



Evaluation of a novel drought-tolerant inoculant on soybean yield and nodulation in the Mid-South (Year 2 & 3)

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Collaborators

- Dr. James Grichar – Texas A&M AgriLife Research.
- Johnson Farm, Fike Farm, Vanderpool Farm in South Texas.
- Dr. Avat Shekoofa – University of Tennessee.
- Dr. Pengyin Chen – University of Missouri.
- Dr. Tessie Wilkerson – Mississippi State University.
- Dr. Trey Price – Louisiana State University.
- Dr. Leandro Mozzoni – University of Arkansas.

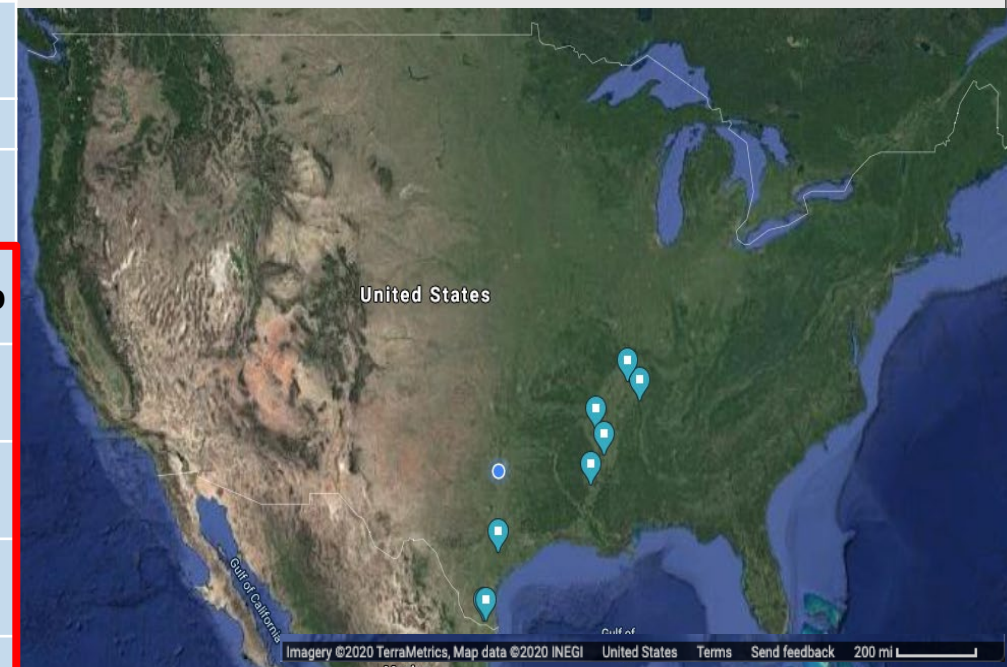


Goal of Project

- Test the Texas-native drought-tolerant inoculant (TX-VA) under the non-irrigated condition across drought prone regions in the Mid-South.
- Three treatments:
 - TX-VA
 - Cell-Tech (commercial inoculant)
 - No inoculant
- In addition to TN16-520, drought-tolerant and drought-sensitive cultivars included:
 - S14-9017R (drought-sensitive), USG-7496 (drought-sensitive)
 - S1120242C (drought-tolerant)

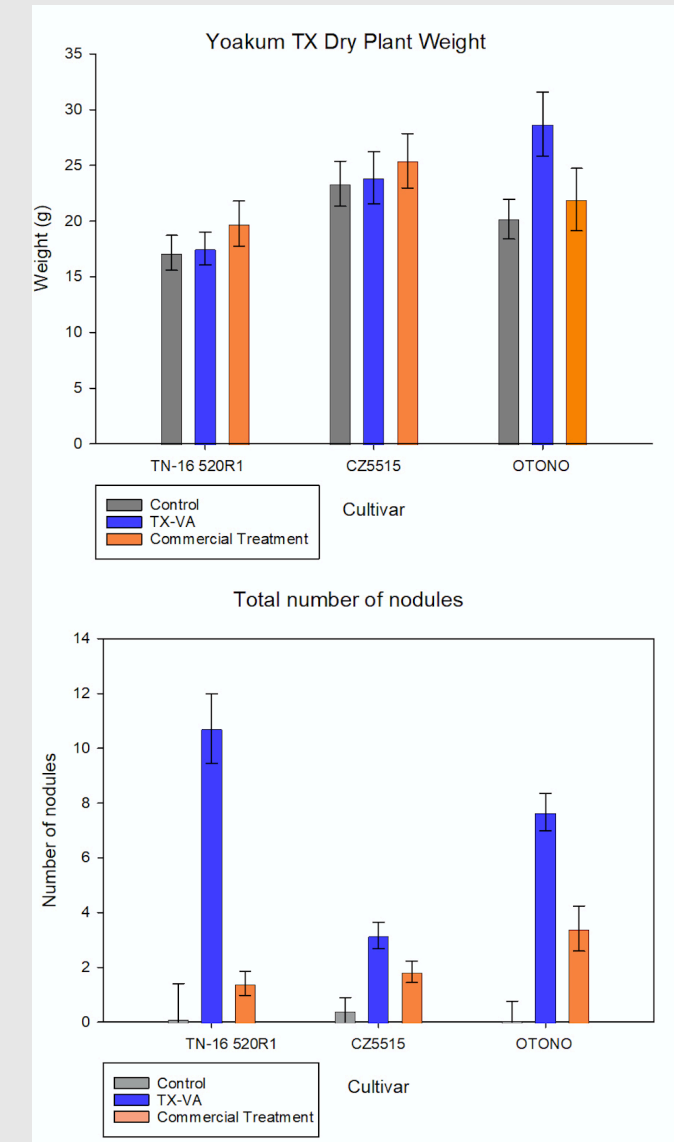
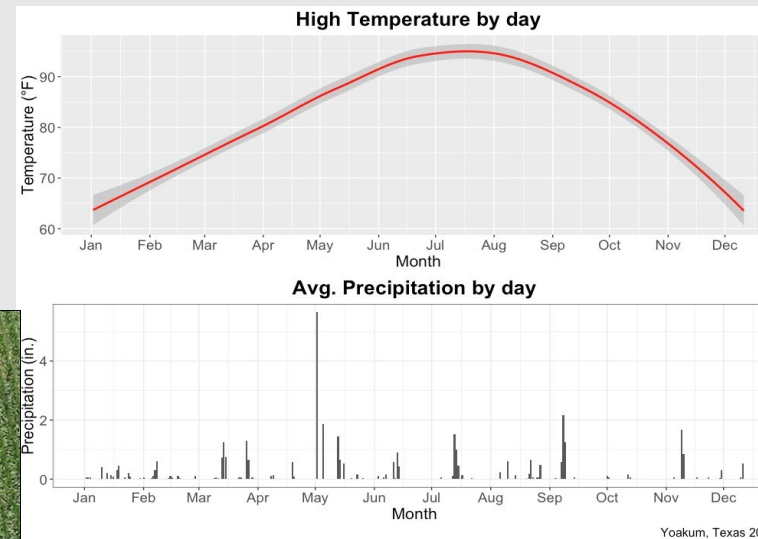
Multi-region evaluation of the drought-tolerant *Bradyrhizobium* inoculant (TX-VA strain)

Location	Field	Planting date	Sampling date	Harvest date	Cultivars
Weslaco, TX	Johnson Farm	2/28	4/30	7/20	V-20
	Fike Farm	3/6	5/1	7/21	O-20 (Lynda-GT)
	Vanderpool Farm	3/25	N/A	8/17	O-10
Yoakum, TX	Grichar Farm	4/1	6/8	9/1	TN16520, CZ5515, Otono
Winnsboro, LA	Macon Ridge	5/11	7/14	9/16	TN16520, CZ5515, USG-7496
Jackson, TN	West TN AgResearch	5/15	7/27	10/21	TN16520, USG-7496
Portageville, MO	Lee Farm	6/2	7/28	11/4	TN16520, S1120242C , S14-9017R
Stoneville, MS	Stoneville, USDA	6/29	9/9	10/29	TN16520, S14-9017R
Stuttgart, AR	Stuttgart	7/1	9/10	11/7	TN16520, S14-9017R



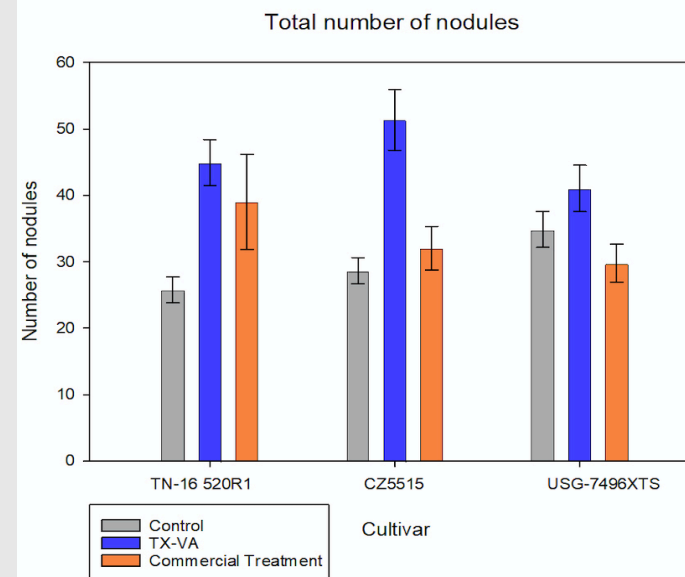
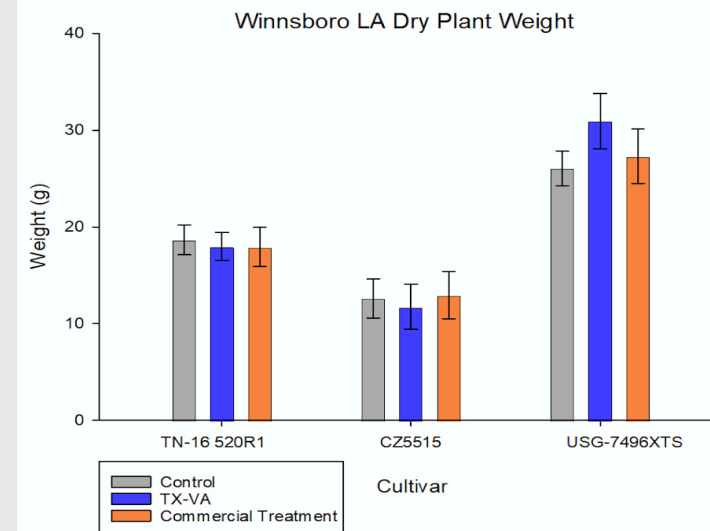
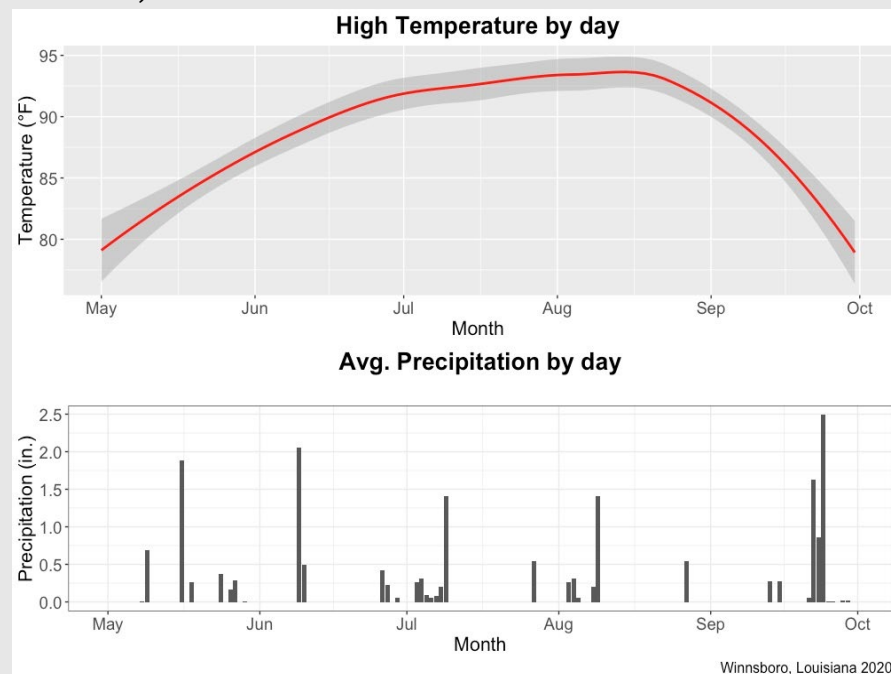
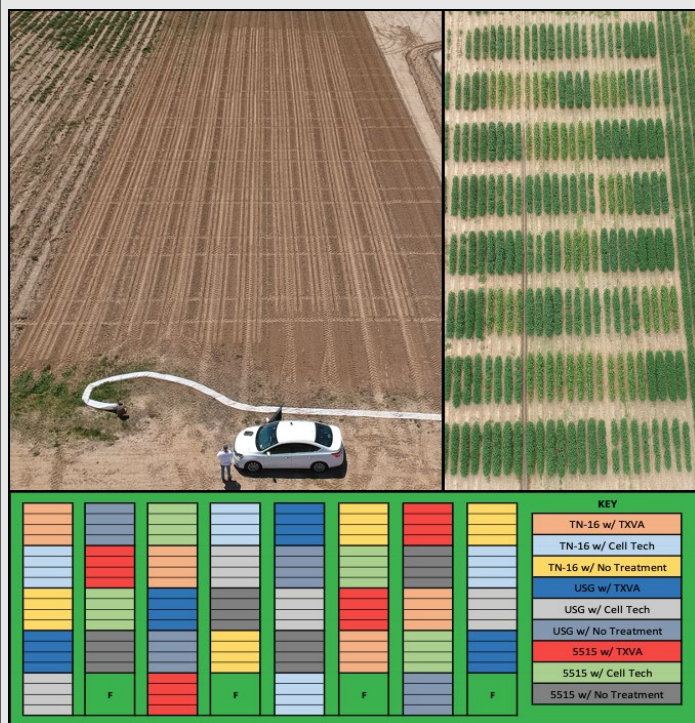
Yoakum, TX

- Plant: 4/1
- Sample: 6/8
- Harvest: 9/2
- 3 treatments w/ 4 replicates.
- 3 cultivars (TN16520, CZ5515, Otono)
- Non-irrigated condition.
- 30 ft. 2-row plots on 38" beds.



Winnsboro, LA

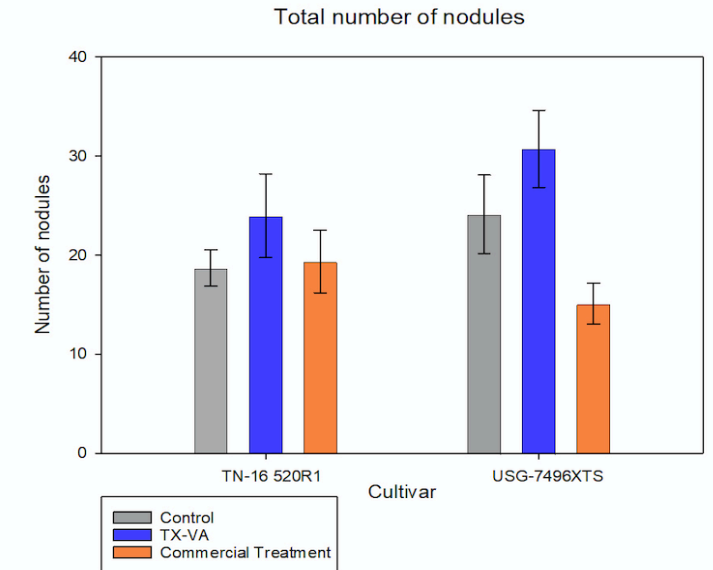
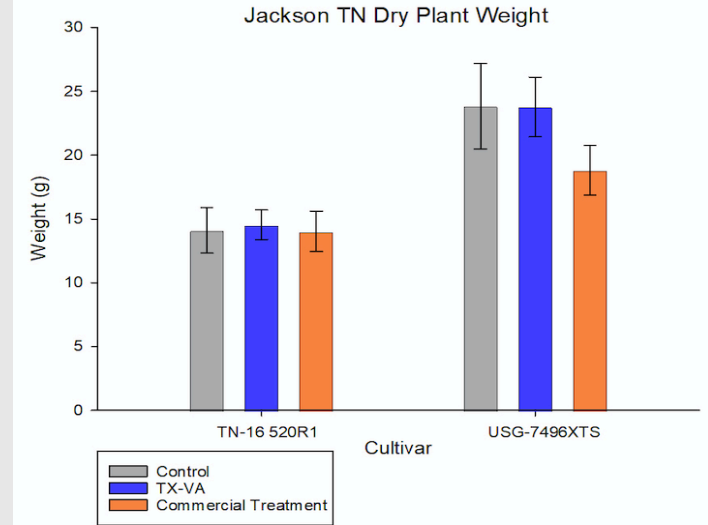
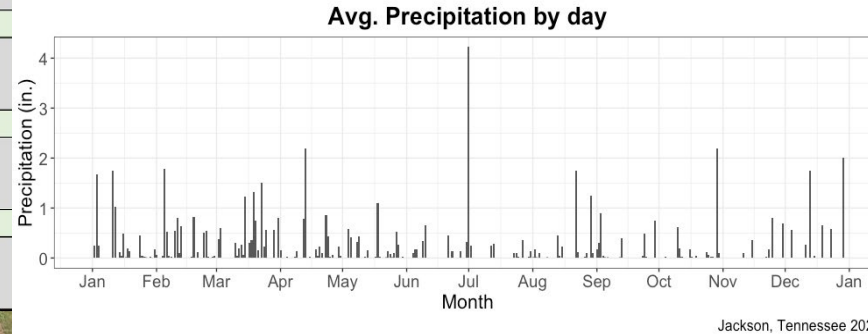
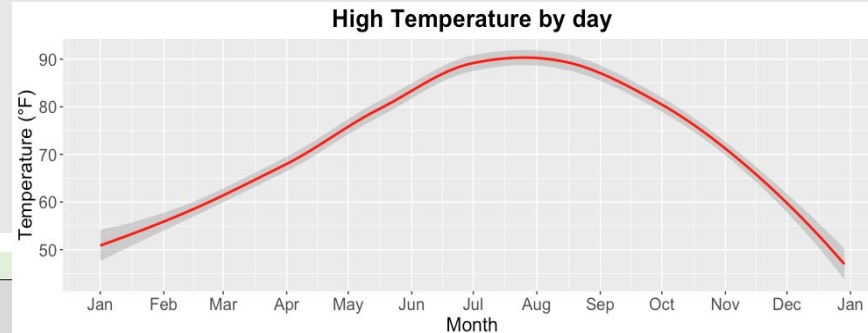
- Plant: 5/11
- Sample: 7/14
- Harvest: 9/16
- 3 treatments w/ 4 replicates.
- 3 cultivars (TN16520, CZ5515, USG-7496)
- Non-irrigated condition.
- 20 ft. 4-row plots on 40" beds.



Jackson, TN

- Plant: 5/15
- Sample: 7/27
- Harvest: 10/21
- 3 treatments w/ 5 replicates.
- 2 cultivars (TN16520, USG-7496)
- Non-irrigated condition.
- 20 ft. 4-row plots on 30" beds.

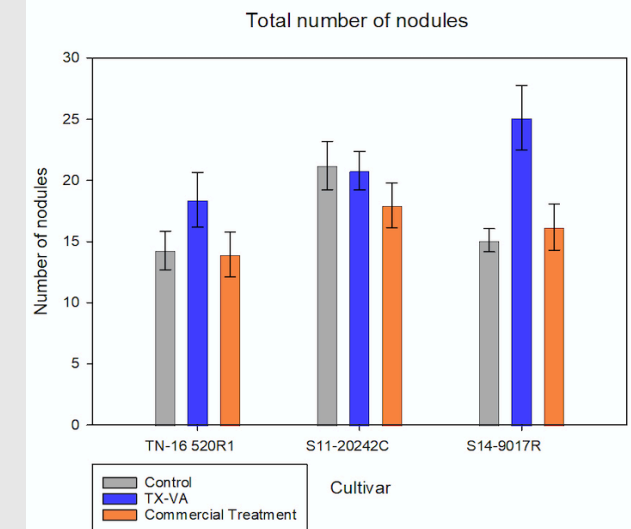
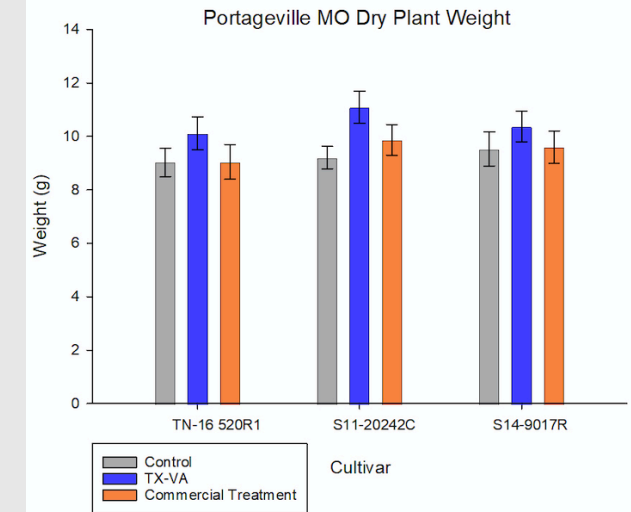
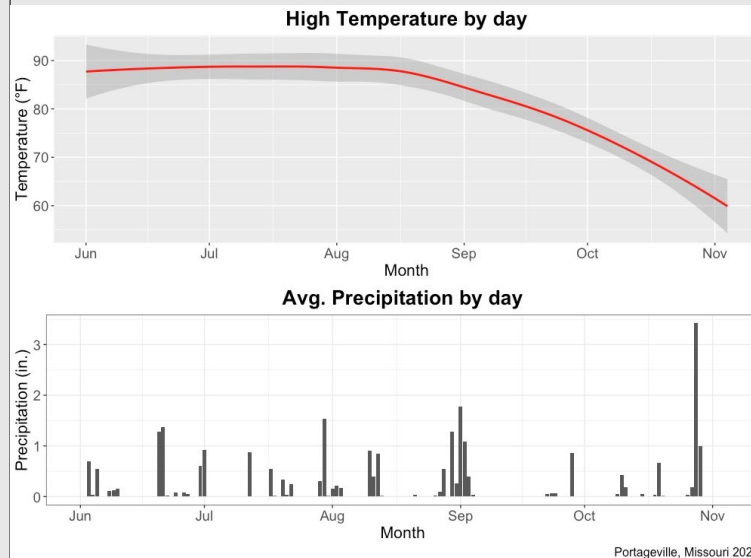
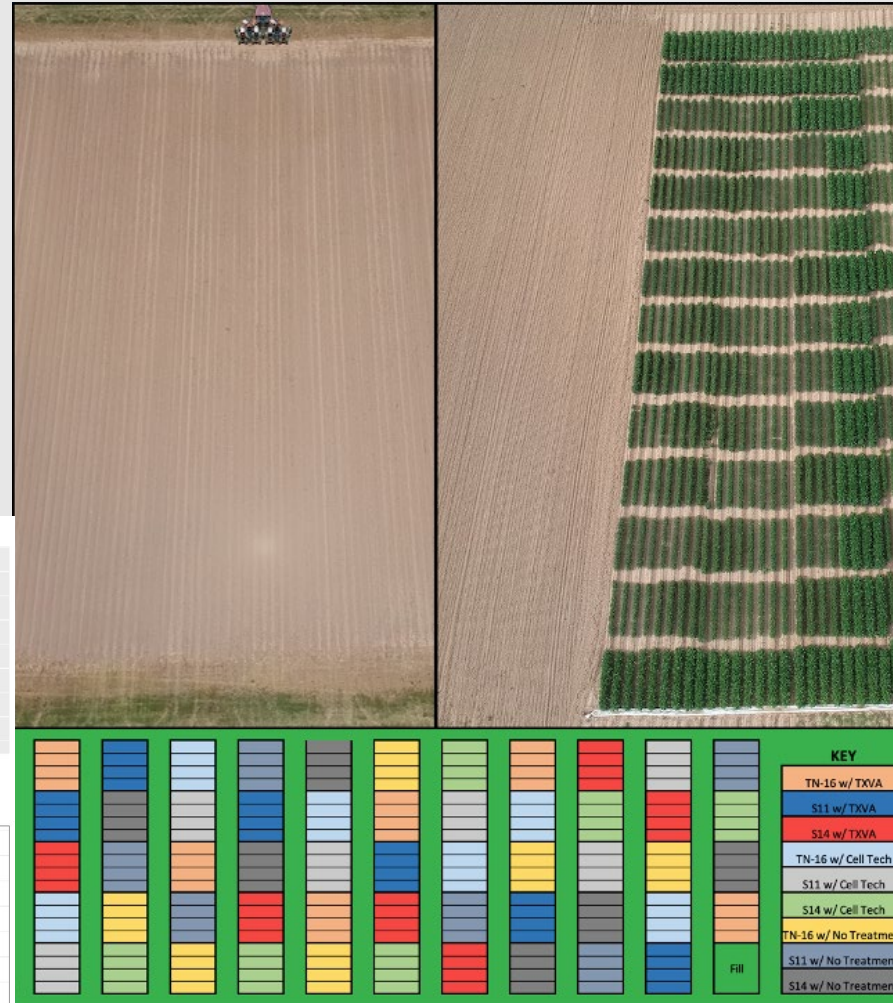
TN16 520R1				USG 7496XT			
B	401 CELL TECH	402 TXVA	403 CTRL	404 CELL TECH	405 TXVA	406 CTRL	B
B	301 CTRL	302 CELL TECH	303 TXVA	304 CTRL	305 CELL TECH	306 TXVA	B
B	201 CELL TECH	202 TXVA	203 CTRL	204 CELL TECH	205 TXVA	206 CTRL	B
B	101 TXVA	102 CTRL	103 CELL TECH	104 TXVA	105 CTRL	106 CELL TECH	B





Portageville, MO

- Plant: 6/2
- Sample: 7/28
- Harvest: 11/4
- 3 treatments w/ 6 replicates.
- 3 cultivars (TN16520, S1120242C, S14-9017R)
- Non-irrigated condition.
- 20 ft. 4-row plots on 30'' beds.

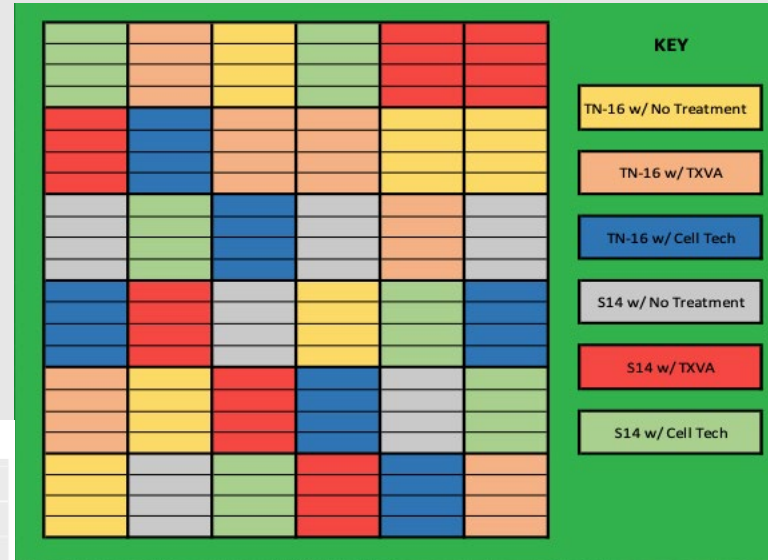




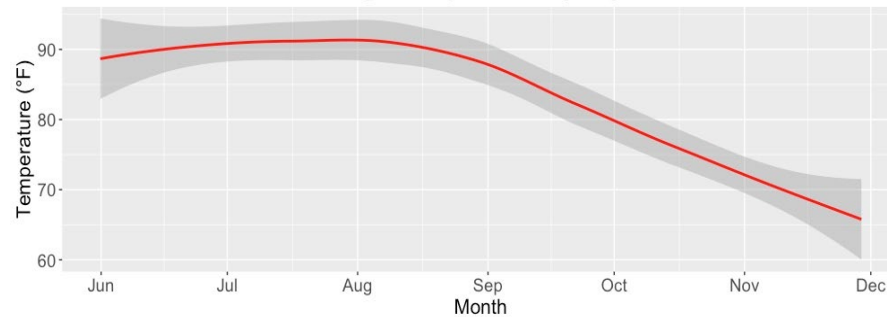
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Stoneville, MS

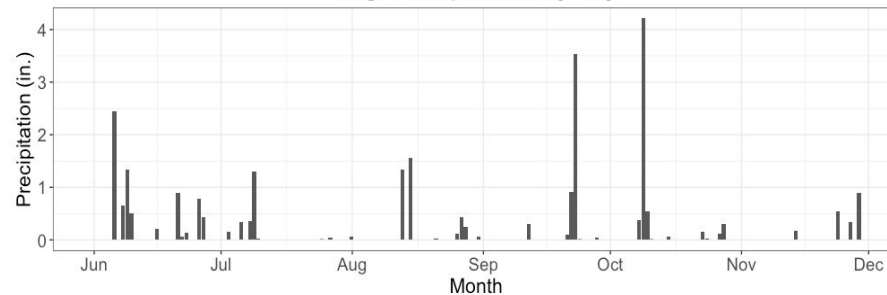
- Plant: 6/29
- Sample: 9/9
- Harvest: 10/29
- 3 treatments w/ 6 replicates.
- 2 cultivars (TN16520, S14-9017R)
- Non-irrigated condition.
- 20 ft. 4-row plots on 30" beds.



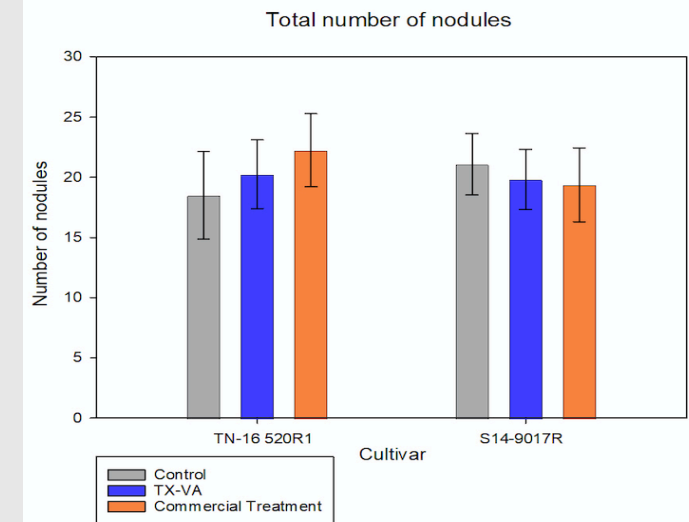
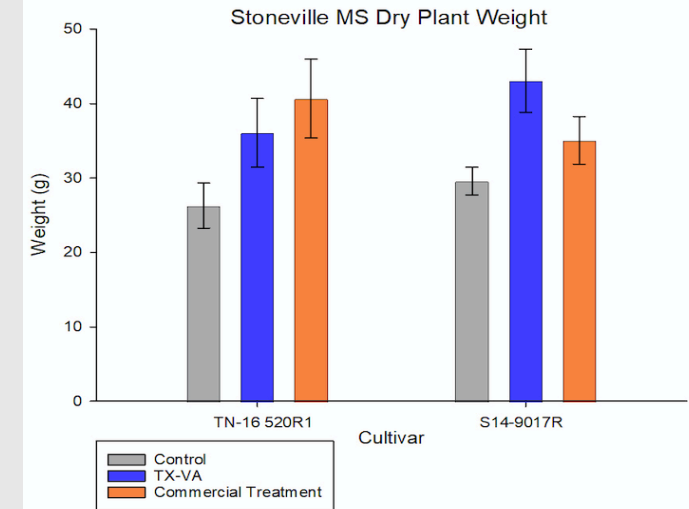
High Temperature by day



Avg. Precipitation by day



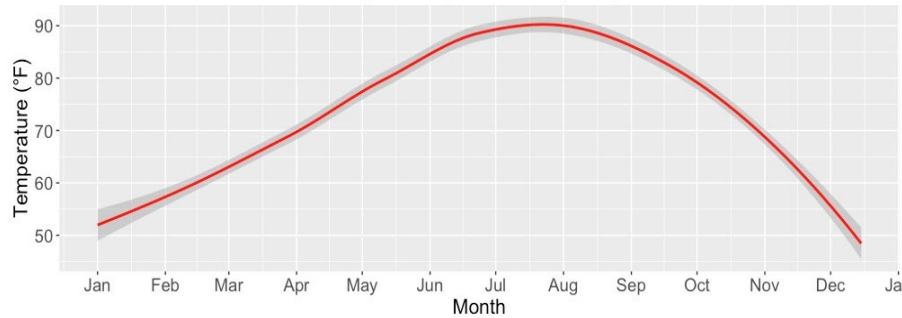
Stoneville, Mississippi 2020



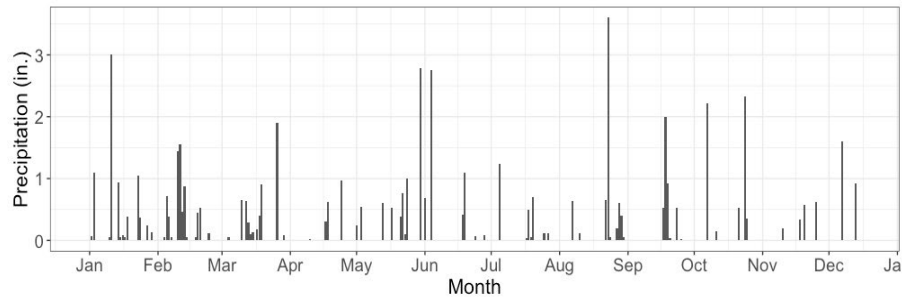
Stuttgart, AR

- Plant: 7/1
- Sample: 9/10
- Harvest: 11/7
- 3 treatments w/ 5 replicates.
- 2 cultivars (TN16520, S14-9017R)
- Non-irrigated condition.
- 15 ft. 4-row plots on 30" beds.

High Temperature by day



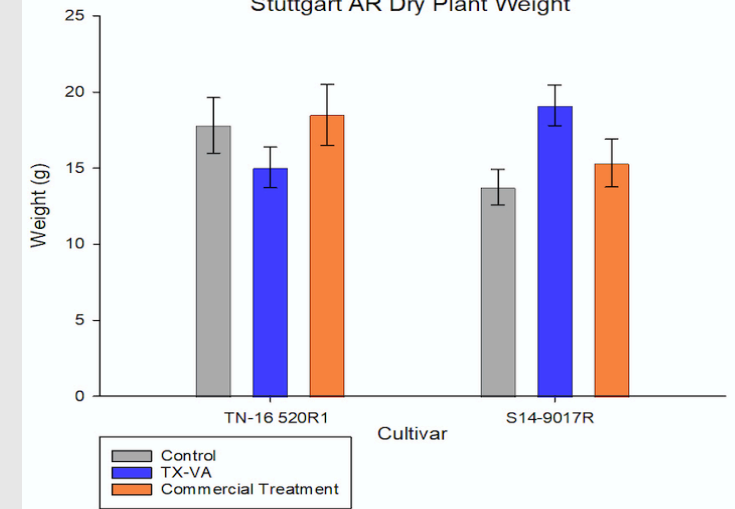
Avg. Precipitation by day



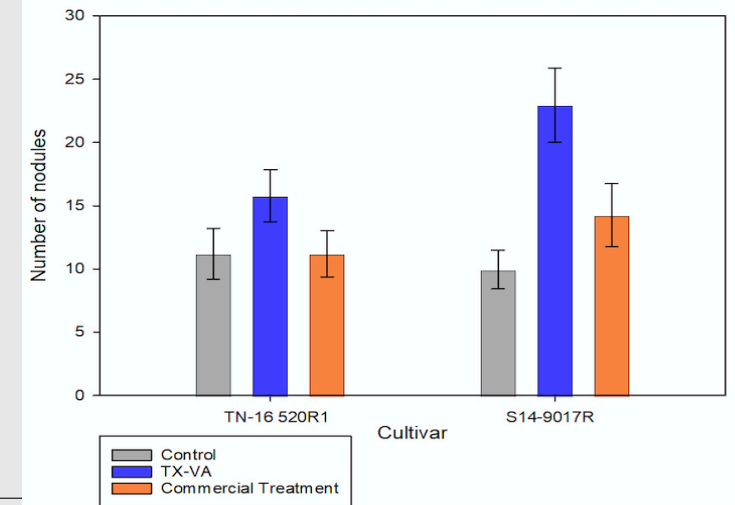
Stuttgart, Arkansas 2020



Stuttgart AR Dry Plant Weight



Total number of nodules





Summary of 2020 soybean yield in the Mid-South

<i>Final Yield (Bushels/acre)</i>	Yoakum, TX*		Jackson, TN		Portageville, MO		
	TN16	CZ5515LL	TN16	USG-7496	TN-16	S14	S11
Cell-Tech	14.0	7.6	51.7	43.4	55.5	64.7	62.7
TX-VA	19.4	12.4	53.3	51.9	61.4	67.4	64.4
<i>Final Yield (Bushels/acre)</i>	Stuttgart, AR		Stoneville, MS		Winnsboro, LA		
	TN16	S14	TN16	S14	TN16	CZ5515LL	USG-7496
Cell-Tech	26.5	21.6	53.2	49.4	33.4	15.1	22.3
TX-VA	27.5	24.4	46.8	58.0	33.5	16.1	24.4

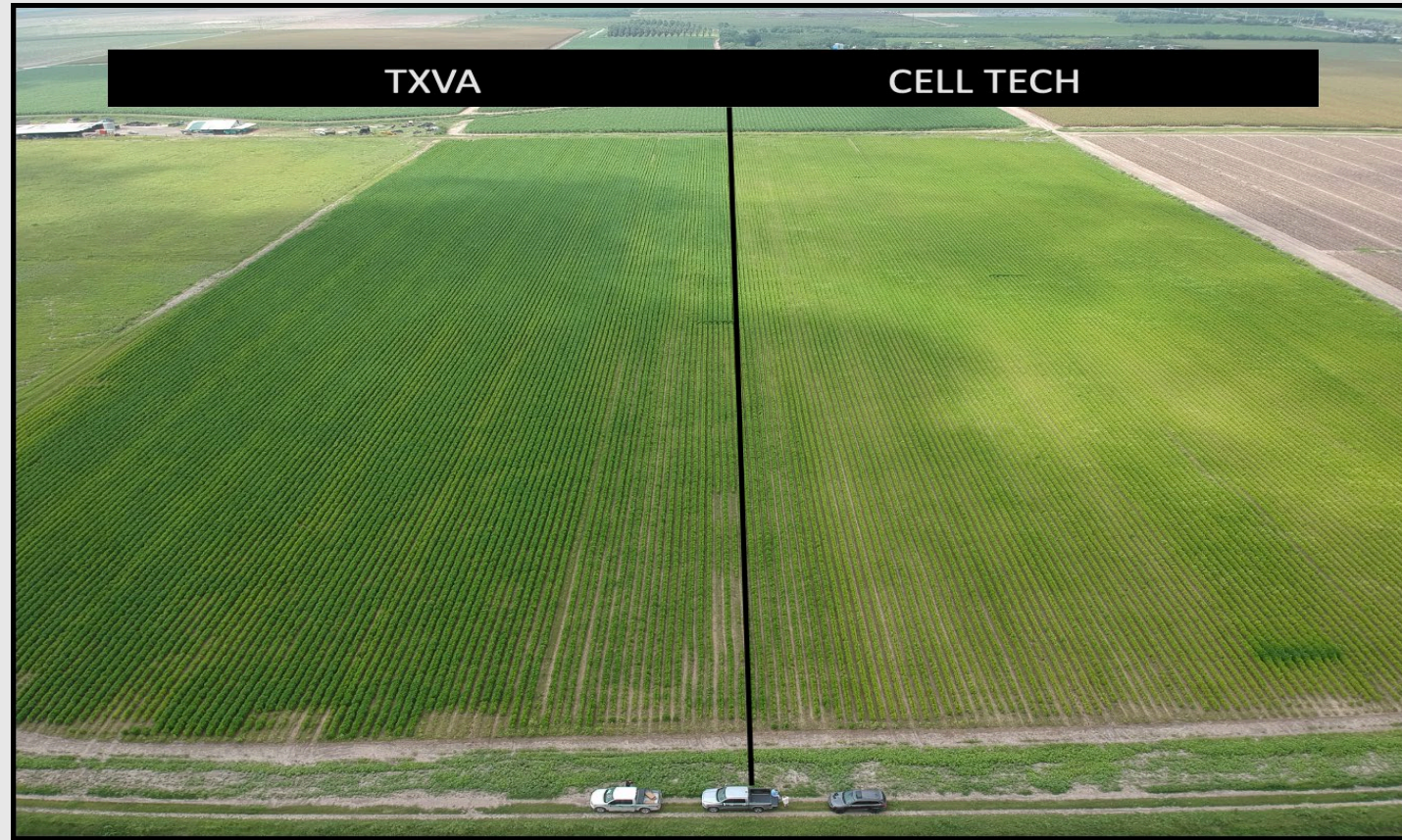
Cultivar information: TN16, TN16-520 (MG 4L), the same cultivar used in the previous year (2019); CZ5515LL (tall, bushy MG 5); **USG-7496** (drought-sensitive MG 4L); **S14, S14-9017R** (drought-sensitive MG 5); **S11, S11-20242C** (drought-tolerant MG 5).

* In the field at Yoakum, TX, it was too hot and dry in August, 2020.

Conclusions:

- 1) For the TN16 cultivar, we have similar results as those in the previous year (2019). There is a general uptrend by the drought-tolerant inoculant TXVA in all research sites, except Stoneville, MS.
- 2) For both drought-sensitive and tolerant cultivars, TXVA provides more benefits compared to the commercial inoculant Cell-Tech, specifically to the drought sensitive cultivars (highlight with yellow, red boxes).
- 3) An invention disclosure is underway to develop this novel drought-tolerant inoculant.

Commercial-sized plot testing in South Texas (Rio Grande Valley)



Vanderpool farm – 30 acre split plot.
Soil had no history of soybean production.

Commercial-sized plot testing in South Texas (Rio Grande Valley)

Fike farm



Fike Farm – 33 acre plot
(application alternating every 18 rows).

Soybean Yield (bushels/acre)

Location	TX-VA	Cell-Tech
Johnson farm (24 acre plot)	46	42
Fike farm (33 acre plot)	64	62

- * Planting date: 2/28 and 3/6 for Johnson and Fike farms
- * Harvest date: 7/20 and 7/21 for Johnson and Fike farms

Summary of 2021 field trials

Location	Field	Planting date	Sampling date	Harvest date	Cultivar used	Maturity Group
Yoakum, TX	Grichar Farm	3/18/21	6/23/21	8/20/21	TN16, S14*	4L, 5
Winnsboro, LA	Macon Ridge	5/27/21	8/5/21	10/4/21*	TN16, S14*, USG*	4L, 5, 5
Jackson, TN	West TN AgResearch	5/19/21	7/22/21	9/27/21*	TN16, USG*	4L, 5, 5
Portageville, MO	Lee Farm	5/19/21	7/20/21	10/4/21*	TN16, S14*, S11**	4L, 5, 5
Leland, MS	Stoneville USDA	6/3/21	8/4/21	10/11/21*	TN16, S14*, S11**	4L, 5, 5
Stuttgart, AR	Stuttgart	6/24/21	8/25/21	11/1/21*	TN16, S14*, S11**	4L, 5, 5
* Tentatively scheduled dates					* drought-sensitive	
					** drought-tolerant	

Whole-genome sequencing

- Whole genome of the novel drought-tolerant inoculant TX-VA has been sequenced.
- Illumina MiSeq V3 PE300 used at the UT-Austin genomic sequencing facility.
- Sequencing depth resulted in 260% coverage.
- Annotation is completed and comparative genomics are forthcoming.





Future Work

- Complete 2021 nodulation data.
- Harvest - final yield analysis for 2021.
- Analyze all 3 years of trials together.
- Invention disclosure to initiate the commercialization process.

- **Contact information:**

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