

TEXAS A&M AGRILIFE

Wheat and Triticale Forage Research



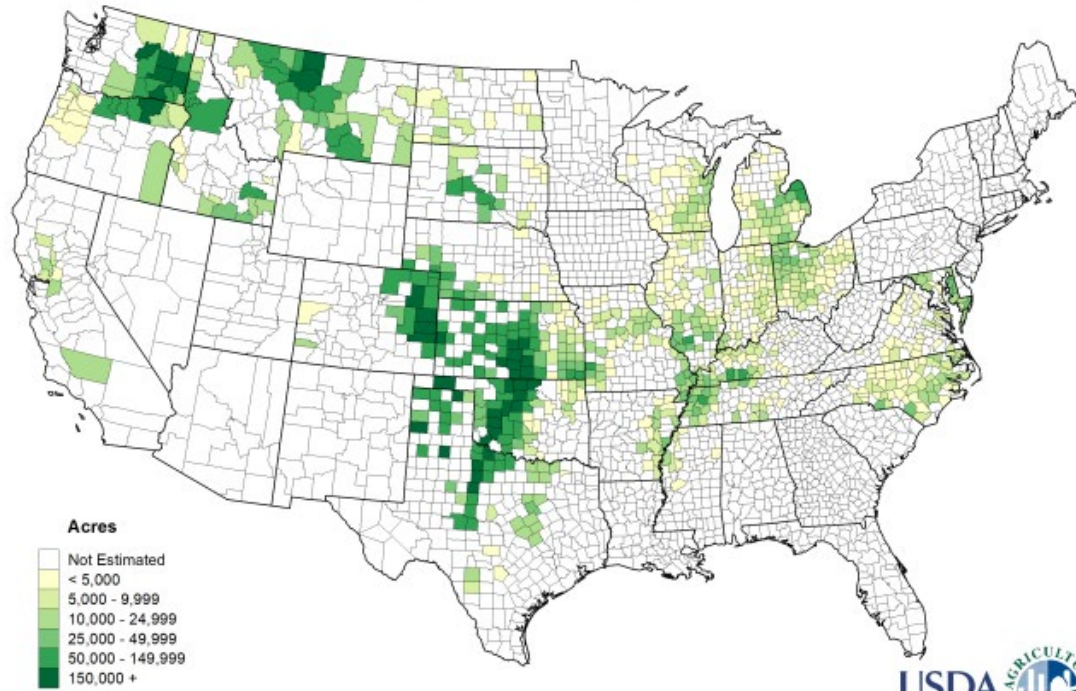
→ **Dr. Jackie Rudd, Jason Baker, Shannon Baker
Bushland, TX**



Agriculture and Food Research Initiative
Competitive Grant 2022-68013-36439

US Winter Wheat Production

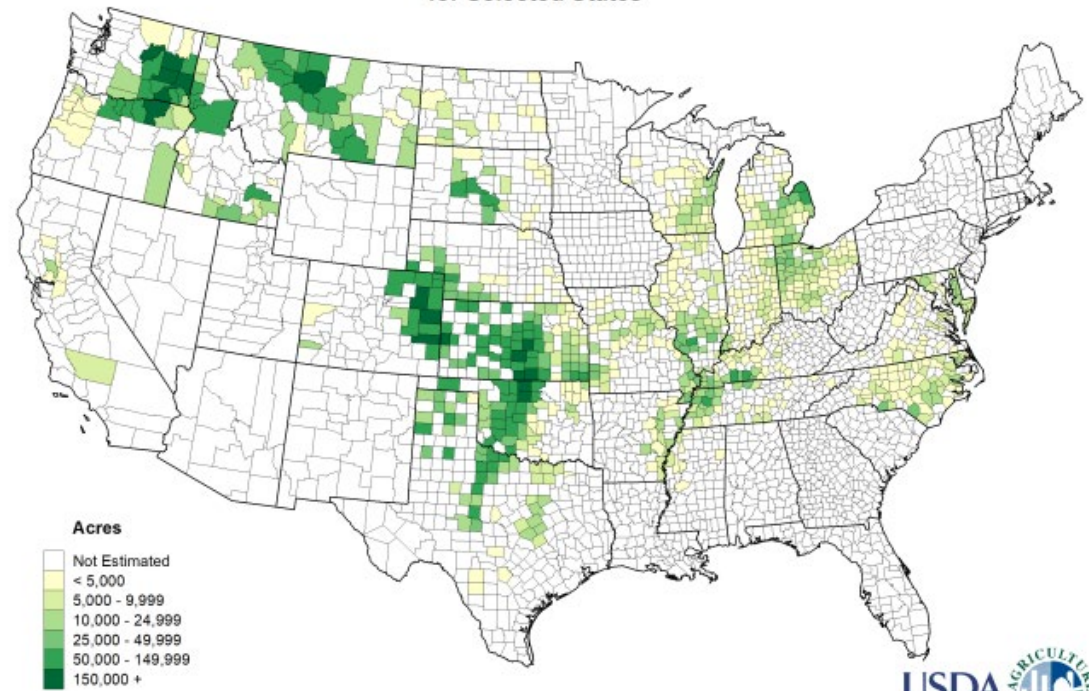
Winter Wheat 2023
Planted Acres by County
for Selected States



U.S. Department of Agriculture, National Agricultural Statistics Service



Winter Wheat 2023
Harvested Acres by County
for Selected States

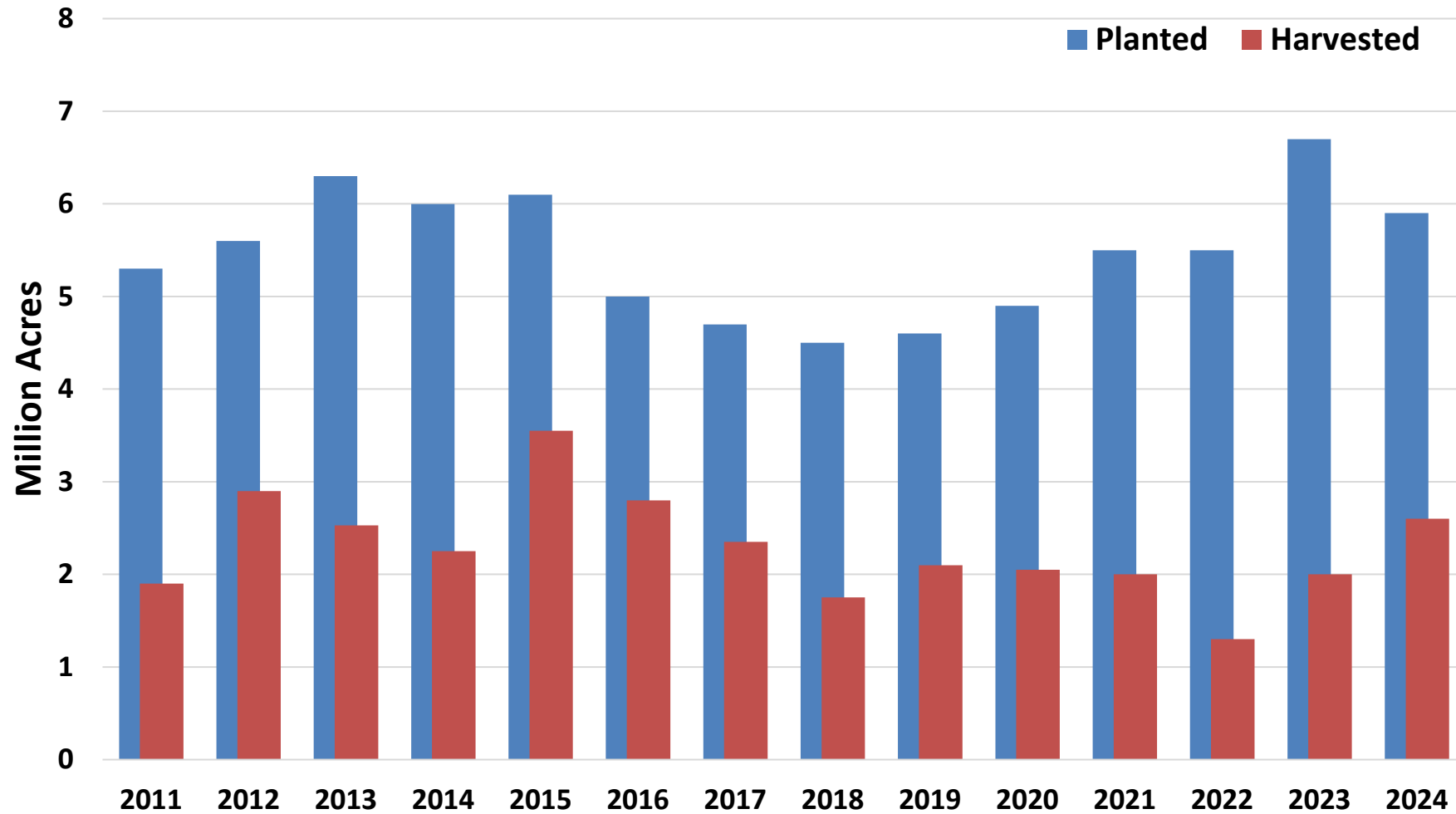


U.S. Department of Agriculture, National Agricultural Statistics Service

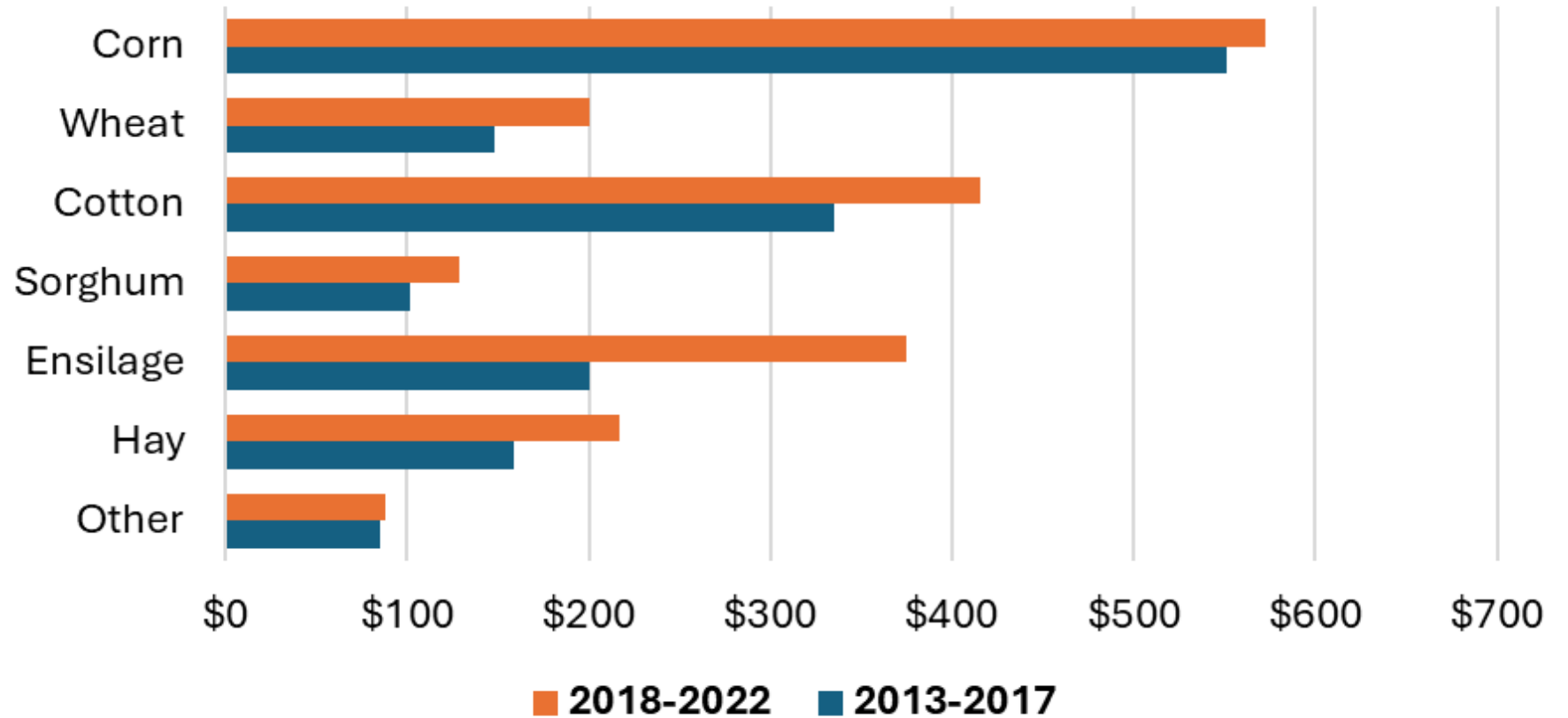


Texas Wheat Acres

USDA National Agricultural Statistics Service



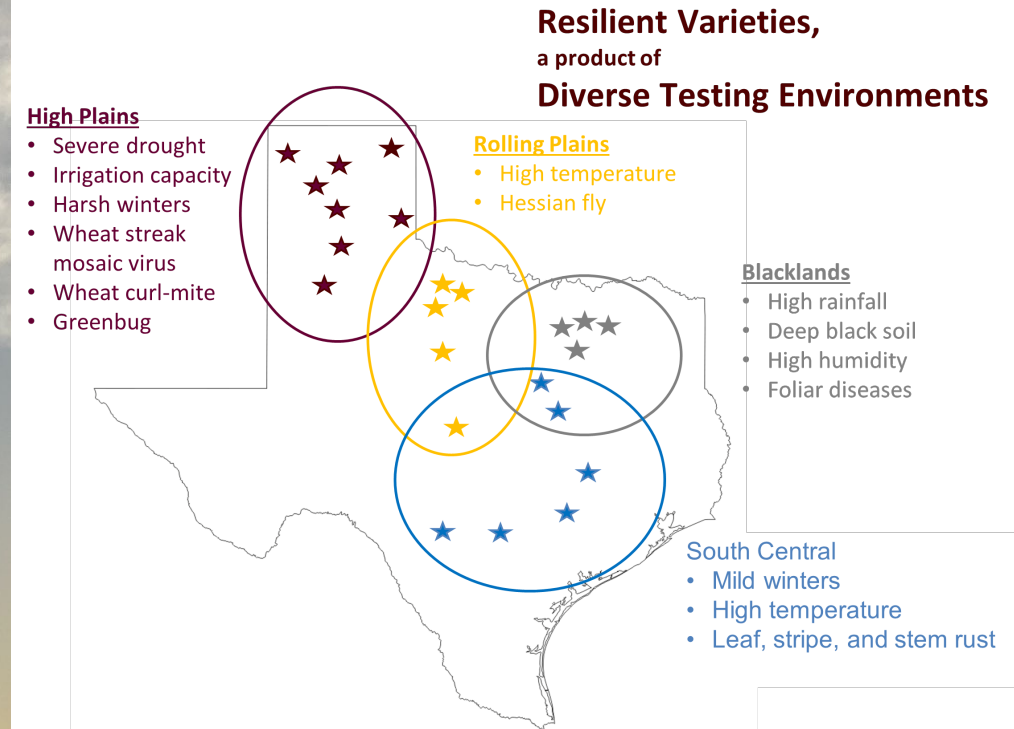
**Figure 8. Cash Receipts by Crop Category,
2018-2022 versus 2013-2017**
(Million Dollars)



What drives breeding objectives?

Grain and Grazing

- Yield and Quality
- Weather stress “climate resilient”
- Pests
 - Wheat curl mite, greenbug, RWA
 - Are we importing pests with feedstocks?
 - WSMV, Yr, Sr
- Forage Yield
 - Regrowth
 - Standability
 - High biomass from rye translocation
 - *A. tauschii* introgressed 20 years ago
- Nutrient deficiency
- ↑ management flexibility
- Stabilize economic income



Texas Wheat Variety Survey

Top 10 Varieties Planted in 2023 and 2024 ¹

Variety	Percent of Acres		Rank	
	2023	2024	2023	2024
TAM 114	5.5	6.5	1	1
TAM 204	3.4	4.0	3	2
TAM 111	3.3	3.9	4	3
TAM 115	1.3	2.4	10	4
TAM 205	0.2	1.9	29	5
TAM W-101/TAM 101	0.7	1.9	15	5
Smith's Gold	3.6	1.9	2	5
TAM 112	2.0	1.7	6	8
Winterhawk	1.2	1.2	11	9
WB 4515	0.6	1.0	16	10

1. 2023 state wheat planted estimate of 6.40 million acres, and 2024 preliminary estimate of 5.90 million acres

https://www.nass.usda.gov/Statistics_by_State/Texas/Publications/More_Features/tx-wheat-variety-2024.pdf

TAM 114, 2014, excellent milling and baking, all rusts.

Current #1 in Texas. We have an awnless

TAM 204, 2014, Beardless, *Gb3*, *Cmc4*, *HF*, *WSMV*, soil borne, acid soil. **Current #1 grazing wheat.**

TAM 115, 2019, high yield, excellent milling and baking, all rusts, *drought*, *WSMV*, *1A1R*, *Gb3*, *Cmc4*.

TAM 205, 2019, high yield, excellent milling and baking, all rusts, *WSMV (Wsm2)*, *Fhb1*

TAM 116, 2023, HP Intensive management, all rusts.

TX14V70214, 2023, Statewide, awnless, APR to all rusts.

TX18A1119, 2024, HP to Blacklands, yield, TW, milling, all rusts.

Variety Development & Trait Introgression



12 to 15 YEARS

Identify donor parents with desired characteristics

Generate genetic variability through sexual hybridization

Self pollinate for 3-4 generations while performing selection among and within populations

Conduct multi-location yield trials to identify candidate varieties

Purification and multiplication

Variety Development & Trait Introgression

	Trial Location and Name	Generation	Entries	Reps	Locs
1	Greenhouse Crossing Block		500		
2	Greenhouse rows	F ₁	300		
3	Field plots	F ₂	300	1	2
4	Field plots	F ₃	500	1	2
5	Field plots	F ₄	450	1	2
6	Head-rows	F _{4:5}	20,000	1	2
7	Preliminary Observation Yield Trials	F _{4:6}	600	1	3
8	Year 1: Advanced yield trials	Advanced	200	2	5
9	Year 2: Advanced yield trials	Advanced	120	2	7
10	Texas Elite (TXE)		40	3	18
11	Regional Nursery (SRPN), TXE, and increase		50	3	42
12	SRPN, TXE, Variety Trial (UVT)		40	3	65
13	Release		1		

GENOMIC SELECTION

Generate genetic variability through sexual hybridization

Self pollinate for 3-4 generations while performing selection among and within populations

Conduct multi-location yield trials to identify candidate varieties

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SPEED BREEDING

Identify donor parents with desired characteristics

Generate genetic variability through sexual hybridization

Self pollinate for 3-4 generations while performing selection among and within populations

Conduct multi-location yield trials to identify candidate varieties

Purification and multiplication

Variety Development & Trait Introgression

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Identify donor parents with desired characteristics

Generate genetic variability through sexual hybridization

DOUBLED HAPLOID

Conduct multi-location yield trials to identify candidate varieties

Purification and multiplication

Variety Development & Trait Introgression

	Trial Location and Name	Generation	Entries	Reps	Locs
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Identify donor parents with desired characteristics

Generate genetic variability through sexual hybridization

Self pollinate for 3-4 generations while performing selection among and within populations

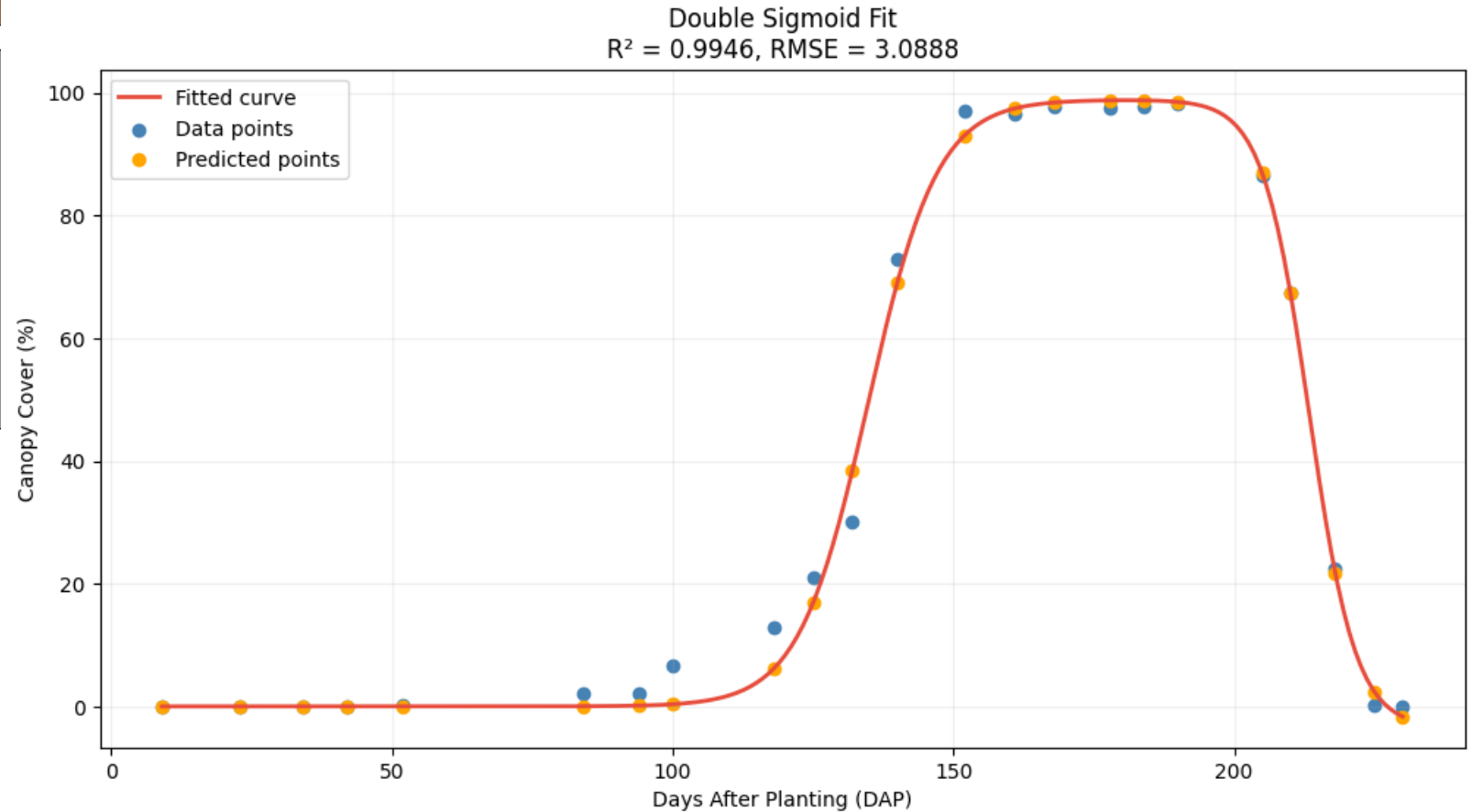
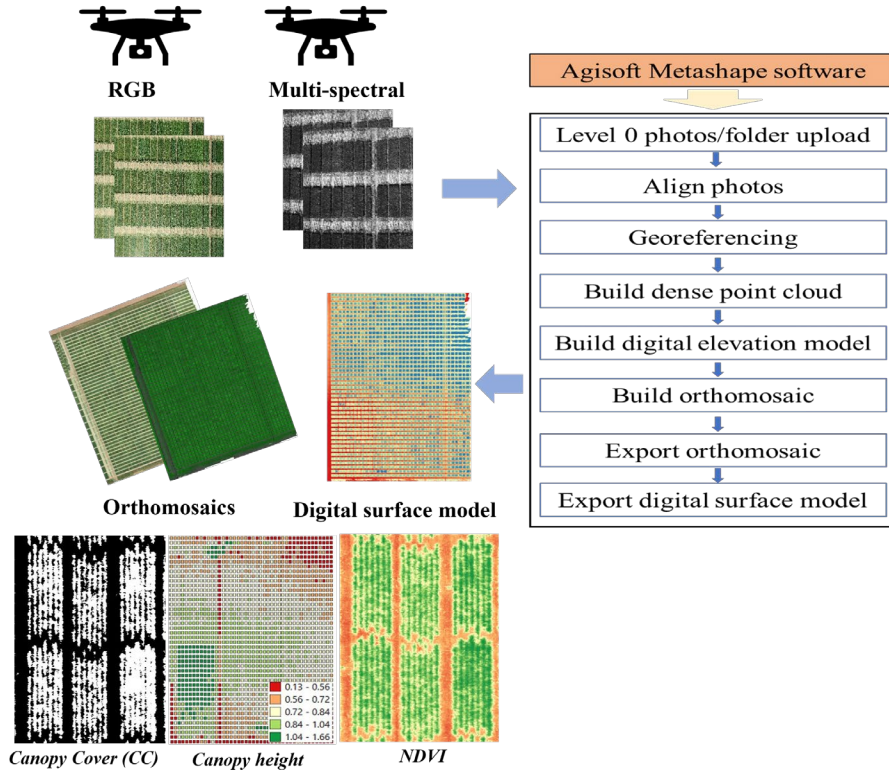
GENOMIC AND PHENOMIC PREDICTION

Purification and multiplication

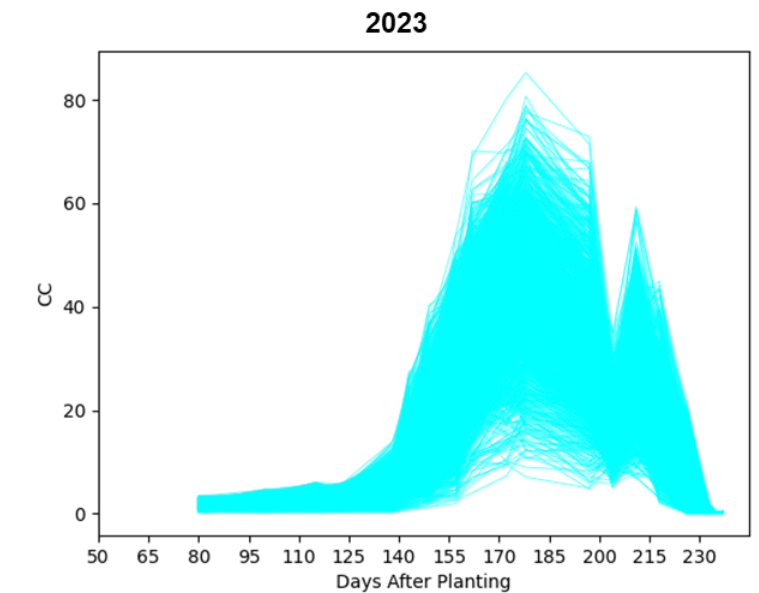
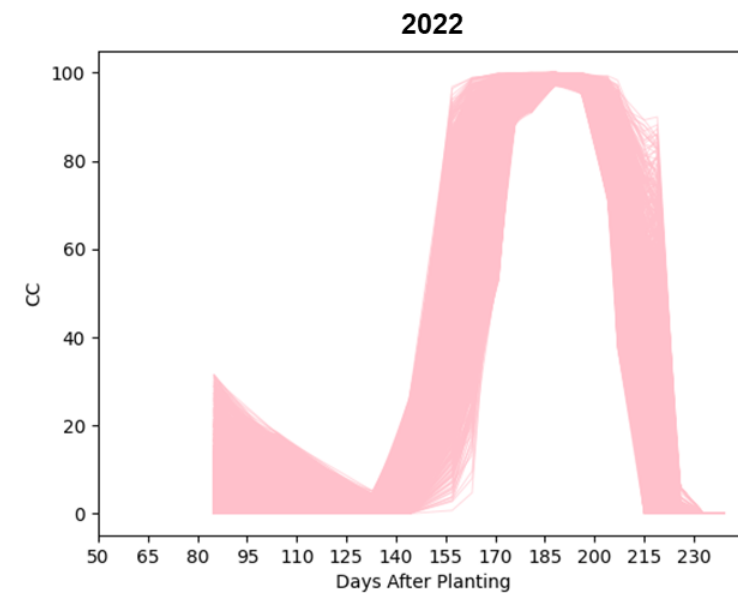
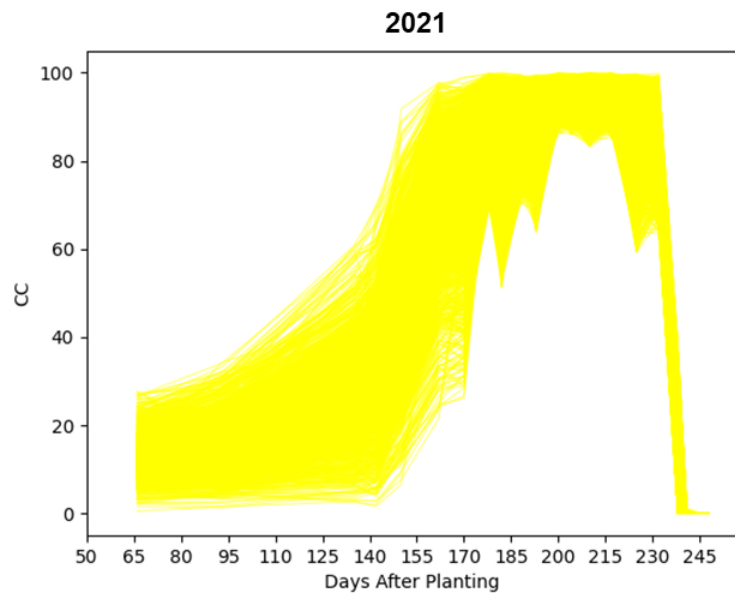
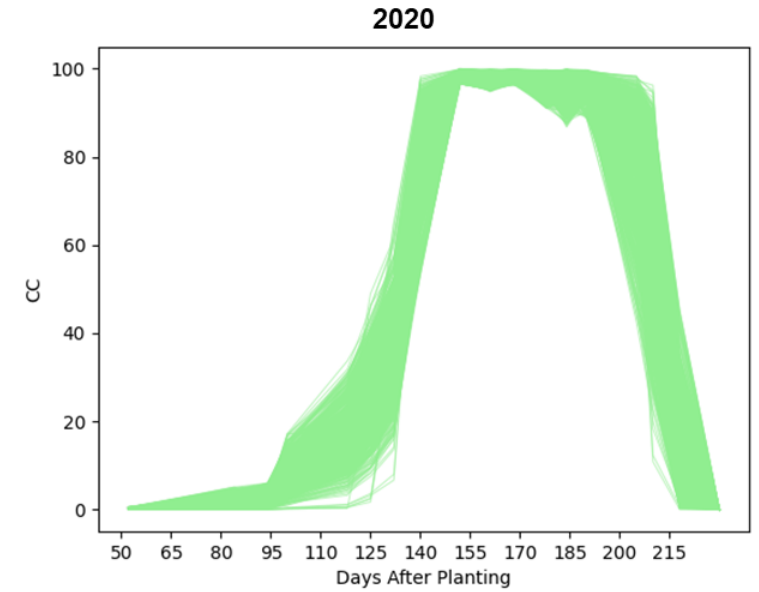
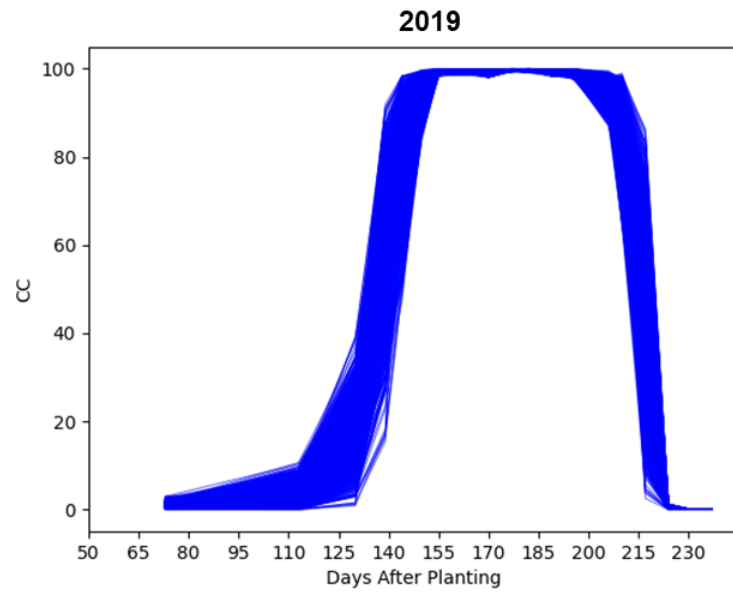
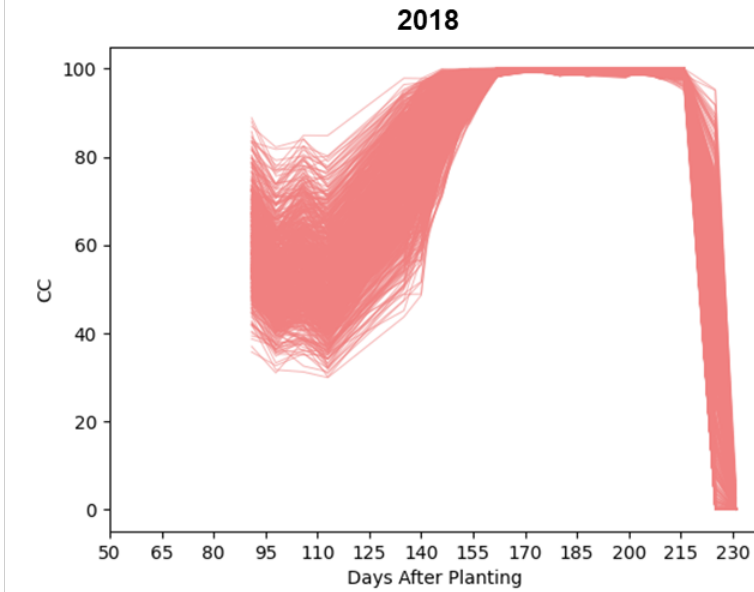
New Tools: UAS Data-Informed Insights

Fitted parameters:

$a_1 = 35.6557$ (steepness of first sigmoid)
 $c_1 = 134$ (center of first sigmoid)
 $a_2 = 0.9887$ (steepness of second sigmoid)
 $c_2 = 11798$ (center of second sigmoid)
 $R^2 \text{ score} = 0.9946$
 $RMSE = 3.0888$



Bushland Irrigated Canopy Cover



An aerial photograph of a large agricultural field. A wide, light-colored dirt road or path runs vertically through the center of the field. On either side of the road, there are rows of crops, likely corn, planted in a grid pattern. The crops are in various stages of growth, with some appearing greener and others more yellowish. The overall scene is a vast, organized agricultural landscape.

Disease Monitoring Chillicothe, TX April, 2024

**“Who cares about
variety selection?”**

New Traits

Biological Nitrification Inhibition (BNI)

JIRCAS and CIMMYT \$Novo Nordisk\$

Came from *Leymus racemosus*

Optimize yields while \uparrow NUE

Stop the nitrogen cascade

\downarrow N₂O emissions through root exudates

High Fiber for Human Nutrition

Arabinoxylan: non-starch polysaccharide

\uparrow Fiber in diet \downarrow chronic diseases

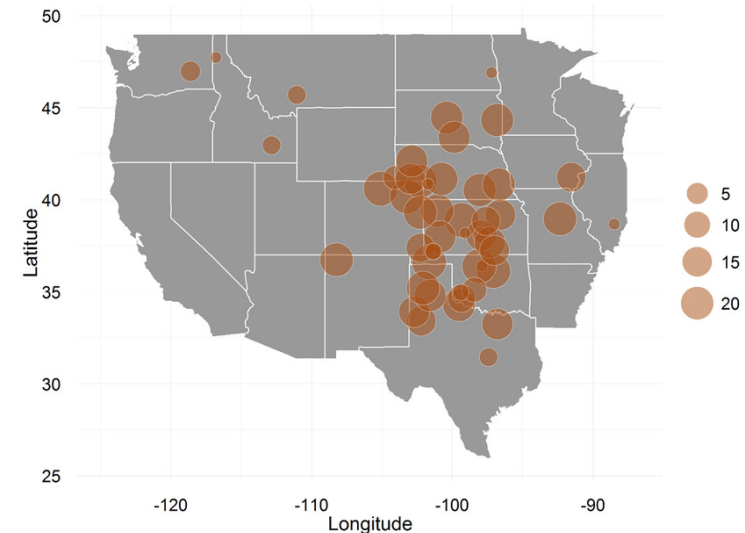
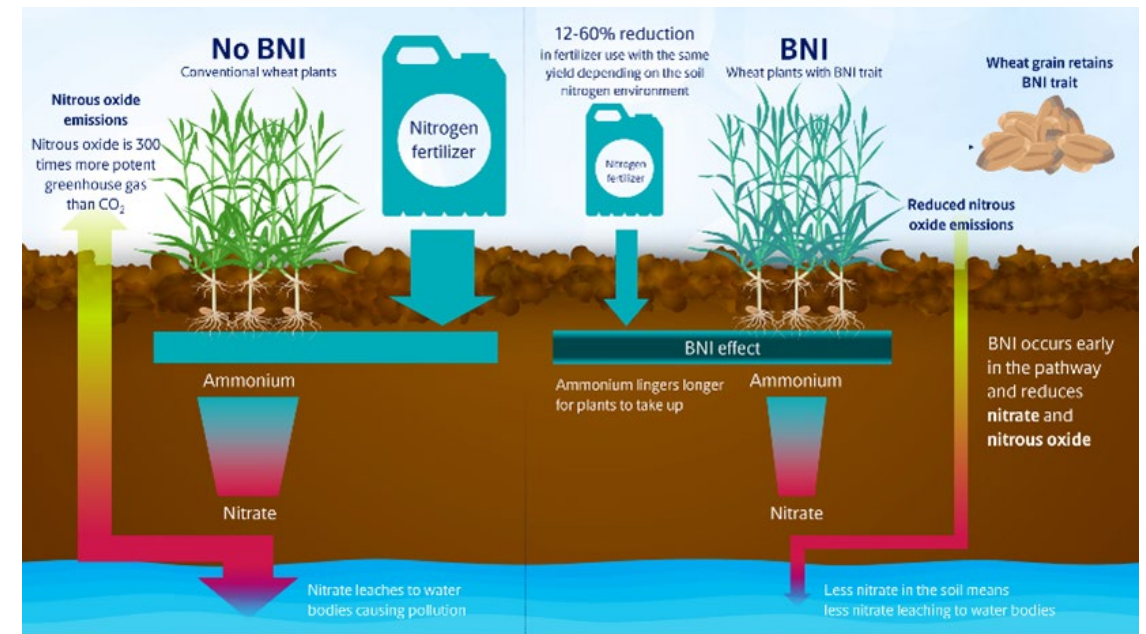
Continued work on Yr, WSMV/WCM

Gene stewardship

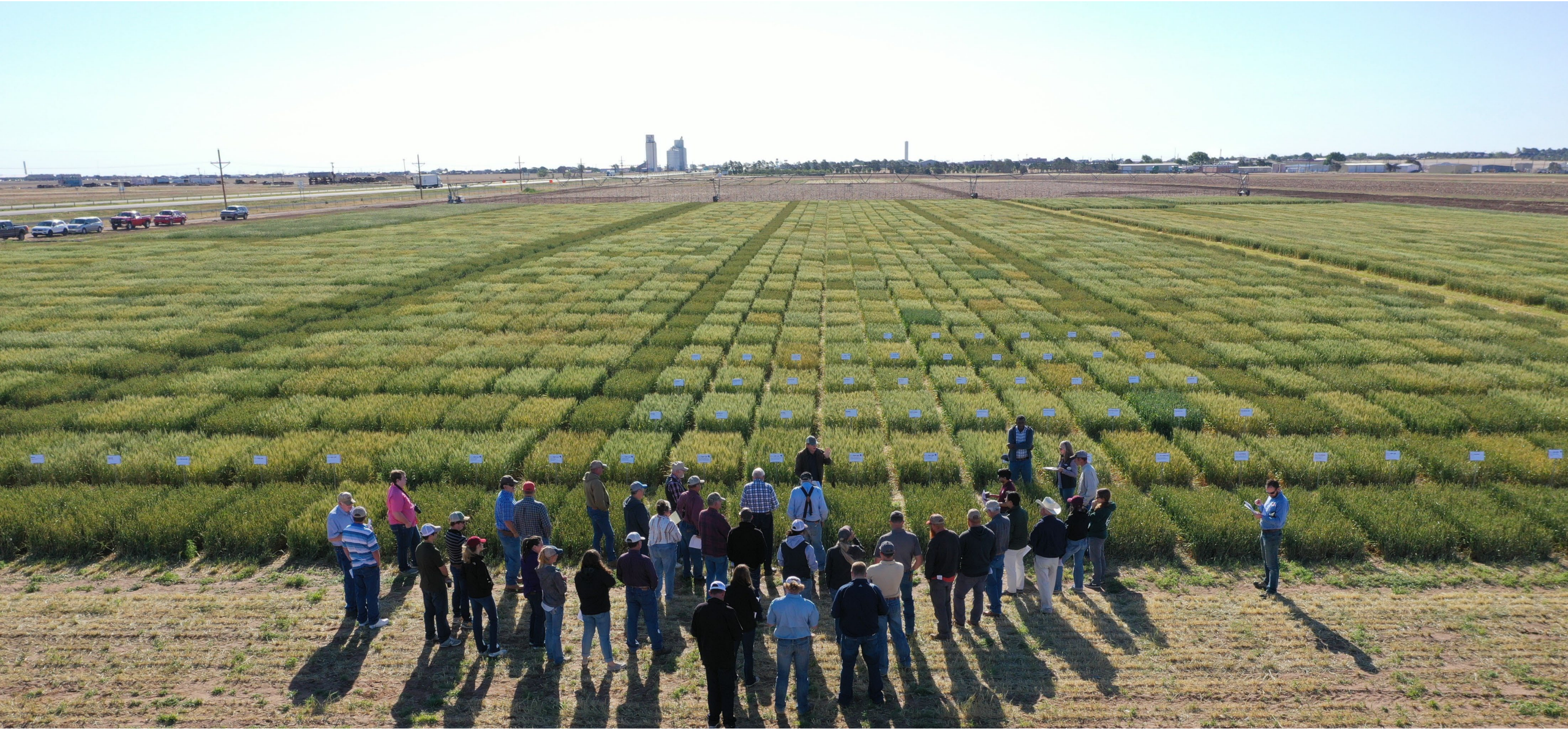
All releases have bread quality

Can release silage-specific varieties

Accelerating awnless lines to release



Technology Transfer



Bushland Forage Trial

2023

Rank [†]	Variety	Species	Source	Dry Matter Yield (lb/a)			
				4-Year AVG	3-Year AVG	2-Year AVG	2023 Total
1	TX14VT70526	Triticale	TAMU	6825	7224	6234	9733
2	TX16VT68295	Triticale	TAMU	6252	6436	5843	8358
3	Dyna-Gro 7322	HRW*	Nutrien	5328	5460	5672	8818
4	Trical Gunner	Triticale	Trical Superior Forage		5929	5643	8564
5	TAM 114	HRW	Adaptive Genetics			6496	10350
6	TX20AT2015	Triticale	TAMU			6112	10262
7	TX20AT2018	Triticale	TAMU			5295	8809
8	Trical 20T06	Triticale	Trical Superior Forage			5271	8238
9	Trical EXP 220	Triticale	Trical				11986
10	Trical EXP 209	Triticale	Trical				10037
11	Trical Flex 719	Triticale	Trical Superior Forage				9865
12	TX20AT2014	Triticale	TAMU				9751
13	TX20AT2005	Triticale	TAMU				9608
14	Trical EXP 305	Triticale	Trical Superior Forage				9575
15	WB4422	HRW	Westbred				9564
16	WB4792	HRW	Westbred				9392
17	TAM 205	HRW	Adaptive Genetics				9328
18	Trical EXP 22W01	HRW	Trical Superior Forage				9008
19	Trical 22T01	Triticale	Trical Superior Forage				7555
20	APB717003	HRS	Arizona Plant Breeders				4592
21	APB717019	HRS	Arizona Plant Breeders				4015
22	APB470308	HRS	Arizona Plant Breeders				3636
23	APB470298	HRS	Arizona Plant Breeders				3302
LSD (0.05)				794	973	NS	1398
CV(%)				14	14	13	12
Mean				6135	6262	5821	8450

[†]Varieties ranked according to 4-year, 3-year, 2-year, then 2023 total yield.

*Awnless/Beardless

December 10, 2024



Wheatlage and the “Forage Gap”

Planned – no longer an “opportunity crop”

Insufficient summer silage produced to meet regional livestock needs

Wheatlage: lower yielding than summer silages but a high-quality option

Forages provide farmers an alternative market

Forages generally use less water than grain crop because of earlier harvest stage – **opportunity for farmers with low well capacities**

Average historical yield

	Average Yield tons/ac	
	DM	65% Moist.
Corn Silage	9.5	27 (22-30)
Sorghum Silage	8.0	23 (20-28)
Wheatlage	5.3	15 (11-22)

(Range)

*Average Yields for the Texas High Plains Production Region



Boot Harvest Stage - Green Chop

Directly fed or wilted prior to ensiling

Optimize forage quality

Less yield but less water

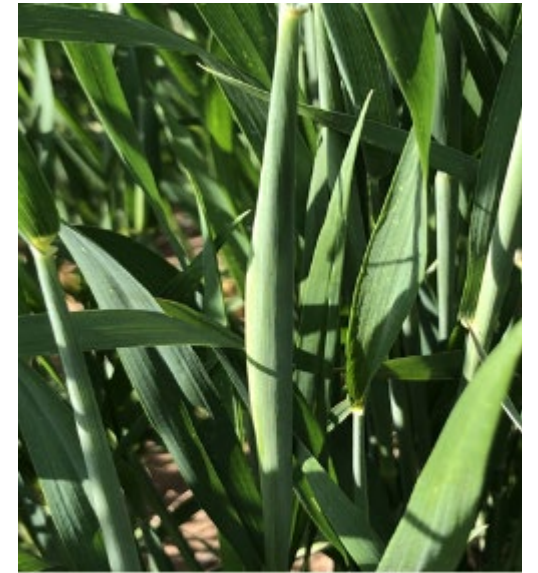
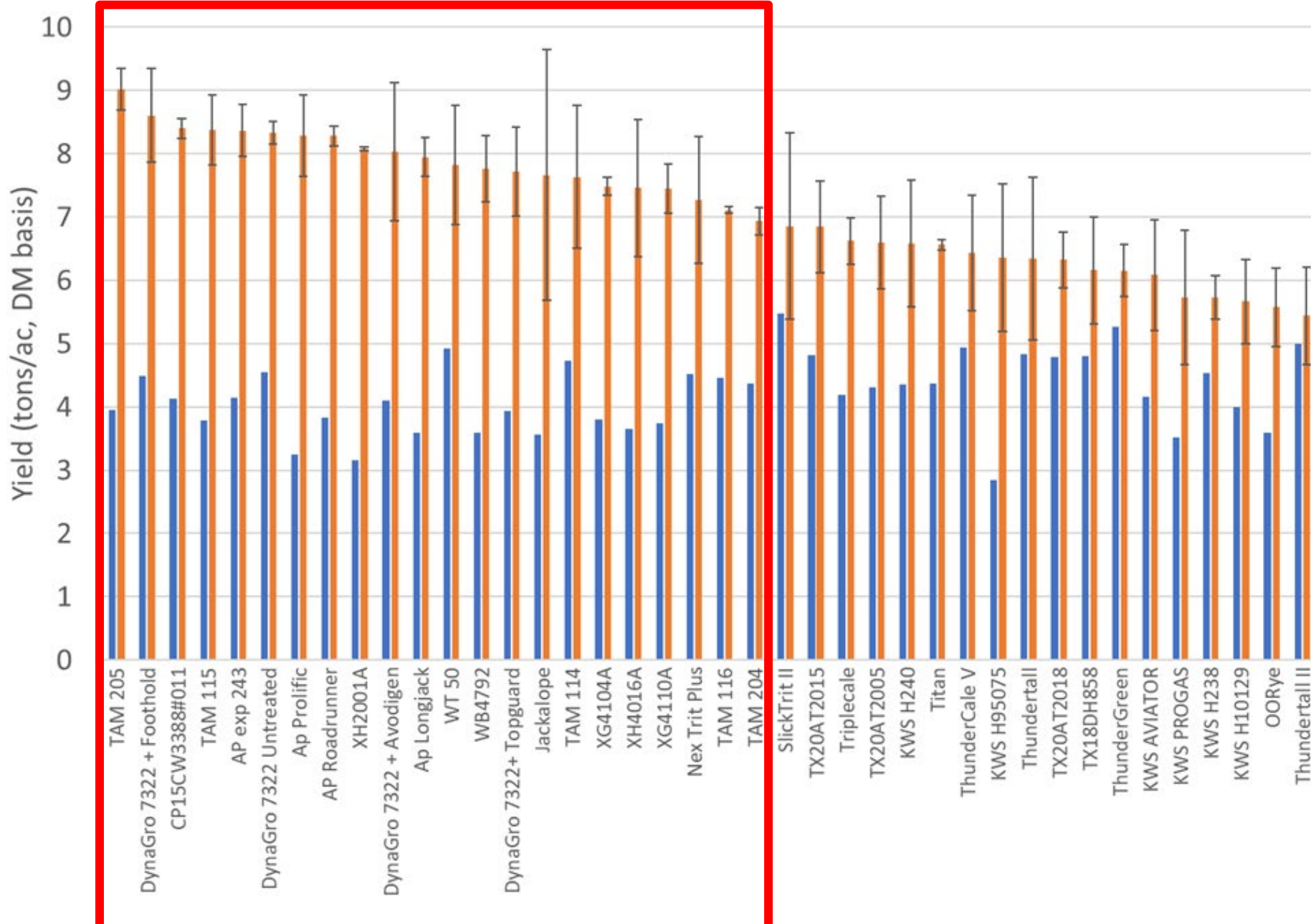


Image from
Shannon Baker

2022-2023 Small Grain Silage Trial at Bushland

	Boot	Soft- Dough
Triticale	2.9	6.8
Rye	2.5	6.1
Wheat	2.1	5.1
Average	2.5	6.0

2023-2024 AgriLife Small Grain Silage Trial - Bushland

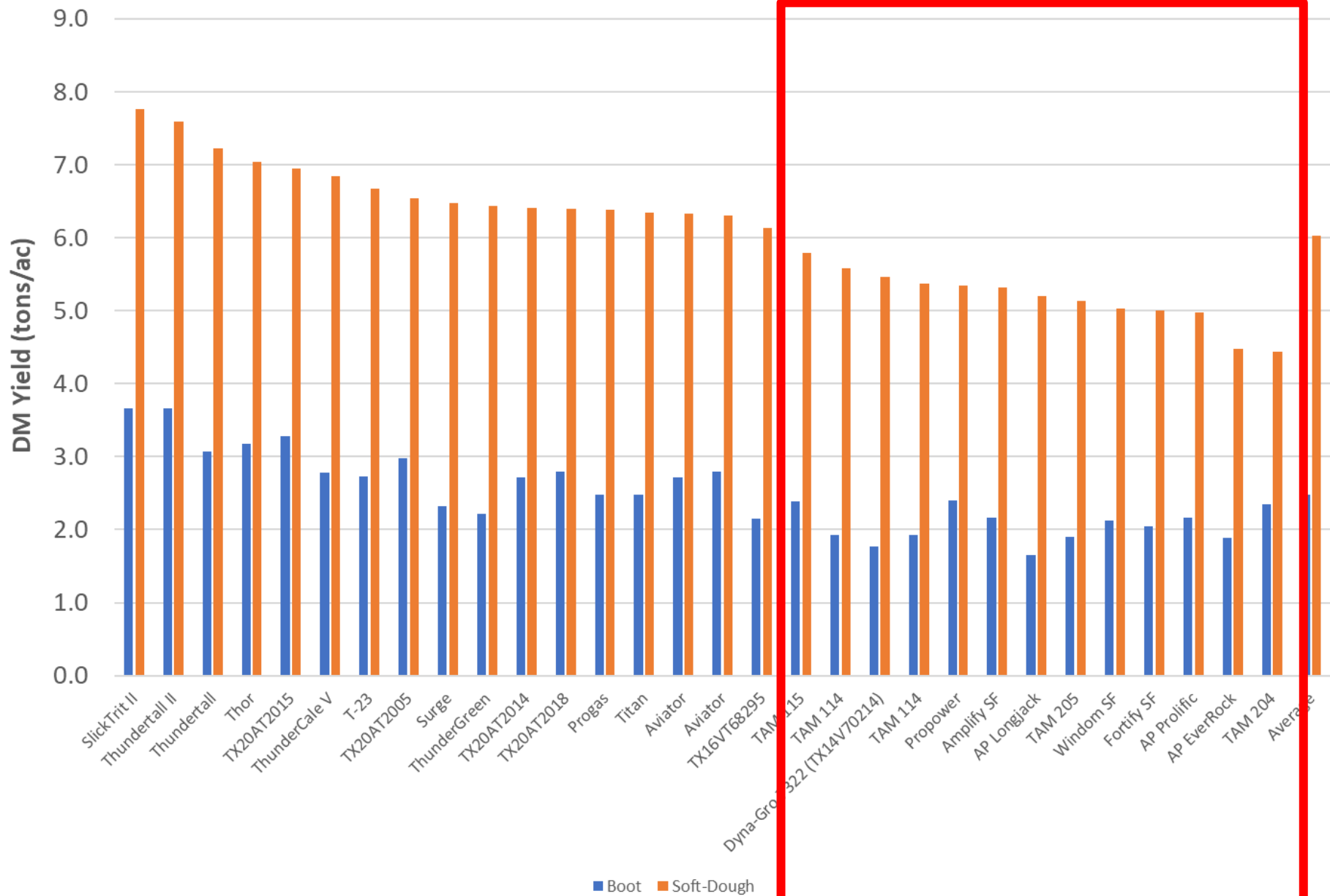


Boot – Green Chop



Soft Dough – Wheatlage

2023 Small Grain Silage Trial at Bushland



Boot – Green Chop



Soft Dough – Wheatlage

Forage Type Yield Response

Triticale – later maturity offers yield advantage IF growing late May weather is favorable

2023 70-85 °F after heading and rain

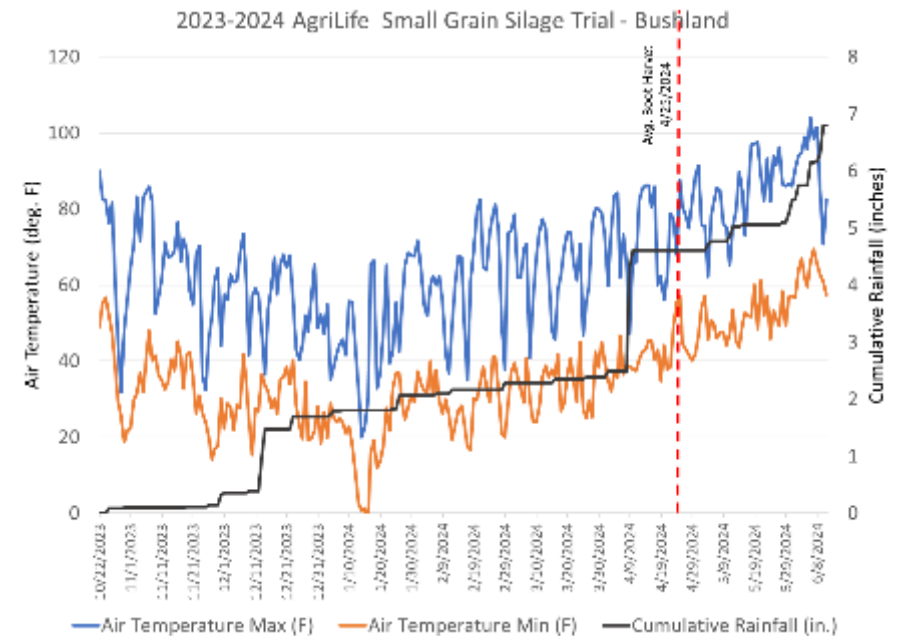
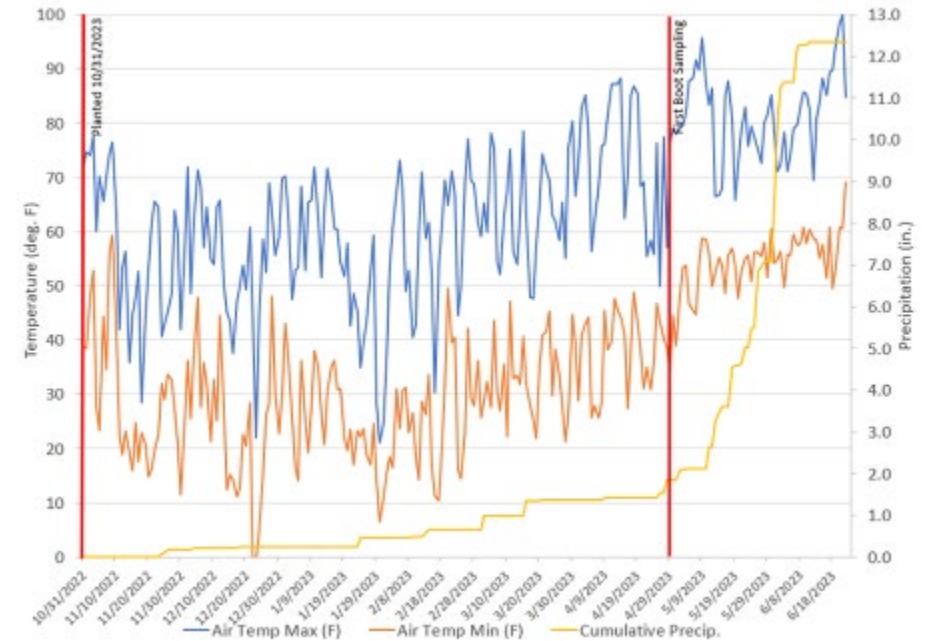
2024 90-100°F after heading and rain **too late**

Wheat – earlier maturing

2023 80-90 °F after heading and **dry**

2024 80-90 °F after heading with rain and irrigation

Need water (irrigation and/or precip) to overcome heat



TEXAS A&M
AGRILIFE
RESEARCH | EXTENSION

Titan



- Excellent forage yield
- Good for early planting
- High tonnage for silage and hay

Released in 2023

Licensed to Watley Seed