

Quality of the United States Soybean Crop: 2021

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Outline

- 2021 Weather highlights
- Historical protein and oil variation
- 2021 Soybean Survey results
 - Protein and Oil
 - Physical Characteristics
 - Amino Acids
 - Sucrose
- 2021 Food Soybean Survey results



CRITICAL WEATHER EVENTS



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

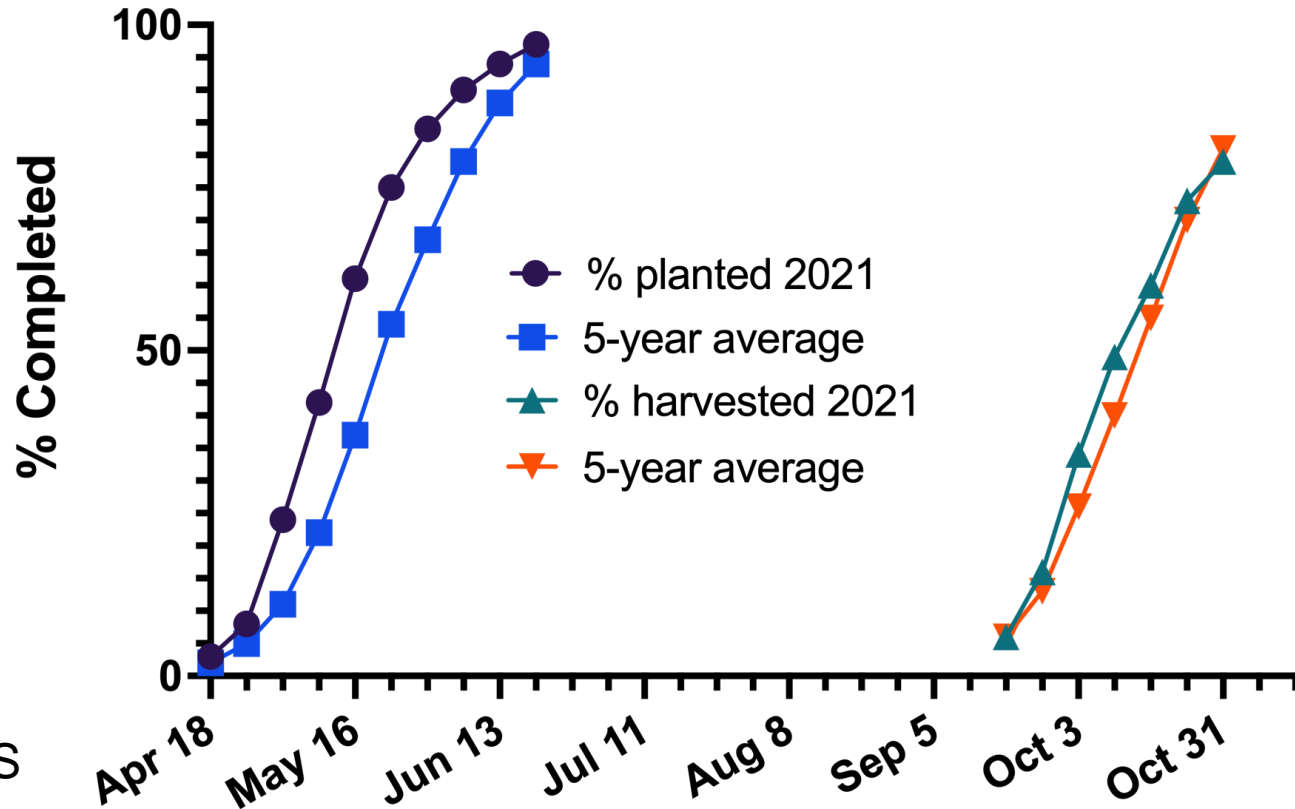


2021 Weather and Soybean Production

- Unusually dry spring weather in the Western Corn Belt and Illinois allowed for very early planting
- Planting in most other states proceeded normally
 - Early planting was delayed in Ohio, but finished normally
- A severe and chronic drought affected many of the Western Corn Belt states throughout the summer
- Rains provided some relief very late in the summer season.

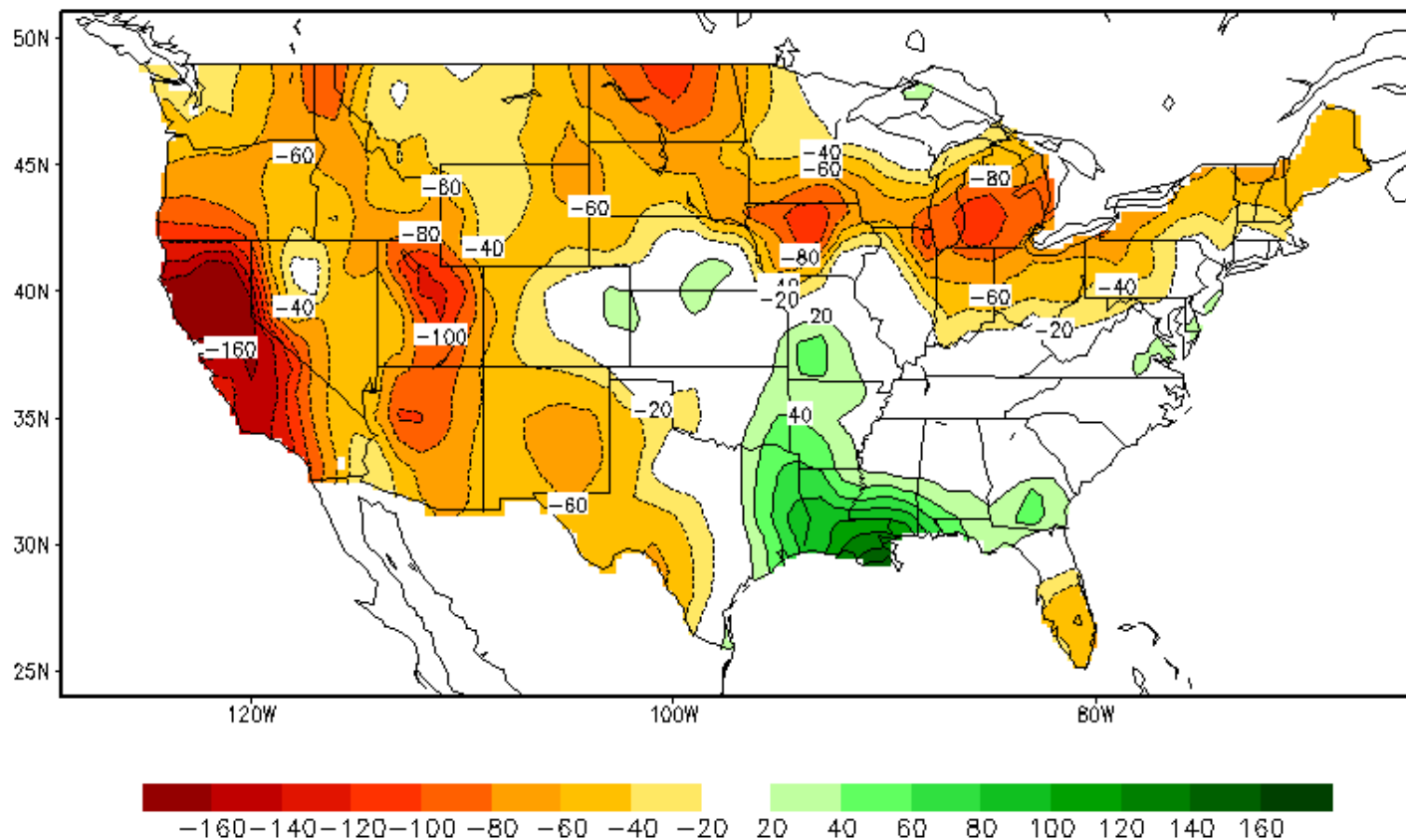


2021 Progress: Planting and Harvesting

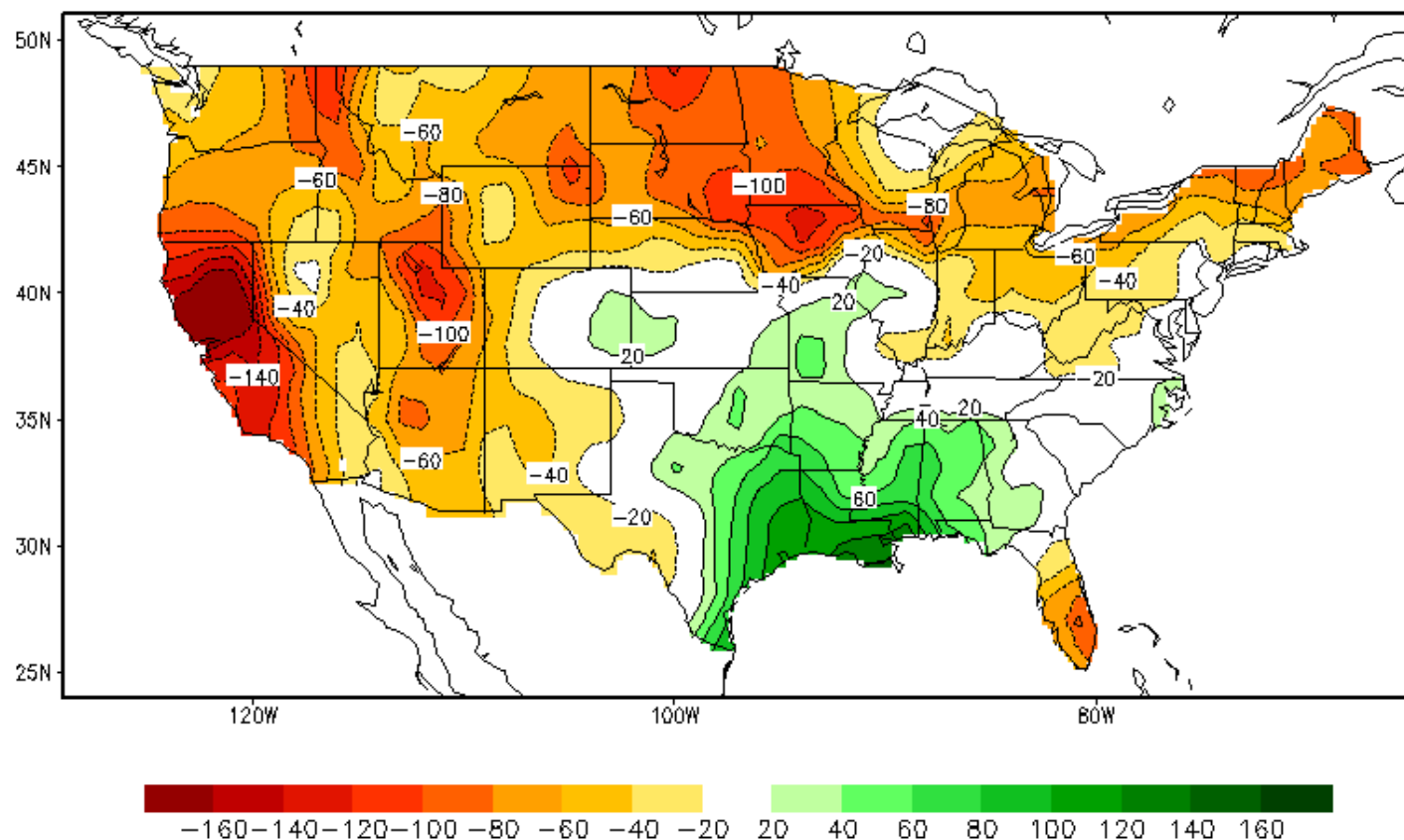


USDA-NASS
Crop Progress

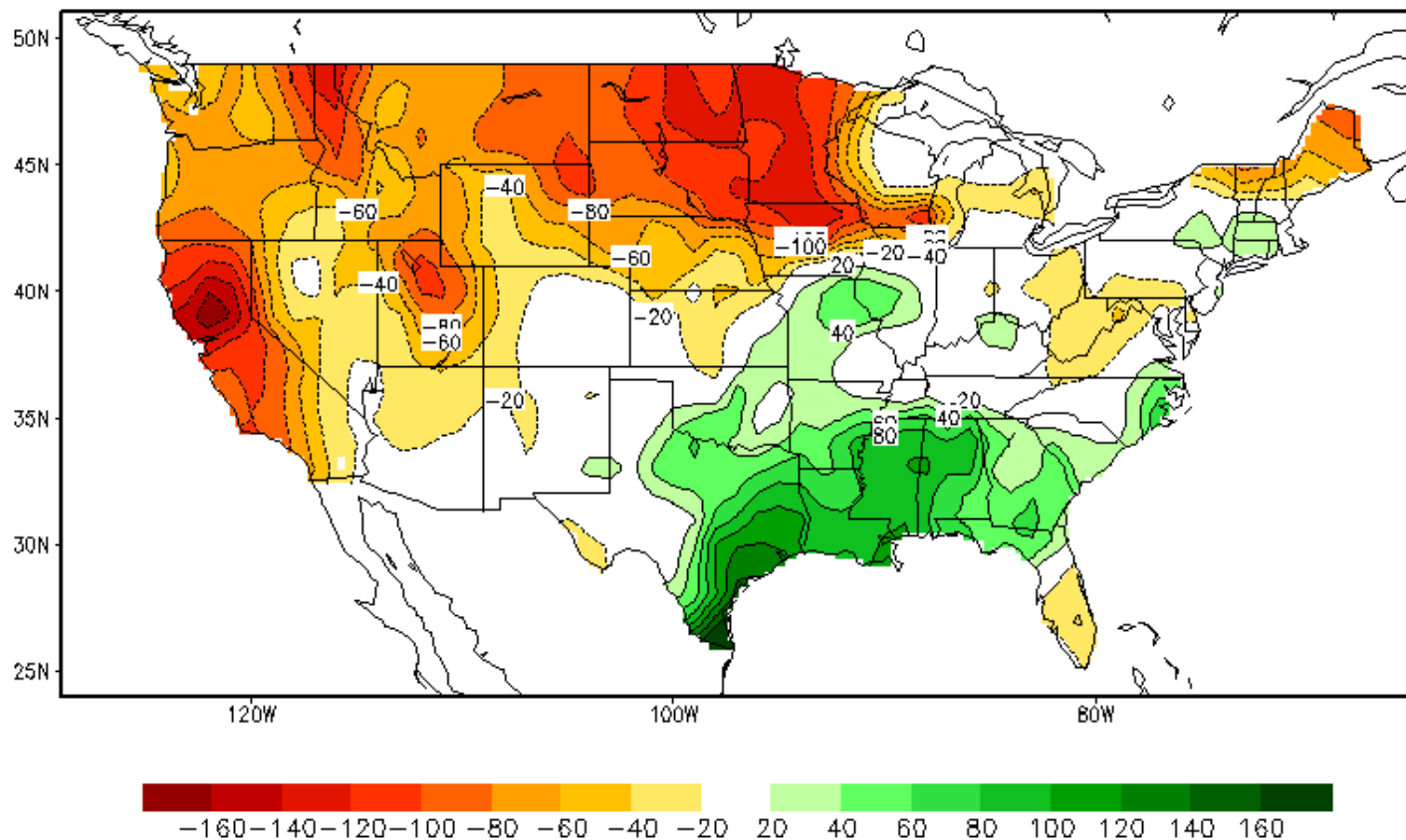
Calculated Soil Moisture Anomaly (mm)
MAY, 2021



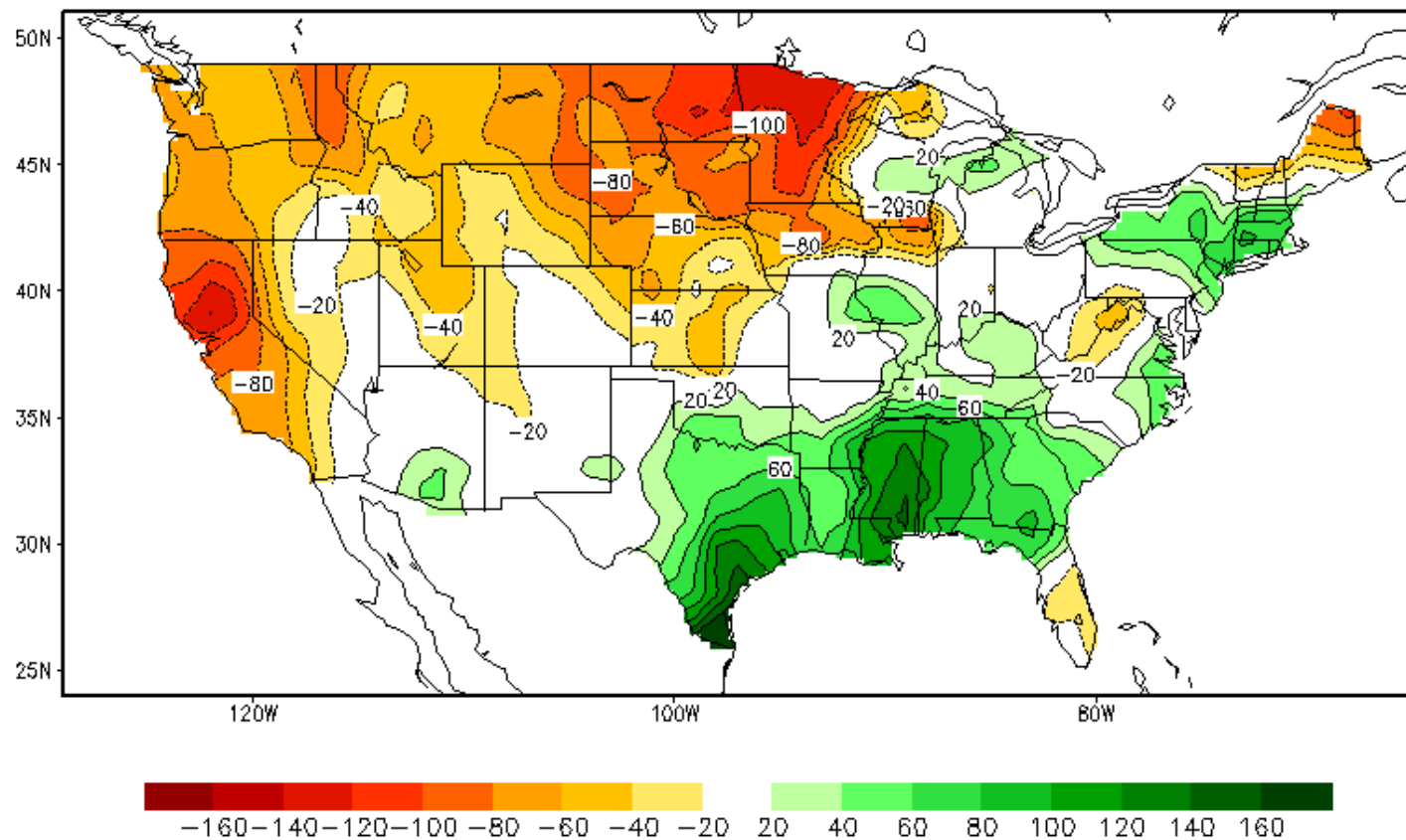
Calculated Soil Moisture Anomaly (mm)
JUN, 2021



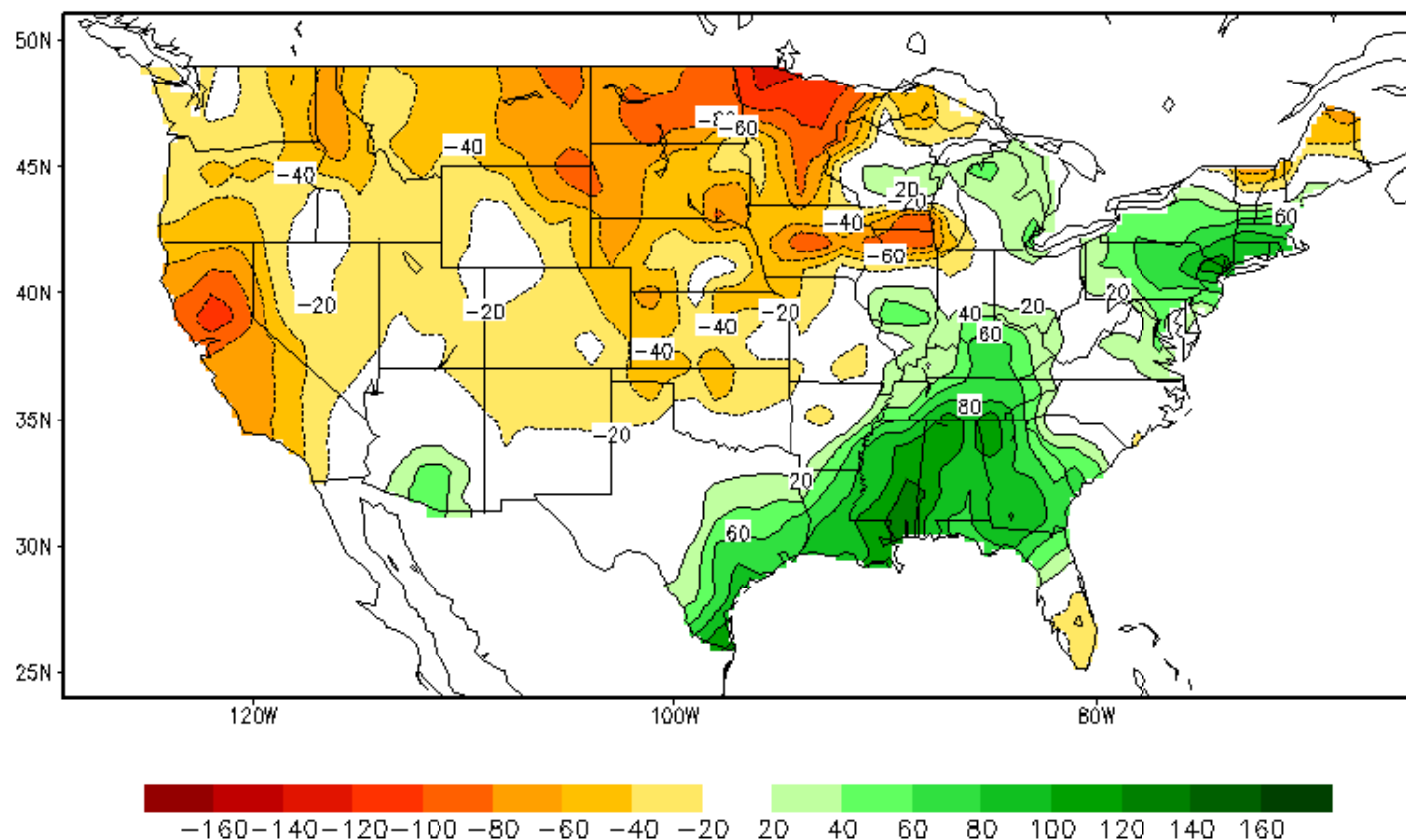
Calculated Soil Moisture Anomaly (mm)
JUL, 2021



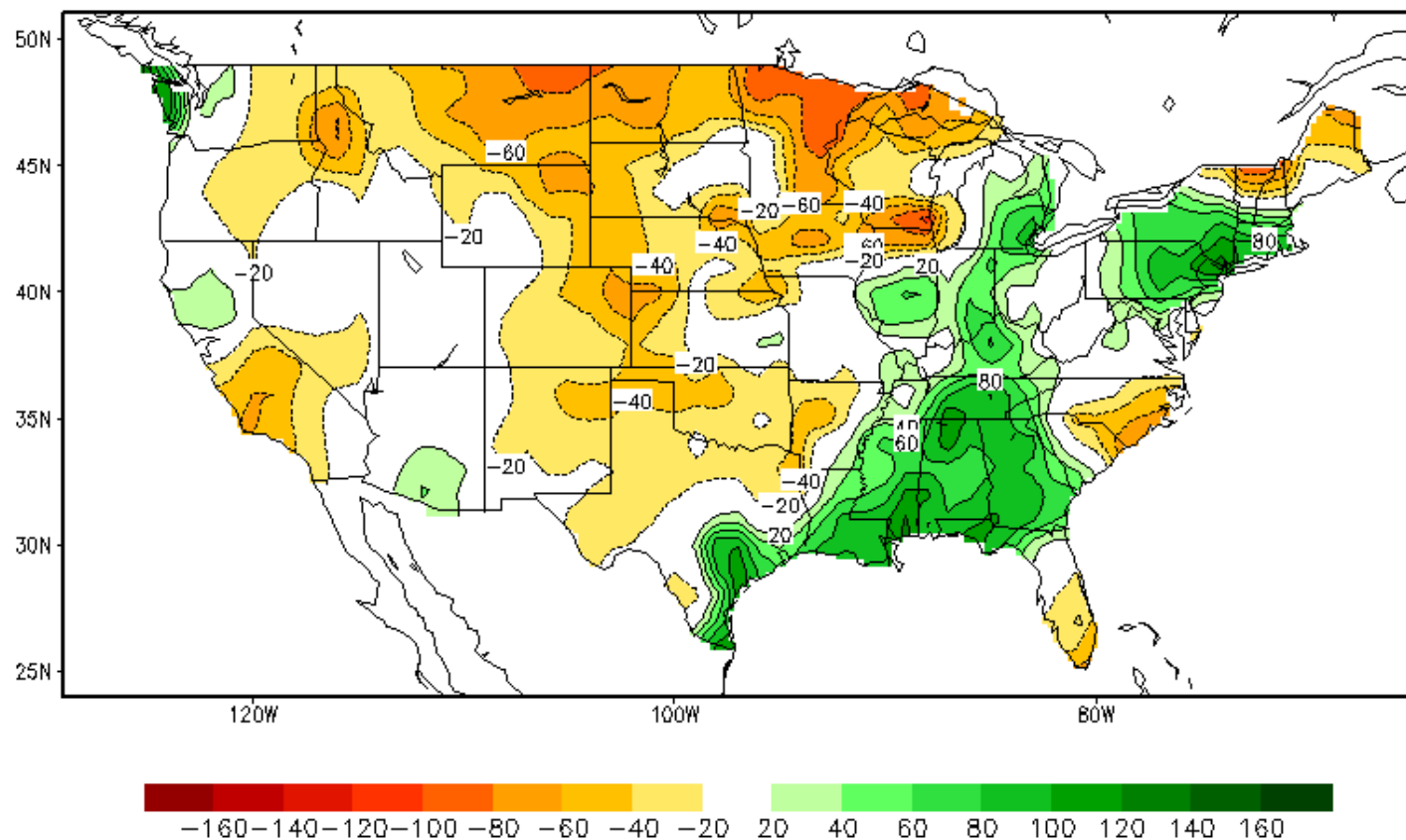
Calculated Soil Moisture Anomaly (mm)
AUG, 2021



Calculated Soil Moisture Anomaly (mm)
SEP, 2021

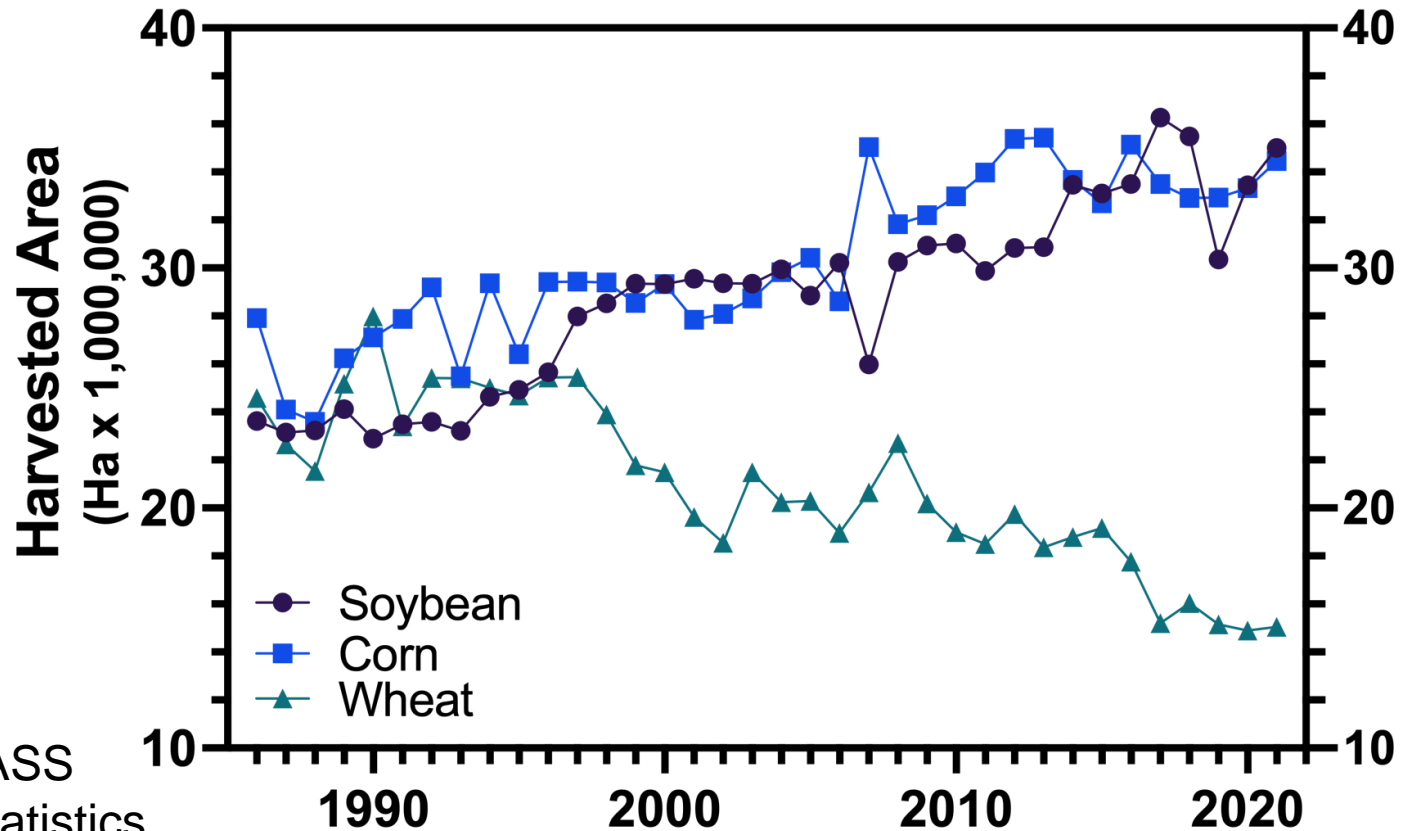


Calculated Soil Moisture Anomaly (mm) OCT, 2021



Soybean, Corn, and Wheat

Area Harvested



USDA-NASS
Data & Statistics

https://www.nass.usda.gov/Statistics_by_Subject/index.php?sector=CROPS

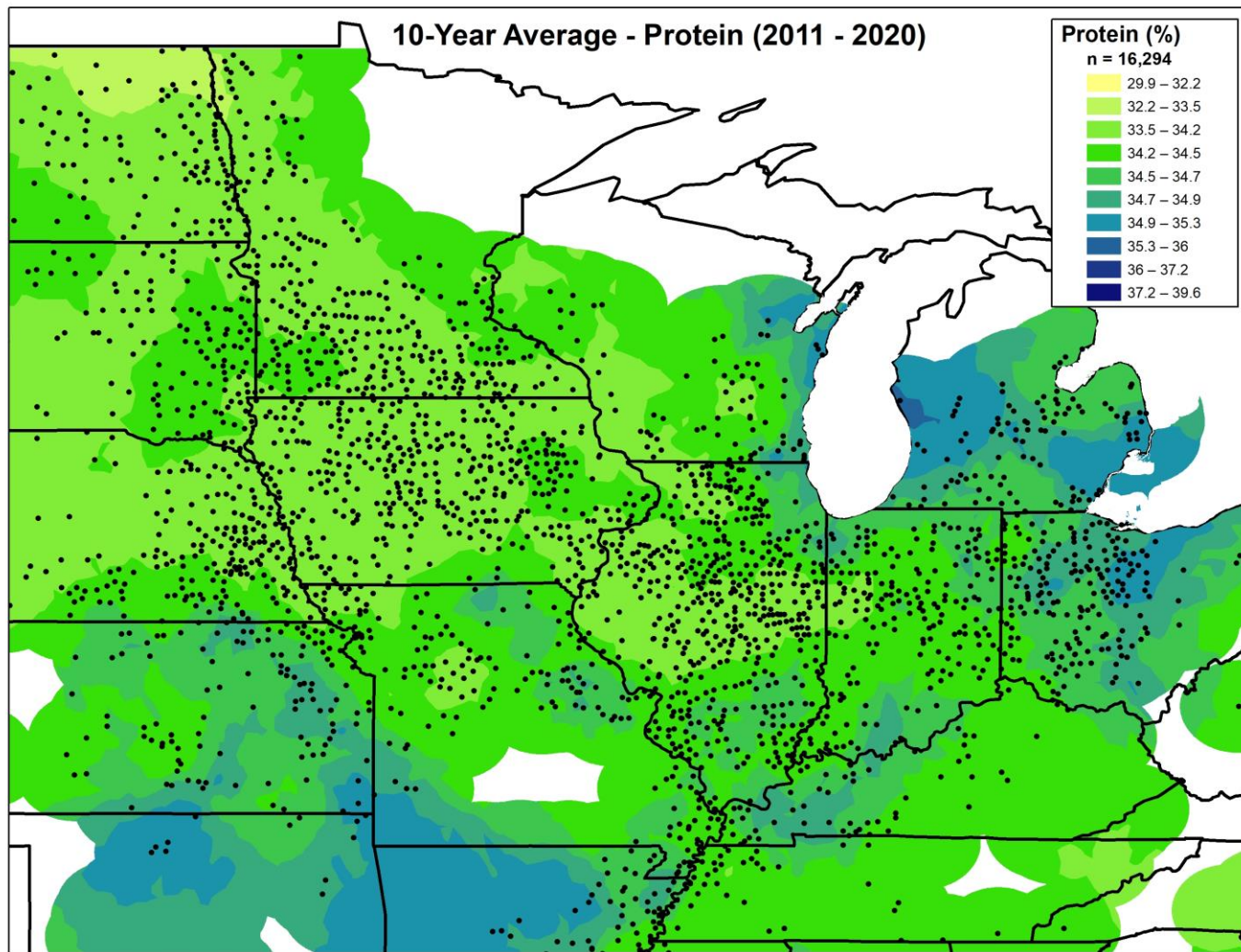


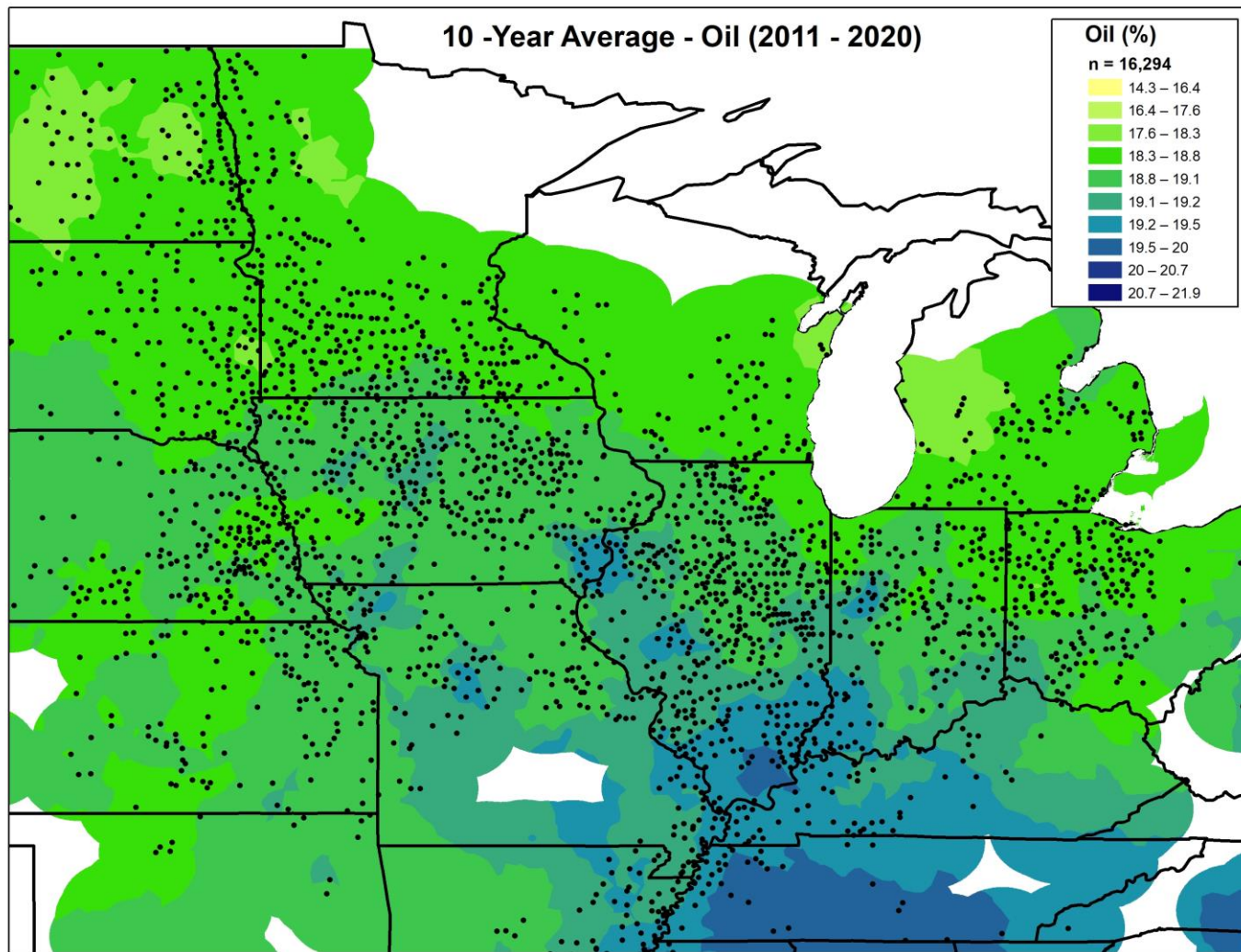


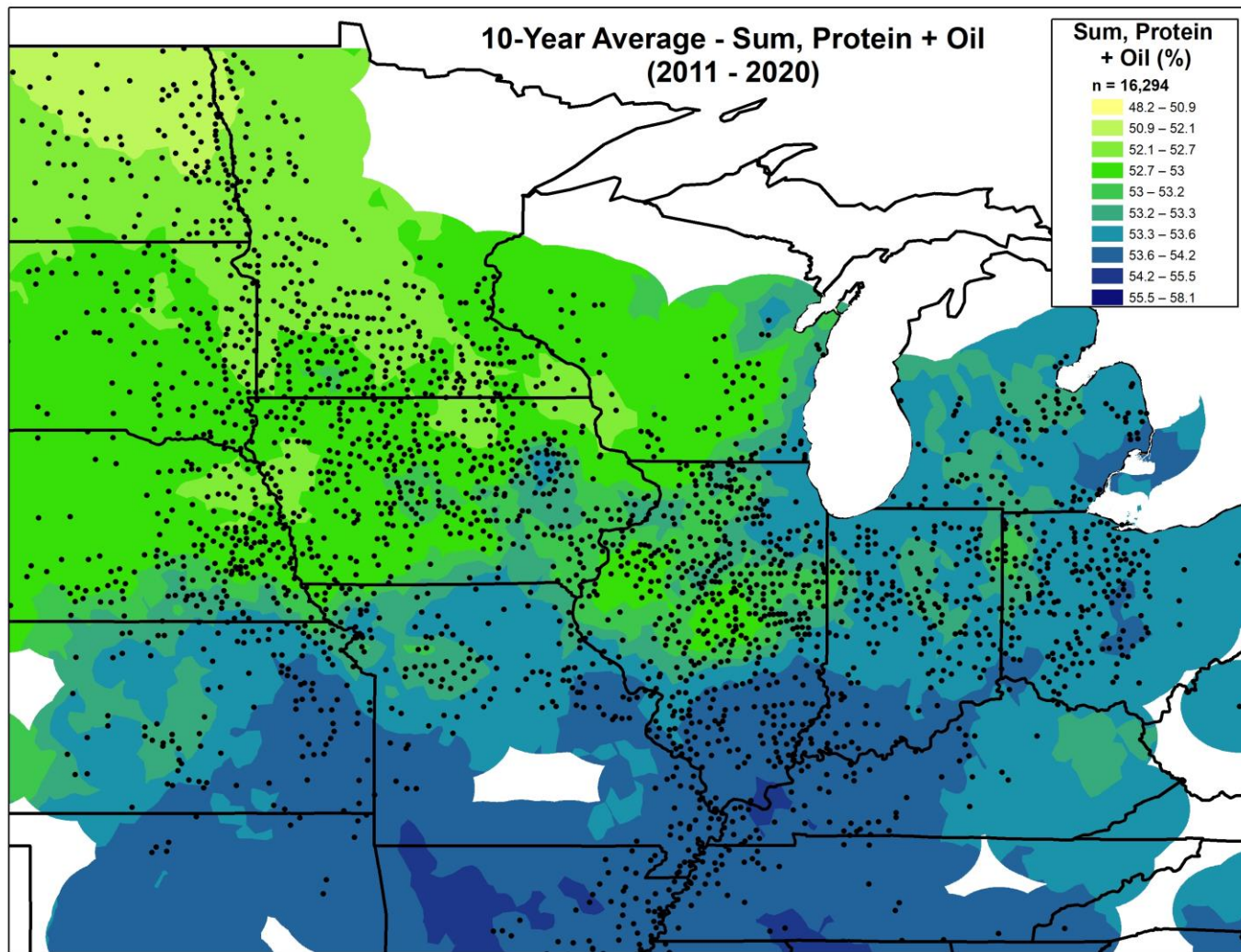
QUALITY OF THE UNITED STATES SOYBEAN CROP: 2021

A close-up photograph of several soybean pods hanging from a stem. The pods are brown and covered in fine, light-colored hairs. The background is a soft, out-of-focus brown. A dark rectangular box is overlaid in the center, containing the title text in white.

HISTORICAL PROTEIN AND OIL VARIATION







2021 SURVEY RESULTS



2021 Survey Methods

- In August, sample kits were mailed to 5,828 soybean producers based on soybean production by state
- By 26 October 2021, 1,160 samples were returned for analysis



PLEASE SEND SAMPLES BY OCTOBER 23

FILL BAG TO HERE >

2021 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

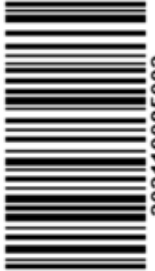
Please note changes to name or address:

Mike Oliver _____

2333 194th St _____

Logan, IA _____

51546-6051 _____



202119085002

2218

2021 Survey Methods - Protein and Oil

Diode Array 7250

At-line & Lab NIR Analysis System



- Samples were analyzed for protein and oil concentration by Near Infrared Spectroscopy (NIRS) using a PerkinElmer diode array instrument
- Average protein and oil values were determined by state
- Regional and US average values were determined by weighting averages based on estimated 2021 production

PROTEIN AND OIL

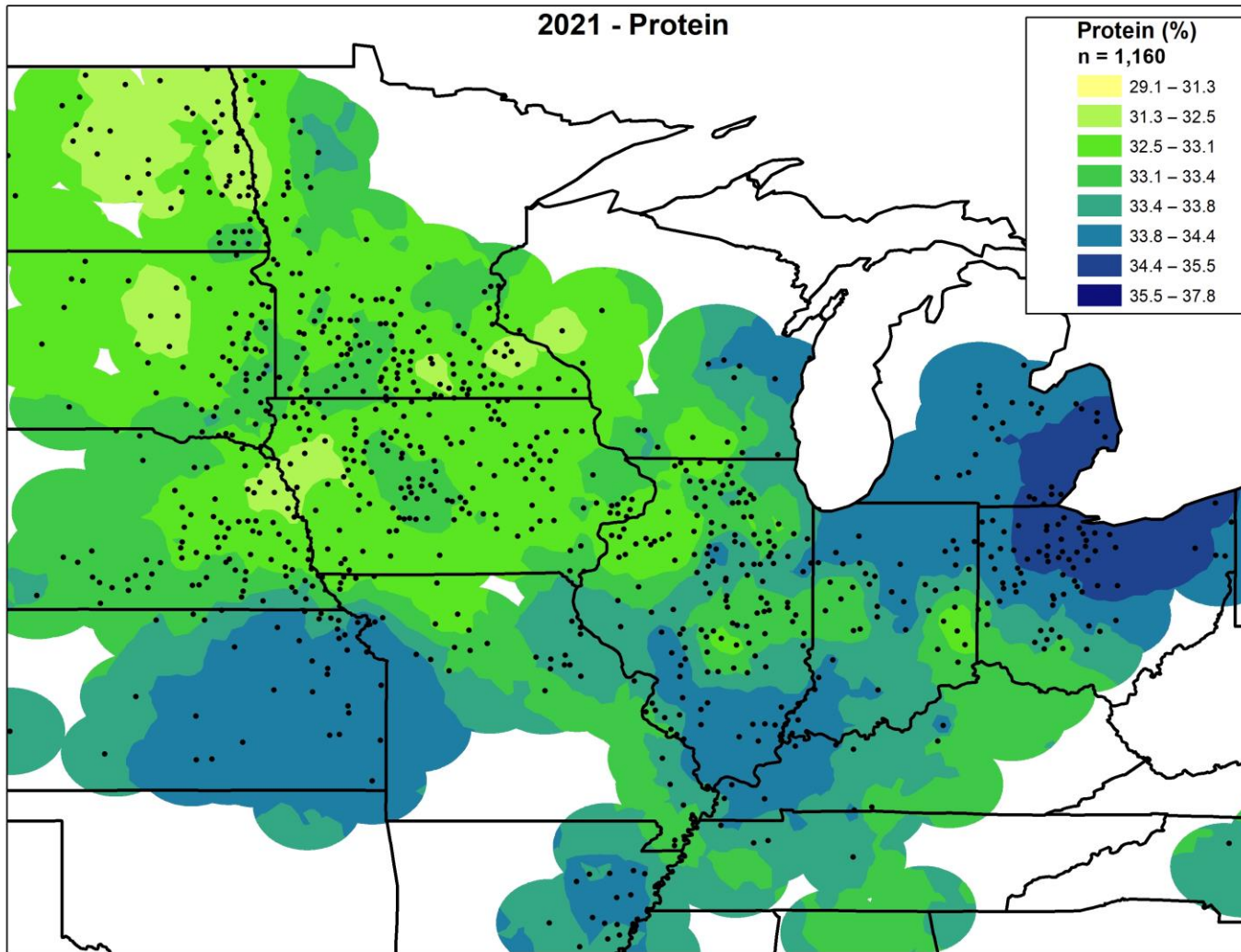


Region	Number of Samples	Protein (13%)	Change from 2020	Oil (13%)	Change from 2020	Seed Weight (g/100 seeds)
US Average	1,160	33.3		20.2		16.8
Average of 2021 Crop [†]		33.4	-0.5	20.2	+0.7	16.5
US 2011-2020 Average [†]		34.3		19.0		

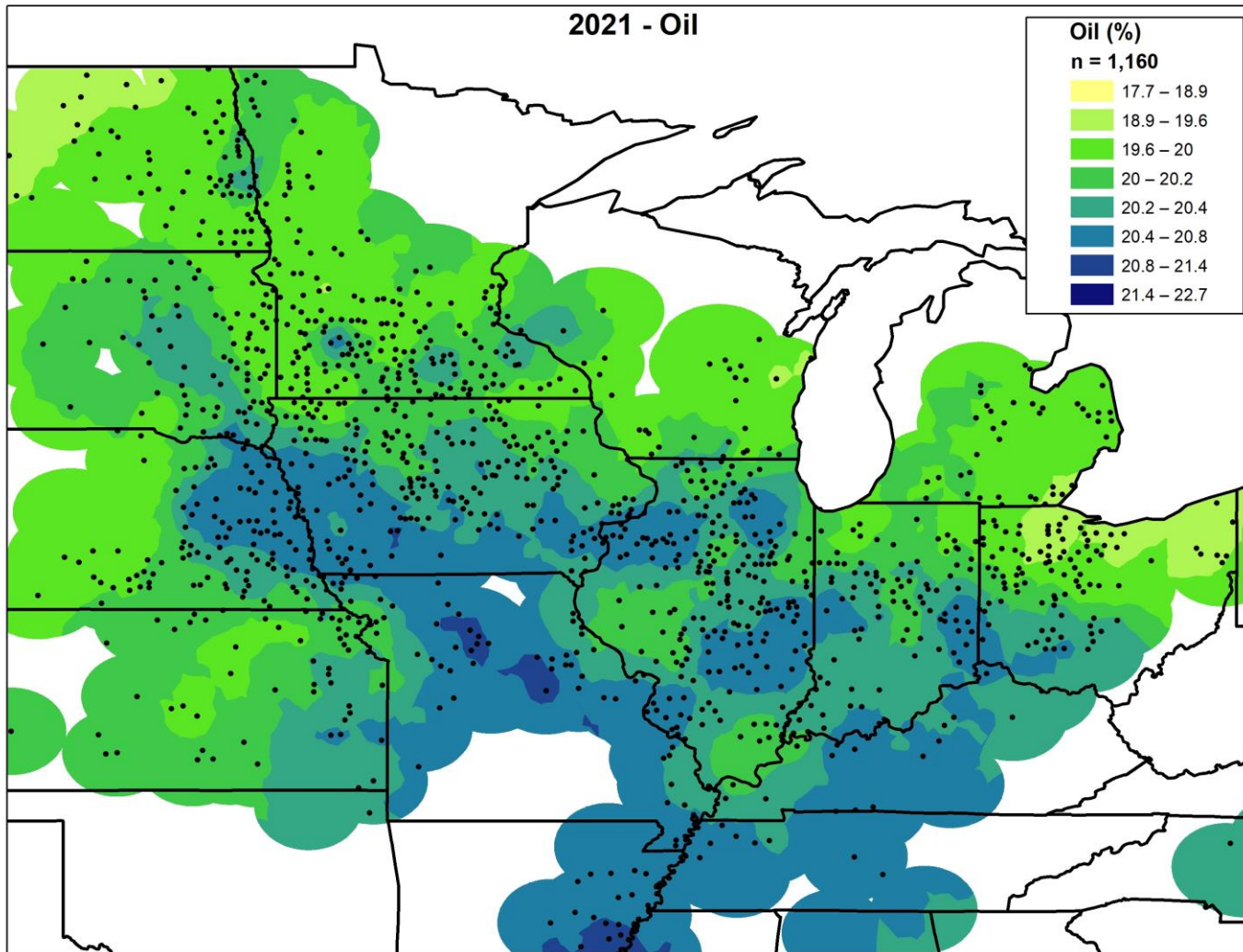
[†]US average values weighted based on estimated production by state, as estimated by USDA, NASS Crop Production Report (October, 2021)



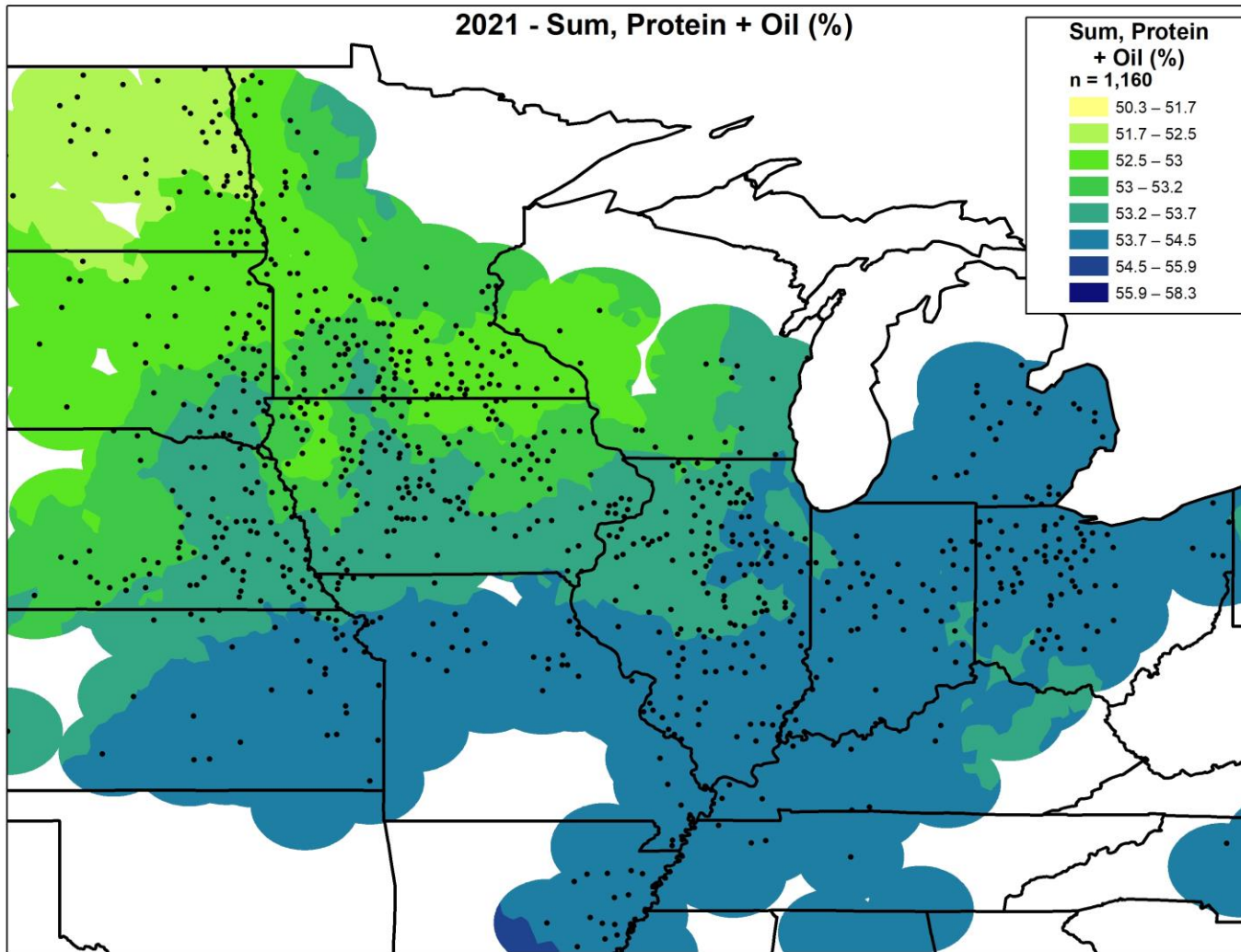
2021 - Protein

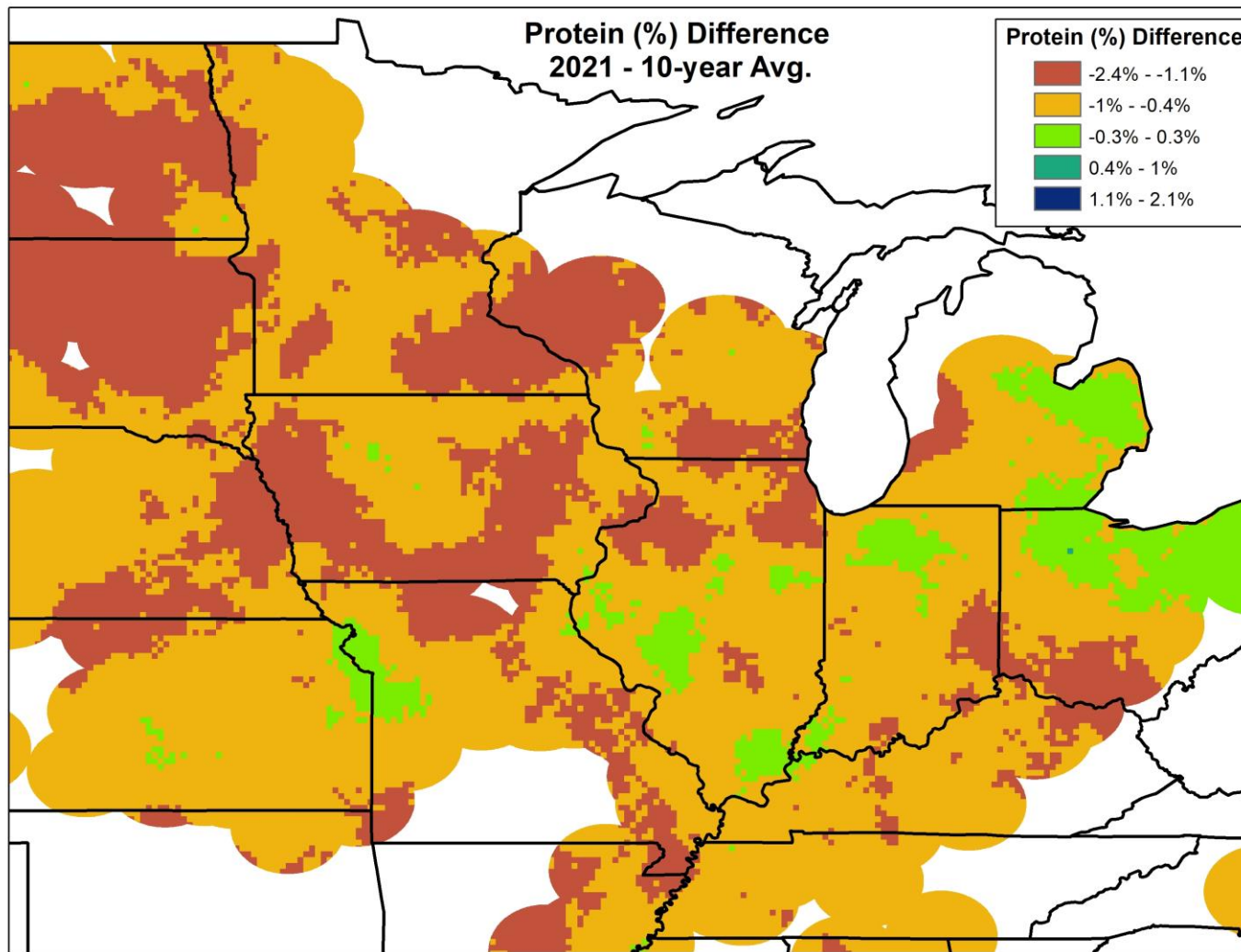


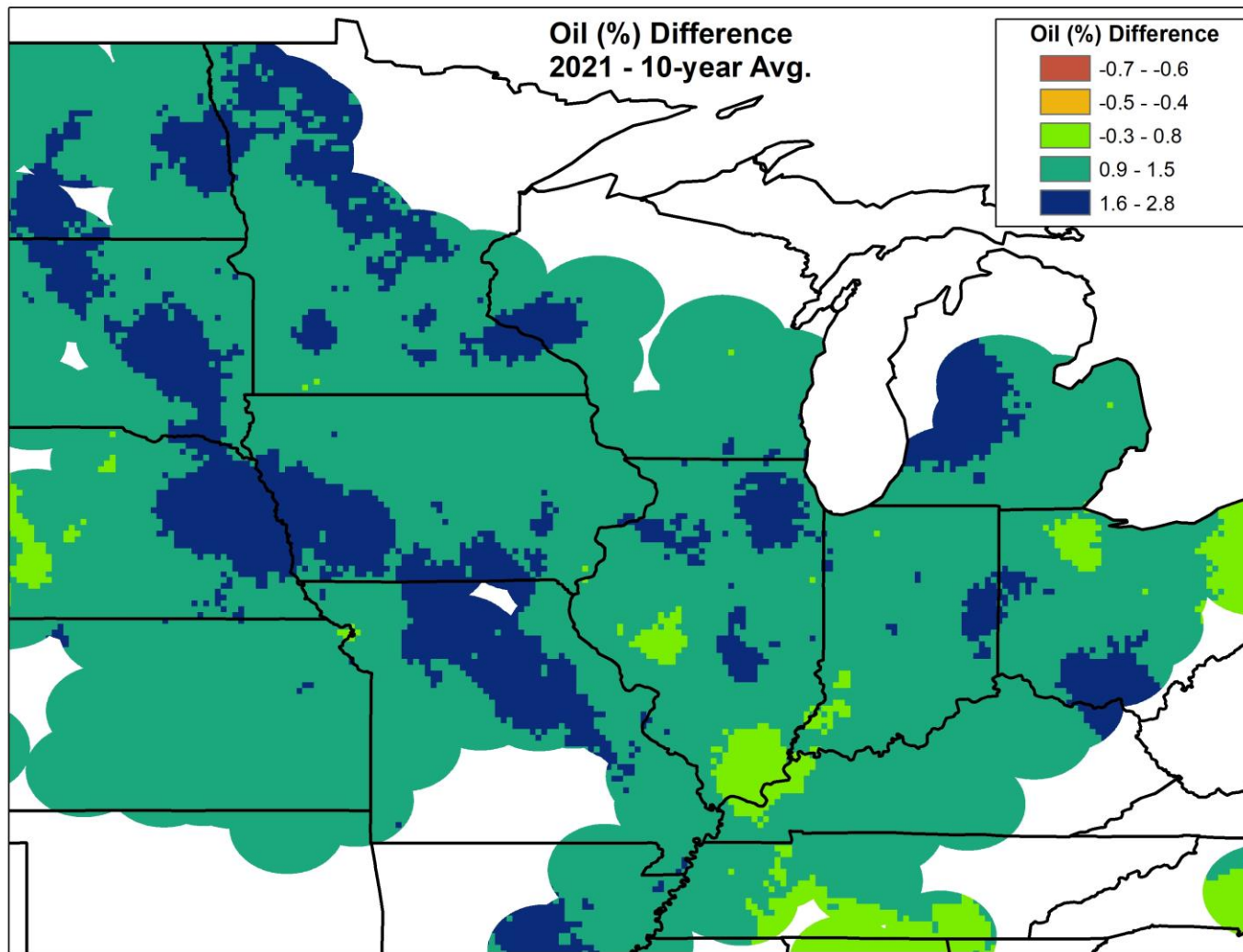
2021 - Oil

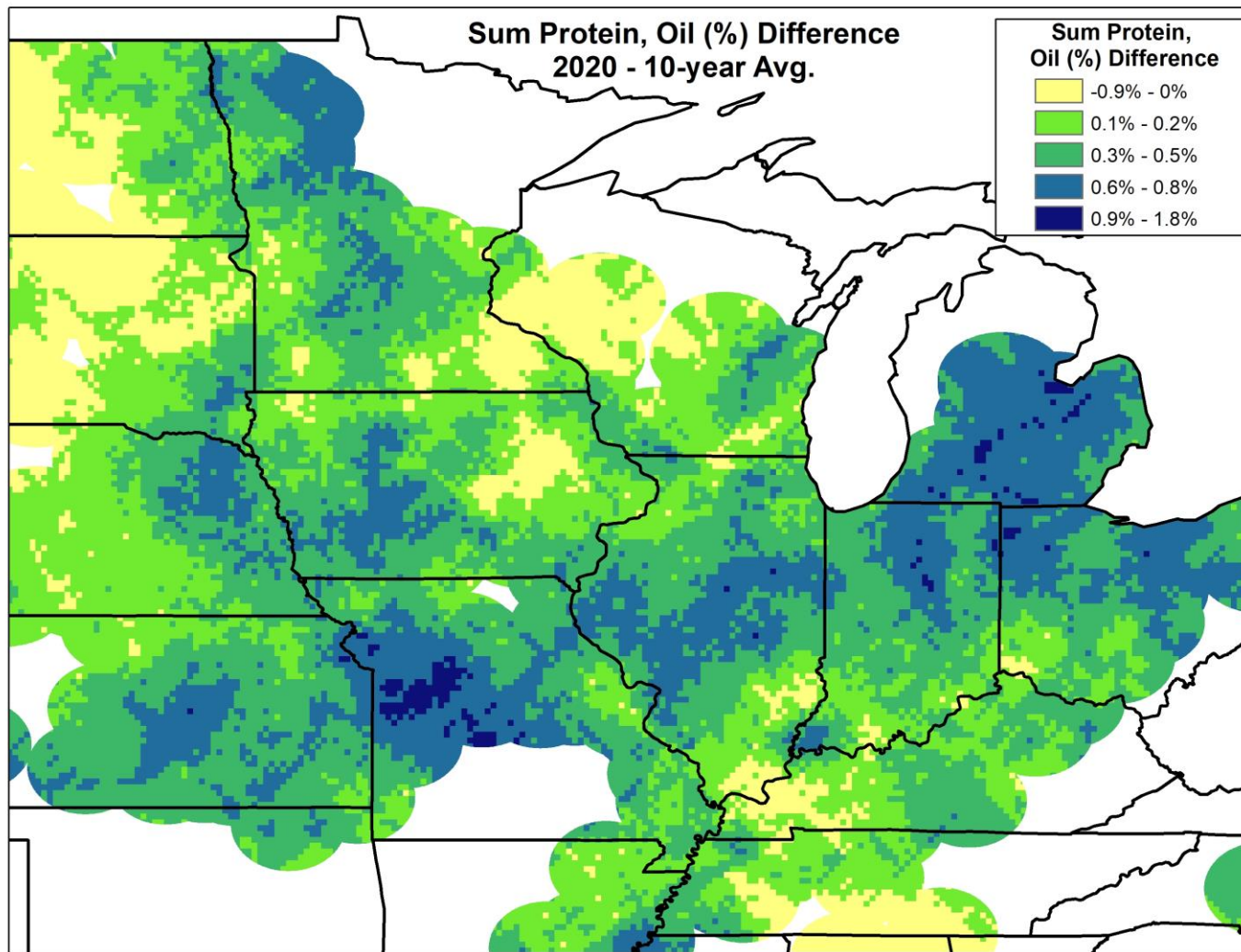


2021 - Sum, Protein + Oil (%)



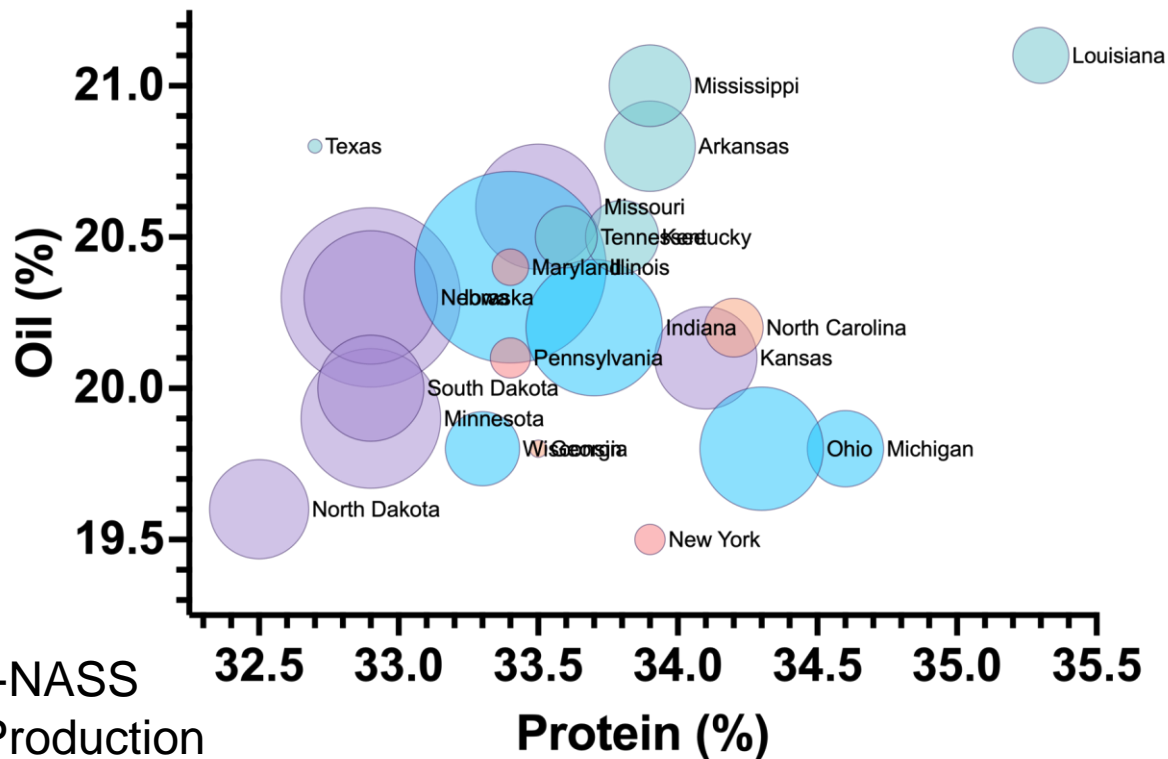




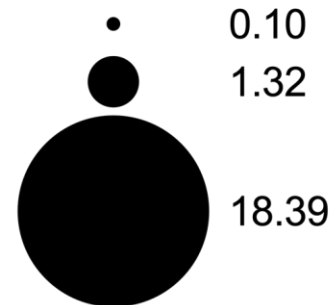


Protein vs Oil by Production

- East Coast
- Southeast
- Midsouth
- Eastern Corn Belt
- Western Corn Belt

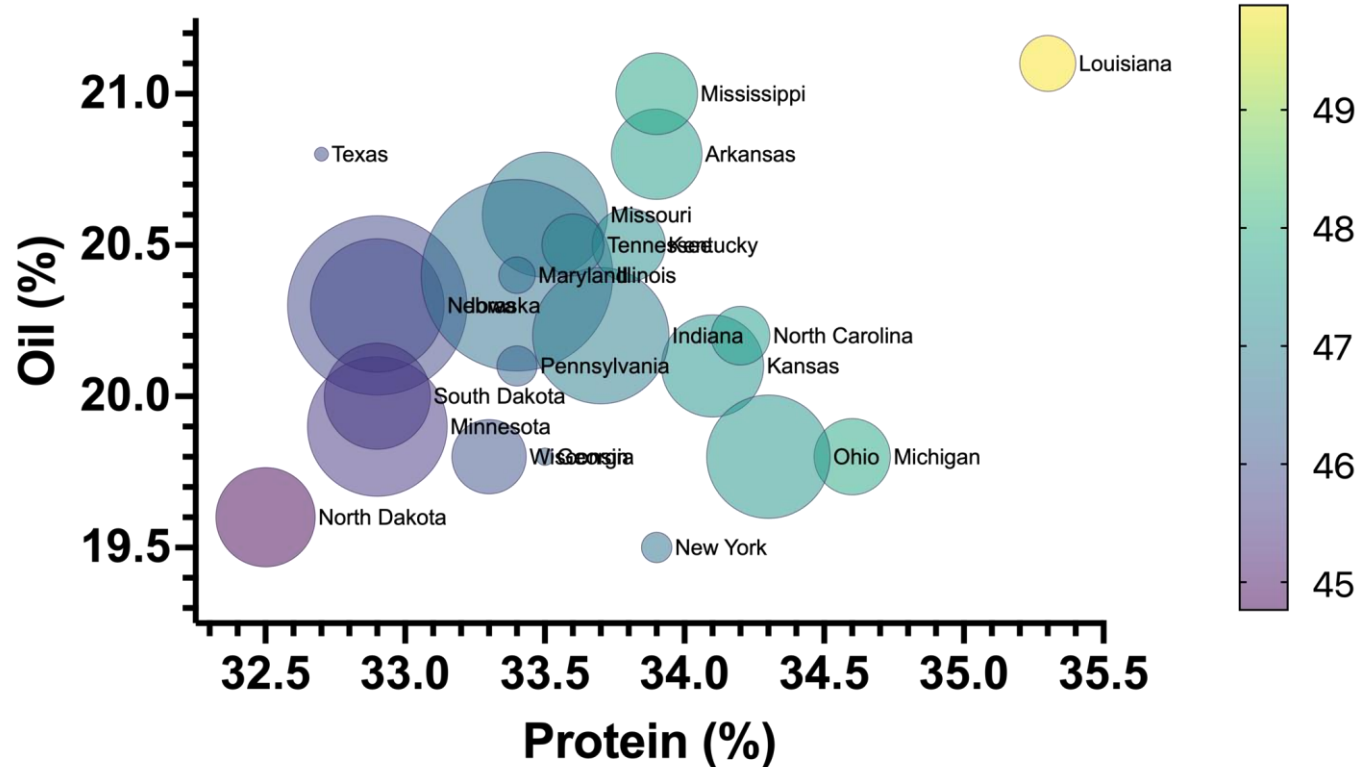


Production (MMT)

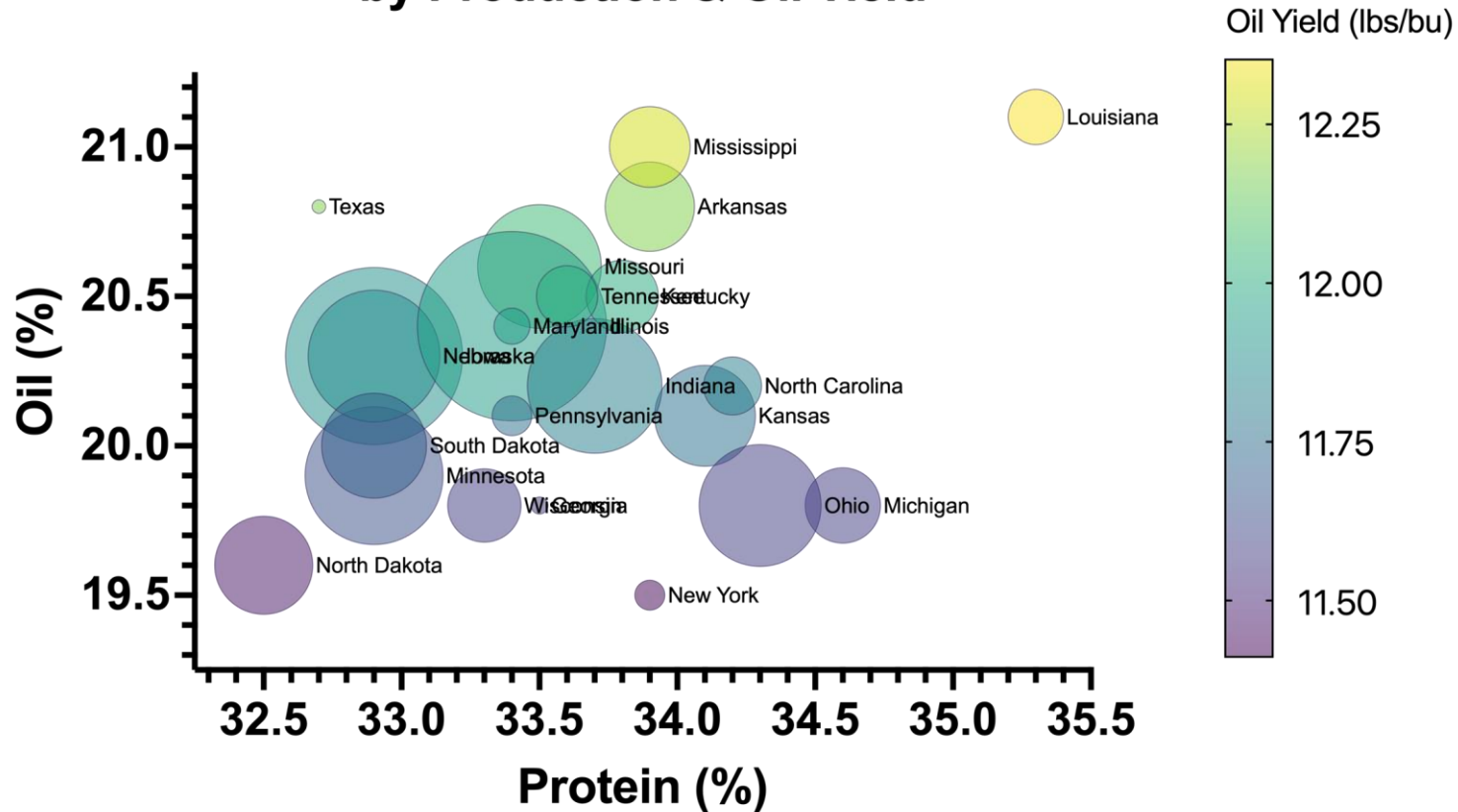


Protein vs Oil by Production & Meal Protein

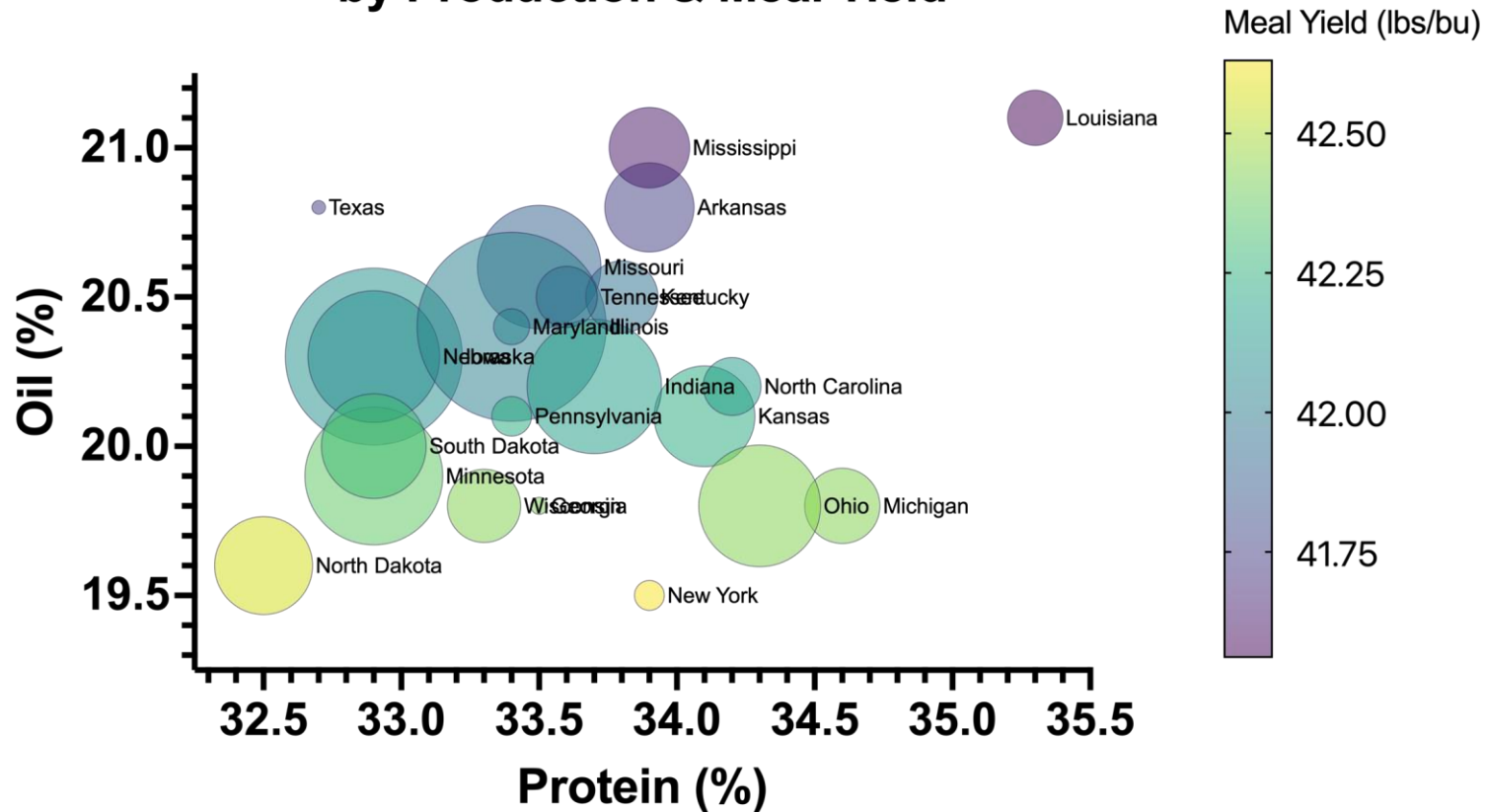
Meal Protein % (12%)



Protein vs Oil by Production & Oil Yield



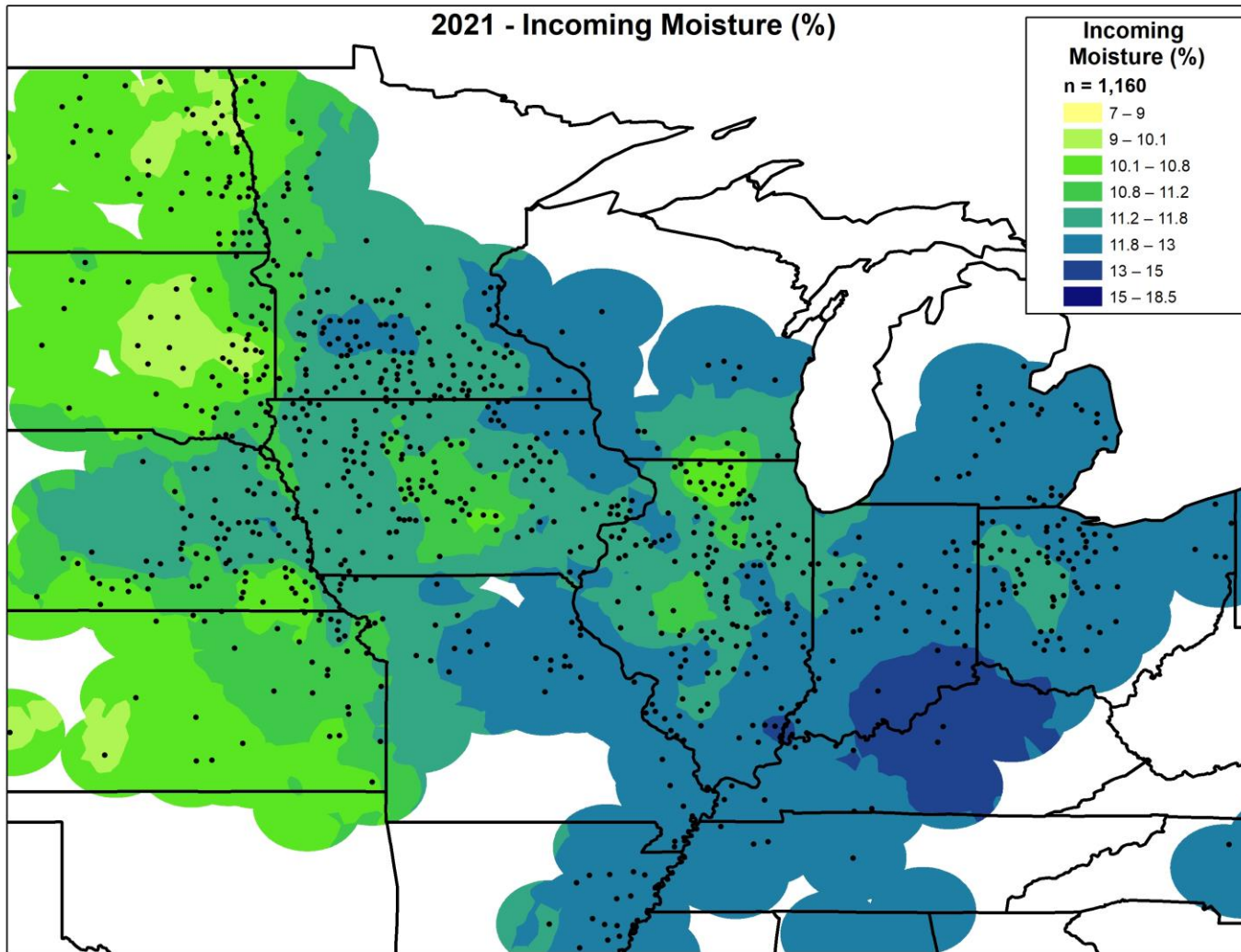
Protein vs Oil by Production & Meal Yield



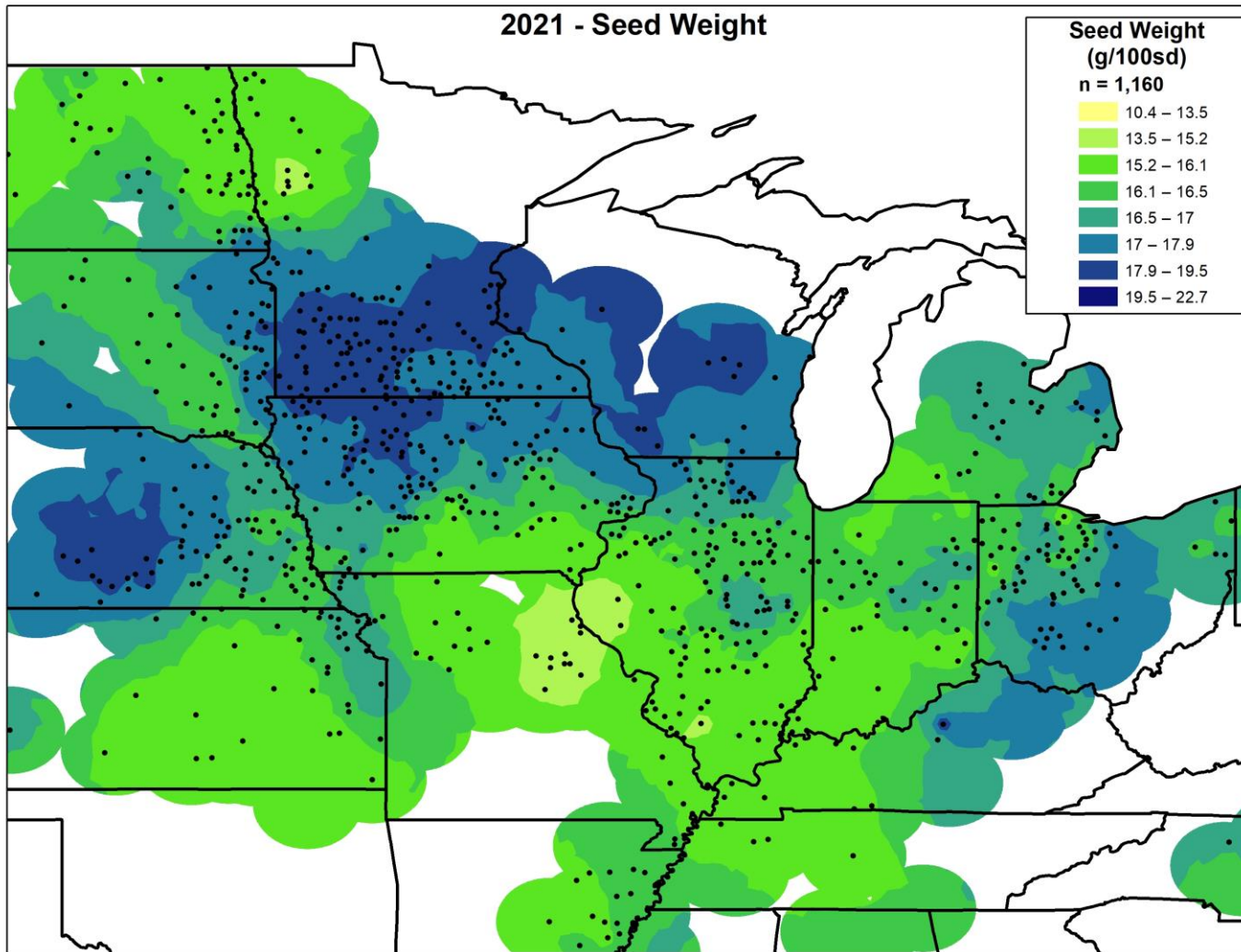


PHYSICAL CHARACTERISTICS

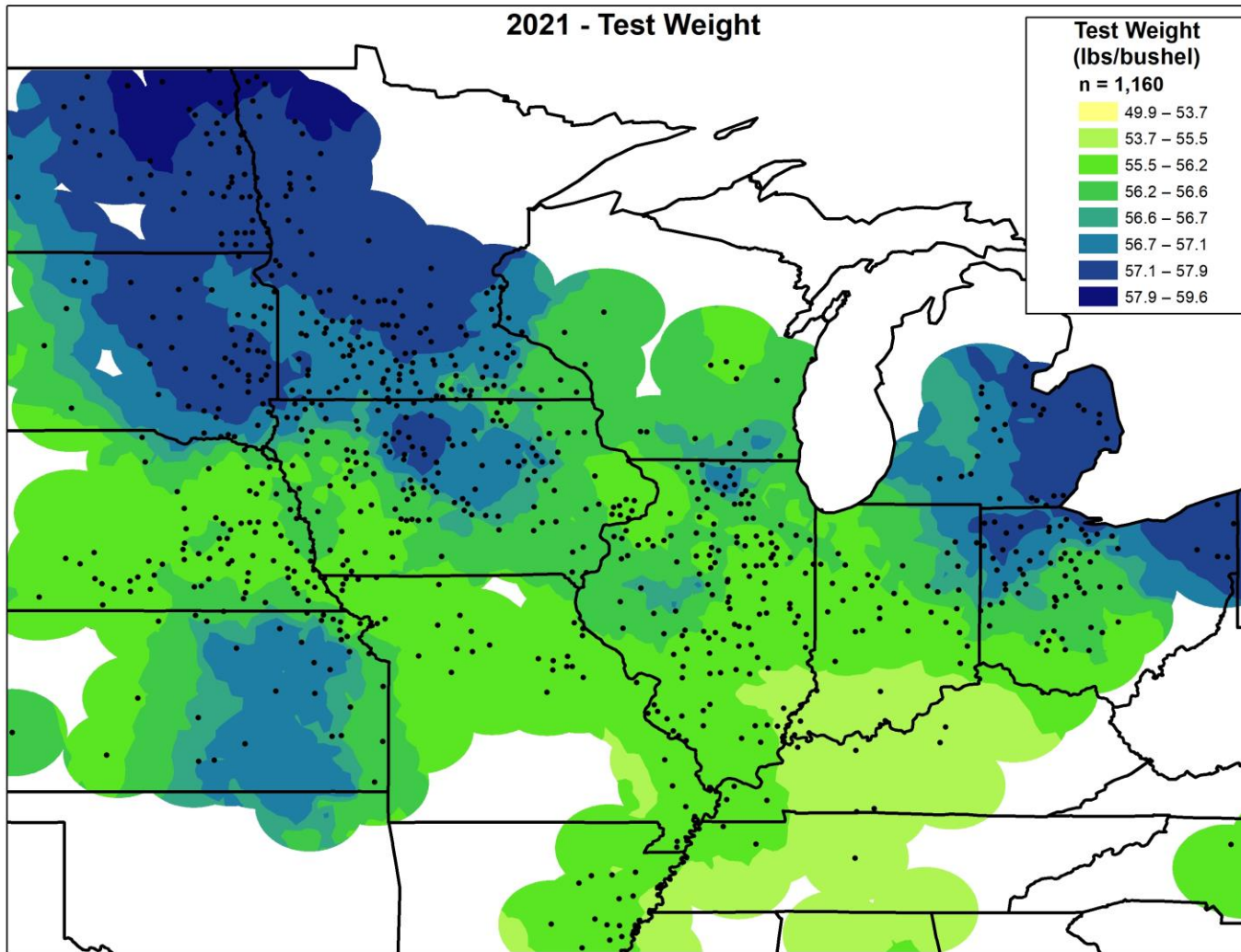
2021 - Incoming Moisture (%)



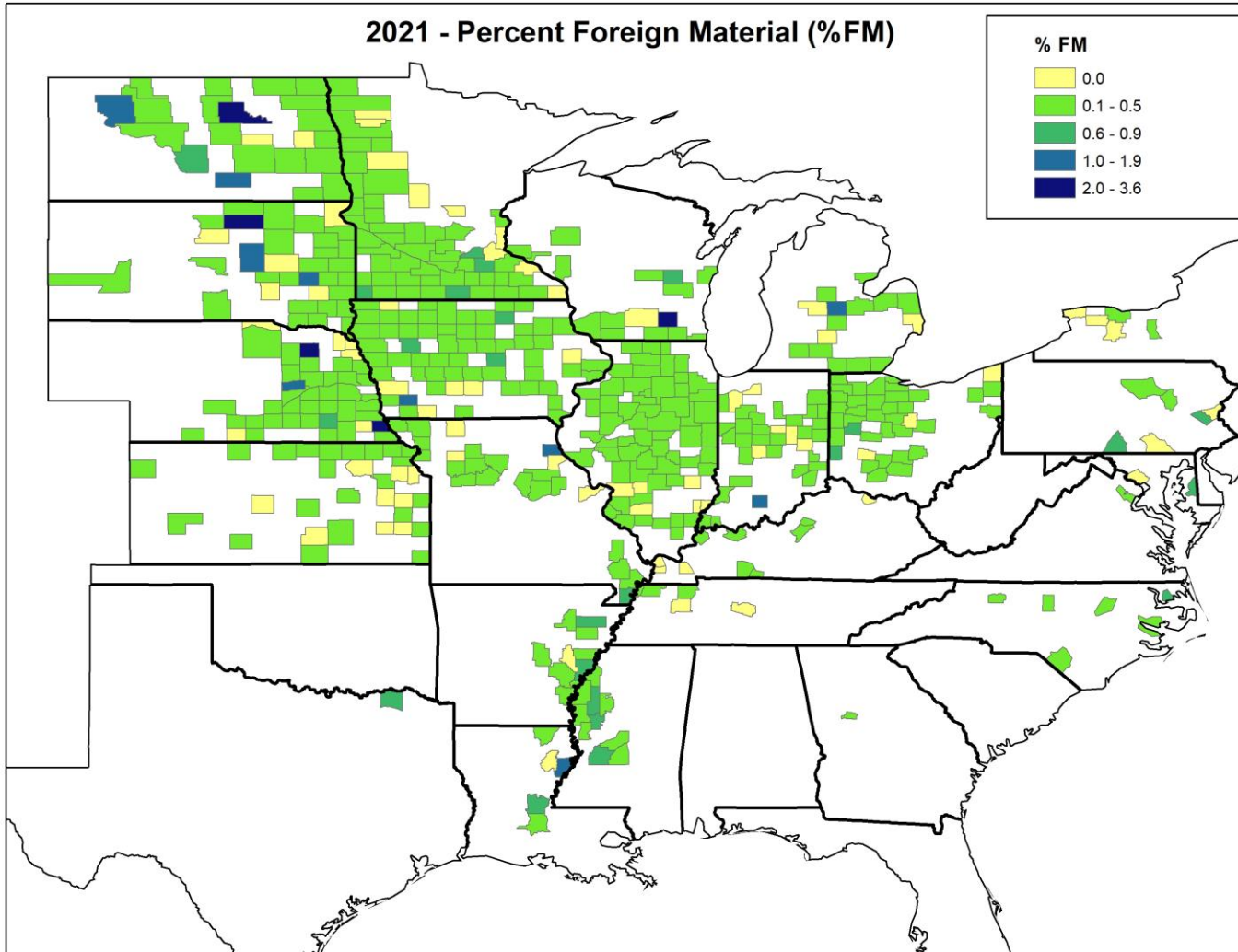
2021 - Seed Weight



2021 - Test Weight



2021 - Percent Foreign Material (%FM)



Better Measures of the Value of Soybeans

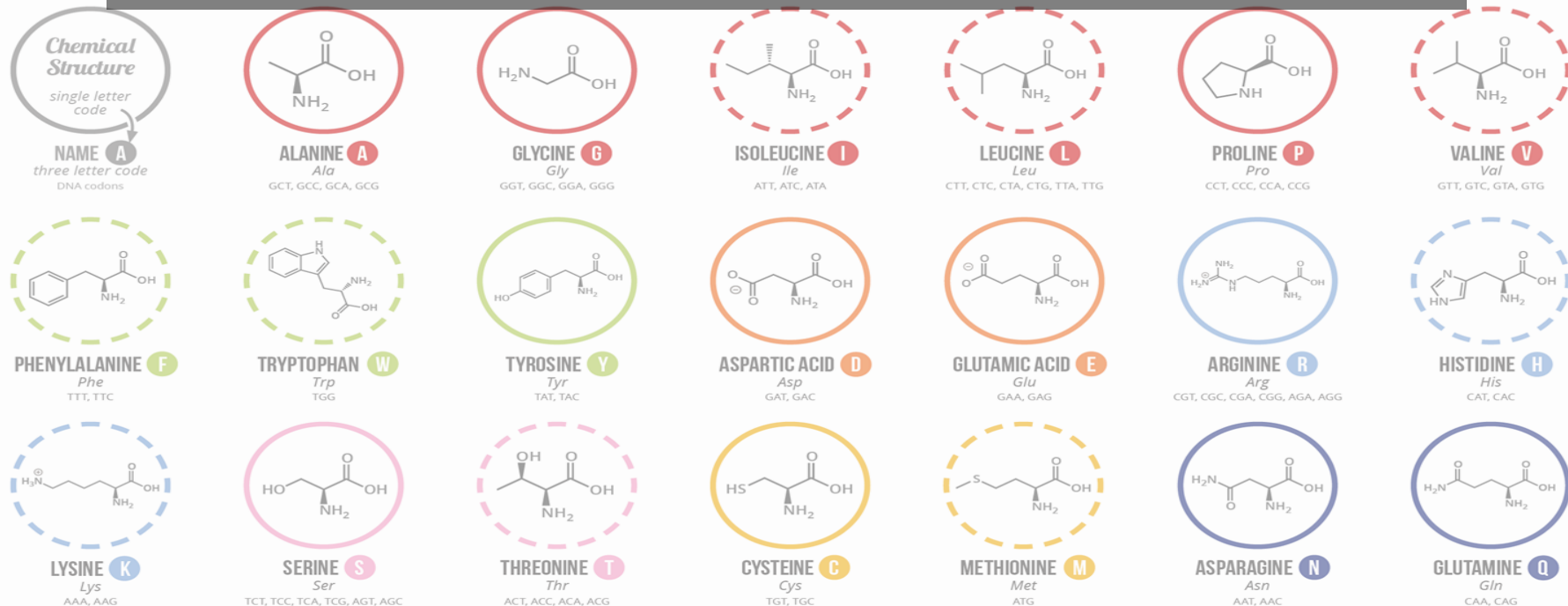
- Soybeans & soybean meal have been valued primarily on an indirect measure of protein – ‘crude protein’
- Crude protein is probably not the best measure of a soybean (or a soybean meal’s) value
 - Overestimates total amino acids (true protein) at higher protein levels
 - No information on protein QUALITY (relative balance of amino acids)
- Both formal and informal feeding trials in destination countries have repeatedly shown that meal from US soybeans performs better than expected based on protein levels



BETTER MEASURES OF QUALITY:

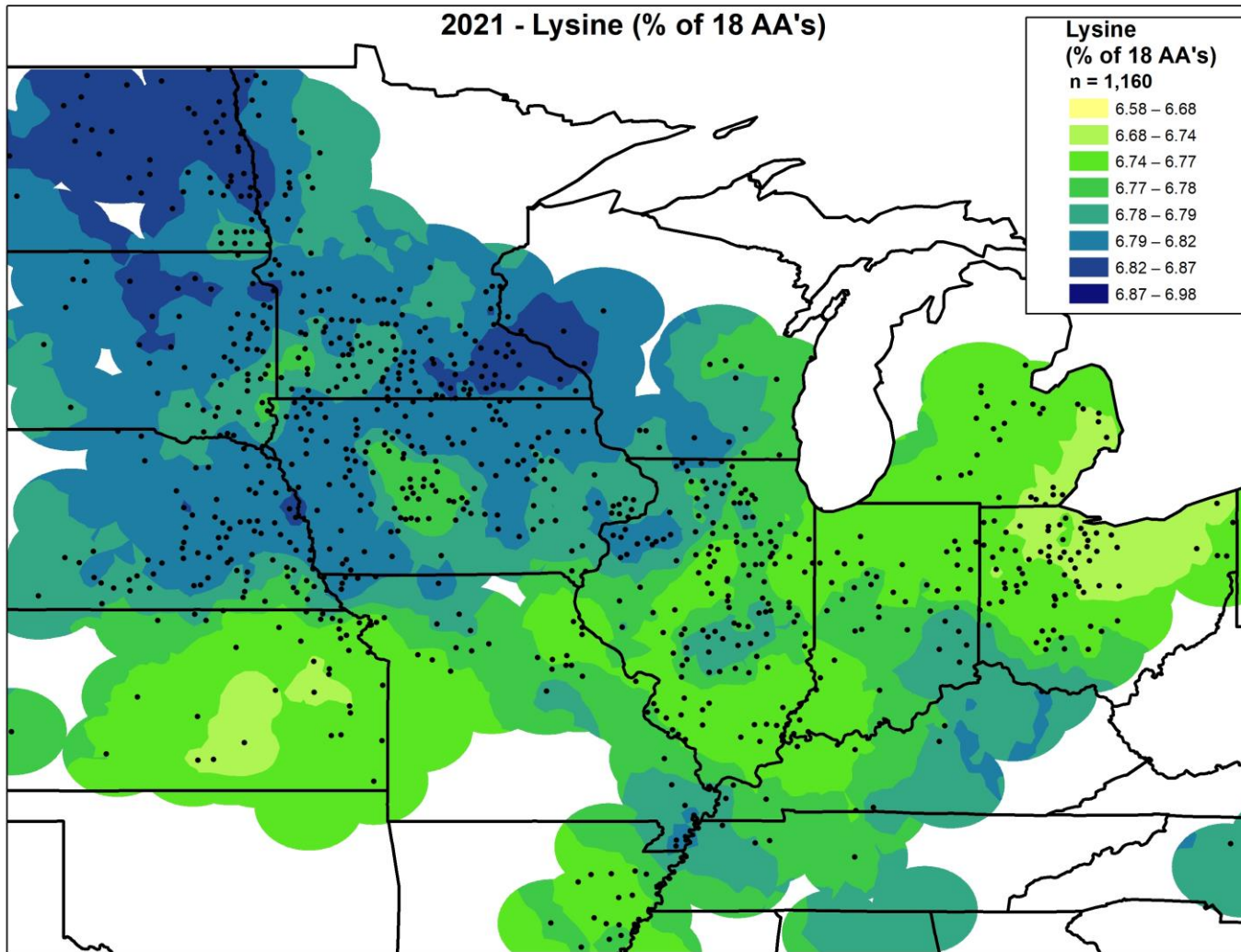
AMINO ACIDS ARE THE BUILDING BLOCKS OF PROTEINS IN LIVING ORGANISMS. THERE ARE OVER 500 AMINO ACIDS FOUND IN NATURE - HOWEVER, THE HUMAN GENETIC CODE ONLY DIRECTLY ENCODES 20. 'ESSENTIAL' AMINO ACIDS MUST BE OBTAINED FROM THE DIET. NON-ESSENTIAL AMINO ACIDS CAN BE SYNTHESISED IN THE BODY.

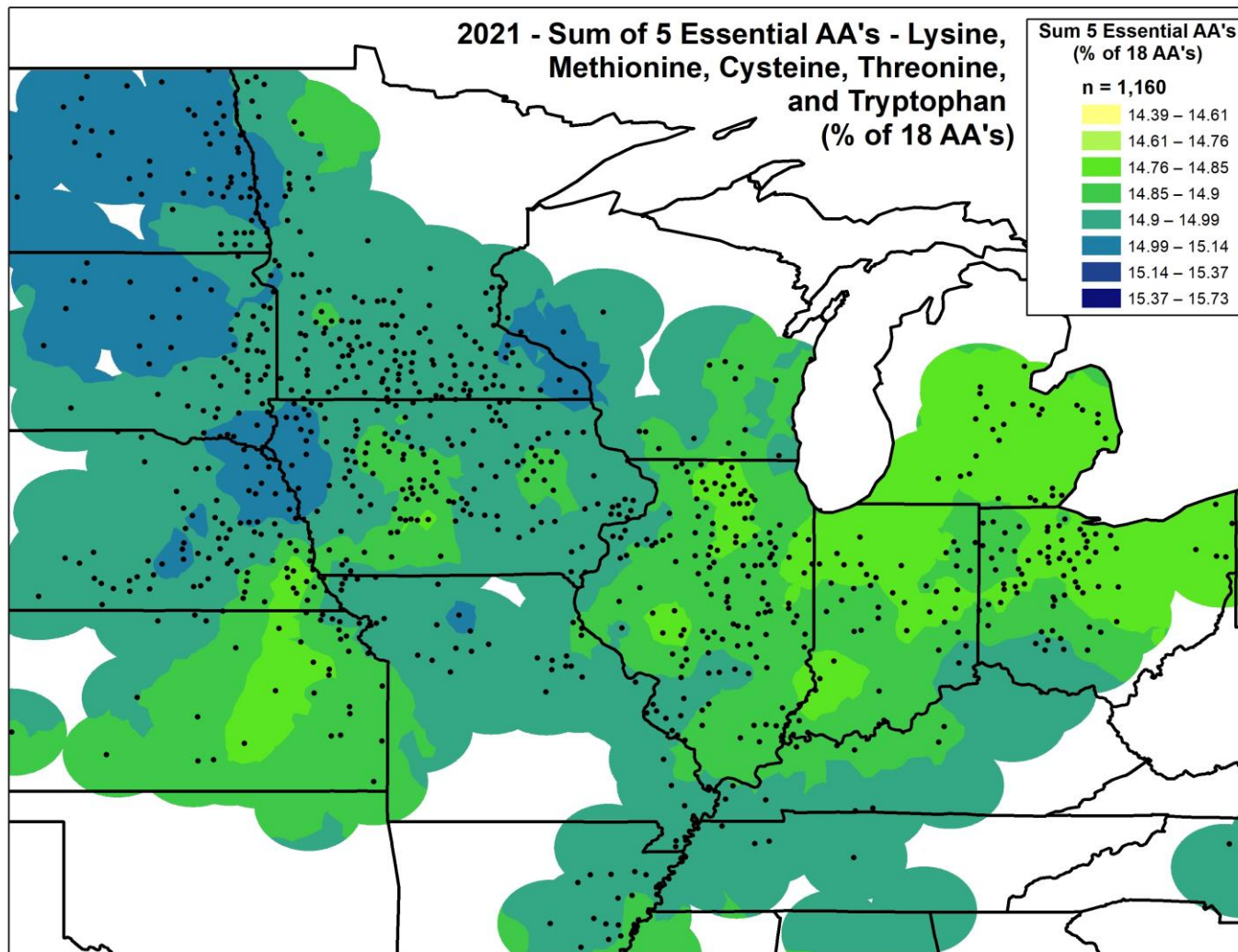
Chart Key: ● ALIPHATIC ● AROMATIC ● ACIDIC ● BASIC ● NEUTRAL ● HYDROPHILIC ● HYDROPHOBIC ● CONTAINING ● AMIDIC ○ NON-ESSENTIAL ○ ESSENTIAL



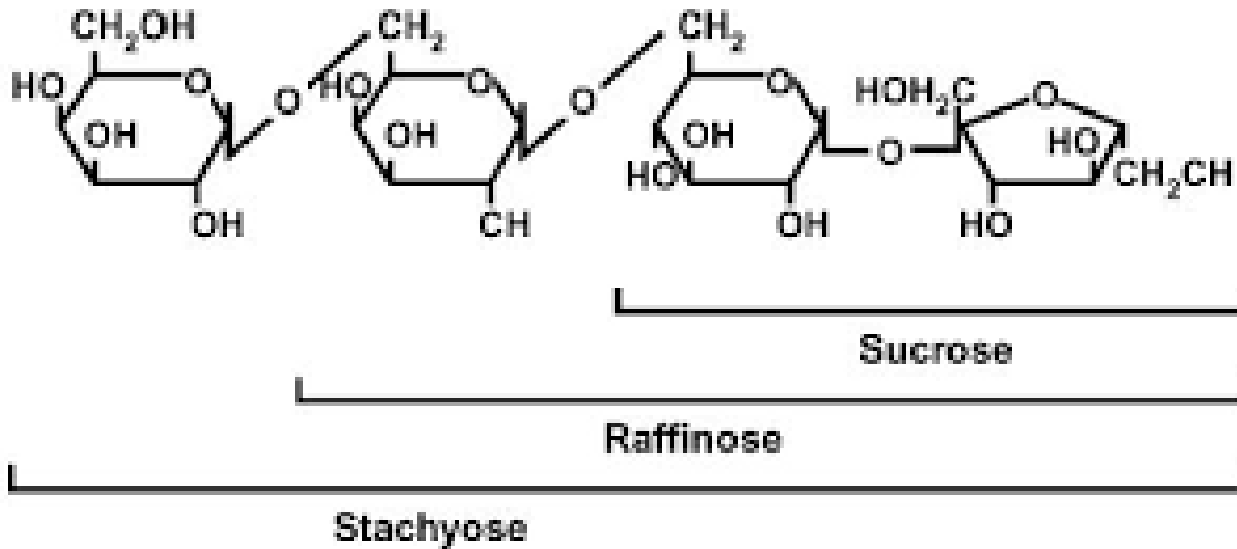
Note: This chart only shows those amino acids for which the human genetic code directly codes for. Selenocysteine is often referred to as the 21st amino acid, but is encoded in a special manner. In some cases, distinguishing between asparagine/aspartic acid and glutamine/glutamic acid is difficult. In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

2021 - Lysine (% of 18 AA's)

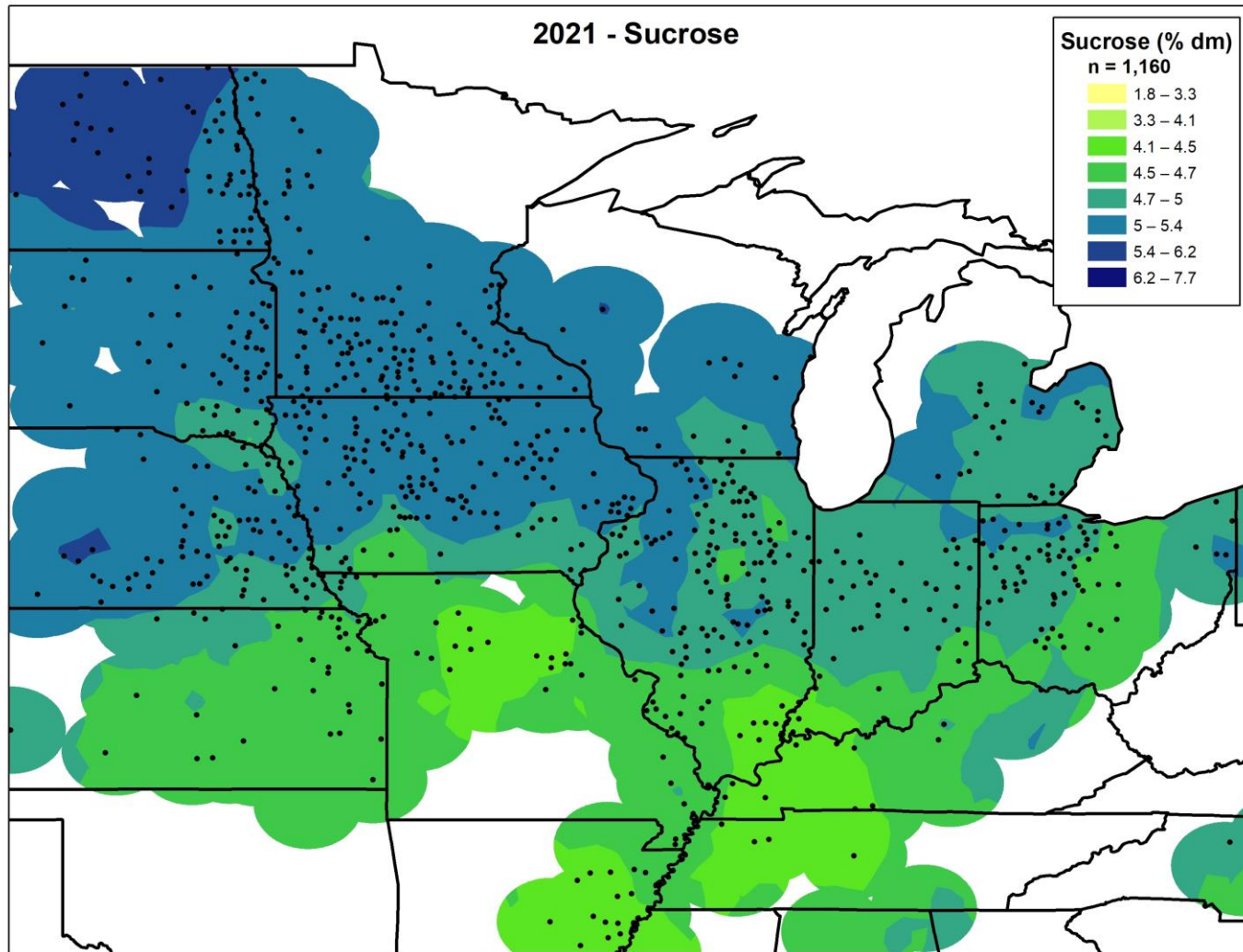




BETTER MEASURES OF QUALITY: SOLUBLE SUGARS



2021 - Sucrose



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2021 Food Soybean Survey Methods

- In September and October, 611 sample kits were mailed to 26 US soybean exporters
- By October 29, 208 samples were returned for analysis

* Please send samples by October 25 *



2021 Food Soybean Quality Survey



202198001001

Contracting company: _____

Field location (state): _____ Co. internal field code (optional): _____

Variety: _____ Maturity Group: _____

Intended use:

☐ Tofu ☐ Natto ☐ Miso ☐ Soy milk ☐ Soy sauce ☐ High oleic ☐ Tempeh

☐ Low lipoxigenase (low beany flavor) ☐ Other: _____

Production type:

☐ Non-GM ☐ Organic

Questions? Call Dr. Seth Naeve at (612) 819-2338

Specialty Soy Database

- Annual program
- Developed in conjunction with U.S. industry and international buyers
- Catalogue of commonly contracted U.S. soyfood beans (120+ varieties)
- Include information pertaining to;
 - Production year, commercial variety name, GM/non GMO/Organic, maturity group, state or area grown, soybean seed type (tofu, soymilk, natto, miso, indeterminate, etc.), photo of the sample



Tested Attributes and Characteristics

- Protein
- Oil
- Hilum color
- Seed size
- Sucrose
- Oligosaccharides
- Total free sugars
- Amino acid profile
- Total carbohydrates
- Fatty acid profile (high oleic)
- Total isoflavones
- Soymilk and tofu yields



The image is a composite of four photographs of soybeans, arranged in a 2x2 grid. The top-left, bottom-left, and bottom-right boxes are filled with yellow soybeans. The top-right box is filled with black soybeans. The text '2020 FOOD SOYBEAN SURVEY RESULTS' is overlaid in white, bold, sans-serif font across the center of the image, spanning across the yellow and black soybean sections.

2020 FOOD SOYBEAN SURVEY RESULTS

State (# of samples)	Region	Protein * (%)	Regional Protein Average	Oil * (%)	Regional Oil Average
Minnesota (10)	WCB	35.5		19.4	
North Dakota (3)	WCB	35.2		18.7	
South Dakota (1)	WCB	34.8	35.4	20.6	19.3
Illinois (76)	ECB	35.5		20.0	
Indiana (4)	ECB	34.6		19.6	
Michigan (40)	ECB	36.5		19.3	
Ohio (28)	ECB	37.8		19.5	
Wisconsin (46)	ECB	35.4	36.0	19.8	19.7

Data as of October 29, 2021

§ WCB: Western Corn Belt; ECB: Eastern Corn Belt

* 13% moisture basis



Region	Seed Size	Number Samples	Seed Size (g/100 seeds)	Protein* (%)	Oil* (%)
WCB	Small	1	9.9	35.3	17.3
	Average	9	19.5	35.2	19.4
	Large	4	24.8	35.8	19.6
ECB	Small	5	7.0	36.6	18.2
	Average	140	18.4	35.7	19.9
	Large	9	23.4	36.8	19.3

Data as of October 29, 2021

Small seed: ≤ 13.0 g/100 seeds; Average: 13.1-21.0 g/100 seeds; Large: >21 g/100 seeds (unofficial categories)

WCB: Western Corn Belt (Minnesota, North Dakota, and South Dakota); ECB: Eastern Corn Belt (Illinois, Indiana, Michigan, Ohio, and Wisconsin)

* 13% moisture basis



Region	Seed Size	Number Samples	Seed Size (g/100 seeds)	Sucrose (% DM)	Raffinose (% DM)	Stachyose (% DM)
WCB	Small	1	9.9	5.80	0.92	3.80
	Average	9	19.5	5.80	0.92	3.80
	Large	4	24.8	4.97	0.91	3.81
ECB	Small	5	7.0	4.42	0.86	3.92
	Average	140	18.4	4.41	1.01	4.04
	Large	49	23.4	4.37	1.00	3.97

Data as of October 29, 2021

Small seed: ≤ 13.0 g/100 seeds; Average: 13.1-21.0 g/100 seeds; Large: > 21 g/100 seeds (unofficial categories)

WCB: Western Corn Belt (Minnesota, North Dakota, and South Dakota); ECB: Eastern Corn Belt (Illinois, Indiana, Michigan, Ohio, and Wisconsin)



Region	Seed Size	Number Samples	Seed Size (g/100 seeds)	Protein* (%)	Lysine (% of 18 AAs)	Five Limiting Essential [¶] Amino Acids (% of 18 AAs)
WCB	Small	1	9.9	35.3	6.8	14.8
	Average	9	19.5	35.2	6.8	14.8
	Large	4	24.8	35.8	6.7	14.8
ECB	Small	5	7.0	36.6	6.7	14.7
	Average	140	18.4	35.7	6.7	14.7
	Large	49	23.4	36.8	6.7	14.7

Data as of October 29, 2021

Small seed: ≤13.0 g/100 seeds; Average: 13.1-21.0 g/100 seeds; Large: >21 g/100 seeds (unofficial categories)

WCB: Western Corn Belt (Minnesota, North Dakota, and South Dakota); ECB: Eastern Corn Belt (Illinois, Indiana, Michigan, Ohio, and Wisconsin)

* 13% moisture basis

[¶] Five limiting essential amino acids: cysteine, lysine, methionine, threonine, and tryptophan





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