

Title: **Breeding for Early-Maturing Peanuts**
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Problem and Need

Development of early-maturing peanuts is a priority objective of the Texas peanut breeding program. Benefits of reducing the days to maturity are a higher-quality (more mature) crop, as well as cost savings from fewer irrigations, fungicide applications for disease control, and fewer days for weeds to grow. The crop would also be less exposed to drought, flood, wind, hail, and freeze. Maturity is especially important in West Texas, where the growing season is shorter than in the southern part of the state, and immaturity is associated with poor flavor characteristics.

We have breeding lines from several generations of work now, and are continuing evaluation of these for yield, grade, maturity, and O/L content. We are also making new crosses involving early-maturing accessions.

Objective.

Our goal is to develop peanut lines maturing approximately two weeks earlier than current varieties. We are also attempting to combine earliness with high O/L content. Earliness is expected to be associated with lower yield on the average, so strong selection pressure must be applied to select early genotypes that equal or exceed the yields of parents.

Current Results

Two major sets of crosses are the F2:5 and F2:6 generations. Results of the F2:5 generation are presented in this report, and the F2:6 data are presented in another report (TPPB/Quality.)

(a) F2:5 populations. The F2:5 generation is a population derived from crosses between BSS56 and high-O/L runner lines. BSS56 is a Bunch/Spanish plant that matures in 90 days in Africa, has small leaves and seeds, and an unusually low (0.7:1) O/L ratio. The runner breeding lines used as parents included what is now TamrunOL01 and sister lines. These are all high-O/L, yield well, and have some tolerance to Sclerotinia and TSWV.

This population was tested as F2 single plants in 2001, and as F2:4 single plants in 2002. These populations included runner, bunch, and Spanish plants. They range from completely-mature to totally immature, poor to good yield, and low to high-O/L. Although these were evaluated as space-planted single plants, and there is a lot of environmental evaluation in single plants, we made selections to emphasize O/L ratio, seed size, plant type, and yield.

Seeds of single plants grown in 2002 were planted as replicated 8-plant rows at 3 locations in 2003 (WPGRF-Denver City, TAES-Halfway, and TAES-Etter but data from Etter are not

available yet). These locations were used to represent Texas #1 peanut-producing county, as well as cooler areas where plants would be under more stress for maturity. Only 8 seeds were planted because of the limited number of seeds available at the time.

Results from 2003 show that this population has promise for developing early, high-O/L varieties. Results obtained so far include:

Runners:

There are a number of varieties that yielded as well as Florunner at Denver City and Halfway, and were more mature than Florunner. Lines Tx026008-04 and Tx026008-11 were in the same yield category as Florunner at Denver City but were more mature (**Table 1**). Florunner and Tamrun96 had only 11% mature pods in this experiment, but Tx026008-04 and Tx026008-11 had 32% and 59% mature pods. The immaturity of standard runner varieties was in part a result of late planting (June 12) needed to wait for 2002 field data to be completed before making selections. In other experiments Florunner was about 30% to 40% mature when planted in early May. Several other breeding lines were somewhat lower-yielding at Denver City but equal to Tamrun96, and also had from 55% to 60% mature pods.

Yields were based on 8 seeds planted per 10 foot row, not the 75 seeds usually planted in a 20 foot row. This was necessary because of the limited number of seeds at this early stage. Yields are a little lower than at the standard planting density. More-importantly, there was more variability because even one or two seeds that failed to germinate made a large difference in yield.

At Halfway, yields were somewhat lower because of later planting and cooler weather (**Table 2**). Maturity was also less, averaging 25% across the experiment, compared to 45% at Denver City. Florunner and Tamrun96 had 6% and 8% mature pods at harvest, but Tx026005-04 and Tx026014-07 had 48% and 51% mature pods. The Spanish check variety Tamspan 90 matured well, with 81% mature pods. Therefore some of the runners were intermediate in maturity between standard runner and Spanish varieties.

Some of the better breeding lines did well at both locations, and some did not. Tx026014-07 had 45% and 51% mature pods at Denver City and Halfway, respectively, and was similar to Florunner in yield at Denver City, and similar to Tamrun96 at Halfway. On the other hand, Tx026008-04 had only 4% mature pods at Halfway. This shows the need for continued testing at multiple locations to find out how well the lines perform, as well as how stable they are across environments.

Seed size in this population varied from Spanish (239 pcs/100g) to runner (149 pcs/100g) to Virginia (103 pcs/100g) in size. Depending on future results, it may be possible to use these lines for developing early-maturing high-O/L runner or Virginia peanuts.

We have yet to run tests for O/L ratio. When we made selections last year, we estimated that about 40% to 45% of these lines would have some plants that are high-oleic

Bunch types:

Several bunch lines also had promising combinations of yield, maturity, and seed size. At Denver City (**Table 3**), Tx026014-01 and Tx026008-02 were in the top yield category along with Florunner, had seed sizes similar to this variety, but were much earlier in maturity. These breeding lines had 63% and 81% mature pods, compared to 14% for Florunner and 83% for Tamspan 90. In addition, there was one line, Tx026033-10, with a seed size similar to NC-7 and a maturity of 81%. However, yield of this line was significantly less than NC-7.

At Halfway (**Table 4**), maturities were less - 0% for Florunner and only 63% for Tamspan 90. The lines Tx026014-01 and Tx026008-02 were 22% and 47% mature at this site. Two additional lines had maturities similar to Tamspan 90. There were no statistically-significant differences for yield in this population at Halfway. This may have been due to weeds, which were both difficult to control because of the surface drip tape and which grew thickly between the tape and the peanut plants. In addition, there were differences in stand between plots.

Spanish.

Among the Spanish lines, one accession stood out as having a good yield and runner-seed size. Tx026002-02 did well at both locations (**Tables 5, 6**), although the maturity of 53% to 58% was about 10 to 20 percentage points lower than Spanco and Tamspan 90. The large seed size could potentially allow seeds of a Spanish variety to substitute for less-mature runners.

(b) Evaluate F₂ single plants from new crosses. We planted and harvested F₂ plants from new crosses at Denver City in 2003. Maturity data will be taken after we have finished taking data on the replicated field trials (such as the F₂:5 population).

(c) Backcross selected early-maturing progeny by selected varieties. We are crossing the most-promising high-yielding, early-maturing F_{2.5} lines from 2002 (grown as F_{2.6} lines this year) by high-O/L varieties (Tamrun OL01 and OLin, for example) to introduce the high-O/L trait and improve grade. The progeny need to be evaluated in 2004, and additional crosses are needed.

(d) Expand the breeding program by introducing additional early-maturing material as parents. We are making additional crosses with runner and Virginia varieties to develop earlier varieties with high O/L content..

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Table 1. Denver City 2003 Runner F2:5 Test

Genotype	Lbs Pods/Acre	100 Seed Wgt	%Maturity
NC7	5913 a	106.40 c	26.50 h-m
Tx026008-04	4741 b	82.15 c-e	32.40 h-j
Florunner	4261 bc	69.55 e-k	10.50 mn
TX966205	4260 bc	65.95 f-m	13.30 k-n
Tx026014-07	3965 b-d	87.85 b-d	45.30 e-h
Tx026014-02	3815 b-e	91.90 bc	57.10 c-g
Tx026008-11	3734 b-e	86.30 b-d	58.60 c-g
Tamrun96	3648 c-e	67.47 f-l	11.50 mn
Tx026027-05	3640 c-e	75.85 d-h	29.00 h-m
TX977235	3616 c-e	64.20 g-n	11.80 l-n
Tx026037-11	3530 c-e	67.35 f-l	56.00 c-g
TX972505	3463 c-f	67.25 f-l	12.40 l-n
Tx026037-10	3312 c-g	87.65 b-d	60.00 c-g
Tx026027-13	3223 c-g	54.40 l-p	27.90 h-m
Tx026014-08	3209 c-g	96.75 ab	4.00 n
Tx026047-12	3188 d-h	47.05 op	42.20 f-i
Tx026016-04	3144 c-i	80.66 c-f	49.60 d-h
Tx026008-01	3032 d-i	81.70 c-e	61.60 b-f
Tx026020-05	2951 d-j	44.25 p	62.20 b-f
Tx026008-05	2816 e-k	87.10 b-d	57.50 c-g
Tx026020-09	2724 d-l	77.85 c-h	28.60 h-m
Tamspar90	2720 e-l	48.10 op	85.90 a
Tx026037-16	2635 e-m	87.45 b-d	52.60 d-g
Tx026008-06	2631 e-m	64.35 g-n	59.00 c-g
Tx026027-04	2588 e-m	63.05 h-n	25.60 i-m
Tx026018-12	2562 e-m	68.35 e-l	72.70 a-d
Tx026037-09	2525 e-m	75.35 d-l	57.80 b-g
Tx026025-08	2436 f-m	70.95 e-i	31.60 h-k
Tx026025-07	2394 g-m	70.10 e-j	30.30 h-l
Tx026020-11	2336 g-m	64.30 g-n	29.70 h-l
Tx026047-08	2249 g-n	57.95 j-o	19.20 j-n
Tx026025-10	2145 h-n	78.75 d-g	17.10 j-n
BSS56 1	965 i-n	52.60 n-p	92.70 a
Tx026025-06	1798 k-o	68.30 f-l	39.80 f-i
Tx026005-04	1699 l-o	52.60 n-p	73.30 a-c
Tx026027-03	1678 l-o	62.55 h-n	63.40 b-e
Tx026035-12	1435 l-o	53.90 l-p	79.20 ab
Tx026035-03	1425 l-o	54.35 k-p	37.10 f-j
Tx026037-02	1402 l-o	75.35 d-i	69.70 a-d
Tx026035-11	1221 no	42.30 p	79.00 ab
Tx026037-14	528 o	79.15 c-g	62.30 b-f
lsd	1064	12.71	18.91%
CV	17.8%	9.0%	22.1%

Table 2. Halfway 2003 Runner F2:5 Test

Genotype	Lbs Pods/Acre	%Maturity
Tx026014-08	4013 a	39.38 b-g
Tx026020-11	3753 a	11.45 i-k
Tx026008-11	3425 ab	24.44 e-j
Tx026005-04	3020 a-c	47.89 b-d
Tx026025-06	3003 a-c	21.01 e-k
Florunner	2858 a-c	6.00 jk
Tx026016-04	2848 a-c	10.75 i-k
Tx026037-10	2829 a-d	22.96 e-j
Tx026047-12	2784 a-e	25.00 e-j
Tx026008-04	2762 a-e	4.17 jk
Tamrun96	2645 b-e	7.52 jk
Tx026027-13	2507 a-f	11.62 i-k
Tamspan90	2483 a-f	81.43 a
Tx026014-02	2439 b-f	24.65 e-j
Tx026037-09	2314 a-g	21.60 d-k
Tx026008-06	2313 b-g	39.00 b-g
TX972505	2311 b-g	2.11 jk
Tx026008-05	2276 b-g	30.00 c-i
Tx026025-10	2269 b-g	6.54 jk
Tx026014-07	2234 b-g	51.00 bc
Tx026037-02	2178 b-h	47.38 b-e
Tx026027-03	2026 b-h	15.38 f-k
Tx026008-01	1995 c-h	16.00 g-k
Tx026020-05	1807 c-h	39.87 b-f
Tx026047-08	1700 c-h	5.50 jk
Tx026027-04	1681 c-h	1.38 jk
TX966205	1587 d-h	0.00 k
Tx026035-12	1549 e-h	34.56 c-h
TX977235	1509 f-h	11.00 i-k
BSS56	1453 f-h	88.00 a
Tx026025-08	1449 f-h	13.78 g-k
Tx026025-07	1439 f-h	12.43 i-k
Tx026037-16	1261 f-h	42.00 b-e
Tx026037-11	1175 g-h	13.90 g-k
Tx026035-03	1053 f-h	33.38 b-i
NC7	1011 g-h	40.42 b-f
Tx026035-11	919 g-h	59.00 b-c
Tx026020-09	817 g-h	11.15 g-k
Tx026027-05	606 h	2.00 jk
Tx026018-12	532 h	19.38 e-k
	1251	21.64
	28.73%	45.98%

Figure 3. Denver City 2003 F2:5 Bunch Trial

Genotype	Lbs Pods/Acre	Wgt 100 Seeds	% Mature
NC7	3706 a	81.52 a	40.83 c
Spanco	3297 ab	53.40 ef	84.19 ab
Tx026014-01	3123 a-c	58.50 de	63.00 bc
Florunner	3086 a-c	58.95 de	14.14 d
Tx026008-02	2960 a-d	62.52 cd	80.73 ab
BSS56	2703 b-d	51.70 ef	89.26 a
Tx026043-02	2679 b-e	55.60 d-f	73.22 ab
Tx026005-01	2605 b-f	44.25 gh	60.67 bc
Tamspan90	2393 b-f	44.20 gh	82.94 ab
Tx026033-10	2113 b-g	77.02 ab	80.55 ab
Tx026037-04	2026 d-g	71.55 bc	47.50 c
Tx026005-12	1969 d-h	40.50 h	79.29 ab
Tx026033-09	1942 c-h	77.62 ab	78.73 ab
Tx026031-10	1894 d-h	48.30 fg	14.24 d
Tx026005-10	1803 d-h	37.80 h	77.69 ab
Tx026037-05	1640 e-h	73.90 b	41.00 c
Tx026037-12	1336 f-i	63.32 cd	36.23 cd
Tx026016-08	967 g-i	41.30 gh	59.31 bc
Tx026005-09	337 i	36.17 g	38.73 cd
Tx026010-04	306 i	38.49 g	55.40 bc
LSD =	1053	7.41	25.04
CV =	20.3%	6.0%	21.1%

Figure 4. Halfway_2003_F2:5_Bunch_Trial

Rank	Genotype	Lb Pods/Acre	% Mature
1	Tx026008-02	3541 nsd	47.22 bc
2	Spanco	3371	81.55 a
3	Tamspan90	3137	63.01 ab
4	Tx026043-02	2979	33.46 cd
5	Tx026014-01	2626	21.57 c-e
6	Tx026031-10	2595	17.99 c-e
7	NC7	2072	30.32 cd
8	Florunner	1954	0.00 e
9	Tx026005-12	1886	61.03 ab
10	Tx026005-10	1797	37.93 b-d
11	BSS56	1745	79.00 a
12	Tx026037-04	1429	8.78 de
13	Tx026005-01	1289	63.21 ab
14	Tx026016-08	1219	18.48 c-e
15	Tx026037-05	1200	3.00 e
16	Tx026005-09	1169	22.78 c-e
17	Tx026037-12	966	24.78 c-e
18	Tx026010-04	424	11.87 c-e
LSD =	2260	25.62	
CV =	53.1%	34.7%	

Table 5. Denver City 2003 F2:5 Spanish Trial

Genotype	Lb Pod/Acre		Wgt 100SMK	% Mature		
NC7	3580	a	74.45	ab	18.43	f-i
Spanco	3383	ab	51.85	f-h	85.00	a
Florunner	2985	a-c	51.85	f-h	1.00	i
Tx026002-02	2624	a-d	61.15	de	53.00	b-e
Tx026002-01	2611	a-d	53.60	f-h	50.00	b-r
BSS56	2500	b-e	48.20	h-k	65.39	a-d
Ts90	2400	c-e	41.63	lm	71.11	a-c
Tx026017-04	2179	c-f	37.25	n	76.00	ab
Tx026031-02	2093	c-f	37.85	mn	11.18	hi
Tx026033-05	1996	c-g	77.50	a	32.64	e-h
Tx026011-01	1932	c-h	36.25	n	48.44	c-e
Tx026035-09	1916	d-h	49.95	g-i	50.57	b-e
Tx026037-13	1836	d-h	73.35	ab	33.75	e-h
Tx026011-08	1815	d-h	36.20	n	51.57	b-e
Tx026043-06	1722	d-h	54.20	fg	51.25	b-e
Tx026002-06	1652	d-i	51.45	f-i	44.00	c-g
Tx026011-05	1597	d-i	49.00	g-j	60.00	a-e
Tx026005-16	1394	d-i	48.21	g-k	74.77	a-c
Tx026033-13	1292	e-i	65.81	cd	53.99	a-e
Tx026011-03	1232	e-i	40.91	k-n	30.77	e-i
Tx026012-05	1180	f-i	45.90	i-l	47.25	c-f
Tx026011-06	1171	f-i	44.20	j-l	74.00	a-c
Tx026033-02	1086	f-i	68.51	bc	30.27	e-i
Tx026021-12	737	g-i	57.31	ef	6.77	hi
Tx026041-07	724	hi	56.80	ef	52.99	b-e
Tx026033-07	671	hi	71.41	a-c	45.63	b-g
Tx026041-09	665	hi	58.04	d-f	47.77	b-f
Tx026002-05	653	i	48.95	g-j	44.45	c-g

Table 6. Halfway 2003 F2:5 Spanish Trial

Genotype	Lb Pods/Acre	% Mature
Tx026011-01	3706 a	55.49 a-d
Tx026002-02	2826 ab	58.22 a-c
Tx026002-06	2787 ab	37.80 b-f
Spanco	2745 a-c	83.05 a
Florunner	2623 a-c	0.00 gh
Ts90	2605 a-c	71.53 a
BSS56	2499 a-d	63.67 ab
NC7	2468 a-e	0.06 e-h
Tx026002-01	2308 a-e	25.15 d-h
Tx026012-05	1958 a-e	30.55 b-h
Tx026031-02	1953 b-e	13.74 e-h
Tx026037-13	1890 b-e	13.00 e-h
Tx026033-13	1746 a-e	56.75 a-d
Tx026017-04	1735 b-e	81.00 a
Tx026043-06	1556 b-e	31.00 b-h
Tx026005-16	1315 b-e	45.94 a-e
Tx026011-05	1288 c-e	40.69 b-e
Tx026011-06	1286 c-e	66.80 ab
Tx026035-09	1264 c-e	39.63 b-f
Tx026041-07	1238 de	20.41 d-h
Tx026011-03	1032 c-e	35.65 b-g
Tx026002-05	841 e	34.78 b-g
Tx026011-08	773 e	26.47 c-h
Tx026033-05	684 e	11.94 d-h
Tx026033-07	620 e	3.94 e-h
LSD =	1400	32.94
CV =	33.6%	33.9%