Summary of Final Report to the Texas Peanut Producers Board for National Peanut Board funding on 2011 Research

Subject area: Breeding, Genetics and Molecular Genetics

Project Title: Molecular and Conventional Breeding to Improve Peanut Yields and Production Efficiency by Reduced Disease and Water Usage

Proposal Coordinator: Michael R Baring, m-baring@ag.tamu.edu, Phone: 979-220-2656
370 Olson Blvd. Bldg. 1502, College Station, TX 77843-2474

2011 was a year filled with heat and drought in Texas. The breeding program lost many yield tests, seed increases, and generation advancement trials in the West Texas region due to the severe drought. We were able to collect important data from our South and Central Texas locations, but many of our plots from the West Texas region simply did not produce enough quantity of seed to analyze any data.

We are attempting to release our first generation of early maturing runner-type breeding lines as a new cultivar. The first generation materials mature approximately two weeks earlier than currently grown cultivars, but they have no disease resistance. We are in the second and third years of yield testing second generation materials where we have tried to combine the multiple disease resistance traits of our elite breeding lines with the early maturity of the first generation materials. Several of these lines performed equal to or better than the check cultivars in last year's South Texas tests yielding from 250 lbs/a to 420 lbs/a higher. Additionally, we screened third generation of 600 F2:3 early generation plant rows for resistance to Sclerotinia. We selected 70+ lines from this screening and we are re-screening them in 2012 with the anticipation that we will select approximately 40 of these lines for yield testing in 2013. We hope to develop a line two weeks earlier maturing than currently grown cultivars with excellent resistance to Sclerotinia blight and perhaps other soil-borne diseases.

The Lubbock program identified several runner accessions as having drought resistance during two years of screening in West Texas; these accessions yielded similarly to Texas runner varieties under well-irrigated conditions, but out-yielded runner varieties by 25% under reduced irrigation. We have also tested 92 of the 108 US minicore accessions for heat stress tolerance. Fifteen genotypes were identified as tolerant, 42 as moderately tolerant, 8 as susceptible, and 27 as highly susceptible. We also repeated a study at Pecos to test for tolerance to salinity. Ten gallons of water at this site has the salt content of 1 gallon of ocean water. We again found several accessions that survived, produced pegs, and remained green for the whole year compared to over 90% of the accessions, and all of the released peanut varieties, that we tested, dying by mid-season. We have already begun crossing with the drought resistant accessions mentioned above and will begin crossing with the heat and salt tolerant accessions in 2012. While we realize that these traits will be difficult to harness, we hope to develop progeny with a combination of these traits in the future.

We continue with the rest of our breeding efforts to work on transferring resistance to Rootknot nematodes into all of our breeding materials as well as improving leafspot resistance and quality traits such as flavor and shell-out. The future of peanut is improving.

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m-baring@ag.tamu.edu
Phone: 979-220-2656
FAX: 979-845-0456
370 Olson Blvd. Bldg. 1502
College Station, TX 77843-2474

Co-PIs: Mark D. Burow, Associate Professor, AgriLife REC, Lubbock and Crop and Soil Sciences Dept. Texas Tech University, Lubbock, TX 79403. mburow@ag.tamu.edu

Michael R. Baring, Assistant Research Scientist, Dept. of Soil and Crop Sciences Dept. Texas A&M University College Station, TX. 77843. mbaring@ag.tamu.edu

Charles E. Simpson, Professor Emeritus, Texas AgriLife REC, Stephenville, TX 76401. c-simpson@tamu.edu

Collaborators:

James L Starr, Professor, Plant Pathology and Microbiology Dept. Texas A&M University, College Station, TX 77843

Jason Woodward, Assistant Professor. Texas AgriLife REC. Lubbock, TX 79409

Research Trials and Results:

Introduction

2011 was a year filled with heat and drought in Texas. The breeding program lost many yield tests, seed increases, and generation advancement trials in the West Texas region due to the severe drought. We were able to collect important data from our South and Central Texas locations, but many of our plots from the West Texas region simply did not produce enough quantity of seed to analyze any data. The following information indicates what we were able to accomplish and the results from the data that we did collect.

Early Generation Lines

Crosses were made in College Station between the early maturing runner-type breeding lines developed at Lubbock and both Tamrun OL07 and Tamrun OL11 in an attempt to combine early maturity with multiple disease resistance. In 2011 we planted nearly 600 $F_{2:3}$ plant row selections from these crosses in the *Sclerotinia* screening nursery located at the Stephenville Research and Extension Center. Eighty selections were made from these original 600 plant rows and these selections are being re-screened for *Sclerotinia* resistance at Stephenville as well as being increased simultaneously in a disease-free nursery at College Station, TX. Final selections from this year's screening will be tested in 2013 for yield, grade, maturity and all other measurable quality characteristics in a replicated format.

Release Proposal for a High-Oleic, High-Yielding, Early-Maturing Spanish Peanut.

We wrote up the release proposal for a high-oleic peanut for the Spanish market. This peanut was tested under the designation TxL054520-34, and we are proposing to name it 'Schubert', in memory of the late Dr. Mike Schubert who worked for many years in the Texas peanut program.

This peanut is designed to replace the Olin variety. The advantages of this variety are: (1) yield 400-500 lb/acre higher than OLin, (2) one week earlier in maturity, and (3) shelling 2 percentage points higher. Schubert peanut is similar on resistance to Sclerotinia blight to OLin.

Advanced Trials of High-Oleic Valencia peanut.

We performed multi-year analysis of data from 2006-2010. Data from 2011 were not used because of a high incidence of mold due to delay in drying due to damage to the dryer electrical system from a lightning strike.

We have five high-oleic breeding lines that we are considering for release. These out-yield New Mexico Valencia C 400 to 750 lb/acre. We are re-growing these in 2012 to have fresh material for chemical and flavor analyses before deciding which breeding line to release.

Drought Resistance

The Lubbock program identified several runner accessions as having drought resistance during two years of screening in West Texas; these accessions yielded similarly to Texas runner varieties under well-irrigated conditions, but out-yielded runner varieties by 25% under reduced irrigation. During 2011 and the spring of 2012, crosses were made between these accessions and several of our high oleic, multiple disease resistant breeding lines at College Station and Lubbock. The resulting F_1 progeny are currently being increased in College Station and Lubbock. We anticipate harvesting 1,000 F_2 seeds for selection and increase in 2013.

Crosses have been made also between a Spanish minicore accession identified as drought tolerant and high-oleic Spanish and Valencia release candidates.

One population developed for drought tolerance was increased at Lubbock in 2011, and was planted for testing in a replicated test in 2012.

Heat stress tolerance.

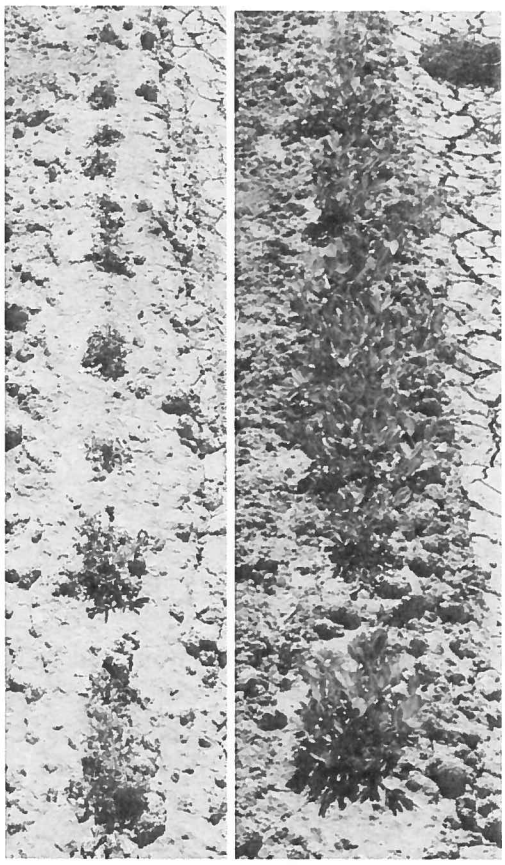

Fig. 2. Comparison of salt-susceptible and salt-tolerant peanut. The accession at left died soon after emergence; the accession at right was able to survive a combination of extreme heat and salinity. The varietal checks were susceptible, as at left.

Screening for High Oleic Peanut by Mid-Infrared Spectroscopy.

We have set up a mid-infrared spectrometer at the Lubbock Center to reduce the time and cost of oil analysis. It has been estimated that it costs $5 per sample (seed) for gas chromatographic analysis. The cost and time meant that we were never able to perform all the analyses that were needed. Several years ago, we began to outsource samples for near-infrared analysis (NIR), but the cost doubled recently to $2/sample. Running about 10,000 seeds per year, this increase in price significantly increased our costs. To reduce costs, TAMU has purchased a NIR spectrometer for the peanut breeding program. We worked this past year on setting this up.

To date, we have been able to cut an end off the seed (as we did for GC analysis), extract oil, and run this on the NIR. We have obtained a 99% correlation between NIR and GC values for oleic acid, 98% for linoleic acid, and 87% for palmitic acid, and expect to have a 95% or greater accuracy in predicting whether individual seeds will be high oleic or not. The remainder of the high oleic seeds can still be planted.

The current methodology will be very useful because it will be a considerable savings in time and cost. Although it will involve extracting the oil from seeds, about 100

Tx071304	6.85	0	0	0	0	0	0	None
TamrunOL11	7.00	0	0	0	0	0	0	None
Tx093532	5.85	0.35	0.25	0	0	1.0	0	Yes
Tx093533	6.00	0	0	0	0	0.5	0	Yes
PR-2	6.65	0	0	0	0	0	0	None

Tamrun OL11 which is a high oleic, high grading line with resistance to Sclerotinia had a good flavor score of 7.0 with no off-flavors detected (Table 2). PR-2 which is a high oleic, nematode resistant breeding line that has moderate levels of resistance to Sclerotinia also had a good flavor score of 6.65 with no off-flavors detected. Tx071304 is a high oleic, breeding line with nematode and Sclerotinia resistance that also had a good flavor profile with a score of 6.85 and no off-flavors detected. The two lines Tx093532 and Tx09353 are high oleic breeding lines with high grade potential had good flavor scores with a 5.85 and a 6.00, but both had off-flavors detected by the flavor panel. The scores above are averaged from two replications and we will be retesting these lines in 2012.

We also had these lines tested for blanchability at the same time. Table 3 reveals a detailed description of the blanchability of each of these lines averaged over two replications. Tx071304, Tamrun OL11, and PR-2 performed well with 99.0%, 96.35%, and 99.5% of their total sound mature kernels blanching. Tx093532 and Tx053533 did not perform as well with only 82.65% and 89.05% of their kernels blanching respectively. We will re-test these lines after the 2012 harvest to check the repeatability of the data.

Table 3. 2011 Blanching Data for Five Advanced Runner-Type Breeding Lines Conducted by J.L. Leek and Associates

Entry	Unblanched Wholes	Unblanched Splits	Rednose Wholes	Rednose Splits	Blanched Wholes	Blanched Splits
Tx071304	0.25	0.15	0.60	0	93.60	5.4
TamrunOL11	3.25	0.20	0.25	0	87.85	8.5
Tx093532	2.05	2.40	12.0	0.9	63.05	19.6
Tx093533	1.50	1.65	6.45	1.30	58.3	30.75
PR-2	0	0	0.55	0.45	91.15	7.9

Leafspot Resistance

We developed crosses at College Station several years ago in an attempt transfer leafspot resistance into some of our elite materials. We conducted a very large 100 entry multiple location yield trial in 2010 to try and investigate the interactions associated with leafspot resistance, *Sclerotinia* resistance, *Tomato spotted wilt virus* resistance, yield, grade, and O/L ratios. Funds and land availability prevented us from repeating this study in 2011. We did plant two smaller yield trials with leafspot resistant materials in them, but the drought and high temperatures in 2011 prevented the development of any leafspot in our nurseries so, had we planted the large trials we would not have gathered any valuable leafspot data anyway. We have re-planted the same 100 entry study again at three locations; Yoakum (leafspot screening nursery), Stephenville (Sclerotinia screening nursery), and west of Seminole (disease-free site) in 2012. The first year's data from 2010 indicated several key factors that we hope to repeat in 2012; 1) No interactions between yield or O/L ratios

oil content, for a second year's worth of data. DNA has been extracted from these materials, and marker work will be done in 2012.