Final Report for 2022 National Peanut Board funding to the Texas Peanut Producers Board.

I. Subject area: Molecular Genetics & Breeding

Project Title: Breeding to Increase Peanut Yields and Production Efficiency by Developing Breeding Lines with Improved Drought and Heat Tolerance combined with Multiple Disease Resistance

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Sub-Project I-1 Multiple Disease Resistant Runner-type trials

The TAMU Peanut project had replicated yield trials located in South Texas, (Pearsall, Dilley, Yoakum and Derby), in Central Texas (Stephenville, Gustine and Highland), in West Texas, (Brownfield, Seminole, Denver City, and Plains), the High Plains (Wellington) and in the

Rolling Plains (Vernon). We conducted 6 small plot Advanced Line Tests (ALT's) and 2 large plot Combine Trials across Texas in 2022 as well as two replicated screening nurseries for Sclerotinia and Leafspot resistance. We narrowed down lines developed for drought tolerance to one high performing line that has been targeted for release and continued collecting accurate information on the line's performance across the state. This line will represent the first drought resistant runner released from our program. In our ALT's two release candidates were included from previous year's results. Thirteen breeding lines were included. Six lines were top performing lines from the 2021 ALT and the remaining 7 lines were top performers in the 2021 Multiple Disease Resistance Test and from the High Yield and Grade tests, and 5 commercial checks Georgia 16HO, AG18, Georgia 09B, Georgia 14N, and NemaTAM II were also included. In 2022 the entire state of Texas was subjected to a prolonged drought that began in the fall of 2021. This caused overall testing for the year to be highly variable. The temperature extremes caused issues with growers' ability to apply irrigation in large enough amounts to overcome the high evapotranspiration rates and do this consistently across the season. Another unexpected consequence of the drought was extreme animal damage to our small plot research. Control measures were put in place but ultimately at some locations the research plots were the only thing green in the area and the plots were a total loss. As mentioned yield and grade data were highly variable for both yield and grade across most locations. Across the state results for individual test were statistically revealing, but when combined the yield and value per acre results did not prove to be statistically significant. However, for brevity, the combined analysis is presented for discussion (**Table 1**).

Table 1. Combined analysis of all Advanced Line Runner Tests across Texas in 2022

	Pods/Ac Lbs.		Value/Ac $		TSMK %		Seed Wt g/100		Seed/Lbs		SS%		Plant Height (cm)	
Cultivar														
TxL100212-03-03	5732	A	1049.24	A	74.3	ABC	67.9	A	674	E	4.9	ABCDE	40	A
TP200606-3-7	5677	AB	1038.48	AB	74.3	ABC	69.7	A	656	E	2.7	GH	40	A
TP200625-3-2	5653	AB	996.77	ABC	71.3	F	60.0	CD	764	BC	4.2	CDEFG	36	AB
NemaTAM II	5645	AB	1024.63	AB	72.6	DEF	69.9	A	654	E	5.5	ABC	34	AB
TP200606-1-8	5602	AB	1008.36	ABC	72.1	EF	67.0	A	684	E	3.1	FGH	35	AB
TP200609-2-15	5598	AB	1040.03	A	74.3	ABC	59.3	CD	772	ABC	6.2	A	34	AB
TP200607-1-2	5519	ABC	977.00	ABC	71.8	EF	61.5	C	747	C	4.6	BCDE	35	AB
TP200610-3-2	5451	ABC	1021.05	AB	75.1	AB	61.8	C	741	C	4.2	CDEFG	33	AB
Georgia 09B	5446	ABC	1009.39	ABC	74.2	BC	60.5	CD	760	C	6.1	AB	35	AB
Georgia 16HO	5436	ABC	1000.93	ABC	73.8	BCD	66.5	AB	688	E	5.7	AB	34	AB
TP200610-4-6	5400	ABC	1000.71	ABC	74.5	ABC	59.6	CD	768	ABC	6.2	A	34	AB
TP200607-1-16	5370	ABC	973.16	ABC	72.5	DEF	61.6	C	742	C	4.2	CDEF	35	AB
TP200610-3-1	5346	ABC	996.63	ABC	74.6	ABC	62.7	BC	739	CD	6.0	AB	33	AB
TP200606-2-9	5321	ABC	971.49	ABC	73.2	CDE	61.7	C	740	CD	3.1	FGH	38	AB
Tx144370	5264	ABC	948.28	ABC	72.0	EF	61.3	C	745	C	5.2	ABCD	35	AB
TP200606-3-10	5246	ABC	940.32	ABC	72.1	EF	61.2	C	748	C	3.5	EFG	36	AB
AG18	5192	ABC	937.91	ABC	72.4	DEF	59.7	CD	767	ABC	1.8	H	37	AB
Georgia 14N	5054	BC	953.38	ABC	75.9	A	56.6	D	813	A	4.9	ABCDE	33	B
TP200610-2-13	4941	C	904.89	BC	74.2	BC	56.6	D	810	AB	4.7	BCDE	34	AB
TP200606-7-10	4936	C	884.52	C	72.5	DEF	66.6	AB	693	DE	3.9	DEFG	32	B
Mean	5337		977.55		73.4		62.6		736		4.5		35	
CV(%)	23.5		24.2		4.1		12.1		12.3		66.3		38.4	
Entry "F"	ns		ns		ns		<.0001		<.0001		ns		ns	

Although yield was not statistically significant, numerically the release candidates, TxL100212-03-03, performed better than all commercial checks with yields of 5732 lbs/ac. Additionally, it was slightly better than Georgia 09B at 74.3% and 74.2% respectively for TSMK%. TP200606-3-7 was numerically the top yielding breeding line for yield at 5677 lbs/ac, while the breeding line TP200610-3-2 performed near the top of the test for TSMK% at 75.1% for the second year in a row.

We also conducted 9 other replicated runner trials for various traits of interest. Four trials were yield and grade trials with materials bred specifically for increased yield and grade. Five other trials were for a combination of multiple disease resistance traits. This is the first year of testing for some of this material. Lines that performed well in 2020 were advanced and were in test 1 or 2 of either the high yield and grade trials or the multiple disease resistance trials. All these tests were significant and are presented in summary charts 1-5, although in some cases variability between replications were higher than we would have liked, which, again, we are attributing to environmental effects during the season. A yield trial was conducted in Central Texas but due to heavy deer pressure the field was a total loss. Personnel attempted to apply wildlife deterrent in the form of physical barriers, over the top spray applications and late season hunting with no effect. The field in question was had the only green active growth in the area. A second yield trial was planted in South Texas and NemaTAM II performed at the top of the Trial (**Table 2**) for yield with a total of 4175 lbs/ac which was statistically better than Georgia 09B a 5343 lbs/ac.. The top grading line in the test was TP200624-1-4 with a grade of 76.8%. Results continued to be encouraging with the new breeding lines performing well in this test.

Table 2. Yield Test #2 in South Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		Plant height (cm)	
Cultivar														
NemaTam II	6475	A	1215.44	A	76.0	ABCD	77.6	A	584	E	2.8	CDEF	45	CDEFG
TP210624-2-1	6457	AB	1223.04	A	76.3	ABCD	68.7	BCDEFG	661	CDE	2.2	DEF	38	J
TP210624-3-4	6304	ABC	1182.22	AB	75.8	ABCD	74.3	ABCD	611	DE	3.5	BCDEF	48	BC
TP210624-3-1	6272	ABC	1185.97	AB	75.7	ABCDE	61.9	FG	780	B	5.9	BCD	47	BCD
Tx144370	6226	ABCD	1118.81	ABCD	72.0	F	67.3	DEFG	676	BCDE	5.5	BCDEF	43	EFGHI
TP220657-1-1-3	6127	ABCD	1161.49	ABC	76.1	ABCD	63.3	EFG	717	BCD	3.8	BCDEF	44	DEFGHI
Georgia 16HO	5753	ABCDE	1079.60	ABCDE	75.9	ABCD	76.2	ABC	595	E	6.3	BC	43	FGHI
TP210624-3-3	5708	BCDE	1043.90	BCDE	74.0	DEF	76.6	AB	593	E	2.0	EF	46	BCDEFG
TP220657-1-1-4	5693	CDE	1060.80	BCDE	74.6	BCDE	68.2	CDEFG	668	BCDE	3.8	BCDEF	42	GHI
TP210624-4-1	5659	CDE	1084.06	ABCDE	76.8	AB	71.3	ABCDE	636	CDE	3.3	CDEF	49	B
TP210624-5-1	5638	CDE	1060.93	BCDE	74.3	CDEF	67.1	DEFG	676	BCDE	4.8	BCDEF	45	DEFG
TP210627-4-1	5505	DE	1060.33	BCDE	76.7	AB	66.4	DEFG	684	BCDE	5.6	BCDEF	43	EFGHI
TP210611-1-3-1	5489	DE	1043.33	BCDE	76.1	ABCD	69.6	ABCDEF	652	CDE	1.8	F	45	CDEFG
Georgia 09B	5343	EF	1019.78	CDEF	77.0	A	70.6	ABCDE	644	CDE	4.2	BCDEF	44	DEFGHI
TP210651-2-1	5314	EFG	1005.31	DEF	76.3	ABCD	66.9	DEFG	679	BCDE	2.9	CDEF	44	DEFGH
AG-18	5203	EFG	985.87	DEF	76.5	ABC	69.8	ABCDEF	651	CDE	2.4	DEF	46	BCDEF
TP210651-2-3	5159	EFG	965.83	EFG	74.9	ABCDE	67.2	DEFG	675	BCDE	5.8	BCDE	41	IJ
TP210650-3-1	4695	FGH	884.83	FGH	75.0	ABCDE	61.1	G	745	BC	5.7	BCDE	46	BCDE
TP210642-1-1	4575	GH	830.38	GH	68.9	G	44.7	H	1023	A	7.2	AB	56	A
TP210646-1-1	4301	H	814.56	H	73.5	EF	49.8	H	917	A	10.6	A	41	HIJ
Mean	5595		1051.32		75.1		66.9		693		4.5		45	
CV	12.7		13.0		3.2		13.4		17.4		65.8		8.9	
Entry "F"	<.0001		0.0002		0.0001		<.0001		<.0001		0.0072		<.0001	

Finally, a third yield trial was also planted in South Texas (**Table 3**). This test contained several breeding lines that are root-knot nematode resistant. In this trial the breeding line TP220663-12RN yielded 6820 lbs/ac which was statistically better than all the commercial checks except AG18 which produced 6073 lbs/ac. It was also the highest grading breeding line in the test with a TSMK% of 73.7%. This was second only to AG18 which topped the test at 76.6%.

Table 3. Yield Test #3 in South Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Plant height (cm)	
Cultivar												
TP220663-3RN	6820	AB	1249.52	A	73.7	ABCD	72.4	ABC	626	FGH	55	ABC
TP220663-12RN	6653	A	1159.78	A	69.4	DEF	63.7	BCDEF	713	EFG	50	BCDE
TP220663-14RN	6371	AB	1169.98	A	72.3	CD	53.9	HIJ	850	ABC	51	BCDE
TP220663-5RN	6163	ABC	1113.15	ABC	71.6	CDE	57.6	FGHI	787	BCDE	58	A
TP220663-11RN	6096	ABCD	1099.29	ABCD	69.7	DEF	54.0	HIJ	845	ABC	51	BCD
AG-18	6073	ABCD	1166.85	A	76.7	A	63.1	CDEF	723	DEFG	53	ABC
Georgia - 06G	5891	BCDE	1116.22	AB	76.1	AB	75.6	A	600	H	50	BCDE
Georgia 16HO	5878	BCDE	1108.01	ABCD	76.1	AB	68.3	BC	665	FGH	46	E
TP220663-8RN	5564	CDEF	1000.16	BCDE	70.9	CDEF	56.1	GHI	809	BCD	55	ABC
TP220661-7RN	5535	CDEF	988.47	BCDEF	70.1	CDEF	59.1	DEFGHI	768	BCDE	55	AB
TP220663-7RN	5503	CDEF	989.59	BCDEF	70.9	CDE	65.1	BCD	698	EFG	53	ABC
TP220663-13RN	5399	DEFG	975.72	CDEF	71.2	CDE	60.5	DEFGH	756	CDEF	50	CDE
TP220663-9RN	5388	DEFG	956.08	EF	67.6	F	48.6	J	939	A	50	CDE
Georgia 09B	5354	DEFG	972.89	DEF	72.7	CD	62.8	CDEFG	724	DEFG	47	DE
TamRun OL19L	5294	EFG	971.83	DEF	73.2	BC	64.8	BCDE	701	EFG	47	DE
TP220663-1RN	5290	EFG	978.83	BCDEF	73.4	BC	70.2	AB	646	GH	51	BCDE
TP220663-6RN	5211	EFG	945.33	EF	71.9	CD	63.8	BCDEF	712	EFG	50	CDE
TP220663-10RN	5112	FG	901.81	EF	68.5	EF	61.0	DEFG	744	DEF	54	ABC
TP220663-4RN	4721	G	857.77	F	71.2	CDE	52.7	IJ	861	AB	50	BCDE
TP220661-10RN	2144	H	353.04	G	62.4	G	58.1	EFGHI	782	BCDE	46	DE
Mean	5501		999.68		71.5		61.3		750		51	
CV	18.1		19.2		5.1		11.7		12.2		8.3	
Entry "F"	<.0001		<.0001		<.0001		<.0001		<.0001		0.0026	

In addition to conducting trials for improved yield and grade we also continued testing several new populations that were created in an effort to combine leafspot resistance, sclerotinia resistance and nematode resistance. Multiple Disease Resistance Trial #1 (**Table 4**) was grown in South Texas and contained lines from several years of crossing programs and represents the lines that have been tested in multiple seasons.

Table 4. Multiple Disease Resistance Test #1 in South Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		Plant height (cm)	
Cultivar														
NemaTam II	6599	A	1170.74	A	70.6	EFG	68.4	BCD	666	HIJ	10.1	CDEFG	50	AB
TP200610-4-9	6209	AB	1148.10	AB	74.0	ABCD	61.1	GH	743	CDEF	6.8	EFGHI	46	BCDEFG
TamRun OL18L	6087	ABC	1091.99	ABC	71.8	DEFG	68.2	BCDE	665	HIJ	12.3	ABCD	51	AB
TP200610-3-6	5972	ABCD	1093.62	ABC	73.1	CDEF	66.7	CDEF	680	GHI	4.3	HI	45	CDEFG
Tx144370	5885	ABCD	1038.76	ABC	70.3	FG	63.9	DEFG	713	FGH	6.0	GHI	46	BCDEF
TP200610-4-4	5884	ABCD	1082.47	ABC	73.8	ABCD	59.2	GH	768	BCD	10.5	BCDEF	44	EFG
TP200610-2-10	5839	BCDE	1096.04	ABC	75.2	ABC	60.5	GH	753	BCDEF	9.7	DEFG	40	G
AG-18	5810	BCDE	1064.63	ABC	73.4	BCDE	63.9	DEFG	712	FGH	3.5	I	50	ABC
Georgia 09B	5784	BCDE	1054.86	ABC	72.9	CDEF	63.5	EFG	714	EFGH	14.5	AB	50	AB
TP200609-3-14	5750	BCDE	1066.84	ABC	74.1	ABCD	75.6	A	601	K	14.2	ABC	48	ABCDE
TamRun OL19	5607	BCDE	998.43	C	70.0	G	69.0	BC	658	IJ	9.3	DEFG	48	ABCDE
Georgia 16HO	5596	BCDE	1006.04	BC	72.2	DEFG	72.8	AB	623	JK	6.5	FGHI	44	DEFG
TP200610-2-4	5581	BCDE	1058.75	ABC	76.4	A	59.6	GH	761	BCDEF	9.5	DEFG	45	DEFG
TP200609-2-11	5524	BCDE	982.64	C	70.3	FG	60.1	GH	756	BCDEF	7.4	EFGHI	45	CDEFG
Georgia 14N	5424	CDE	1031.91	ABC	76.2	AB	59.4	GH	765	BCDE	14.2	ABC	40	G
TP200610-1-17	5390	CDE	997.36	C	74.3	ABCD	56.8	H	799	B	10.8	BCDE	42	FG
TP200606-3-10	5370	CDE	974.55	C	72.4	DEFG	62.8	FG	722	DEFG	3.2	I	52	A
TamRun OL11	5347	DE	989.72	C	74.4	ABCD	66.6	CDEF	682	GHI	4.1	HI	50	ABCD
TP200608-3-7	5132	E	955.97	C	74.3	ABCD	57.5	H	790	BC	16.0	A	43	EFG
TP220714-2	4265	F	747.42	D	66.1	H	41.6	I	1096	A	7.7	EFGH	53	A
Mean	5653		1032.54		72.8		62.9		733		9.0		47	
CV	11.6		12.2		3.9		11.8		14.2		50.6		10.0	
Entry "F"	0.0034		0.006		<.0001		<.0001		<.0001		<.0001		0.0002	

The best yielding line at this location was NemaTAM II which yielded 6599 lbs/ac and was statistically better than Georgia 09B which yielded 5784 lbs/ac. Both NemaTAM II and Georgia 09B had plant height measurements of 50 cm at this location. The top grading breeding line was TP200610-2-10 with a grade of 76.4% which was numerically higher grading check Georgia 14N which graded 76.2%.

Multiple Disease Resistance tests #2 and #3 were also grown in South Texas (**Table 5-6**). At these locations several new breeding lines performed very well with respect to yield; within Test #2 TP220670-3-1 yielded the most at 6656 lbs/ac. It was also in the top statistical grouping for grade with a TSMK of 77.7%. This line numerically and statistically outperformed the commercial checks Georgia 09B for both yield and grade, which was 5427 lbs/ac and 73.9% (**Table 5**). In Test #4 TP200625-3-4 yielded 6571 lbs/ac, which was also statistically better than Georgia 09B and AG18 for yield and equal to Georgia 16HO in plant height (**Table 6**). An additional MDR #4 test was planted at the Stephenville center but was lost due to animal feeding as mentioned before.

Table 5. Multiple Disease Resistance Test #2 in South Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		Plant height (cm)	
Cultivar														
TP220670-3	6656	A	1276.07	A	77.7	ABC	73.3	A	621	G	6.3	ABC	53	ABCD
TP220670-2	6208	AB	1178.01	AB	76.8	ABCD	66.4	BCDE	683	DEFG	9.0	A	52	ABCDE
TP220670-13RN	6093	ABC	1189.53	AB	78.3	AB	65.5	CDE	693	CDE	6.6	ABC	50	ABCDE
TP210628-1-1	6074	ABC	1111.46	ABC	73.6	FG	65.7	CDE	691	CDE	2.9	E	50	CDEF
TP220670-16RN	6048	ABC	1117.44	ABC	74.0	EFG	72.5	AB	626	FG	5.9	BCD	55	A
TP220670-12RN	5959	ABC	1127.44	ABC	75.5	CDEFG	71.0	ABC	644	EFG	7.7	AB	45	FG
TP210625-3-1	5892	ABC	1107.75	ABC	75.6	BCDEFG	69.8	ABC	652	EFG	6.1	BCD	54	ABC
TP220670-7RN	5869	ABC	1131.46	ABC	76.9	ABCD	67.3	ABCD	674	DEFG	5.2	BCDE	53	ABCD
TamRun OL18L	5862	ABC	1072.52	BC	73.2	G	68.6	ABCD	662	EFG	5.5	BCDE	53	ABCD
TP220670-1RN	5833	ABC	1120.51	ABC	77.1	ABCD	66.3	CDE	685	CDEF	4.6	CDE	52	ABCDE
AG18	5694	ABC	1087.54	ABC	76.1	BCDEF	59.1	FGH	769	AB	3.3	DE	51	ABCDE
Tx144370	5546	BC	1032.05	BC	73.7	FG	58.5	GH	775	AB	7.1	ABC	46	EFG
Georgia 09B	5448	BC	1009.50	BC	73.9	EFG	62.6	DEFG	728	BCD	5.2	BCDE	49	CDEFG
TP220670-8RN	5422	BC	1017.50	BC	75.7	BCDEFG	70.8	ABC	642	EFG	4.5	CDE	49	CDEFG
Georgia 16HO	5387	BC	1026.77	BC	75.9	BCDEF	68.5	ABCD	671	DEFG	4.9	BCDE	48	DEFG
TP220670-9RN	5349	BC	1013.14	BC	76.5	BCDE	65.1	CDEF	700	CDE	7.3	ABC	55	AB
TP220670-14RN	5315	BC	1014.58	BC	75.4	CDEFG	60.9	EFGH	748	BC	5.1	BCDE	50	BCDEF
TP220670-4	5240	BC	982.12	C	74.6	DEFG	67.4	ABCD	674	DEFG	6.7	ABC	52	ABCDE
Georgia 14N	5212	BC	1033.71	BC	79.4	A	55.3	H	823	A	6.0	BCD	45	G
TP220670-3RN	5116	C	959.91	C	75.0	DEFG	58.4	GH	778	AB	5.0	BCDE	50	CDEFG
Mean	5711		1080.45		75.8		65.7		697		5.7		51	
CV	11.1		11.4		2.8		9.3		9.5		37.1		7.9	
Entry "F"	NS		NS		0.0011		<.0001		<.0001		0.0219		0.0052	

Table 6. Multiple Disease Resistance Test #3 in South Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		Plant height (cm)	
Cultivar														
TP210625-3-4	6571	A	1161.43	AB	71.8	DEF	77.0	C	590	G	2.7	ABCDE	46	AB
TP210614-1-1-1	6388	AB	1219.25	A	77.5	ABC	66.4	EFG	684	CDE	3.0	ABCDE	45	ABCD
TP210615-2-2-1	6170	ABC	1134.96	AB	74.9	ABCDE	71.5	D	635	F	2.7	ABCDE	40	CDEF
Tx144370	6152	ABC	1149.64	AB	75.8	ABCD	69.0	DE	658	EF	4.5	AB	40	CDEF
TP210621-2-1-5	5962	ABC	1075.90	AB	73.1	CDEF	77.9	C	583	GH	1.8	CDE	39	DEFGH
TP210625-3-8	5940	ABC	1105.06	AB	75.9	ABCD	69.7	DE	651	EF	3.0	ABCDE	41	CDEF
Georgia 16HO	5920	ABC	1099.11	AB	75.7	ABCD	76.8	C	592	G	2.2	BCDE	46	ABC
TP200625-3-2	5908	ABC	1025.03	ABCD	69.4	F	67.0	EF	678	DE	3.3	ABCD	48	A
TP210614-1-2-1	5858	ABC	1074.18	AB	75.7	ABCD	61.5	HI	739	AB	3.9	ABC	36	FGH
TP200609-3-11	5814	ABCD	1147.78	AB	79.7	A	77.4	C	586	GH	2.2	BCDE	36	EFGH
TP200609-2-9	5483	BCDE	1005.08	ABCD	74.3	BCDEF	71.3	D	637	F	1.7	CDE	38	EFGH
Georgia 09B	5427	BCDE	1071.53	ABC	79.6	A	68.1	DEF	667	DEF	2.6	ABCDE	42	BCDE
AG18	5418	BCDE	981.67	BCD	72.9	CDEF	68.8	DE	660	EF	0.9	DE	37	EFGH
TP210613-6-1-1	5387	BCDE	976.14	BCD	73.5	CDEF	60.3	I	752	A	0.6	E	34	H
TP210612-3-1-1	5299	CDE	998.34	ABCD	76.3	ABCD	82.8	B	548	H	2.3	BCDE	34	GH
TP210614-2-1-5	5244	CDE	976.39	BCD	75.3	ABCDE	60.9	HI	745	A	4.9	A	41	BCDEF
Georgia 14N	5174	CDE	1013.40	ABCD	79.2	AB	62.9	GHI	723	ABC	2.4	ABCDE	40	DEFG
TP210615-2-1-1	5141	CDE	1003.57	ABCD	78.7	AB	92.1	A	493	I	3.5	ABC	41	BCDE
TP210643-1-8	4768	DE	838.74	CD	70.4	EF	64.4	FGH	705	BCD	2.1	BCDE	49	A
TP210615-2-3-1	4672	E	826.87	D	72.9	CDEF	62.7	GHI	725	AB	4.1	ABC	44	ABCD
Mean	5635		1044.20		75.1		70.4		653		2.7		41	
CV	12.9		14.6		5.1		12.0		11.2		60.4		12.5	
Entry "F"	0.0429		ns		0.0039		<.0001		<.0001		ns		<.0001	

In closing for this section, 4 large plot combine trials were conducted at several different locations, one in the High Plains, one in South Texas and 2 in Arkansas were conducted using 2 row combines. In our program, large plot trials are used as a final look before release to evaluate how candidate breeding lines perform and the more locations we can do this the more accurate a reading we can get on large scale harvest. Dr. Travis Faske is the Arkansas Extension Pathologist and has graciously agreed to evaluate our materials in his environment. Additionally we routinely participate in Dr. Emi Kimura Statewide variety trials with our most advanced lines. The High Plains combine trial contained all the lines evaluated in the small plot Advanced Line Trial but only yield data was collected (**Table 7**). TP 200606-2-9 was the top yielding breeding line in the test at 5941 lbs/ac. Additionally, the release candidate x144370 performed in the same statistical grouping and both lines have multiple disease resistance line. Both lines performed statistically better than the commercial check Georgia 09B at 4181 lbs/ac.

Table 7. Advanced Line Combined Test on the High Plains for 2022

	Pods/Ac. Lbs.	
Cultivar		
TP200606-2-9	5941	A
TX144370	5471	AB
TP200625-3-2	4948	ABC
Georgia 14N	4438	ABC
AG18	4438	ABC
NemaTAM II	4247	BC
Georgia 09B	4181	BC
TxL100212-03-03	4155	BC
TP200606-3-7	3602	C
Mean	4584	
CV(%)	22.2	
Entry "F"	0.1032	

The South Texas combine trial included specific lines that are under consideration for release (**Table 8**). Release canidate Tx144370 was the top yielding breeding line in the test at 5800 lbs/ac, which was numerically greater than Georgia 16HO, which yielded 4588 lbs/ac. Tx144370 also had a plant height of 43 cm, similar to Georgia 16HO at 42 cm. Finally a new opportunity to evaluate our lines in an additional environment arose. We evaluated our lines in 2 locations in (varietytesting.tamu.edu) and the

Arkansas Extension Cotton Research Series Report. **Tables 9-12** are abbreviated results from those trials. A complete presentation of the data can be found at the Texas A&M AgriLife Extension peanut variety testing website (varietytesting.tamu.edu) and the Arkansas Extension Cotton Research Series Report.

Specific lines considered for release will be discussed later.

Table 8. Advanced Line Combine Trial in South Texas for 2022

	Pods/Ac. Lbs.		Plant Height	
Cultivar				
Tx144370	5800.7		43	
TP200606-7-10	5310.7		50	
TP200606-2-9	4766.2		48	
TP2000606-3-10	4886.0		49	
NemaTAM II	5488.6		46	
Gerogia 16HO	4588.3		42	
Diesel Nut (31-08-05-03)	4399.6		43	

Table 9. Arkansas Variety Trial in Mississippi Co. for 2022

	Oil Type	Seed Source	Stand Count		Pobs/Ac Lbs.		TSMK %	
Cultivar								
Georgia 16HO	High O/L	Alabama Crop Improvement Association	55	A	6,997	A	74	
Georgia 06 G	Standard	Georgia Seed Development, Plains, GA	49.8	BCB	6,870	A	76	
Georgia 09B	High O/L	Alabama Crop Improvement Association	51	ABC	6,757	A	75	
Georgia GA20VHO	High O/L	Georgia Seed Development, Plains, GA	50.4	ABC	6,707	A	79	
Georgia 18RU	Standard	Georgia Seed Development, Plains, GA	53.2	ABC	6,340	AB	76	
AG18	High O/L	Texas A & M AgriLife Research	55.2	A	6,286	AB	74	
ARSOK R96-8	High O/L	Oklahoma State/USDA	48	C	6,201	AB	68	
NemaTAM II	High O/L	Texas A & M AgriLife Research	50.6	ABC	6,128	AB	73	
Tamrun OL18L	High O/L	Texas A & M AgriLife Research	50.8	ABC	6,126	AB	68	
ARSOK R95-1	High O/L		53	ABC	6,102	AB	75	
ARSOK R93-1	High O/L	Oklahoma State/USDA	53.4	ABC	5,609	B	74	
Tamrun OL19L	High O/L	Texas A & M AgriLife Research	47.8	C	5,406	B	72	

aStand count is total number of plants per 10 row ft.

bMeans with different letters indicate a significant difference at $\alpha = 0.05$ according to Fishers LSD test.

Table 10. Arkansas Variety Trial in Jackson Co. for 2022

	Scl Rating	Pobs/Ac Lbs.
Cultivar		
Tamrun OL 18L	27	4804
Tamrun OL 19	48	3984
AG18	10	4925
NemaTAM II	11	4723

.20% DIof tomato spotted wilt in the test

Table 11. Texas Variety Trial in Central Texas in 2022

	Pods/Ac. Lbs.		TSMK %		Seed Wt g/100		Splits	
Cultivar								
Contender	8701		155.2		43.2		19.0	
Georgia 09B	8113		40.6		83.0		26.0	
AG18	8042		169.0		55.0		10.7	
NemaTam II	7673		167.0		59.1		17.9	
Georgia 16HO	7559		164.9		64.7		20.6	
IPG QR-14	7462		162.5		58.6		23.1	
AT9899	7181		88.9		76.6		24.0	
Tx144370	6996		161.7		54.7		20.7	
OLe	6895		159.8		58.7		16.8	
Span 17	6877		161.7		54.7		20.7	
ACI 442	6803		88.9		76.6		24.0	
Lariart	6761		159.7		63.4		20.1	

Table 12. Texas Variety Trial in South Texas for 2022

	Pods/Ac. Lbs.	
Cultivar		
TP200606-3-10	4927	
Comrade	4724	
Tx144370	4608	
TxL100212-03-03	4453	
AG-18	4375	
Contender	4279	
AT 9899	4230	
IPG 914	4153	
GA 09B	4114	
NemaTam II	3988	
Span 17	3920	
IPG 3628	3901	
IPg 1288	3707	
GA 16HO	3262	
GA	3223	
Ole	3098	
Schubert	3098	
TP200652-1-1	2865	
Olin	2633	
Tamval OL14	1878	

Spanish-type Yield Trials

We expanded our testing of Spanish-type lines in West Texas during the 2022 growing season with new breeding lines entering testing for the first time. Breeding lines represent true Spanish growth and hybrid Spanish growth types. Growing conditions were difficult in West

Texas and the test results reflected these conditions. During the 2022 season we conducted 4 Spanish tests consisting of 47 breeding lines, 5 commercial checks: and 3 historic varieties for disease evaluation. Two of the trials were grown in certified organic fields and will be discussed in a later section.

Spanish Test #1 (**Table 13**) was grown in West Texas under conventional production and on the rolling plains under organic conditions. During the middle of the season the grower could not keep irrigation levels high enough to meet evapotranspiration levels and it is highly possible is limited yield and grade. The test contained 16 breeding lines with various combinations of nematode and sclerotinia resistance. TP210656-2-1 is a hybrid Spanish candidate release that yielded and graded statistically better than any other line in the test with an overall yield of 5020 lbs/ac. and a TSMK% of 74.5%. Seed size was limited in this test but was equal to Tamspan 90 in statistical comparison.

Table 13. Spanish Test #1 in West Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		Plant height (cm)	
Cultivar														
TP210656-2-1	5020	A	943.84	A	74.5	A	42.7	ABC	1072	FGH	2.9	F	24	G
TP210641-5-1	4269	B	713.02	B	64.4	DEFGH	41.6	ABCDE	1112	EFGH	13.3	BCD	34	BCDE
Tamspan 90	3941	BC	693.58	BC	69.4	B	42.2	ABCD	1077	FGH	8.5	DEF	36	AB
TP210641-4-3	3670	BCD	620.05	BCDE	63.5	EFGHI	30.6	HI	1484	A	5.1	EF	39	A
Tamnut OL06	3610	CD	623.80	BCD	68.8	BC	43.4	AB	1046	GH	5.1	EF	35	BC
TP210655-1-1	3534	CDE	609.15	BCDEF	65.2	CDEFGH	29.7	I	1530	A	22.2	A	31	EF
TP210641-1-1	3475	CDE	582.32	DEFG	62.4	GHI	29.4	I	1543	A	8.2	DEF	32	CDEF
TP210652-2-3	3402	CDEF	590.08	CDEFG	64.5	DEFGH	31.4	HI	1454	A	17.1	AB	30	F
TP210640-2-1	3384	CDEF	599.57	CDEF	68.5	BCD	36.7	EFG	1239	DE	7.3	DEF	36	AB
Schubert	3370	CDEF	552.55	DEFGH	65.2	CDEFGH	44.6	A	1020	H	2.9	F	35	BC
TP210653-2-2	3295	CDEF	568.41	DEFG	66.4	BCDEFG	35.7	FGH	1284	BCD	16.2	ABC	34	BCD
TP210641-4-1	3248	DEF	501.39	FGHI	57.8	J	32.5	GHI	1401	AB	10.3	BCDE	34	BC
#00-16	3109	DEFG	503.16	FGHI	60.8	IJ	38.2	CDEF	1189	DEFG	5.0	EF	31	DEF
TP210631-4-1	3088	DEFG	503.48	FGHI	61.7	HIJ	38.1	CDEF	1191	DEFG	4.8	EF	33	BCDEF
TP210655-3-2	3026	DEFG	525.41	DEFGH	67.3	BCDE	32.5	GHI	1397	ABC	8.6	DEF	33	BCDEF
Olin	2950	EFG	512.39	EFGHI	66.6	BCDEF	39.2	BCDEF	1163	DEFGH	8.3	DEF	33	BCDEF
TP210639-4-1	2932	EFG	487.51	GHI	62.7	FGHI	36.7	EFG	1241	DE	12.1	BCDE	34	BCDE
TP210631-2	2769	FG	457.57	HI	63.0	FGHI	38.5	BCDEF	1180	DEFG	10.5	BCDE	31	CDEF
TP210639-4-1B	2569	G	408.53	I	61.2	HIJ	37.4	DEFG	1215	DEF	9.6	CDEF	34	BCD
TP210633-3-1	1569	H	259.71	J	62.1	HI	37.0	EFG	1251	CDE	10.6	BCDE	33	BCDEF
Mean	3311		562.78		64.8		36.9		1254		9.4		33	
CV	22.8		26.0		6.5		14.3		14.4		66.0		9.9	
Entry "F"	<.0001		<.0001		<.0001		<.0001		<.0001		0.0003		<.0001	

The Hybrid Spanish Test (**Table 14**) was located in the same field on Gaines/Yoakum Co. Line and faced similar production challenges as the Spanish Test #1. "Hybrid Spanish" lines are lines that are runner in appearance, but have small, Spanish-size seeds. The advantage is higher yield as runners, but maturity is less than Spanish. The top yielding and grading line in the test was TP 200610-2-2 with a yield of 5486 lbs/ac and a grade of 77.1%. The size of the breeding lines varied with TP 210627-5-1 being the largest seeded line in the test at 54.9 g/100 seed, which was statistically equal to Schubert at 54.2 g/100 seed. In contrast the smallest sized line in the test was a sister line from the same original cross, TP 220708-3-1, which had a g/100 seed weight of 43.9 g/100. As mentioned, the best performing of the lines from both tests will be carried forward into 2023 with continued testing and new lines being added.

Table 14. Hybrid Spanish Test in West Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		Plant height (cm)	
Cultivar														
TP200610-2-2	5486	A	1038.42	A	77.1	ABCD	51.2	ABC	888	CDEF	3.0	BC	24	CDE
TP200610-2-6	5447	AB	1042.38	A	77.7	ABCD	50.9	ABCD	893	CDEF	2.9	BC	24	CDE
TP200610-2-10	5362	AB	1023.83	AB	78.0	ABC	51.5	ABC	880	CDEF	4.7	ABC	26	BCD
TP200610-1-16	5337	AB	987.39	ABC	75.3	ABCDE	51.1	ABC	889	CDEF	2.2	BC	22	DE
TP200610-1-13	5287	AB	1028.38	A	78.9	A	50.0	ABCDE	907	BCDEF	5.2	ABC	25	CDE
TP200610-2-8	5242	AB	1011.08	AB	78.4	AB	49.2	ABCDE	931	ABCDEF	2.6	BC	24	CDE
Georgia 14N	5217	AB	995.61	AB	77.5	ABCD	50.6	ABCD	900	BCDEF	5.1	ABC	23	DE
TP220708-3-3	5100	ABC	907.67	ABCDE	70.9	EFG	48.2	BCDE	947	ABCDEF	2.4	BC	22	DE
TP200610-2-3	5064	ABC	981.90	ABC	79.3	A	49.0	ABCDE	931	ABCDEF	4.0	ABC	24	DE
TP200610-4-5	5061	ABC	953.17	ABC	75.7	ABCD	47.6	BCDE	959	ABCDE	4.5	ABC	22	E
TP200609-1-2	5039	ABC	936.38	ABCD	73.4	DEF	46.6	CDE	977	ABCD	1.6	C	25	CDE
TP210627-5-1	4997	ABC	919.68	ABCDE	74.3	BCDEF	54.9	A	834	F	4.4	ABC	23	DE
TP220667-2	4801	ABCD	798.15	BCDE	65.5	H	46.4	CDE	983	ABC	2.9	BC	37	A
TP210629-3-1	4692	ABCD	881.58	ABCDE	74.9	ABCDE	50.8	ABCD	893	CDEF	8.6	A	22	DE
TP210613-6-1-3	4594	ABCD	863.92	ABCDE	76.4	ABCD	53.3	AB	856	DEF	6.5	AB	24	DE
TP220708-3-2	4514	ABCD	832.04	ABCDE	73.9	CDEF	49.4	ABCDE	925	ABCDEF	3.7	BC	26	BCD
TP220708-5A-1	4372	BCD	761.52	CDE	68.7	GH	52.3	ABC	873	CDEF	1.6	C	28	BC
Schubert	4001	CD	717.52	DEF	71.1	EFG	54.2	A	847	EF	1.8	BC	34	A
TP220708-3-1	3849	DE	697.31	EF	70.5	FG	43.9	E	1041	A	2.2	BC	29	B
Olin	2820	E	499.50	F	70.0	FG	44.4	DE	1022	AB	5.9	ABC	34	A
Mean	4814		893.87		74.373333		49.8		919		3.8		26	
CV	17.5		20.1		5.8		9.2		9.3		79.6		18.1	
Entry "F"	0.0025		0.0013		<.0001		0.0996		NS		0.3111		<.0001	

Resistant Spanish-types

We continue to cross with breeding line Tx144432 and Georgia 14N which is high oleic and nematode resistant lines or cultivars. The seed size of the Spanish line is below average and further crossing is needed. We continue to make crosses with released varieties OLin, Tamnut OL06, and Schubert as well as other selected runner or hybrid Spanish germplasm to develop ment populations for testing. These are continually increased in our greenhouses over the summers crossing and then planted in Yoakum for evaluation and entry into testing.

Sub-Project I-2 Drought Tolerant Runner and Spanish-type yield trials

Two runner populations have been grown and tested at two locations – the USDA-ARS in Lubbock and the Lubbock AgriLife Center, where we could grow plots under drought conditions that commercial growers would like to avoid. The materials at the ARS have been photographed using weekly UAS overflights scheduled by Dr. Payton (who last year accepted a job in private industry) and which were continued by Dr. Andrew Young. We expect that when aerial images are analyzed and correlated with ground-based measurements and pod yield at harvest, this will give us new ways to measure and select for favorable responses of peanut to water deficit stress. We also plan to experiment using pole-mounted cameras at the Lubbock AgriLife Center, where UAS flights are banned due to the center being located at the north end of the airport runway.

Runner trials – First population.

The first runner drought test involves sister lines of what we plan to be our first drought-tolerant runner release, the breeding line TxL100212-03-03. This breeding line did reasonably well in drought tests, and at the top of the test in irrigated trials. However, testing has shown that there may be other breeding lines that yield better under water deficit, and so we are running more tests on sister lines of this expected release. These breeding lines were made to develop a drought-tolerant, high-oleic runner variety.

The test was performed under water deficit at two locations, and under full irrigation at the same locations. Water deficit involved irrigating only as much as was necessary to bring total rainfall plus irrigation during June, July, and August, to 1/3 the amount provided to fully-irrigated plots. This figure is intended to mimic rainfed conditions during these months, the time when temperatures are highest and demand for water is the greatest.

From **Table 15**, it can be seen that 12 of the breeding lines yielded numerically better than TxL100212-03-03, although the difference was significant statistically for only one of these lines. However, the top 3 lines (TxL100225-03-08, TxL100225-03-05, and TxL100212-05-10) for yield this year were the top 3 in 2021, so there is some consistency in the results across years. Several of the breeding lines (including the top 2 for yield) graded >68% under water deficit, equivalent to Georgia-09B. However, as was the case in 2021, TxL100212-03-03 graded very well (72.7% in 2022).

Table 15. Results of the First Runner Drought Test, grown under water deficit.

Genotype	Pod Yield (lb/ac)		Shellout (% TSMK)		Seed Wgt (100 SMK)	
TxL100225-03-08	2236	a	68.59	b-f	43.91	g-m
TxL100225-03-05	1826	ab	68.95	b-f	45.50	e-l
TxL100212-05-10	1706	bc	65.03	c-g	53.75	ab
TxL100225-03-10	1702	bc	67.99	b-f	45.30	f-m
TxL100225-03-04	1563	b-d	69.46	a-f	45.10	f-m
TxL100212-02-01	1545	b-e	63.87	d-g	40.85	k-n
TxL100212-02-02	1512	b-f	64.07	d-g	57.95	a
TxL100212-07-01	1497	b-f	64.73	d-g	43.60	h-m
TxL100225-03-11	1491	b-f	62.57	fg	47.75	c-j
TxL100225-06-02	1460	b-f	62.90	e-g	50.05	b-f
TxL100212-03-12	1407	b-f	**76.59**	a	50.55	b-e
TxL100212-02-05	1403	b-f	63.61	d-g	58.10	a
TxL100212-03-03	1370	b-f	**72.67**	ab	48.30	c-i
...						
TxL100212-07-03	1298	c-f	64.07	d-g	46.10	c-j
TamrunOL02	1294	c-f	72.19	a-c	49.05	b-g
...						
TxL100225-06-12	1290	c-f	70.33	a-d	50.80	b-d
...						
TamrunOL18L	1265	c-f	58.31	g	48.85	b-g
Georgia09B	1260	c-f	68.43	b-f	40.10	mn
...						
TxL100225-03-02	1183	d-f	70.60	a-d	48.10	c-j
TxL100212-03-11	1167	d-f	72.25	ab	47.89	c-j
...						
ICGS-76	1136	d-f	63.60	d-g	47.50	c-j
...						
FlvRun458	1057	ef	64.15	d-g	43.40	i-m
...						
TxL100212-05-01	1025	f	63.74	d-g	47.65	c-j
p	0.021		0.014		0.001	
Mean	1333		66.77		47.22	
LSD	492		7.20		5.21	
CV	22.3%		5.1%		5.2%	

There is a high variability in yield among replications under water deficit, but we hope that further testing will give reproducible evidence that several of the breeding lines will prove superior to the checks and possibly to TxL100212-03-03 under water deficit. (We have also grown the same test under irrigation, but we have analyzed the drought tests first.

Second runner population.

The second runner drought test was made to combine tolerance to water deficit with high oleic oil as well as resistance to root-knot nematode. We had previously found lines that yielded better than check varieties, but grades were low. This was likely due to the poor grade of the donor parent that had tolerance to water deficit. Initial selections had been made using markers. We rescreened 4 of the 8 best lines with the 5 markers that had been used early in the breeding program, and found that there was some segregation (**see Table 16**). We backcrossed these to better-grading varieties, and obtained 150 progeny. These were sown in the greenhouse, and are waiting being planted this summer,

We also made the cross in the reciprocal direction (switched which were the male and female parents), and selected progeny using markers. These were increased, and planted at two locations in 2022 for evaluation under water deficit and full irrigation. The experiment was grown under water deficit and ful irrigation at two locations, with the target of providing irrigation to 1/3 of normal needs (rainfall plus irrigation) in June, July, and August, when temperatures are highest and demand for irrigation is the greatest **(Table 17)**. A number of breeding lines yielded >2000 lb/ac under water deficit, with Georgia-09B and Flavorunner 458 yielding 1877 and 1369 lb/ac. Five of the top 10 lines for yield (of 40 in the test) were in the top 10 also in 2021. In addition, grades of several breeding lines were between 66.0 and 67.3%, which were equivalent to Georgia-09B and better than Flavorunner 458. Seed sizes were smaller than would be expected under irrigation, but two lines had seed weights >55g per 100 SMK, considerably higher than Georgia-09B or Flavorunner. Tamrun OL18L also compared favorably to the other check varieties in this test.

Table 16. Marker Segregation in 4 Breeding Lines. FAD2 is the marker for high oleic oil, Ma-1 for resistance to root-knot nematodes, and the last 3 are for tolerance to water deficit.

	DrtTol, RKN S, LOL	**HOL, RKN R DrtSusc**
Ma1	**51**	**17**
008	13	5
030	14	5
035	14	4
094	11	3
FAD2B	**21**	**50**
008	3	11
030	1	22
035	17	0
094	0	17
PM204	**51**	**33**
008	9	9
030	23	1
035	18	0
094	1	23
TC2A02	**33**	**53**
008	10	10
030	3	21
035	18	0
094	2	22
TC3A12	**38**	**45**
008	2	16
030	3	21
035	10	8
094	23	0

Table 17. Second Drought Test Results, grown under water deficit.

Genotype	Pod Yield (lb/ac)	Shellout (% TSMK)	Seed Wgt (100 SMK)
TxL144301-044	2385 a	64.07 b-e	48.93 b-g
TxL144301-131	2253 ab	66.01 a-c	55.93 a
TxL144301-103	2202 a-c	64.18 b-d	50.00 b-g
TxL144301-170	2185 a-c	66.85 a-c	55.60 a
TxL144301-001	2147 a-d	67.30 a-c	43.60 h-k
TxL144301-171	2095 a-e	55.86 g-j	47.20 e-i
TxL144301-112	2073 a-e	55.45 g-j	46.13 f-j
TxL144301-119	2044 a-e	54.86 h-k	48.33 c-g
TamrunOL18L	2018 a-e	69.96 a	53.33 ab
TxL144301-035	1953 a-f	65.18 a-d	50.53 b-f
…			
Georgia09B	1877 a-f	66.66 a-c	41.33 k
…			
COC270	1643 b-f	40.48 l	35.80 l
…			
FlvRun458	1369 fg	60.24 d-g	42.97 i-k
…			
p	0.001	0.001	0.001
Mean	1788	59.78	47.68
LSD	631	5.31	4.53
CV	20.5%	5.1%	5.6%

Spanish Drought Test

This was the second year that this test was run. The purpose is to combine drought tolerance with high oleic oil, and possibly resistance to aflatoxin contamination. Although aflatoxin contamination has not been a major concern in Texas, J Leek and Associates reported this year that they have occasionally seen issues with contamination. Also, as available irrigation declines, it is possible that aflatoxin issues may become more common.

Three breeding lines yielded statistically more than Schubert did, and many lines yielded more numerically (**Table 18**). Several breeding lines graded 70% or more, higher than Schubert, four lines grading 70% or better. Unlike the runner drought tests, hundred seed weight was not reduced much due to drought (although yield was).

In 2021 and 2022, there were many breeding lines that yielded or graded better than Schubert under water deficit. However, rankings of top-yielding lines were not consistent across years, so additional testing is needed.

Table 18. Results of the Spanish Breeding Line Drought Test, grown under water deficit.

Genotype	Pod Yield (lb/ac)	Shellout (% TSMK)	Seed Wgt (100 SMK)
TxL054520-27	2041 a	67.93 b-v	48.00 e-q
14GAF1466	2019 ab	64.13 u-C	34.65 GH
14GAF1418	1999 a-c	64.48 t-C	37.00 B-H
14GAF1349	1953 a-d	69.94 a-i	46.85 f-t
14GAF1412	1920 a-e	70.76 a-d	46.35 h-u
14GAF1339	1906 a-f	69.31 b-m	45.55 k-x
14GAF1303	1873 a-g	65.80 j-B	39.45 z-H
14GAF1302	1859 a-h	68.40 b-t	46.70 g-u
14GAF1380	1852 a-i	47.29 D	45.35 k-y
14GAF1340	1852 a-i	65.18 n-C	49.60 c-l
14GAF1452	1852 a-i	66.13 i-B	45.10 k-y
14GAF1367	1804 a-j	70.24 a-g	40.70 v-E
14GAF1325	1742 a-k	67.37 c-y	41.25 u-D
14GAF1348	1741 a-k	65.83 j-B	47.85 e-r
55-437	1738 a-k	66.53 e-B	34.95 F-H
14GAF1356	1737 a-k	69.72 a-j	45.05 k-y
14GAF1381	1726 a-k	67.39 c-y	41.80 s-D
14GAF1388	1725 a-k	63.67 x-C	40.45 w-F
14GAF1448	1718 a-k	63.68 x-C	45.20 k-y
…			
14GAF1342	1667 a-p	68.81 b-q	51.10 b-j
14GAF1314	1664 a-q	69.21 b-n	44.90 k-z
14GAF1350	1657 a-q	68.78 b-q	54.85 a-c
14GAF1413	1634 a-r	70.62 a-d	44.55 l-z
14GAF1459	1634 a-r	70.79 a-d	40.40 w-F
14GAF1311	1631 a-r	67.69 b-x	36.65 C-H
14GAF1408	1629 a-r	69.00 b-p	44.55 l-z
14GAF1420	1597 b-s	66.82 d-A	42.45 r-B
…			
Schubert	1560 d-u	63.64 y-C	45.50 k-x
…			
14GAF1402-2	983 x	64.99 p-C	49.00 d-n
p	0.0001	0.0001	0.0005
Mean	1532	66.59	45.07
LSD	434	4.04	5.53
CV	14.3%	3.0%	6.2%

Virginia New Breeding Lines

We also began testing new materials at one location in West Texas and another in Central Texas. This material had a wide range of parental materials. The candidate lines mentioned above were used as parents for some lines and others has large-seeded runners parents. Others had exotic germplasm from our cultivated germplasm collection. As much as possible these lines were grouped together in tests for evaluation. As mentioned the extreme drought produced high variability among the replications across the field. It is anticipated that if it have acceptable grade and seed size the lines will be tested again in 2023. In the Virginia Test #1 (**Table 19**) a large portion of them graded comparably and had acceptable seed size when compared to the commercial check Bailey with a TSMK% of 71.4% and a 93.4 g/100 seed.

Table 19. Virginia Test #1 in West Texas in 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		21.5/64 scr		Plant height (cm)	
Cultivar																
Bailey	4404	A	986.90	A	71.4	ABC	93.4	AB	485.8	EFGH	3.0	ABCD	51.0	AB	22	DEFGHI
TP220688-8	4192	AB	841.48	ABCD	64.8	GH	98.8	A	528.4	DEFG	0.9	EFG	40.8	CDEF	25	BCDE
TP220696-2	4181	ABC	873.86	ABC	69.3	BCDEF	86.1	BCD	488.5	EFGH	1.3	DEFG	51.2	AB	21	FGHI
TP220688-6	4178	ABC	954.11	AB	75.3	A	86.2	BCD	615.8	B	0.7	EFG	38.5	EFG	21	GHI
TP220688-10	4007	ABC	802.43	ABCDE	63.8	H	73.9	E	466.3	GH	0.7	FG	47.3	BC	25	BCDEF
TP220692-3	4004	ABC	876.64	ABC	71.6	ABC	89.9	ABCD	528.6	DEFG	3.2	ABC	41.4	CDEF	27	B
TXL09105-07	3959	ABC	891.98	ABC	72.6	AB	90.0	ABCD	527.8	DEFGH	2.8	ABCD	49.4	B	21	FGHI
TP220688-3	3954	ABC	826.57	ABCDE	66.5	DEFGH	80.9	DE	513.6	DEFGH	0.4	G	48.9	B	23	CDEFGH
TP220692-4	3819	ABCD	739.55	CDE	65.2	GH	94.8	AB	504.9	DEFGH	1.4	DEFG	44.8	BCDE	23	CDEFGH
TP220688-2	3819	ABCD	726.65	CDE	65.1	GH	89.3	ABCD	614.2	BC	3.4	AB	20.4	H	22	EFGHI
TP220688-9	3737	ABCD	778.65	ABCDE	65.6	FGH	90.0	ABCD	462.2	H	0.7	FG	49.6	B	33	A
TXL09106-15	3711	ABCD	833.80	ABCD	72.9	AB	52.3	F	504.5	DEFGH	2.1	BCDEF	46.5	BCD	19	I
TP220692-1	3595	ABCD	760.55	BCDE	69.8	BCDE	84.9	BCD	506.1	DEFGH	2.4	ABCDE	49.2	B	21	FGHI
TP220688-1	3585	ABCD	765.17	BCDE	70.4	BCD	97.4	A	549.7	CDE	3.5	AB	36.4	FG	26	BC
TP220688-4	3568	ABCD	715.38	CDE	65.1	GH	86.8	BCD	561.4	BCD	0.8	EFG	39.5	DEF	22	EFGHI
TP220688-5	3550	BCD	736.32	CDE	68.2	CDEFG	73.8	E	524.3	DEFGH	1.3	DEFG	36.5	FG	24	BCDEFG
TP220693-3	3529	BCD	800.22	ABCDE	71.5	ABC	93.1	ABC	479.9	FGH	2.3	BCDEF	57.8	A	21	HI
TP220687-4NR	3340	CD	646.90	DEF	66.2	EFGH	82.8	CDE	869.4	A	4.1	A	15.2	H	27	BC
TP220692-2	3046	DE	624.12	EF	67.3	DEFGH	86.8	BCD	536.3	DEF	1.5	CDEFG	37.8	EFG	26	BCD
TP220687-2	2290	E	461.18	F	66.3	EFGH	55.9	F	811.2	A	2.1	BCDEFG	31.9	G	27	B
Mean	3724		782.12		68.4		84.4		553.9		1.9		41.7		24	
CV	16.8		19.9		5.4		15.5		19.7		1.9		25.6		14.8	
Entry "F"	0.007		0.0047		0.0001		<.0001		<.0001		0.0026		<.0001		<.0001	

Due to space limitations, the Virginia Test #2 (**Table 20**) was grown in Central Texas. Although Central and South Texas are not historical Virginia growing regions in Texas it does give us the opportunity to evaluate the lines under higher disease pressure. Interestingly in 2022 the yield for the Central Texas trial were higher than those in the traditional West Texas growing region. TP200691-1-1 had the highest yield in the test at 6005 lbs/ac and it had a TSMK% of 69.9% both of which where statistically equal to the commercial check Bailey.

Table 20. Virginia Test #2 in West Texas in 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		21.5/64 scr		Plant height (cm)	
Cultivar																
TP220691-1	6005	A	1152.80	A	69.9	ABC	89.7	A	521	DEFG	15.4	AB	42.2	AB	23	H
TP220686-10	5531	AB	1121.99	AB	71.7	AB	91.3	A	528	DEFG	13.7	ABC	42.4	A	34	AB
TP220691-5	5445	ABC	986.16	ABCD	66.5	CD	87.5	A	548	DEFG	17.1	A	34.6	EFG	23	H
Bailey	5246	ABCD	1026.91	ABC	73.8	A	92.0	A	498	FG	13.0	ABCDE	37.2	BCDEFG	31	ABCD
TP220691-7	5144	ABCD	843.29	BCDEFG	64.0	D	87.2	A	510	EFG	10.2	CDEFGH	40.1	ABCD	24	GH
TP220691-8	5044	ABCD	927.50	ABCDE	69.6	ABC	89.1	A	495	G	16.5	A	38.3	ABCDE	25	FGH
TP220690-1	5023	ABCD	867.99	ABCDEF	67.0	BCD	62.0	BC	506	EFG	13.2	ABCDE	40.4	ABCD	31	ABCDE
TP220696-1	4873	ABCD	877.21	ABCDEF	65.8	CD	80.0	AB	567	BCD	11.4	BCDEF	36.5	CDEFG	27	DEFGH
TP220691-2	4828	ABCD	890.60	ABCDEF	68.6	BCD	87.9	A	540	DEFG	13.7	ABCD	37.7	ABCDEF	23	H
TP220686-5	4758	BCDE	717.21	DEFGH	65.9	CD	82.6	A	542	DEFG	8.5	EFGHI	32.3	G	35	A
TP220691-6	4547	BCDEF	723.93	DEFGH	64.4	D	59.0	C	523	DEFG	11.0	BCDEFG	34.7	EFG	23	H
TP220691-4	4302	CDEFG	790.77	CDEFGH	68.7	BCD	73.2	ABC	520	DEFG	13.5	ABCDE	37.4	ABCDEF	26	EFGH
TP220686-4	4120	DEFG	655.59	EFGH	68.7	BCD	73.4	ABC	549	CDEF	4.4	I	41.5	ABC	33	ABC
TP220691-3	4109	DEFG	764.77	CDEFGH	70.0	ABC	84.2	A	620	B	13.4	ABCDE	33.5	EFG	27	DEFGH
TP220686-9	4096	DEFG	749.91	CDEFGH	69.8	ABC	82.2	A	734	A	6.1	GHI	21.0	H	22	H
TXL09105-07	4087	DEFG	747.04	CDEFGH	65.8	CD	84.6	A	538	DEFG	6.4	FGHI	42.0	AB	25	GH
TP220686-3	3606	EFGH	610.11	FGHI	66.1	CD	75.7	ABC	620	B	5.1	I	25.8	H	29	CDEFG
TXL09106-15	3433	FGH	569.20	GHI	66.3	CD	82.9	A	549	DEFG	8.6	DEFGHI	36.0	DEFG	26	EFGH
TP220686-7	3160	GH	539.07	HI	63.9	D	83.8	A	556	CDE	5.7	HI	32.6	FG	30	BCDEF
TP220686-2	2590	H	363.10	I	65.9	CD	86.7	A	603	BC	7.0	FGHI	25.2	H	34	AB
Mean	4497		796.26		67.6		83.0		553		10.7		35.6		28	
CV	24.1		32.0		5.7		10.6		11.6		46.2		18.2		17.3	
Entry "F"	0.0006		0.0013		0.0304		0.0558		<.0001		0.0002		<.0001		<.0001	

Virginia Test #3 was grown in West Texas and represented materials that used exotic germplasm as on of the parents (**Table 21**). These high risk crosses were made to increase the seed size to try to create lines that had a seed size more in line with NC-7. The downside of these type crosses are the undesirable characteristics that are introduced along with the increased seed size. We were able to increase seed size dramatically as evidenced by TP220664-1-1 which had a seed size of 110.6 g/100 seed and an ELK% of 60.7%. However further evaluation and crossing will be needed to adapt the lines to commercial standards.

Table 21. Virginia Test #3 in West Texas in 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits		21.5/64 scr		Plant height (cm)	
Cultivar																
TP220694-1	5577	A	1271.63	A	74.7	A	110.6	A	534	A	3.5	A	60.7	A	24	A
TP220694-2	5196	AB	1190.08	AB	72.9	AB	108.6	A	525	A	2.9	AB	57.1	AB	23	AB
TXL09105-07	5118	ABC	1137.73	ABC	72.8	AB	101.1	B	519	A	2.1	BC	56.6	AB	23	AB
TP220689-1	4968	ABCD	1133.20	ABC	71.9	AB	97.5	BC	517	AB	1.6	CD	56.4	AB	23	AB
TP220694-3	4726	BCDE	1050.12	BCD	71.7	B	97.4	BC	489	BC	1.5	CDE	56.1	AB	23	AB
TP220694-5	4713	BCDE	1047.56	BCD	71.6	B	92.9	CD	466	CD	1.2	CDE	52.8	BC	22	ABC
TXL09106-15	4453	BCDE	993.45	BCD	70.9	BC	89.8	DE	466	CD	0.9	DE	51.2	BC	22	ABC
TP220694-4	4318	CDE	967.45	CD	70.6	BC	87.5	DE	449	D	0.9	DE	50.8	BC	20	BCD
Bailey	4257	DE	943.58	CD	70.1	BC	87.2	DE	418	E	0.8	DE	50.2	BC	20	CD
TP220689-2	4011	E	910.06	D	68.6	C	85.1	E	417	E	0.5	E	46.9	C	19	D
Mean	4734		1064.49		71.6		95.8		480		1.6		53.9		22	
CV	13.2		14.4		3.0		11.8		11.5		70.5		10.0		9.1	
Entry "F"	0.0172		0.0294		0.0185		<.0001		<.0001		0.6868		0.0222		0.0213	

Developing a Wild Species Pathway for Introgression of Drought Tolerance and germplasm maintenance.

This project continues as part of the long-term drought project. It was first funded internally but has been absorbed into our overall drought program. The initial phase of this project was to identify 14 candidate genes associated with drought tolerance by conducting an imposed drought transcriptomics study. Specifically, we identified transcription factors that occur early in genetic pathways and represent excellent candidates for marker development. We received funding for the Peanut Research Foundation to validate the presence of the candidate genes in the original drought tolerant species and to expand the study to include other related species. Sequencing is complete and a manuscript is in preparation. This project remains a vital part of our overall drought program. Transcriptomics is a powerful tool that can not only tell if a gene is present but can also determine how strongly a gene is expressed. Once the genes are validated for expression, level marker development can be conducted and used to aid in introgression of genes into our elite material.

Crossing and chromosome doubling continues as part of the wild species introgression pathway and is under development. When completed this will allow identified genes to be moved into the cultivated peanut. At this point, we have made the initial cross and confirmed hybridization. The next step in pathway development is to double the chromosome number. This is proving to be very challenging. We are exploring alternate pathways using other species and or accessions to move the genes. One related complex hybrid has already been doubled and has cultivated materials that are being backcrossed into more advanced materials. Tamrun OL11 is the recurrent parent in this crossing program, however, several more backcrosses are needed to make the lines commercially viable. We also expanding this backcrossing program to include the candidate line Tx144370.

One final area of interest is our ongoing germplasm maintenance program. We have been coordinating with the Arachis collection curator Dr. Shyam Tallury to assist in germplasm increase and reintroduction into the national collection. This allows us to serve as a vital additional repository for this valuable wild germplasm.

Identify Markers for Drought Tolerance in Mini-core Collection

We have tentatively identified 558 markers associated with response to water deficit stress, in the field or in post-harvest measurements. Of these, 169 were associated with either more than one trait, or were repeated across locations (TX, OK, VA) or years. We have identified a set of these markers to synthesize and test on one of our runner drought populations. An example of these markers can be seen in **Table 22**, which shows the state or states where a given marker was significant in one year.

Table 22. Sample markers for yield, field response to water deficit, and grade. Letters tell where the marker was significant (Tx= Texas, Ok=Oklahoma, Va=Virginia, Al=All 3 locations' data pooled.)

Trait -->	Yield	100SMK	NDVI	Flwr	SPAD	Width	Height	Clos	Wilt	Grade	CTD	NO1	MED	ELK	
Marker	205	59	49	48	37	31	30	26	22	17	8	6	4	2	#Traits
M_0072			Va	AlTxOk	AlVa	AlTx	AlTxVa		AlTx						6
M_0230	Va	TxOk	Va	Al	Tx	TxOk	AlOkVa								7
M_0609		Tx													1
M_0654	AlVa														1
M_0702	TxOkVa	TxOk			AlTxVa	AlTxOk	AlTxOkVa	TxOk	Tx						7
M_0704	AlOk	TxOk	Va	Al	AlTxOkVa	AlTxOkVa	AlTx		AlTx				Tx		9
M_0706	Al				AlTxOkVa	Va	AlTx		AlTx	Tx			Tx	Tx	8
M_0806	AlTx	Ok		Al	AlTx	Tx	TxVa	Ok		Tx	Va				9
M_0854		TxOk													1
M_0887	Tx	Ok	Va	Va	AlOkVa	AlTxOk	Ok	AlTx			Va		Tx		10
M_1412					TxOk	Tx		Ok	AlVa		Tx				5
M_1418	AlOk														1
M_1543	TxOkVa		Va	AlVa	TxOkVa	Al		AlTx		Tx					7
M_1577	TxOkVa		Va	AlVa	TxOkVa	Al		AlTx		Tx					7

Current Releases

We have a new nematode resistant runner variety called NemaTAM II, which is a high-yielding, high oleic fatty acid, runner-type peanut cultivar with resistance to root-knot nematodes. The cultivar was developed to provide growers with a replacement option for the former Webb cultivar which had excellent nematode resistance, but also had a very large vine size that made harvest difficult for peanut farmers. Like Webb, NemaTAM II maintains resistance to root-knot nematodes, but has equal to or better yield, higher grade potential and a shorter canopy for easier digging and inverting at harvest. In 2023 there will be approximately 15 acres of foundation seed being grown at the Texas A&M Foundation Seed offices in Vernon, TX.

We are sending breeders' seed of our new early-maturing runner varieties for increase this year. **Tables 23 and 24** below give some of the data from the release proposal, with data pooled across runner advanced line tests over 3 years. Tamrun OL18L topped the test for yield, with a yield statistically greater than Tamrun OL11, and numerically greater than TufRun 511, FloRun 107, and Georgia 09B. Grades were similar to these varieties, except lower than Tamrun OL11. Seed weight for Tamrun OL18L (the "L" stands for "larger seed") was similar to Georgia 09B and Webb, but larger than Tamrun OL11, TUFRun511, and FloRun107. Tamrun OL19 had a smaller seed than OL18L, similar to Tamrun OL11 but larger than TUFRun and FloRun.

Maturity for Tamrun OL18L was similar to Tamrun OL12, about 2 weeks earlier than Tamrun OL07. Tamrun OL19 was also earlier than Tamrun OL07 by about 1 week. All these runner varieties were later maturing than the large-seeded Spanish variety Tamnut OL06. We have enough seed for planting about 10 acres of TamrunOL18L and 5 acres of Tamrun OL19 for increase in 2023.

Table 23. Yield and Grade Data for Tamrun Ol18L and 19

Variety	Pod Yield (kg/ha)		Grade (% TSMK)		Seed Weight (g/100 SMK)	
Tamrun OL18L	6007	a	73.5	bc	74.8	a
Tamrun OL19	5803	a	73.6	bc	70.2	b
TUFRun 511	5692	ab	73.2	c	67.1	c
FloRun 107	5758	ab	74.4	b	66.1	c
Georgia-09B	5719	ab	73.4	c	75.2	a
Webb	5680	ab	73.1	c	75.6	a
Tamrun OL11	5365	b	76.7	a	68.2	bc
p	0.037		<0.001		<0.001	
LSD	386		1.0		3.2	

Table 24.Maturity and Sclerotinia Data for Tamrun OL18L and Tamrun OL19

Variety	% Black + Brown		Black + Brown + Orange		Sclerotinia Incidence	
Tamrun OL07	4.5	e	32.1	c	3.4	ns
Tamrun OL19	12.8	d	48.4	b	4.6	
Tamrun OL18L	19.4	cd	53.4	b	3.7	
Tamrun OL12	22.6	c	55.9	b	3.9	
Tamnut OL06	58.5	a	72.7	a	3.6	
Tamspan 90	40.7	b	57.2	b	2.0	
p	<0.001		<0.001		0.184	
LSD	7.4		10.1		ns	

Anticipated Virginia Releases

We anticipate releasing two high-oleic Virginia varieties, TxL090105-07 and TxL090106-15. These will be the first Virginias released by AgriLife. Both release candidates yielded well in variety trials, numerically higher than NC-7 and Champs. TxL090105-07 had a smaller seed size than TxL090106-15, and other trials also indicated a smaller seed size. But yield data show a numerically higher yield for TxL090105-07. Both varieties are high oleic. Both are high yielding and developed to compete with the industry standard Bailey. Increases of both will be sent to Vernon in the 2024 season.

Other previously released cultivars are also being repurified as part of our ongoing seed program. AG18, Schubert, OLin and TamVal OL14 have all had recent breeders seed increases that will be turned over to the Texas A&M Foundation Seed Service.

Future Runner Releases

The Tx144300's were developed for resistance to Root knot nematodes and Sclerotinia. While they performed lower in yield to the drought lines mentioned above, Tx144370 has performed well in South Texas, which is where they were developed to give growers a nematode resistant line with better characteristics than the previously released Webb and NemaTAM II variety. These two lines have yielded 400-600 lbs/ac better than Webb and graded 1-3 percentage points higher. Additionally, they have a much shorter growth habit than NemaTAM II and a slightly smaller seed size in most of the trials over the past four years. The decision was made to move forward with the breeding lines for release. A release article has been sent to the Texas A&M Plant Release Committee for consideration for release with the name Murray, in honor of long time South Texas peanut farmer Murray Phillips.

Of the materials developed from the runner drought testing, several lines have done well in irrigated trials. In particular, TxL100212-03-03 (see above) has been in advanced trials for a couple of years now and has consistently done well. We plan to release it because of its high yield potential both under irrigation and water deficit, and because it has high grade under water deficit, unlike many of our other accessions. It was in a ¼ ac row increase last year and is being increased again this year in anticipation for release. We expect to write up the release proposal later this year or early next year.

Sub-Project IV. SNP Marker Development

This year, we have focused our development efforts on (1) developing a less-expensive marker system, called resequencing, and on (2) developing a rapid marker-based system for confirming identity of varieties, as well as being an improved system for distinguishing hybrids from selfs in progeny obtained from the greenhouse crossing program.

Genotyping by Resequencing

Although the peanut community has developed a SNP chip for marker analysis (and the AgriLife program donated 4 of the 22 accessions sequenced to develop the SNP chip), it has the drawbacks of still being too expensive for routine analysis in breeding programs, and does not allow focusing on specific gene for traits; for example, genes for oil content.

We have worked with Tecan, Inc. to develop a less-expensive system for genotyping, by focusing on sequencing about 2,500 targets in the chromosomes. Or test experiment worked when genotyping 48 peanut varieties and other accessions simultaneously. **Table 25** shows an example of the results, comparing sequences of 4 varieties. In some cases, no sequence are shown. We are planning to have the libraries sequenced on a machine that can produce more sequences, to improve the coverage of the sequencing results.

To test further, we have extracted DNA from 144 more peanut accessions, run the reactions to make the sequence-ready pooled libraries, and hope ro send these off for sequencing within the next couple of weeks.

Table 25. Example of genotype-by-resequencing markers mapped to linkage group B06. Genotypes are shown for SNPs for 4 varieties.

Target	REF	CHROM	POS	RefGt	OLin	TamrunOL07	Jupiter	NMValC
M_5529[†]	**Tifl**	**B06**	**20241804**	**C**	**C/C**	**T/T**	**T/T**	**C/C**
M_5538[†]	**Tifl**	**B06**	**22214152**	**C**	**T/T**	**C/C**	**.**	**.**
M_5547	Tifl	B06	23461075	G	.	G/G	T/T	.
M_5550[†]	**Tifl**	**B06**	**24709249**	**A**	**.**	**A/A**	**G/G**	**.**
M_5578	Tifl	B06	33921277	G	A/A	G/G	.	A/A
M_5590[†]	**Tifl**	**B06**	**37070569**	**G**	**A/A**	**G/G**	**.**	**G/G**
M_5617	Tifl	B06	48201849	G	.	G/G	A/A	.
M_5643[†]	**Tifl**	**B06**	**77306508**	**C**	**A/A**	**.**	**C/C**	**.**
M_5672	Tifl	B06	107783925	C	C/C	C/C	T/T	C/C

Markers for Varietal Identification. We initially developed a set of 72 highly-polymorphic SNP markers to test for their ability to distinguish different varieties or breeding lines. The goal is to be able to use markers to verify the identity of varieties and reduce the chance of misidentification of varieties. **Table 26** shows markers (denoted with a "1" in the box) that were able to distinguish closely-related varieties or sets of breeding lines. With this set, it was possible to distinguish all accessions tested. We used a second set of 16 accessions to test the markers against, and it was possible to distinguish all accessions. However, some markers were more effective against others (numbers summed down), and we are working on replacing those that were less capable of distinguishing different accessions. **Figure 1** shows one marker, SC26, and its distinguishing different varieties or breeding lines.

Table 26. Use of KASP markers to distinguish sets of closely-related varieties or breeding lines.

Marker-->	SC_24	SC_12	SC_20	SC_37	SC_43	SC_05	SC_10	SC_18	SC_26	SC_28	SC_29	SC_30	SC_33	RS_02	RS_10	SC_03	SC_15	SC_25	SC_31	SC_35	RS_01	RS_03	RS_14	RS_13	Sum
TOL12 x TOL11	1	1	1	1	1		1						1	1	1										9
TxL08 x TxL09	1	1	1			1			1			1	1			1		1				1			10
Tx05Sp x TVOL14														1			1								2
AS x SH x CN								1		1		1			1				1	1					6
TOL11 x Flo	1	1		1			1																		4
GM vs Flo	1				1																1		1		4
BSS56 x TOL12	1	1	1		1			1	1		1														7
NMVC vs TOL14				1		1				1	1														4

Sum Diffs	5	4	3	3	3	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	0	
SNP#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	

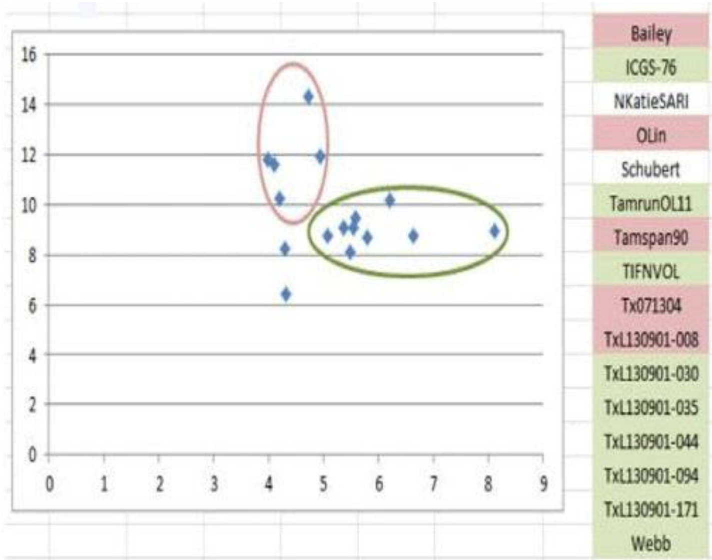

Figure 1. Example of use of a primer (SC26) to distinguish peanut accessions. The ovals mark two different groups that the marker distinguished.

Lab Analyses for the High Oleic Trait and Hybridity

We also continue to perform routine analyses on seeds for the high oleic trait, and to confirm hybrids.

Table 27. Number of Seeds screened by NIR for the High Oleic Trait.

Experiment	Seeds Screened
Spanish, Valencia Increases (potential release)	125
High Yielding, Good Grade, Drought Tolerant Spanish lines	4
Virginia Purified Seeds for Bulk Increase	160
F1 runner drought from greenhouse crosses	265
West African Spanish Drought Lines	320
AgriLife Stephenville Breeding Lines	205
Varieties from NMSU, University of Georgia	110
Population 1AB Drought, potentially RKN Resistant Lines	160
Total	**1,349**

Table 28. Numbers of Seeds screened by KASP Marker Genotyping for Hybridity and for Varietal Identification in Peanut.

Experiment	Seeds Screened
Screening Peanut for Hybridity and for Varietal Identification	96
Total	**96**

Sub-Project IV. High Throughput Phenotyping

The ongoing UAS program continues to develop. For the 2022 season we continued to use the borrowed UAS from the Corpus Christi AgriLife Center as we worked to replace our drone fleet that was stolen in 2021. New units were obtained in the late summer of 2022 and were vetted and set up for us in 2023. We are currently working out methodologies for data collection in peanut that will maximize our data and the conclusions we can draw from it.

Unmanned Aircraft System (UAS) and sensors is an emerging remote sensing technology that provides imagery datasets with exceptional spatiotemporal resolutions.. UAS can collect images quickly and repeatedly under appropriate weather conditions for agricultural applications. UAS-based imagery data also provides advanced phenotypic data using image processing and computer science algorithms, which is very useful and practical to extract crop traits. In 2022, UAS data was collected, and UAS-based Hight Throughput Phenotyping system was adopted to extract various crop parameters such as canopy cover, plant height, vegetation indices, etc. In 2022 UAS data were collected from multiple sites including Alison 5 times, field day 4 times, Keith 6 times, and N-5 one time. To better understand the collected UAS data and their association with yield, we closely analyzed the data collected from Keith location.

UAS Data Collection

Texas A&M AgriLife Research at Stephenville conducted UAS data collection using DJI Phantom 4 Pro and DJI Matrice 200 equipped with Slantrange 4P+ to acquire RGB and multispectral images, respectively. The UAS data collection protocol developed by Texas A&M AgriLife Corpus Christi was followed to collect high quality UAS data. This protocol included UAS flights at 25–30-meter altitude with 80-85% overlaps, depending on the sensors used and proper installation of Ground Control Points (GCPs).

UAS Data Processing

As review the overall UAS image processing pipeline developed by our team is divided into three levels and presented in **Figure 4**. The workflow starts with the collection of raw images (Level 0 data product from different sensors and platforms). Level 0 data are then processed using the Structure from Motion (SfM) algorithm to generate Level 1 geospatial data products, such as Digital Surface Model (DSM), orthomosaic images, and 3D point cloud data. Level 2 data products are generated from the Level 1 data products and represent relevant biological crop features, canopy height, canopy cover, various vegetation indices, such as

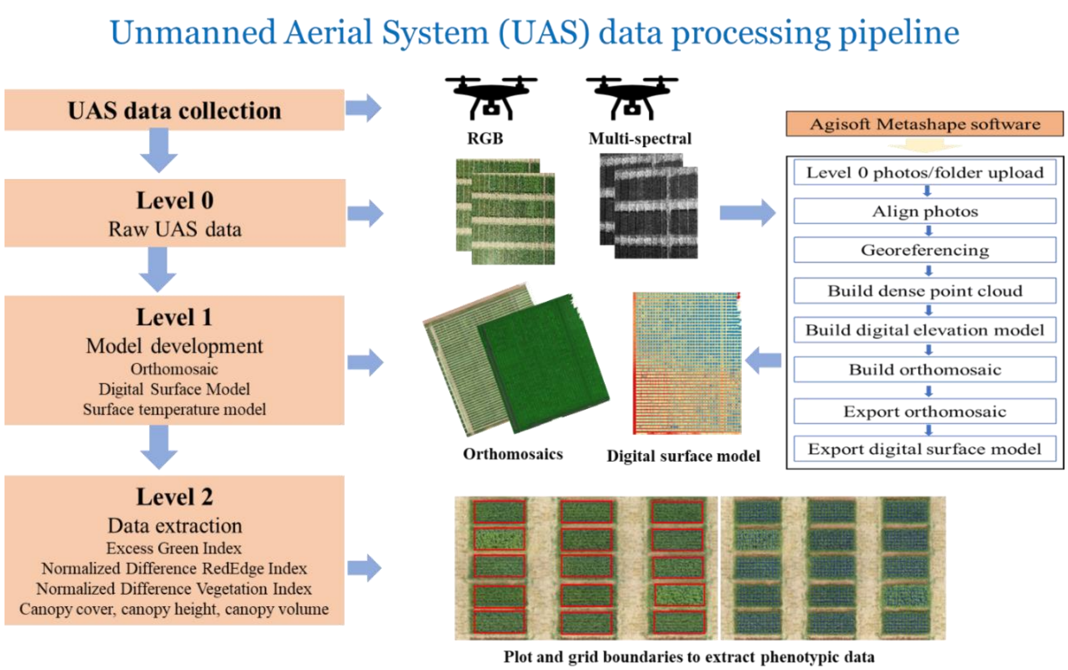

Figure 4. Overall UAS data processing pipeline used to process raw images and obtain phenotypic information.

Normalized Difference Vegetation Index (NDVI), Soil Adjusted Vegetation Index (SAVI), and Excessive Greenness Index (ExG).
All raw data collected from UAS was processed to generate an orthomosaic and DSM. We adopted the Agisoft Metashape software (Agisoft LLC, St. Petersburg, Russia), which is one of the famous commercial software to stitch UAS raw images using SfM GCPs' GPS coordinates were also input in image stitching process for removing distortion and precise geo-referencing.

Once the orthomosaic is generated, canopy features such as canopy height, canopy cover, and vegetation indices were obtained. **Canopy height (CH)** is generated from the DSM**,** which represents the surface elevation of objects on the ground. To estimate CH for each flight date the Crop Height Model (CHM) is generated by subtracting the Digital Elevation Model (DEM) from the DSM. The DEM is generated from UAS data acquired prior to plant emergence. A classification algorithm will be used to obtain **canopy cover (CC)** from orthomosaic images. The classification algorithm uses red, green, and blue spectral bands of orthomosaic images and Red Green Blue Vegetation Index (RGBVI) to generate a binary classification that separates canopy areas from non-canopy areas on the image. A plot boundary file with plot/grids will be created and overlaid on the CHM to obtain height measurements and to calculate percentage of green pixels (CC) within each grid/boundary. **Canopy volume (CV)** provides an estimate of plant biomass as a combination of canopy size and height. CV for individual grids is calculated as the sum of pixels classified as canopy multiplied by the individual pixel height. We also calculated multi-spectral and RGB-based vegetation indices to assess canopy efficiency and canopy health.

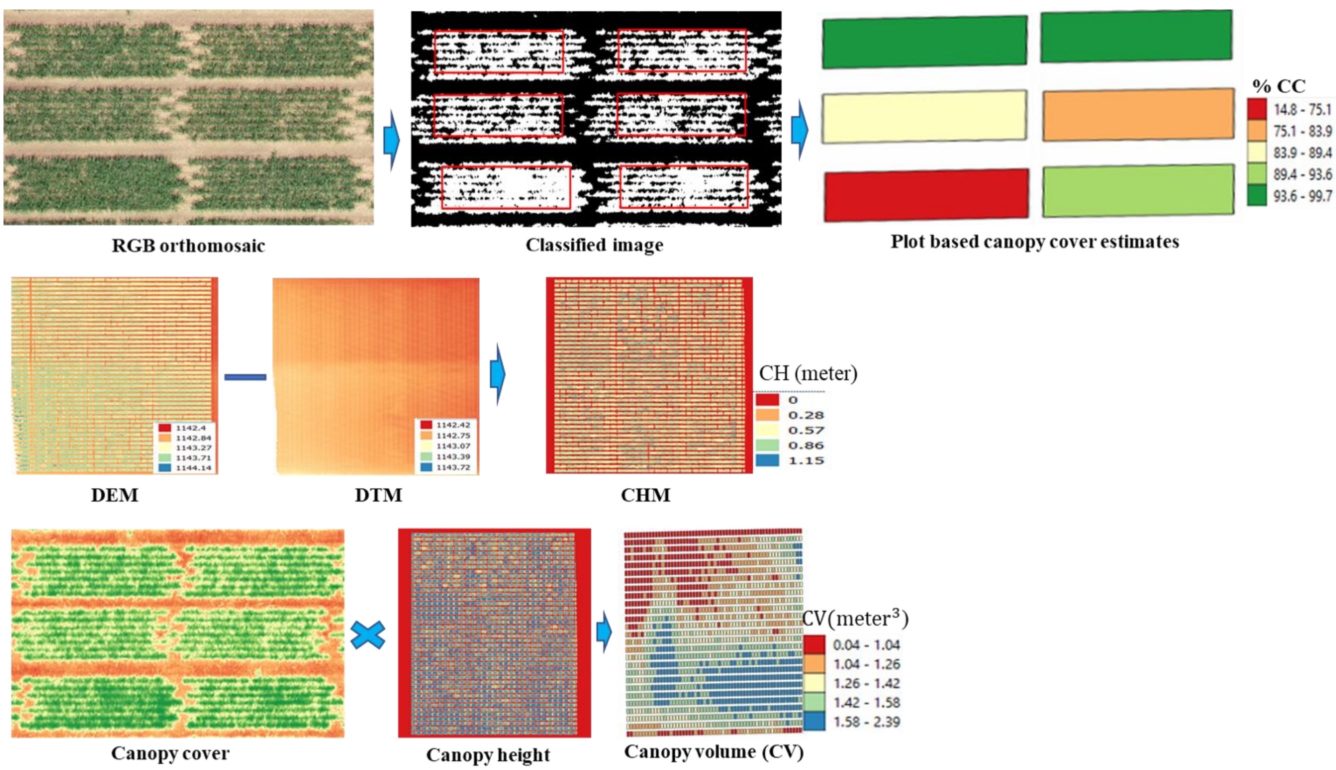

Figure 5. Estimating canopy cover (CC), canopy height (CH), and canopy volume (CV) from Unmanned Aerial Systems (UAS)-based orthomosaic and digital surface models (DSMs)

Data extraction and analysis

Canopy cover, Excess Green Index (ExG), and the standard deviation (sdExG) obtained from Keith location trials that includes ALT (Figure 6) and VIR (**Fig. 7**) are summarized and presented in this report.

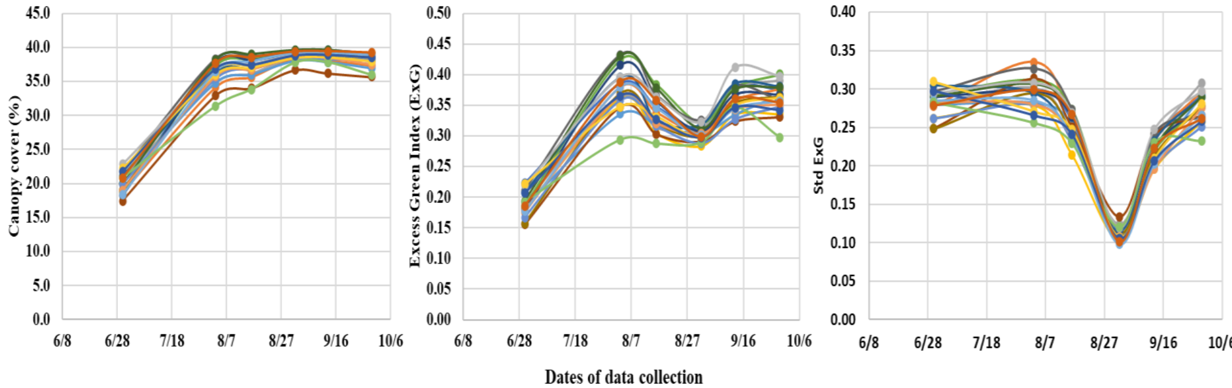

Figure 6. Percent canopy cover, excess green index (ExG), and standard deviation of ExG obtained from Unmanned Aerial System (UAS) based imagery data collected from Keith ALT study.

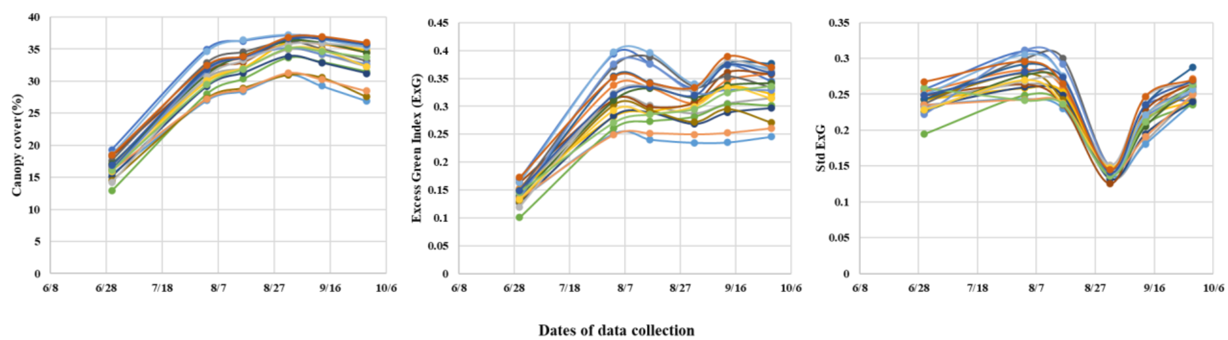

Figure 7. Percent canopy cover, excess green index (ExG), and standard deviation of ExG obtained from Unmanned Aerial System (UAS) based imagery data collected from Keith VIR study.

Averaged across genotypes, canopy cover measurements ranged from 15% to 45% coverage of the plot area. This information is helpful to determine the time to lapping and estimate plant vigor. The excess green index (ExG) ranged from 0.15-0.45. Looking at the standard deviation of ExG graph we can clearly see that the plot variability is high early in the season, reaches minimum at one point of time during the season and again increases. This information is helpful to assess the plot variability and the senescence differences when merged with ExG measurements. Additionally, locating highly variable plots early in the season will help breeders to discard the yield estimation measurements obtained from the plots. We hope that this can be used to isolate the genotype and environmental effects.

Table 29: UAS based measurements: canopy cover (CC), excess green index (ExG) and standard deviation of ExG averaged across genotypes from ALT study.

Name	ENTRYNO	lbs	CC 6/30	CC 8/3	CC 8/16	CC 9/1	CC 9/13	CC 9/29	ExG 6/30	ExG 8/3	ExG 8/16	ExG 9/1	ExG 9/13	ExG 9/29	sdExG 6/30	sdExG 8/3	sdExG 8/16	sdExG 9/1	sdExG 9/13	sdExG 9/29
TxL100212-03-03	1	636.22	19.00	37.46	38.23	39.53	39.56	39.06	0.22	0.39	0.35	0.31	0.38	0.38	0.28	0.30	0.26	0.12	0.24	0.29
TP 200606-3-10	2	652.62	18.71	34.14	35.62	38.43	38.07	37.34	0.17	0.38	0.34	0.31	0.36	0.38	0.28	0.33	0.26	0.12	0.23	0.30
TP 200610-1-2	3	661.41	20.84	34.83	36.16	38.74	39.12	38.31	0.19	0.36	0.31	0.31	0.38	0.39	0.28	0.30	0.24	0.12	0.23	0.31
TP 200606-2-9	4	669.10	21.06	36.49	37.42	38.94	38.92	38.40	0.18	0.36	0.30	0.28	0.34	0.34	0.26	0.28	0.21	0.10	0.20	0.26
TP 200625-3-2	5	670.22	20.12	34.81	35.98	38.03	37.85	36.95	0.19	0.34	0.32	0.30	0.34	0.37	0.28	0.28	0.25	0.12	0.21	0.29
TP 200607-1-2	6	673.05	18.86	37.27	38.20	39.35	39.43	38.98	0.19	0.42	0.38	0.32	0.38	0.40	0.29	0.31	0.27	0.11	0.22	0.28
TP 200606-6-10	7	693.54	18.20	37.78	38.08	39.08	39.16	38.71	0.18	0.42	0.36	0.31	0.37	0.37	0.29	0.30	0.26	0.11	0.22	0.28
TP 200608-1-14	8	697.18	17.45	32.96	33.99	36.69	36.21	35.67	0.16	0.35	0.30	0.29	0.32	0.33	0.25	0.31	0.25	0.13	0.24	0.27
TP 200608-1-6	9	705.76	21.73	38.33	38.64	39.18	39.18	38.70	0.21	0.43	0.37	0.33	0.38	0.36	0.30	0.33	0.27	0.11	0.24	0.26
TP 200609-1-5	10	716.84	19.17	35.76	36.75	38.77	38.87	38.61	0.16	0.37	0.32	0.30	0.35	0.36	0.25	0.29	0.24	0.11	0.21	0.28
TP 200610-3-2	11	722.88	21.13	36.31	36.92	38.58	38.59	38.05	0.21	0.40	0.33	0.32	0.39	0.38	0.30	0.29	0.23	0.12	0.23	0.29
TP 200606-2-14	12	723.79	19.91	38.20	39.01	39.64	39.65	39.04	0.19	0.43	0.38	0.31	0.38	0.38	0.29	0.31	0.27	0.10	0.22	0.29
TP 200607-1-17	13	731.33	19.86	35.42	36.97	38.53	38.29	38.23	0.17	0.36	0.32	0.29	0.33	0.35	0.26	0.28	0.23	0.11	0.20	0.25
TP 200606-7-10	14	743.48	19.00	35.71	36.72	38.48	38.44	37.43	0.18	0.37	0.32	0.30	0.34	0.35	0.28	0.28	0.24	0.11	0.20	0.28
Tx144370	15	744.82	22.81	36.72	37.54	38.97	39.30	38.87	0.22	0.40	0.36	0.32	0.41	0.40	0.29	0.31	0.27	0.12	0.25	0.30
Georgia 16HO	16	749.87	22.22	36.02	37.01	38.45	38.53	37.97	0.22	0.35	0.33	0.30	0.35	0.36	0.31	0.27	0.25	0.11	0.21	0.28
AG18	17	769.72	18.34	36.46	37.90	39.17	39.18	38.86	0.18	0.38	0.35	0.30	0.34	0.36	0.28	0.29	0.24	0.10	0.20	0.27
NemaTAM II	18	774.04	20.86	31.37	33.83	37.76	37.81	35.94	0.19	0.29	0.29	0.29	0.35	0.30	0.28	0.26	0.23	0.12	0.23	0.23
Georgia 09B	19	802.19	21.75	36.88	37.39	38.80	38.88	38.51	0.21	0.37	0.33	0.30	0.35	0.34	0.30	0.27	0.24	0.11	0.21	0.26
Georgia 14N	20	831.04	20.83	37.62	38.50	39.36	39.40	39.20	0.19	0.39	0.36	0.30	0.36	0.35	0.28	0.30	0.27	0.10	0.22	0.26
Mean			**20.35**	**36.03**	**37.04**	**38.72**	**38.72**	**38.14**	**0.19**	**0.38**	**0.34**	**0.30**	**0.36**	**0.36**	**0.28**	**0.29**	**0.25**	**0.11**	**0.22**	**0.28**

We assessed the relationship between the UAS-based features and peanut yield. Among all the measurements and dates, standard deviation of ExG showed a better relationship with yield (**Fig. 8**). These dates represent the plot variability and senescence variability.

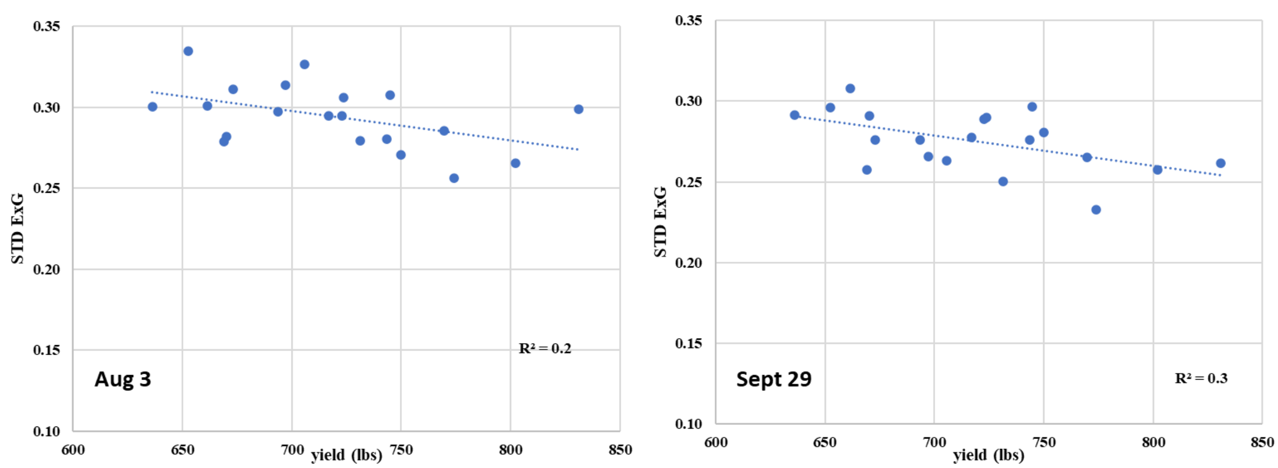

Figure 8. Relationship between standard deviation of ExG obtained from Unmanned Aerial System (UAS) based imagery and yield data collected from Keith ALT study.

Sub-Project V. Organic Breeding

We initiated an organic breeding program in the spring of 2019 before the funding for this sub-project began and have continued the program. Initial crosses were grown as plant rows in 2021. In addition, we evaluated some of our current elite breeding lines in certified organic fields in Terry County and Wilbarger Co. Interestingly, the top yielding line for the test was TamVal OL14 with a yield of 5376 lbs/ac. Tamnut 74 and PI221057 also yield in the top statistical group. Both of these lines were developed before seed treatments and herbicides were readily available. TP210656-2-1, a possible release candidate also preformed very well with a yield of 4665 lbs/ac and a grade of 78.2% (**Table 30**).

Table 30. Organic Test in West Texas for 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Seed Wt g/100		Seed/Lbs		Splits	
Cultivar												
TamVal OL14	5376	A	923.43	A	69.5	IJ	54.6	ABC	830	HIJ	4.1	FGH
Tamnut 74	4975	AB	890.93	AB	73.0	DEFG	44.1	GH	1028	CD	8.5	ABCD
PI221057	4968	AB	867.74	AB	72.0	EFGHI	56.6	AB	802	IJ	7.9	ABCDE
TP220683-1	4922	AB	921.60	A	75.5	ABCD	43.4	GH	1047	BCD	9.3	AB
TP210656-2-1	4665	BC	885.92	AB	78.2	A	56.8	A	799	J	3.3	GH
Schubert	4603	BC	790.11	BC	70.1	HIJ	52.6	CD	864	GHIJ	4.3	EFGH
OLin	4442	BC	787.51	BC	73.2	DEFG	48.0	EF	945	EF	6.4	BCDEFG
TP220684-1	4155	C	758.65	CD	73.7	CDEF	43.3	GH	1049	BCD	1.8	H
TP220683-8NR	4126	C	746.12	CD	72.8	DEFGH	41.5	H	1093	BC	5.8	BCDEFG
TP220683-4NR	3514	D	626.91	E	73.3	DEFG	51.9	CD	876	FGHI	8.5	ABCD
TP220683-2	3492	D	628.67	E	74.1	BCDE	55.0	ABC	825	HIJ	9.1	ABC
TP220683-2-3	3491	D	666.86	DE	76.7	AB	45.5	FG	998	DE	7.3	ABCDEF
#00	3440	DE	615.71	EF	73.2	DEFG	50.0	DE	913	FG	5.4	DEFGH
TP220683-2RN	3265	DEF	593.83	EFGH	74.1	BCDE	53.2	BCD	856	GHIJ	5.7	CDEFG
TP220683-3	3180	DEFG	603.99	EFG	76.3	ABC	42.4	GH	1070	BCD	8.8	ABCD
TP220683-6NR	2853	EFG	507.60	FGH	70.8	GHI	40.7	H	1114	B	8.9	ABCD
TP220683-5NR	2851	EFG	504.02	GH	71.0	FGHI	50.5	DE	898	FGH	6.5	BCDEFG
TP220683-7	2789	FG	507.17	GH	72.4	EFGH	42.8	GH	1061	BCD	8.7	ABCD
TP220683-7NR	2625	G	493.94	H	76.2	ABC	41.4	H	1101	BC	10.9	A
TP220683-5	1552	H	266.47	I	67.7	J	37.0	I	1226	A	6.1	BCDEFG
Mean	3764		679.36		73.2		47.6		970		6.9	
CV	28.1		27.9		4.0		13.0		13.1		41.9	
Entry "F"	<.0001		<.0001		<.0001		<.0001		<.0001		0.0031	

Table 31. Organic Test on the Rolling Plains for 2022

	Pods/Ac Lbs.		TSMK %		21/16 scr		18/64 scr		16/64 scr		Sound Splits %		Other Kernals %		Damaged Kernals %	
Cultivar																
Schubert	4379	A	64.0	AB	63.6	AB	86.5	BCDEF	4.4	DEFGH	5.5	DE	6.5	FG	3.8	BC
TP210655-1-1	3883	AB	64.7	A	58.5	AB	93.6	ABCDE	6.3	BCDEFG	3.3	E	8.0	EFG	2.2	C
TP210655-3-2	3519	ABC	59.7	ABCDEF	24.5	FG	108.2	AB	5.5	BCDEFGH	11.6	ABCD	11.7	CDEFG	3.3	BC
Tamspan 90	3465	ABCD	63.3	ABCD	69.4	A	75.3	DEF	6.0	BCDEFG	7.2	CDE	7.2	EFG	2.6	BC
TP210656-2-1	2930	BCDE	62.7	ABCD	70.1	A	76.8	DEF	6.7	ABCDEFG	3.5	E	14.8	BCDEF	2.9	BC
OLin	2832	BCDE	63.7	ABC	57.3	ABC	88.0	BCDE	5.4	CDEFGH	8.2	CDE	9.9	EFG	3.2	BC
TP210639-4-1	2653	BCDEF	57.3	DEFG	64.5	AB	67.9	EF	4.3	EFGH	6.3	DE	10.9	DEFG	8.6	A
#00	2493	BCDEFG	56.3	EFG	54.0	ABCD	74.7	DEF	5.3	CDEFGH	7.2	CDE	19.2	BCD	2.3	C
TP210653-2-2	2236	CDEFG	62.7	ABCD	59.2	AB	86.2	BCDEF	2.3	H	9.3	CDE	6.1	G	5.9	ABC
TP210641-5-1	2224	CDEFG	60.3	ABCDE	60.4	AB	80.1	CDEF	5.6	BCDEFGH	4.9	DE	12.3	CDEFG	3.0	BC
TP21064-2-1	2098	DEFG	58.0	BCDEFG	37.3	CDEF	98.7	ABCD	3.9	GH	5.3	DE	15.8	BCDE	7.0	AB
TP210639-4-1	2055	EFG	61.0	ABCDE	35.8	DEF	104.9	ABC	3.5	GH	8.3	CDE	13.7	BCDEFG	2.7	BC
TP210631-2	1939	EFG	52.0	G	54.6	ABCD	61.0	F	7.9	ABC	6.6	CDE	21.1	B	5.9	ABC
Tamnut OL06	1760	EFG	57.7	CDEFG	50.9	ABCDE	77.8	DEF	7.4	ABCDEF	8.3	CDE	13.9	BCDEFG	2.2	C
TP210631-4-1	1749	EFG	55.0	EFG	47.3	BCDE	78.9	CDEF	4.1	FGH	6.6	CDE	13.9	BCDEFG	6.2	ABC
TP210641-4-3	1689	EFG	40.0	H	11.0	G	69.7	EF	8.9	AB	10.8	BCD	37.6	A	3.8	BC
TP210652-2-3	1415	FG	64.0	AB	47.5	BCDE	92.0	ABCDE	7.8	ABCD	13.5	ABC	9.4	EFG	4.4	ABC
TP210641-4-1	1346	FG	60.0	ABCDE	26.8	FG	98.3	ABCD	7.6	ABCDE	17.0	AB	11.2	CDEFG	3.9	ABC
TP210633-3-1	1234	G	53.7	FG	30.7	EFG	88.8	BCDE	7.8	ABCD	6.8	CDE	19.6	BC	3.2	BC
TP210641-1-1	1173	G	62.7	ABCD	11.2	G	117.6	A	10.1	A	17.9	A	10.3	EFG	1.7	C
Mean	2247		58.7		20.5		86.2		6.1		8.6		14.0		3.9	
CV(%)	44.7		11.6		44.8		22.2		44.2		61.6		57.2		76.4	
Entry "F"	0.0005		<.0001		<.0001		0.0091		0.0034		0.0034		0.0591		0.2669	

A second organic test was planted at the Vernon Research and Extension Center. Due to tornado damage at the location irrigation was somewhat limited during critical times during the growing season and affected overall yield potential. In this situation the true Spanish lines performed best under these challenging conditions. Schubert yielded 4379 lbs/ac with a grade of 64%. While not ideal yield or grade it does give indications to possible germplasm that could be used to for drought tolerance breeding.

Sub-Project VI. Leafspot Screening and Sclerotinia Screening

Leafspot Resistant Spanish-types

Disease screening is an important part of the multiple disease resistance program. The year-to-year screening gives a good picture of the overall resistance package that is present in breeding lines. Year to year the variability is high in screening nurseries, so it is essential to evaluate lines for several years for a comprehensive picture of their resistance.

We are working with two crosses to add resistance to leaf spots to develop a resistant Spanish peanut. We evaluated the populations in 2021, and kept the most-resistant lines that year for evaluation again in 2022. The first population (**Table 32**) used wild species introgression lines as parents, and Bailey as a resistant (though Virginia type) check. Data from two ratings are presented, an earlier rating where disease pressure was low but late enough to suffer serious fall armyworm damage, and a second rating that was confounded with an early freeze, which made it harder to distinguish leaf spot damage from other damage. Significant differences were seen in the early rating, with several lines having leaf spot ratings similar to the resistant Bailey (though it was a Virginia).

Table 32. Introgression Line-Derived Spanish Leafspot Test. Values are leafspot ratings on the Florida scale (1=least damage, 10 = all plants dead).

Genotype	ELS1102		ELS1128	
T0103-04-00	2.31	d	–	ns
T0122-12-01	2.81	cd	5.79	
BaileyII	3.49	bc	5.77	
T0119-07-01	3.58	bc	6.27	
60-02-03-02	3.83	bc	5.94	
T0126-13-02	3.83	bc	5.77	
T0122-11-01	3.99	b	5.60	
T0133-05-01	4.08	b	6.94	
T0130-01-01	4.16	b	4.94	
T0118-08-01	4.31	ab	7.10	
T0118-01-01	5.31	a	7.10	
p	0.0202		0.3644	
Mean	3.79		6.12	
LSD	1.05		–	
CV	11.9%		16.1%	

The second population was developed from a cross by a resistant Virginia variety. Five breeding lines were superior to the susceptible Schubert variety in the first rating, and similar to the resistant NkatieSARI (**Table 33**). Three of the five most resistant lines were among the most-resistant lines in the second rating. There were no scores for Schubert in the second rating- all of its plants were dead, but this appeared to be a result of having leaves that were a favorite of armyworms. Breeding lines will be evaluated again for disease resistance, and will be evaluated for yield in West Texas.

For the 2022 season we also screened most elite lines in our nursery. Leafspot was light due to the hot dry weather and ratings were not significant. Breeding line TP200606-1-8 was rated at 2.0 on the Florida leaf spot scale which numerically had the highest disease in the test, while the new candidate line Tx144370 had one of the lowest in the test at 1.4 (**Table 34**). This test is conducted in an effort to establish Leafspot resistance in our most elite materials. The Advanced Lines Test was planted at the Texas A&M Yoakum Research sub-Station in Yoakum, TX.

Table 33. Virginia-Derived Spanish Line Test.

Genotype	ELS1102		ELS1128	
TxL151144-01-01	2.69	d	6.57	b-d
TxL151161-02-00	2.76	d	4.11	e
TxL151153-03-01	2.85	cd	4.75	de
NKatieSARI	3.02	cd	5.24	c-e
TxL151161-03-01	3.06	cd	5.91	c-e
TxL151208-02-01	3.19	b-d	4.74	de
TxL151153-02-01	3.35	a-d	5.50	c-e
TxL151147-01-01	3.35	a-d	4.74	de
TxL151161-02-02	3.36	a-d	5.21	c-e
TxL151153-03-00	3.36	a-d	5.21	c-e
TxL151171-01-01	3.56	a-d	5.16	c-e
TxL151153-07-02	3.65	a-d	5.30	c-e
TxL151198-02-01	3.69	a-d	5.74	c-e
TxL151152-01-04	3.69	a-d	6.74	b-d
TxL151206-04-01	3.69	a-d	5.41	c-e
TxL151187-01-01	3.69	a-d	6.07	c-e
TxL151151-04-01	3.85	a-c	4.75	de
TxL151137-02-01	3.85	a-c	5.05	c-e
TxL151159-02-01	4.15	ab	7.05	bc
60-02-03-02	4.35	a	5.74	c-e
TxL151162-02-04	4.36	a	9.21	a
Schubert	4.36	a	–	
TxL151156-01-03	4.36	a	8.21	ab
p	0.043		0.0453	
Mean	3.57		5.75	
LSD	1.06		2.09	
CV	13.8%		17.1%	

Table 34. Leafspot screening in South Texas in 2022

Cultivar	Rating	
TP200606-1-8	2.0	A
TP200607-1-16	2.0	AB
TP200625-3-2	2.0	AB
TxL100212-03-03	1.7	AB
Georgia 14N	1.7	AB
TP200606-2-9	1.7	AB
TP200610-3-1	1.6	AB
TP200610-3-2	1.6	AB
AG18	1.6	AB
Georgia 09B	1.6	AB
Georgia 16HO	1.6	AB
TP200606-3-10	1.6	AB
NemaTAM II	1.5	AB
TP200610-2-13	1.5	AB
TP200606-3-7	1.5	AB
TP200609-2-15	1.4	AB
Tx144370	1.4	AB
TP200607-1-2	1.3	B
TP200610-4-6	1.3	B
Mean	1.6	
CV	17.6	
Entry "F"	ns	

Additionally, this year for the first time we evaluated a population of materials that were specifically crossed for development of leafspot resistance (**Table 35**). These lines were evaluated for yield and grade. Yield in the test was not statistically significant due to heavy nutgrass pressure. However, breeding line TP220736-3-19 was the highest producing line in the test with a yield of 6084 lbs/ac. It also had the highest TSMK % in the test with a grade of 75.2%. Our intention is to screen these for leafspot resistance in the coming year and make crosses with resistant materials for further population development

Table 35. Leafspot Resistance Yield Trial in South Texas in 2022

	Pods/Ac. Lbs.		Val/Ac. $		TSMK %		Splits		Plant height (cm)	
Cultivar										
TP220736-3-19	6084	A	1119.72	A	75.2	A	6.2	EF	50	CD
Georgia 16HO	6008	A	1108.87	A	74.3	A	12.3	ABC	56	AB
TP220736-4-17	5913	A	1041.70	A	74.1	AB	8.0	DE	60	A
TP220736-6-27	5686	A	1063.53	A	70.7	C	14.6	A	49	CD
TP220736-1-10	5503	A	980.80	A	71.7	BC	10.4	BCD	56	AB
Webb	5413	A	996.17	A	73.8	AB	3.2	F	56	AB
TP220736-6-24	5158	A	911.37	A	73.0	ABC	8.5	CDE	52	BC
AG-18	4814	A	898.29	A	74.3	AB	10.5	BCD	45	D
TP220736-6-19	4800	A	874.48	A	71.0	C	12.9	AB	52	BC
TP220736-4-31	4600	A	820.23	A	70.8	C	8.6	CDE	57	A
Mean	5398		981.52		72.9		9.5		53	
CV	17.9		18.2		2.8		39.7		9.1	
Entry "F"	NS		NS		0.0064		0.0005		0.0001	

Crossing and marker development for improved leafspot resistance from the Burow lab continues with ongoing projects under other funding and will be evaluated in the field in 2022 (see Leafspot-resistant Spanish types section above). The Cason group will also be moving forward with population development from a different genetic background in additional materials. Crosses were made in 2021 and were grown as F1 plants in the greenhouses of Texas A&M AgriLife. These show promise for leafspot resistance and will be followed with testing and molecular marker development work. Crosses are ongoing that focus solely on leafspot resistance as well as incorporation into the multiple disease resistance program. As field rating and marker development continues, the information gathered will help us determine the best candidates to include in our 2021 leafspot crossing program.

Table 36. Sclerotinia Resistance in Central Texas for 2022

Cultivar	Rating	
TP200606-1-8	19.3	A
Tx144370	18.0	A
Georgia 16HO	17.3	A
TP200606-2-9	17.3	A
TP200609-2-15	17.3	A
TP200606-3-7	17.2	A
Georgia 14N	16.3	A
TP200625-3-2	16.0	A
TP200606-3-10	15.7	A
TP200607-1-16	15.3	A
TP200610-4-6	14.3	A
TP200610-3-2	14.0	AB
NemaTAM II	13.7	AB
TP200607-1-2	13.0	AB
TP200610-3-1	12.7	AB
TxL100212-03-03	12.0	AB
AG18	11.7	AB
TP200610-2-13	10.7	AB
Georgia 09B	10.3	AB
Mean	14.3	
CV	50.9	
Entry "F"	ns	

Finally, in related testing, **Table 36** presents the same advance lines that were evaluated for yield and grade as well as leafspot. In Central Texas these lines were also evaluated for *Sclerotinia minor* resistance as part of an ongoing screening nursery. A late season cool wet spell aided in disease pressure. No statistical differences were observed but Georgia 090B was numerically the lowest entry in the test with a hits per plot of 10.3 in 20 row feet. This was similar to AG18 and the release candidate which were 11.7 and 12 respectively. The other release candidate Tx144370 had one o f the highest ratings in the test at 18.o which is consistent with what we have observed during its testing.

Closing Comments

Many exciting projects are well underway. Texas A&M AgriLife Research is leading a large program to develop climate smart agricultural practices. Peanuts growers will be targeted to begin testing these practices to validate their effectiveness. Development of germplasm and algorithms will continue on the 3 new sub-projects, keeping our program at the cutting edge of research and variety development. Projects in high throughput phenotyping using UAS and handheld Raman spectroscopy are underway, as well as development of new populations for drought, yield, leafspot and organic production. In addition, we began new projects that specifically deal with nutrition and health of the peanut, robotics in agriculture, a high throughput grading platform. Finally, we began development of a project involving high oil content peanuts for the Chevron Corporation. As this project unfolds it has the potential to be transformative in peanut production in Texas as well as Texas Agriculture in general.