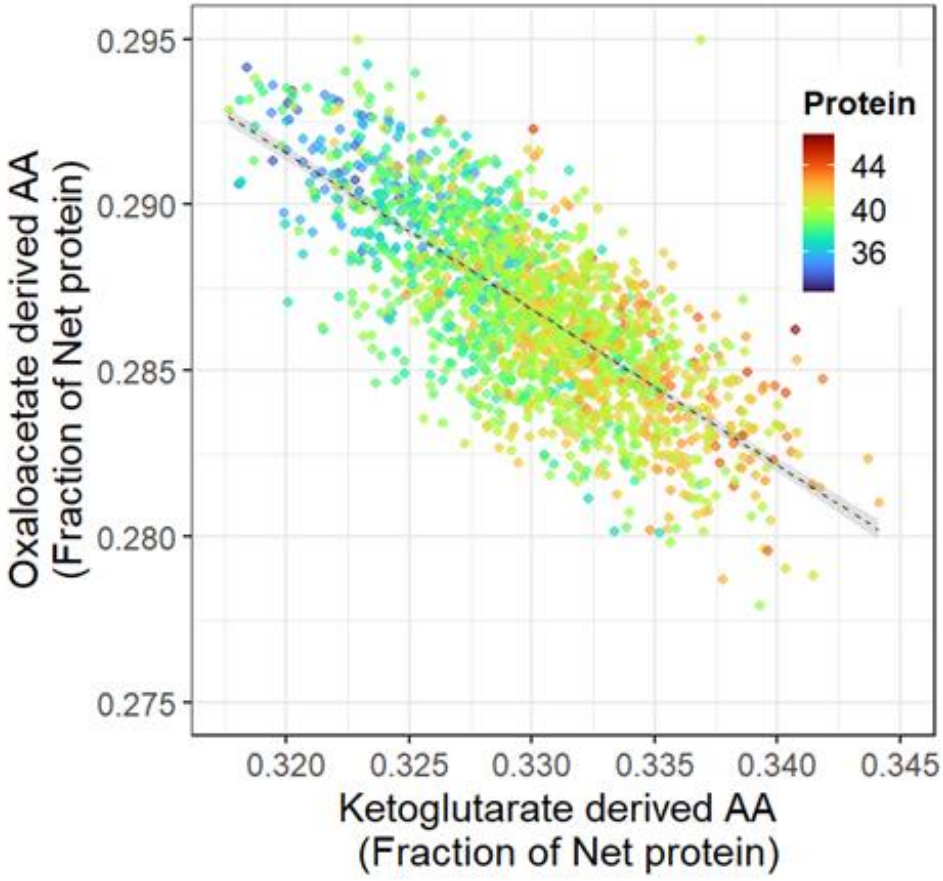
[1]Department of Agronomy and Plant Genetics, University of Minnesota, Saint Paul, MN, United States,
[2]Ecofisiología de cultivos, Unidad Integrada Balcarce (INTA-FCA), Balcarce, Argentina



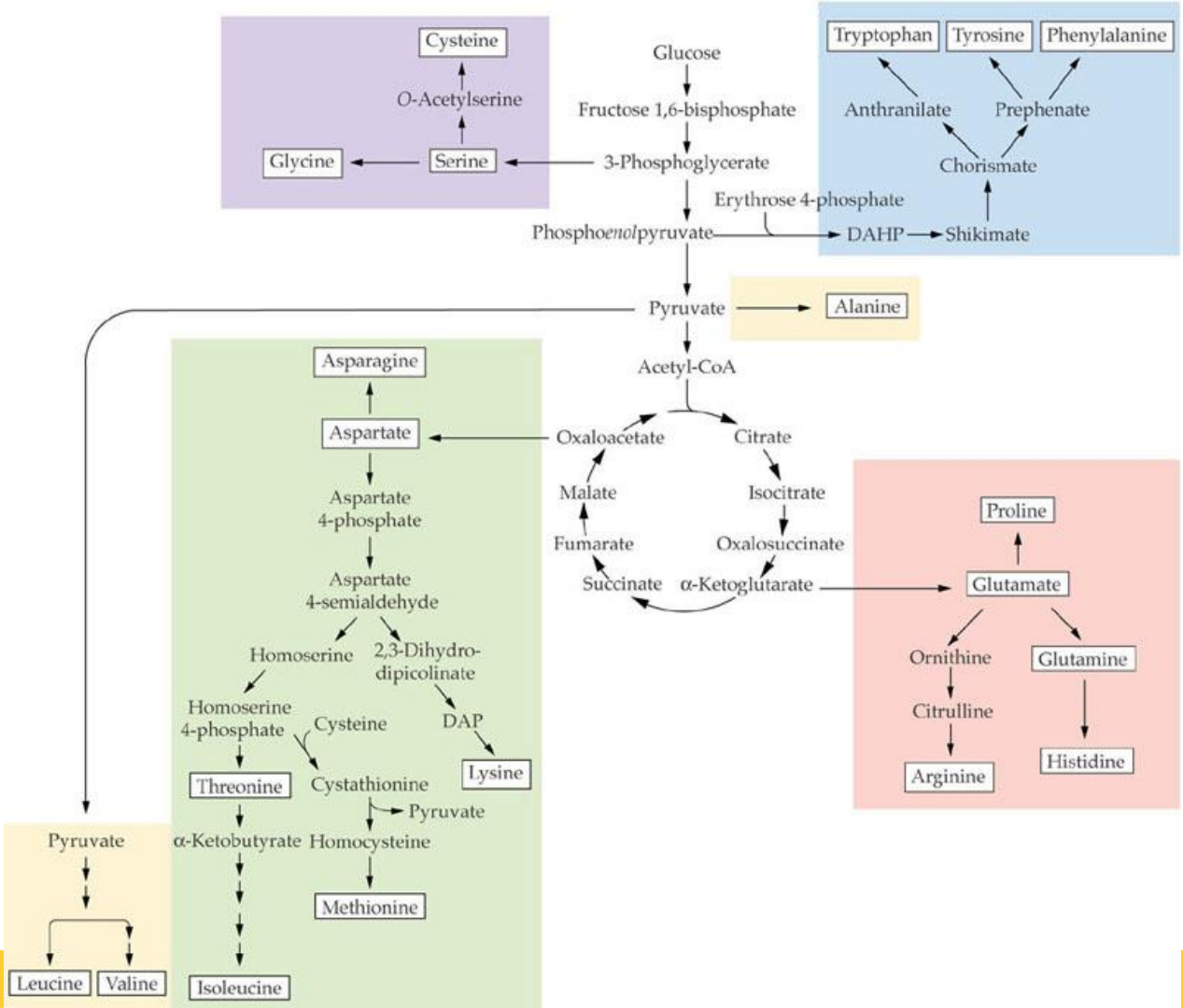
Cerrudo, Garvin-Miller, and Naeve, 2023

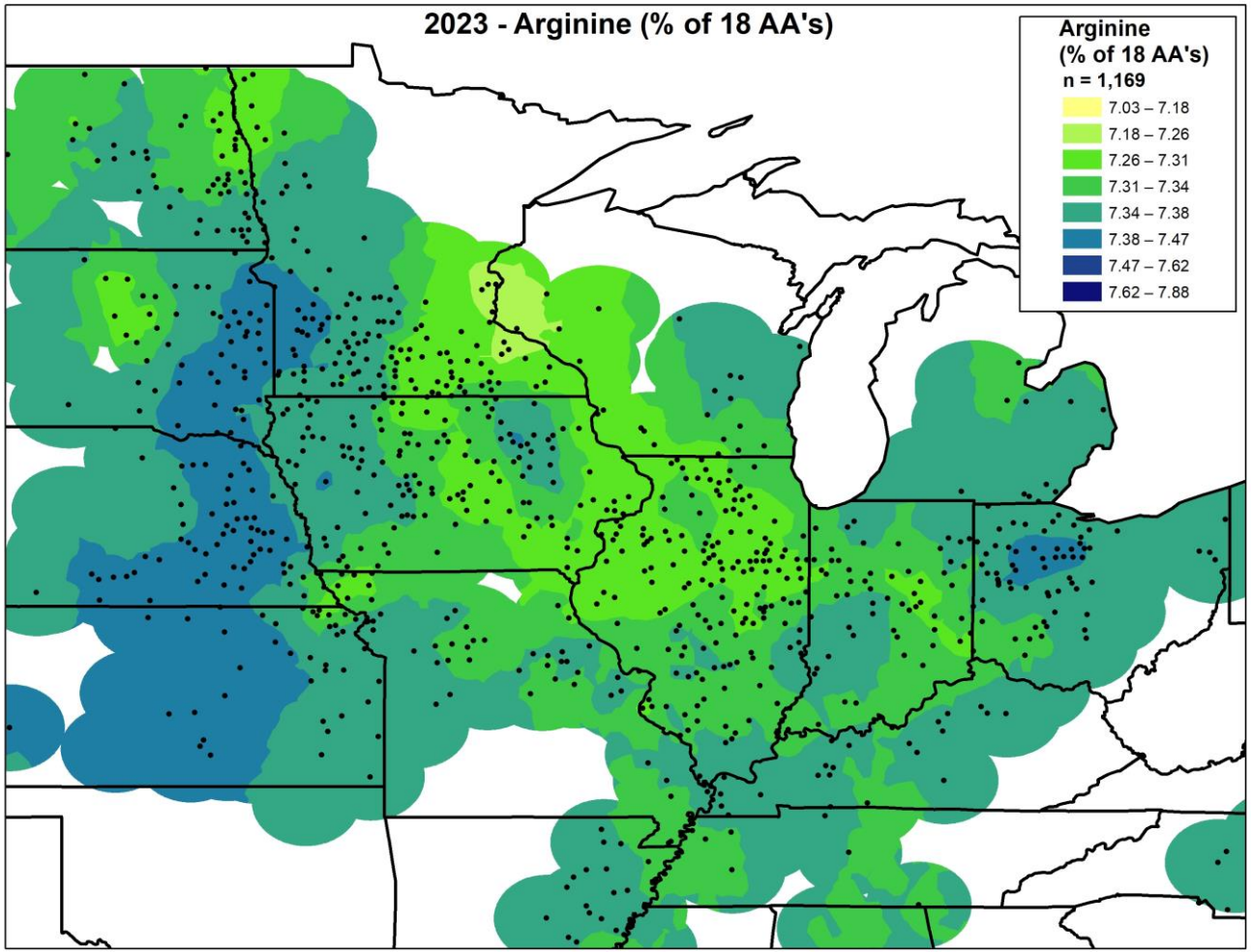


Cerrudo, Garvin-Miller, and Naeve, 2023

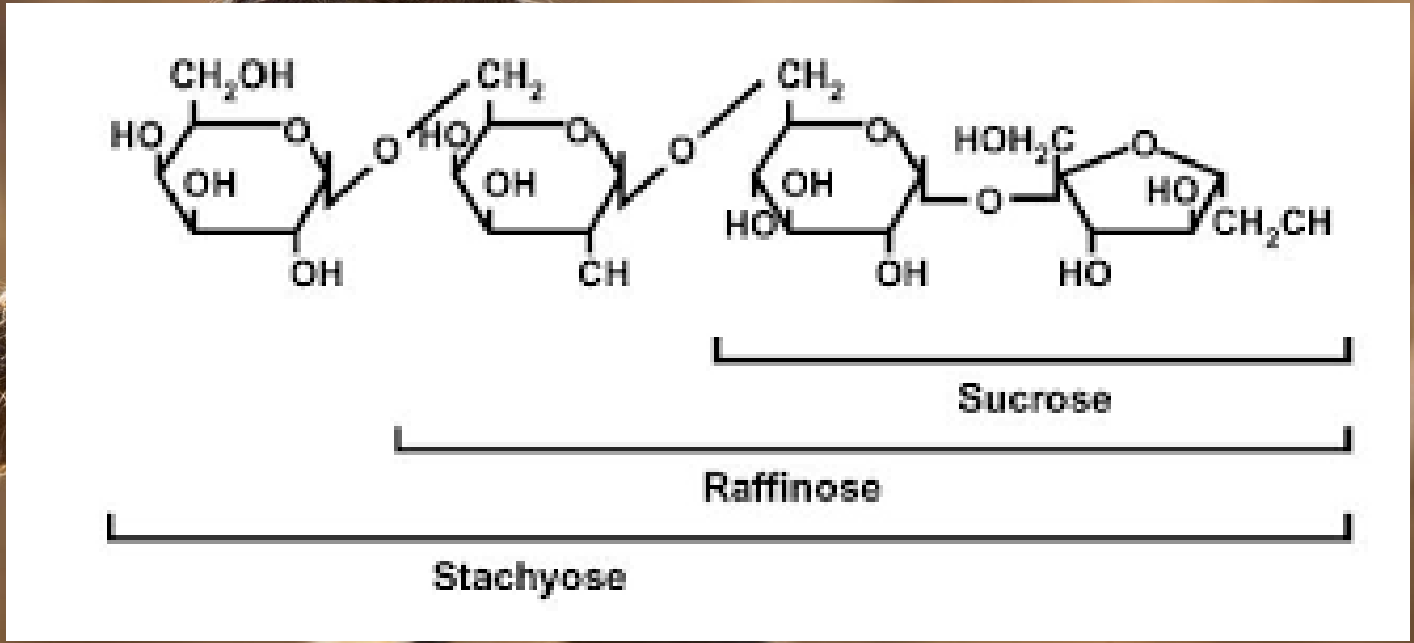


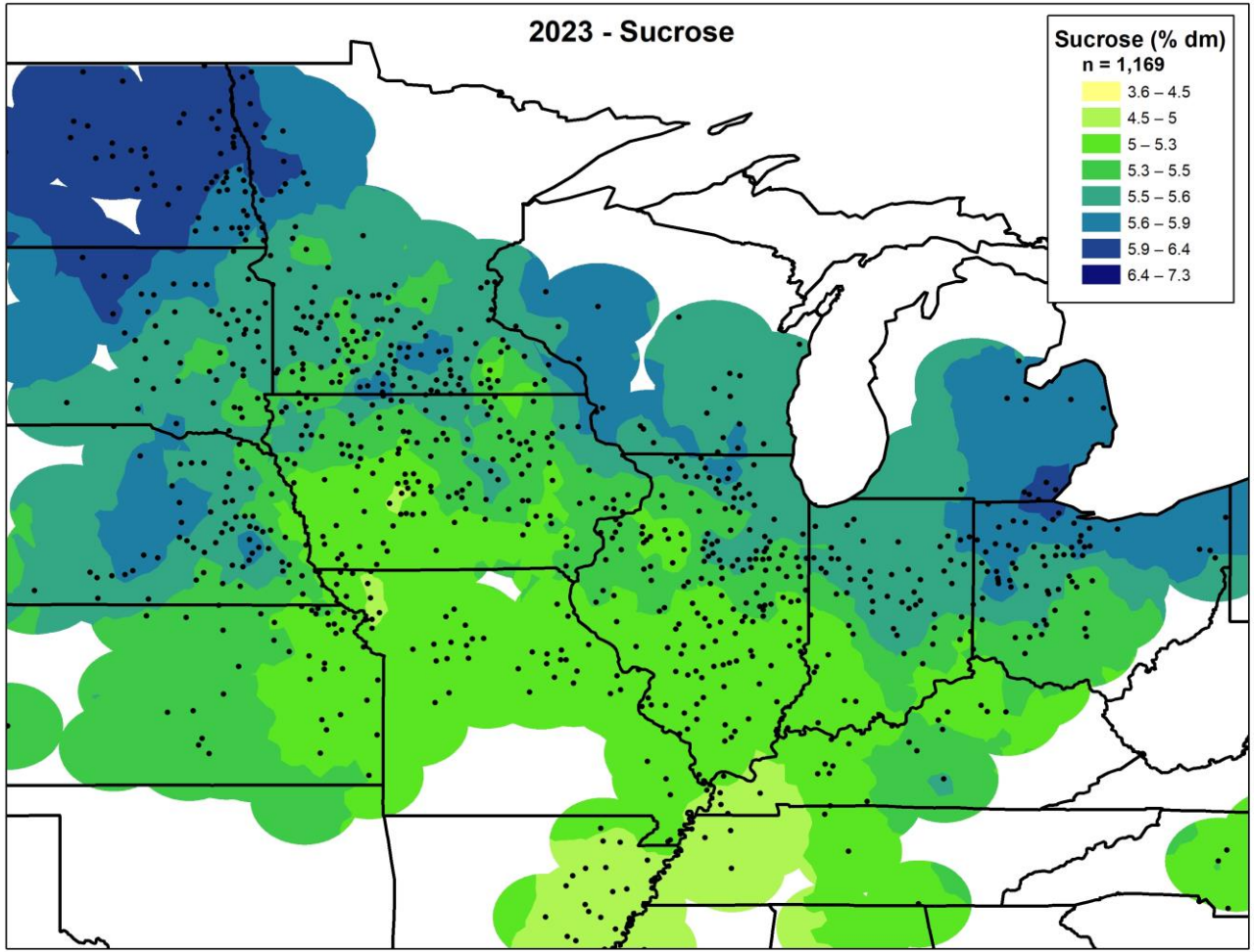
Cerrudo, Garvin-Miller, and Naeve, 2023

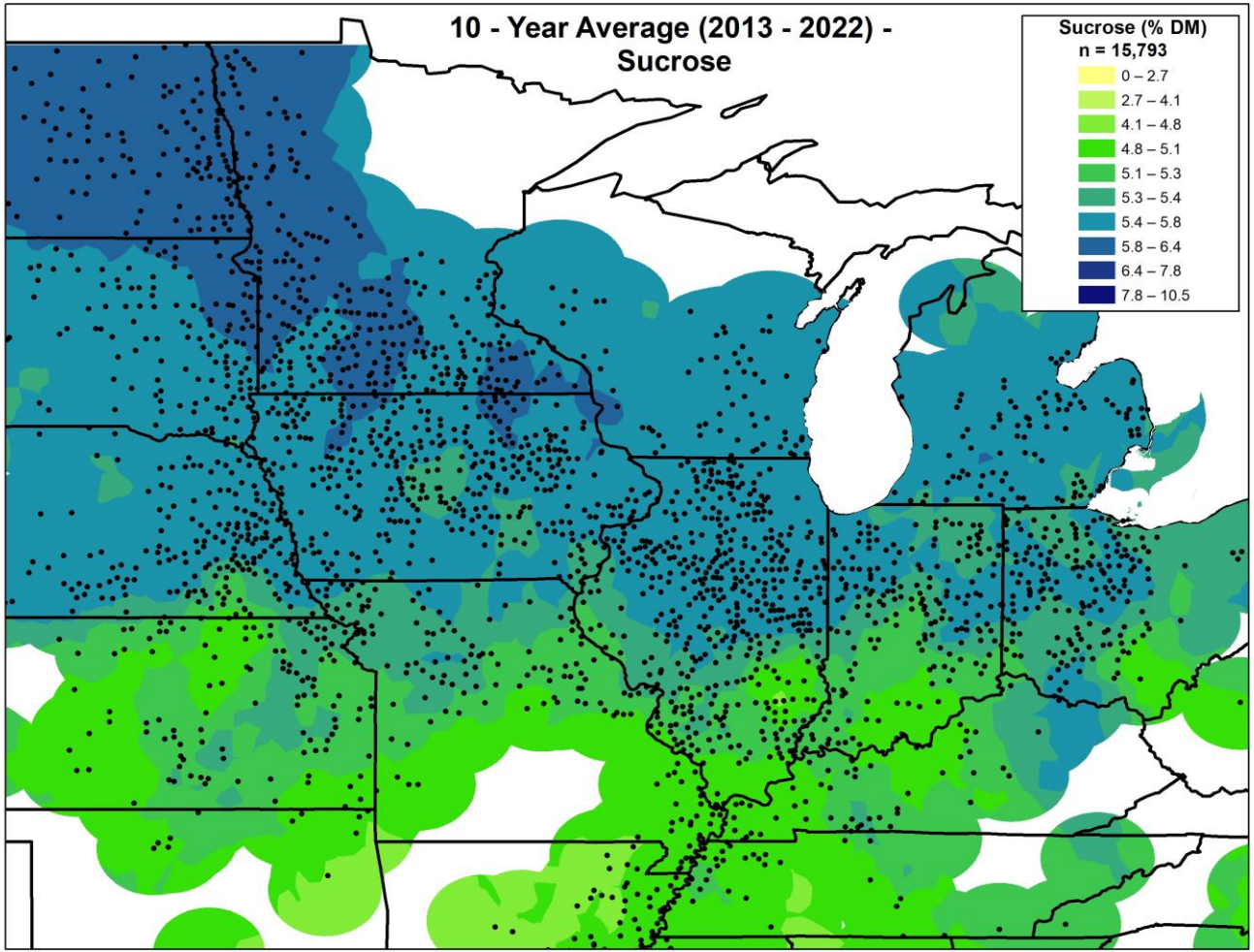

Cysteine
O-Acetylserine
Glycine
Serine
Glucose
Fructose 1,6-bisphosphate
3-Phosphoglycerate
Tryptophan
Tyrosine
Phenylalanine
Anthranilate
Prephenate
Chorismate
Erythrose 4-phosphate
Phosphoenolpyruvate
DAHP
Shikimate
Pyruvate
Alanine
Asparagine
Aspartate
Acetyl-CoA
Oxaloacetate
Citrate
Malate
Isocitrate
Fumarate
Oxalosuccinate
Succinate
α-Ketoglutarate
Proline
Glutamate
Ornithine
Glutamine
Citrulline
Arginine
Histidine
Aspartate 4-phosphate
Aspartate 4-semialdehyde
Homoserine
2,3-Dihydro-dipicolinate
Homoserine 4-phosphate
Cysteine
DAP
Lysine
Threonine
Cystathionine
Pyruvate
α-Ketobutyrate
Homocysteine
Methionine
Pyruvate
Leucine
Valine
Isoleucine


2023 - Arginine (% of 18 AA's)
Arginine
(% of 18 AA's)
n = 1,169
7.03 – 7.18
7.18 – 7.26
7.26 – 7.31
7.31 – 7.34
7.34 – 7.38
7.38 – 7.47
7.47 – 7.62
7.62 – 7.88

BETTER MEASURES OF QUALITY: SOLUBLE SUGARS




2023 - Sucrose
Sucrose (% dm)
n = 1,169
3.6 – 4.5
4.5 – 5
5 – 5.3
5.3 – 5.5
5.5 – 5.6
5.6 – 5.9
5.9 – 6.4
6.4 – 7.3


10 - Year Average (2013 - 2022) -
Sucrose
Sucrose (% DM)
n = 15,793
0 – 2.7
2.7 – 4.1
4.1 – 4.8
4.8 – 5.1
5.1 – 5.3
5.3 – 5.4
5.4 – 5.8
5.8 – 6.4
6.4 – 7.8
7.8 – 10.5

2023 Summary

- A severe and chronic drought affected soybean production across most of the major soybean states in 2023.
- Despite exceedingly challenging production environments, U.S. farmers will still produce a crop that averages 3.3 MT per ha. (~50 bushels per acre).
- Average composition of the crop is very similar to 2022.
- One could consider this an ‘Oil Year.’
- Dryer than normal soybeans will increases both protein and oil yields per ton due to increased ‘as-is’ values.
- Protein is not a good indicator of soybean quality or value

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