

Title: Increase of Early-Maturing Peanut Lines

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Objectives.

Our goal is to develop peanut lines maturing approximately two weeks earlier than current varieties and that have the high-oleic trait. We are also putting selection pressure to select for high-yielding material despite being earlier and are emphasizing disease resistance now. This is because of the serious levels of Sclerotinia bight in Central and West Texas and TSWV in South Texas.

Results

As a result of the winter increase, we had a large number of runner materials to evaluate in the field in 2006, as well as a lesser number of high-oleic Valencias. Among the runners, we tested some pure high-oleic lines and found two that performed very well at the limited number of sites for which we had seed. We also had a much larger number of lines which we have not finished evaluating. Among the Spanish and Valencias, we also have lines with good yield and maturity but which are segregating for the high-oleic trait. The high-oleic Valencias that were received from the nursery were also planted, and will be analyzed later this spring.

1. Winter nursery increase in Puerto Rico. We sent a large amount of materials for increase in Puerto Rico. Because of the amount and nature of the material (a lot of single plants), we sent Yolanda Lopez to help with planting and harvest of the material.

The materials that we received back from the nursery included:

- Approximately 500 runner backcross lines developed to combine early maturity in a breeding line developed earlier with the high oleic trait and disease resistance.
- Approximately 40 high- and mid-oleic runner accessions selected from the best runner lines evaluated in 2004 and 2005.
- Approximately 70 high-oleic lines of Valencias, selected from Valencia materials that had good yield, maturity, and shelling characteristics but needed to incorporate the high oleic trait and proper seed coat color.

- Runner lines from crosses made to begin incorporating drought tolerance into peanut. Several hundred F_2 single plants from crosses made by a former graduate student were sent to Puerto Rico. Unfortunately, many of these populations did not segregate and were considered to be inadvertent self-pollinations. However, we did recover about 200 families from crosses that did appear to be true crosses. This demonstrates that proof of hybrids using molecular markers would be a major asset and allow us to prescreen the F_1 generation and omit selfs early in the breeding program.

2. Field evaluation of advanced materials in Texas.

(a) Testing of early runners in West Texas. These were advanced from selections of $F_{2:7}$ runner and bunch materials evaluated in 2005. The bunch materials were eliminated because they did not yield as well, although several accessions had good combinations of earliness and disease resistance. (We are going back to make selections for high-oleic lines from these bunch lines to carry forward in a crossing program in 2007.) Among the runners there were several breeding lines with good combinations of yield, maturity, shelling, and seed size in 2004 and 2005. These were segregating for the high-oleic trait, and we selected high-oleic seeds (and mid-oleic seeds where we did not find high-oleic seeds) for increase in the summer of 2005 and at Puerto Rico in the winter of 2005/2006.

This experiment was grown at 4 locations in Texas; the data from West Texas are presented here, and the Stephenville and Yoakum tests in the Quality report. Materials were not planted in Frio County because previous tests indicated that only 2 runner and 1 bunch line had any appreciable resistance to TSWV, but these lines had other, undesirable traits that resulted in their being eliminated from further testing. (Instead, we are making backcrosses to better lines to incorporate TSWV resistance.)

At the J Leek farm, two high-oleic, early-maturing lines were in the top three accessions in the test (**Table 1**). The top lines 05LUB268 and 05LUB267, yielded similarly to FlavorRunner 458; one yielded 300 lb/ac more and the other 130 lb/ac less, but these differences were not significant statistically. Both selections were derived from the top-yielding breeding line evaluated in 2005, and yielded significantly better than Tamrun OL02, which did not do well at this location this year, unlike in other years. Maturity was significantly better in the two breeding lines, with 55% and 48% pods with brown and black hulls, compared to 27% for FlavorRunner 458 and 15% for Tamrun OL02. This is a difference of about two weeks in maturity. If the orange-colored pods are included, 83% and 71% of the pods were out of the yellow maturity zone which causes the greatest problem with off flavors (data not shown). Seed size was intermediate between FlavorRunner 458 and Tamrun OL02. Shelling of 05LUB268 was similar to FlavorRunner 458, but 05LUB267 had a lower shellout.

Table 1. Early Runner Test, J Leek Farm 2006

Genotype	Yield (lb/ac)	%Mature Pods	Seed Wgt (g/100)	%TSMK
05LUB268	5445 a	54.7 c-e	67.70 i-k	74.80 a-f
Flv458	5131 ab	26.7 i-k	66.03 j-l	77.00 a
05LUB267	5003 a-c	48.0 d-h	70.47 h-k	73.40 d-i
05LUB278	4699 b-d	23.3 j-k	80.27 b-e	71.90 g-k
05LUB280	4618 b-e	35.3 f-j	81.17 b-d	68.20 m
05LUB281	4586 b-e	24.0 j-k	73.27 f-i	71.10 i-l
05LUB277	4390 c-f	32.6 g-k	83.40 b-c	74.50 b-f
NC7	4370 c-f	76.0 a-b	99.30 a	75.30 a-e
05LUB279	4350 c-f	23.3 j-k	77.30 d-g	70.50 j-m
Tx036922	4297 d-f	52.7 c-f	73.33 f-i	70.20 k-m
05LUB269	4235 d-g	28.0 i-k	64.87 k-m	73.80 d-h
TamrunOL02	4176 d-g	15.3 k	72.60 g-i	75.20 a-e
Tx036926	4176 d-g	39.3 e-j	75.30 e-h	73.50 d-i
05LUB270	4126 d-h	44.7 d-i	73.37 f-i	75.00 a-e
Tx036920	4048 d-i	39.3 e-j	75.20 e-h	71.10 i-l
Tx036938	3968 e-i	59.3 b-d	71.43 h-j	71.50 h-k
Tx036932	3793 f-j	33.3 g-k	71.00 h-j	75.70 a-d
Tx036874	3576 g-k	69.3 a-c	79.67 b-e	71.70 h-k
05LUB275	3568 g-l	44.7 d-i	84.63 b	72.50 f-k
Tx036934	3452 h-m	30.7 h-k	70.83 h-j	75.30 a-e
05LUB271	3451 h-m	23.3 j-k	70.60 h-k	76.80 a-b
Tx036937	3425 h-n	48.7 d-h	66.10 j-l	74.20 c-g
05LUB303	3411 i-n	57.3 c-e	83.13 b-c	70.10 k-m
Tx036925	3214 j-n	50.0 d-g	70.13 h-k	72.90 e-j
Tx036878	3192 j-n	44.7 d-i	59.53 m-n	68.80 l-m
Tx036939	3007 k-n	44.7 d-i	56.20 n	71.10 i-l
Tx036940	2865 l-n	52.7 c-f	78.43 c-f	76.30 a-c
Tx036903	2838 m-n	59.4 b-d	61.43 l-n	70.90 j-l
Tx036877	2745 n	41.3 d-j	58.57 n	72.00 g-k
BSS56	1735 o	86.0 a	56.60 n	75.60 a-d
Mean =	3863	43.62	72.40	73.03
LSD =	704	18.64	5.73	2.46
CV =	11.1%	26.14%	4.85%	2.06%

Means followed by the same letter are not significantly different by Fisher's LSD ($p=0.05$).

These lines were tested at two additional sites in Terry County. At Ramon Chavez's farm at Tokio (**Table 2**), 05LUB268 had a value per acre and yield numerically but not statistically lower than FlavorRunner 458 and Tamrun OL 02; Tamrun OL 02 performed similarly to FlavorRunner 458 at this site. Seed size was smaller than expected (59 g/100); however the proportion of seeds that rode an 21.5/64 screen was similar to Florunner and Tamrun OL02. Maturity data have not been obtained yet. The line 05LUB267 was not planted here for lack of seed. The lines were planted also at Delwin Morrow's farm near Wellman, but data have not been analyzed yet.

Table 2 Early Runner Test, Tokio 2006

Genotype	Value/Acre	Yield (lb/ac)	Seed Wgt (g/100)	PctTSMK	PctELK
NC7	967 a	5078 a	100.77 a	72.61 d-g	44.71 a
Flarunner	963 ab	5108 a	66.03 h	76.01 ab	18.97 g-j
Tamrun OL01	932 ac	5150 a	77.50 b-d	74.41 b-d	33.62 b
FlRun 458	923 ac	4769 ac	64.90 hi	77.73 a	21.81 e-i
Tamrun OL02	917 ac	4923 ab	71.30 e-g	75.00 b-d	19.80 f-j
TX033630	914 ac	4906 ab	74.13 c-e	75.50 ac	29.02 bc
Tamrun96	856 ad	4834 ab	66.01 h	73.31 c-f	27.42 c-e
05LUB279	843 ae	4980 ab	77.33 b-d	68.51 j-l	24.76 c-g
05LUB268	819 be	4491 ae	59.06 j-m	73.87 b-e	20.25 fi
Tx036926	814 ce	4597 ad	74.00 c-e	72.71 d-g	28.49 b-d
Tx036920	790 cf	4648 ad	72.23 ef	68.70 i-l	21.34 fi
Tx036903	749 dg	4145 c-g	60.46 i-k	72.98 c-g	5.86 m
05LUB270	738 dg	4128 c-g	65.60 h	73.98 b-e	13.84 j-l
05LUB280	729 dh	4388 b-f	78.67 bc	66.99 l	28.14 b-d
Tx036938	723 dh	4077 dh	71.43 e-g	71.73 e-h	17.97 h-j
Tx036874	710 eh	4111 c-g	75.37 b-e	70.82 f-j	41.02 a
Spenco	667 fi	3693 gi	54.23 mn	72.65 d-g	10.00 lm
Tx036877	664 fj	3665 gi	56.50 k-n	73.00 c-g	5.95 m
05LUB269	658 fk	3697 gi	54.53 l-n	70.93 f-j	25.66 c-f
Tx036878	639 gl	3833 e-i	53.53 n	70.41 g-k	17.83 h-j
Tx036922	612 gl	4146 c-g	65.17 hi	68.05 kl	25.56 c-f
Tx036925	590 h-m	3712 gi	65.72 h	71.19 fi	16.55 i-k
05LUB271	552 i-m	3753 fi	67.17 gh	67.78 kl	8.29 lm
Tx036940	519 j-m	2992 jk	72.72 df	73.22 c-f	11.82 k-m
05LUB281	518 k-m	3301 i-k	80.07 b	69.09 h-l	22.61 dh
Tx036932	512 lm	2880 jk	63.47 h-j	72.68 d-g	23.72 c-h
Tx036937	508 lm	3270 i-k	59.36 j-l	68.03 kl	9.59 lm
Tx036934	500 lm	3434 h-j	68.00 f-h	70.98 f-j	13.90 j-l
Tx036939	461 m	2672 k	55.47 l-n	69.48 h-l	6.91 m
BSS56	278 n	1505 l	54.53 l-n	73.01 c-g	9.35 lm
Mean =	702	4029	67.51	71.85	20.16
LSD =	145	672	4.84	2.66	6.01
CV =	11.9%	9.6%	4.1%	2.1%	16.9%

Means followed by the same letter are not significantly different by Fisher's LSD (p=0.05).

We do have some lines that appear to combine yield, early maturity, runner seed size, and the high-oleic trait. It will take additional evaluation to determine whether these lines have the potential to be released. We hope to have a number of additional high-oleic runner lines and perhaps some backcrosses involving these high-oleic selections to evaluate next year.

(b) Evaluation of early runners increased in Puerto Rico. A total of 450 entries were planted at the J. Leek farm for evaluation of yield, seed size, and maturity. These were the materials that were developed from a backcross between a low-oleic early-maturing runner breeding line developed earlier, and Tamrun OL01 and Tamrun OL02 as the high-oleic, disease-resistant donor parents. There were not sufficient seed to plant the experiment at an additional location. Approximately 70 additional entries were planted for increase at the TTU farm, as there was insufficient space to plant the rest at the J Leek farm, and many of these had too few seed to

make for a meaningful test. The materials have been harvested, but because of the large size of this experiment, we have not finished processing this test yet and are not able to report results. We expect to finish analysis in April, and to make selections for testing in 2007. In addition, approx. 40 lines from a more-advanced generation were also planted at TTU and data remain to be analyzed.

(c) Evaluation of advanced Spanish breeding lines. We made crosses previously to combine the high-oleic trait with high yield and early maturity in Spanish germplasm. This was done to improve on OLin, which typically yields about 7% less than Tamspan 90, and which is not as mature as Tamspan 90 at locations with cooler temperatures (for example, Lamb and Moore counties.) These lines are currently in the F₅ generation and were evaluated at the J. Leek farm and at the TAES Experiment Station at Halfway; we had performed evaluations on-farm in Lamb County in 2005, but were not able to find cooperators in 2006 because of reduced peanut acreage.

At the J Leek farm (**Table 3**), several accessions were statistically similar to Tamspan 90 in value per acre, yield, and grade. Some of these accessions were in the top category last year also, and are worth pursuing further. We have not measured maturity yet, and so this information is not presented. Last year, we saw differences in maturity between many of the accessions and OLin in Lamb County, but not in Terry County.

Table 3. Early Spanish Test, J. Leek 2006

Genotype	Value/Acre	Yield (lb/ac)	Seed Wgt (g/100)	PctTSMK
Tamspan90	723 a	3957 a	45.73 g-l	74.43 a-e
Tx036776-09	664 ab	3595 a-c	45.00 i-m	75.44 ab
Tx036784-47	657 ab	3768 ab	43.73 j-m	70.73 f-i
Tx036776-43	652 ab	3531 a-d	49.67 b-e	75.33 a-c
Tx036784-55	635 a-c	3609 a-c	47.20 e-i	71.34 e-i
Tx036776-11	630 a-c	3564 a-d	45.53 g-m	71.81 b-i
Spanco	623 a-c	3521 a-d	52.13 ab	71.94 b-i
Tx036784-29	618 a-c	3568 a-d	46.87 e-j	70.19 g-j
Starr	613 a-c	3412 a-e	45.80 g-l	73.20 a-g
Tx036776-26	606 bc	3244 b-e	48.47 d-h	76.15 a
Tx036776-23	604 bc	3310 b-e	55.20 a	74.19 a-f
Tx036784-09	598 bc	3403 a-e	46.67 e-j	71.33 e-i
Tx036776-35	597 bc	3368 a-e	43.00 k-m	71.89 b-i
Tx036784-12	594 bc	3396 a-e	46.03 f-k	70.72 f-i
Tx036784-02	593 bc	3467 a-d	45.80 g-l	69.08 i-j
Olin	592 bc	3344 a-e	49.27 b-f	71.91 b-i
Tx036776-04	589 bc	3363 a-e	45.20 h-m	71.01 e-i
Tx036776-08	582 bc	3217 b-e	51.93 a-c	74.16 a-f
Tx036776-12	581 bc	3232 b-e	47.13 e-i	72.99 a-h
Tx036776-13	581 bc	3331 b-e	51.50 b-d	70.97 e-i
Tx036784-26	578 bc	3321 b-e	47.83 e-i	70.03 g-j
Tx036784-51	576 bc	3320 b-e	47.13 e-i	70.16 g-j
Tx036784-28	571 bc	3241 b-e	47.57 e-i	71.70 c-i
Tx036776-48	570 bc	3219 b-e	45.97 f-k	71.67 d-i
Tx036776-34	567 bc	3348 a-e	42.33 m	69.54 h-j
Tx036776-31	549 bc	3151 b-e	51.63 b-d	70.88 e-i
Tx036776-45	549 bc	3332 b-e	47.70 e-i	66.98 j
Tx036776-38	528 c	2950 d-e	48.67 c-g	73.40 a-g
Tx036784-50	524 c	2993 c-e	46.47 e-j	70.68 f-i
Tx036776-27	521 c	2823 e	42.57 l-m	75.12 a-d
Mean =	596	3363	47.32	71.97
LSD =	117	619	3.31	3.65
CV =	12.0%	11.3%	4.3%	3.1%

Means followed by the same letter are not significantly different by Fisher's LSD (p=0.05).

(d) Test advanced Spanish x Valencia high O/L breeding lines for yield. The goals are to develop a high-oleic Spanish variety that matures better than OLin, and a high-oleic Valencia variety.

Among the Spanish materials, line Tx047914 was the top yielder at the J. Leek farm (Table 4), although this was statistically similar to a large number of lines, including Tamspan 90 and New Mexico Valencia C. The Spanish breeding line has been among the top two or three lines for yield at multiple locations. In 2005 and 2006, this line had better maturity in Lamb

County than OLin, and was similar to Tamspan 90. We have not blasted the pods from the 2006 materials yet, so do not have data this year on maturity. This experiment was planted also at the TAES-Halfway site, and we expect to have additional data also. This line is still segregating for the high-oleic trait, and we have identified and planted high-oleic seeds to develop high-oleic sublines for further testing. Some additional lines, including Tx047909S and Tx047919S also did well. These were selections from lines that performed well in previous years, but were segregating for seed coat color and number of seeds per pod.

Table 4. Spanish x Valencia Test, J. Leek 2006

Genotype	Value/Acre	Yield (lb/ac)	Seed Wgt (g/100)	PctTSMK
Tx047914	712 a	4057 a	52.07 c-e	71.80 b-e
Tamspan90	699 a	3894 ab	47.07 g-i	73.08 a-c
NMValC	682 a	3715 a-c	54.53 bc	70.84 c-f
Tx047919S	650 ab	3554 a-c	45.54 hi	74.34 ab
Tx047909S	645 ab	3444 a-e	48.43 e-h	76.25 a
Tx047910	639 ab	3665 a-c	52.20 cd	70.86 c-f
Tx047906	636 ab	3620 a-c	51.33 c-f	67.41 gh
Tx047908	633 ab	3672 a-c	59.53 a	68.46 f-h
Tx047914Imp	632 ab	3630 a-c	53.53 b-d	70.73 c-f
Tx047922	632 ab	3715 a-c	53.67 b-d	68.84 e-g
Tx047901V	630 ab	3542 a-c	50.27 d-g	72.79 b-d
Tx047901	625 ab	3462 a-d	51.57 c-f	70.50 c-g
Tx047919	599 a-c	3356 b-e	46.80 g-i	72.50 b-d
Tx047909	590 a-d	3148 c-e	47.97 f-i	76.10 a
Tx047924	587 a-d	3324 b-e	56.57 ab	68.78 e-g
Tx047905	548 b-d	3139 c-e	50.00 d-g	70.65 c-f
Tx047925	524 b-d	3233 b-e	45.83 hi	65.43 h
Tx047903	496 cd	2860 de	39.97 j	69.71 d-g
Tx047913	470 de	2775 e	44.83 hi	68.56 f-h
Tx047907	356 e	2013 f	44.63 i	72.58 b-d
Mean =	599	3391	49.82	71.01
LSD =	127	675	3.73	3.22
CV =	12.7%	11.9%	4.5%	2.7%

Means followed by the same letter are not significantly different by Fisher's LSD ($p=0.05$).

Among the Valencias, Tx047910 did well, as in 2005. At J. Leek, this line yielded and graded similarly to New Mexico Valencia C. In 2005, this line outyielded New Mexico Valencia C at some locations. This line also is not a pure high-oleic line and sublines need to be isolated. Several other Valencia lines (such as Tx047901V) were similar to the Valencia check. Sublines were established from some of these and increased at Puerto Rico.

(e) Evaluation of high-oleic Valencias. These were developed from single-plant, high-oleic selections made from lines that had good yield and maturity. These were grown at J Leek and Texas Tech, and are awaiting processing and analysis. There was not enough seed to test for Sclerotinia resistance at Stephenville this year.

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