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**Abstract: National Peanut Board Final Progress Report – 2014 South Carolina**

**Title: Breeding, Evaluation, and Selection of Virginia and Runner Type Peanut Varieties in Response to Agronomic Practices and Environmental Conditions Unique to South Carolina**

**Principle Investigators: (note: John Mueller replaced Scott Monfort as P.I. when Dr. Monfort accepted a position at the Univ. of Georgia.)**

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**Cooperating Personnel: Jay W. Chapin, James S. Thomas, Justin Heirs**

**Project I. Evaluation of Newly Released and Experimental Lines**

Several experimental lines had late leaf spot (LLS) resistance statistically equivalent to (and numerically lower than) the Bailey standard (see lines shaded in green, Table 1). Lines were also identified as having significantly greater LLS susceptibility than the current standard (red shaded, Table 1).

For S. C. conditions, Sullivan is the most promising hi-oleic virginia-type alternative to the Bailey standard. Note that Bailey was the highest yielding virginia type, with Sullivan a close second, in both the UPPT and variety challenge tests (Tables 2, 4). PVQE yield was disregarded for the reasons stated in the full report. Several experimentals (N10047ol, N10046ol, N08082olJCT, N09042olF) were also very competitive (Table 4).

Among runner types, Georgia 12Y is the most promising non high-oleic alternative to the current Ga 06G standard. Ga 13M and TUFRunner 511 are the most promising high oleic alternatives to the Ga 09B and Fl 07 oleic standards. Ga 092709 and Ga 112720 were yield competitive with the Ga 06G standard and Ga 13M (Tables 2, 4).

Several tested lines had significantly more TSWV relative to a Bailey standard (N10082oljc, N10043olj, N10051ol, and TUFRunner 727. TxL 080243-06, TxL 080244-03, TxL 080212-02, ARSOK-V3, and ARSOK-V30B appear to be very susceptible to TSWV. This may explain their relatively lower yield performance in the UPPT test (Table 3).

Champs and two experimentals (N08082olJCT, N09042olF) had the highest virus ratings among virginia types in the variety challenge (Table 4).

Ga 09B was much more susceptible to physiological leaf spot than 28 other lines in the variety challenge test (Fig. 1). Fl 07 was also relatively susceptible.

Fl 07 had better canopy closure than the Ga 06G standard, Ga 12Y, and TUFRunner 511.

## **Project II. Breeding for High Yielding, High-Oleic Lines with Multiple Disease Resistance.**

In 2014, over 2000 single plant selections were made for late leaf spot resistance. Additionally, 103 whole plots were selected based on desirable plant, pod traits and late leaf spot resistance. Preliminary high-oleic acid estimations of top 10 lines indicated that three of them are (1 Virginia and 2 runners) are 100% high-oleic lines with another 7 still segregating for the high-oleic trait. These will be purified by single plant harvest in 2015. New F1 hybrids were made in the greenhouses to combine the high oleic trait with multiple disease resistance and early maturity. The hybrid seeds were planted in Puerto Rico and progenies will be grown in 2015 in Florence to select desirable plants for further evaluations. Characterization of the interspecific hybrid, Gregory x *Arachis diogeni* population showed high levels of Tomato spotted wilt virus resistance in an unreplicated field test. Additional progenies of this population will be tested in yield as well as disease tests in 2015.

As the populations are advanced and additional data from field testing become available, the anticipated results from the project will include the development of peanut populations (Virginias as well as runners) for future commercial releases in SC, and also advance our understanding of disease resistance mechanisms.

## National Peanut Board Final Progress Report – 2014 South Carolina

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### **Project I. Evaluation of Newly Released and Experimental Lines**

**Procedures:** All experimental procedures were conducted using appropriate experimental designs with blocking determined by soil conductivity maps to reduce experimental error and maximize test sensitivity. Other techniques used to increase sensitivity include sufficient plot size to eliminate all traffic on yield rows and conscientious culling of plots with stand establishment, plot maintenance, or harvest equipment errors throughout the production season. Data were analyzed with accepted standard statistical procedures using SAS and/or ARM.

Test areas were soil sampled and appropriately limed and fertilized according to Clemson University's Soil Lab recommendations prior to planting. Gypsum (2000 lbs/ac) was applied pre-plant in order to simplify and more accurately apply the product to a broad area of relatively small test plot designs. Valor (3 oz) + Prowl H<sub>2</sub>O (1 qt) applied 3 days after planting (DAP) followed by Cadre (4 oz) + 2,4 DB (1.5 pt) applied 35 DAP was used for basic weed control. Small escaped pigweed and sicklepod were controlled as needed with 12 oz Gramoxone Inteon + 1.5 pt Storm + 0.25 % v:v 80-20 surfactant about 21 DAP. For escaped grass, Select 1EC + crop oil was applied at the highest labeled rate for targeted grass. Non-fungicide tests were protected from disease using the following program: Bravo (1.5 pt) + generic tebuconazole (7.2 oz product/ac) applied 45 DAP; Provost (10.7 oz) applied 60 and 90 DAP; Convoy (16 oz) + Bravo (1.5 pt) applied 75 and 105 DAP. Irrigated tests were irrigated during periods of low rainfall. Normally, slightly less than the recommended 1.5" / week less rainfall was applied due to logistics of other tests using the same irrigation system. Peanuts were dug with a two row KMC digger and harvested with a two row Hobbs combine modified with a small load cell basket and automated grade sampler.

### **Results and Discussion:**

#### **Objective 1.: Resistance Screen / PVQE Test.**

Planted 14 May; inverted 2 Oct (141 DAP); harvested 22 Oct (161 DAP)

1. Several experimental lines had late leaf spot resistance statistically comparable to and numerically lower than the Bailey standard (see lines shaded in green, Table 1). Lines were also identified as having significantly greater LLS susceptibility than the current standard (red shaded, Table 1).
2. Although the test field consistently developed economic levels of white mold (southern stem rot) in previous 3-yr peanut rotations, white mold levels in this test were too low to provide any meaningful measure of line susceptibility.
3. Tomato spotted wilt symptoms were also moderate, but several tested lines had significantly more TSW relative to a Bailey standard (N10082oljc, N10043olj, N10051ol, and TUFRunner 727. Late season virus symptoms were confounded by other chlorosis and therefore later season readings were not reported.
4. Yield data in this test are severely biased by very unfavorable weather / soil moisture conditions delaying harvest. Peanuts were by necessity dug while soil was wet and heavy so digging losses occurred. Repeated rain also delayed combining, resulting in loss from weathering in wind rows for three weeks. This harvest delay also prolonged exposure to wildlife damage in some plots. Consequently, some of the highest yielding cultivars were later maturing runners (and medium maturity Ga 06 G which tends to lower harvest loss) and Spain which is a late maturing Va.-type.

**Table 1. Yield and disease ratings of peanut cultivars planted 7 May, PVQE, Blackville, SC 2014.**

Description Rating Date Rating Type Rating Unit	YIELD LB	White Mold 2014/10/2 %	TSWV 2014/7/30 %	LLS Def. Rating 1-9	LLS Lvs with Is %
Trt Treatment No. Name					
32 Ga 12Y	4467 a	0.0 a	0.1 e	6.5 a-f	82.5 a-f
7 07036-1-2-1	4438 a	0.8 a	0.1 e	6.0 b-h	82.5 a-f
34 Ga 06G	4291 ab	0.0 a	0.4 e	5.5 e-j	66.3 e-h
5 Spain	4021 abc	1.3 a	1.3 cde	5.8 c-j	82.5 a-e
35 Ga 13M	4021 abc	0.0 a	0.2 e	7.3 ab	93.8 ab
20 N11028ol	3834 bcd	0.0 a	1.2 cde	5.8 c-j	76.3 c-h
28 N12010ol	3810 bcd	0.0 a	0.4 e	5.8 c-j	76.3 c-h
25 N12007ol	3699 b-e	0.0 a	0.1 e	5.3 f-j	62.5 fgh
27 N12009olCLT	3670 cde	2.1 a	1.5 cde	5.3 f-j	62.5 e-h
36 TufRunner 515	3634 c-f	0.0 a	1.8 cde	7.0 abc	93.8 ab
31 Ga 11J	3617 c-f	2.9 a	2.4 a-e	4.8 ij	63.8 e-h
33 TufRunner 727	3611 c-f	0.0 a	5.2 abc	5.3 f-j	60.0 gh
4 Sullivan	3611 c-f	0.0 a	0.1 e	5.8 c-j	70.0 d-h
12 N10046ol	3529 c-g	0.0 a	0.6 e	5.3 f-j	72.5 c-h
19 N11020olJ	3470 c-h	0.8 a	2.6 a-e	6.0 b-i	72.5 c-h
26 N12008olCLSmT	3453 c-i	0.0 a	0.4 e	4.5 j	66.3 e-h
16 N10078olJC	3408 d-i	0.0 a	5.2 abc	6.5 a-f	86.3 a-d
24 N12006ol	3394 d-i	0.4 a	1.9 cde	6.3 b-g	76.3 c-h
22 N11048ol	3377 d-i	0.0 a	2.0 b-e	6.8 a-e	90.0 abc
2 Sugg	3300 d-j	0.0 a	2.2 a-e	5.3 f-j	73.8 c-h
21 N11034ol	3271 d-k	0.0 a	0.1 e	6.0 b-h	78.8 c-h
6 07030-1-10-1	3195 e-l	0.0 a	0.8 de	6.3 b-g	82.5 a-e
9 N09039olF	3189 e-l	0.0 a	2.4 a-e	5.0 g-j	65.0 e-h
3 Wynne	3171 e-l	0.0 a	2.4 a-e	5.8 c-j	76.3 c-h
17 N10080olJCL	3158 e-l	1.3 a	2.3 a-e	6.8 a-e	87.5 a-d
8 N09037ol	3150 e-l	0.0 a	1.4 cde	5.5 d-j	75.0 c-h
1 Bailey	3148 e-l	0.0 a	0.1 e	5.0 g-j	66.3 e-h
23 N11051olJ	3056 f-l	0.0 a	0.1 e	6.8 a-e	88.8 a-d
30 N12015ol	3013 g-l	0.0 a	1.5 cde	7.0 abc	88.8 abc
13 N10047ol	2954 g-l	0.4 a	0.4 e	7.0 abc	87.5 a-d

18 N10082olJC	2884 h-l	0.0 a	4.5 a-d	6.3 b-g	75.0 c-h
11 N10043olJ	2868 i-l	0.0 a	7.3 ab	7.0 a-d	87.5 abc
14 N10051ol	2755 jkl	0.0 a	7.5 a	6.3 b-g	77.5 b-g
10 N09042olF	2714 jkl	1.3 a	0.6 e	4.8 hij	58.8 h
29 N12014ol	2691 kl	1.3 a	0.6 e	8.0 a	95.0 a
15 N10066olSmT	2657 l	0.8 a	1.7 cde	5.3 f-j	72.5 c-h
LSD P=.05	594.1	2.05	7.58t	0.28t	13.00t
Standard Deviation	423.1	1.46	5.40t	0.20t	9.27t
CV	12.43	394.83	81.79t	7.93t	14.77t
Replicate F	6.088	0.072	2.911	11.145	9.679
Replicate Prob(F)	0.0008	0.9747	0.0380	0.0001	0.0001
Treatment F	4.992	0.887	2.149	2.659	2.489
Treatment Prob(F)	0.0001	0.6494	0.0015	0.0001	0.0002

## Objective 2. Uniform Peanut Performance Test (UPPT)

Planted 7 May; inverted 26 Sept (142 DAP); harvested 8 Oct (154 DAP)

### Results:

1. TxL 080243-06, TxL 080244-03, TxL 080212-02, ARSOK-V3, and ARSOK-V30B appear to be very susceptible to TSWV. This may explain their relatively lower yield performance.
2. The Bailey standard was the highest yielding Virginia type, with Sullivan a close second.
3. Among runner types, Ga 092709 and Ga 112720 were yield competitive with the Ga 06G standard and Ga 13M.

**Table 2. Yield of peanut cultivars, UPPT, Blackville, SC 2014.**

Description	YIELD	TSWV	TSWV
Rating Date	2014/Oct/8	2014/Sep/16	2014/Jul/31
Rating Unit	LB/AC	%	%
Trt Treatment			
No. Name			
21 Ga 13 M	4695 a	0.0 h	1.3 a
6 GA 092709	4633 a	1.0 gh	2.1 a
19 Ga 06G	4621 a	1.1 gh	0.4 a
8 GA 112720	4483 ab	1.5 fgh	0.8 a
18 Bailey	4430 abc	0.0 h	0.4 a
22 Ga 12Y	4411 abc	0.0 h	1.7 a
3 UF 14301	4401 abc	0.0 h	0.8 a
4 UF 14302	4284 a-d	2.4 e-h	2.1 a
20 Sullivan	4268 a-d	0.0 h	0.0 a
7 GA 112719	4072 b-e	0.2 h	1.3 a
13 TxL 080243-06	4052 b-e	29.9 a	4.2 a
5 UF 14303	4038 b-e	0.0 h	0.4 a
12 TxL 080212-02	3995 cde	33.3 a	1.7 a
11 N10078olJC	3969 cde	5.8 d-g	3.8 a
15 ARSOK-R35	3931 de	8.6 c-f	0.0 a
10 N10046ol	3900 def	0.1 h	0.8 a
14 TxL 080244-03	3837 def	30.2 a	0.8 a
2 Florunner	3823 def	19.4 abc	0.0 a
16 ARSOK-V30B	3761 ef	31.3 a	0.8 a
9 N09042IF	3613 ef	13.0 bcd	6.3 a
1 NC 7	3450 f	9.5 cde	4.2 a
17 ARSOK-V31	2714 g	25.1 ab	0.8 a
LSD (P=.05)	470.5	10.55t	8.21t
Standard Deviation	332.7	7.46t	5.81t
CV	8.19	55.83	140.11
Replicate F	9.608	0.413	1.083
Replicate Prob(F)	0.0001	0.7444	0.3630
Treatment F	7.450	12.744	1.267
Treatment Prob(F)	0.0001	0.0001	0.2322

### Objective 3. Variety Challenge Test

Planted 8 May; inverted 25 Sept (140 DAP); harvested 9 Oct (154 DAP)

#### Results: Runners:

1. Ga 09B, Florunner 107, and TUFRunner 727 had relatively high TSW ratings.
2. Ga 09B had the most physiological leaf spot, followed by Fl 07.
3. Fl 07 had better canopy closure than the Ga 06G standard, Ga 12Y, and TUFRunner 511.
4. Excellent yield and grade performance of TUFRunner 511 and Ga 09B relative to the Ga 06G standard or Ga 12Y may reflect test bias toward earlier maturing lines. The three varieties from Meherrin (Asus 18, Asus 06, Mrs 35) and the experimental line PD 13003 had the lowest yields.

#### Virginias:

1. Champs and Bailey had the highest canopy closure scores.
2. Wynne and N08082olJCT had the highest levels of physiological leaf spot.
3. The intermediate levels of TSW in the Bailey standard and Sugg in this test were more than we typically see for these varieties. Champs and two experimentals (N08082olJCT, N09042olF) had the highest virus ratings.
4. Sullivan and several experimentals (N10047ol, N10046ol, N08082olJCT, N09042olF) were most yield competitive with the Bailey standard.

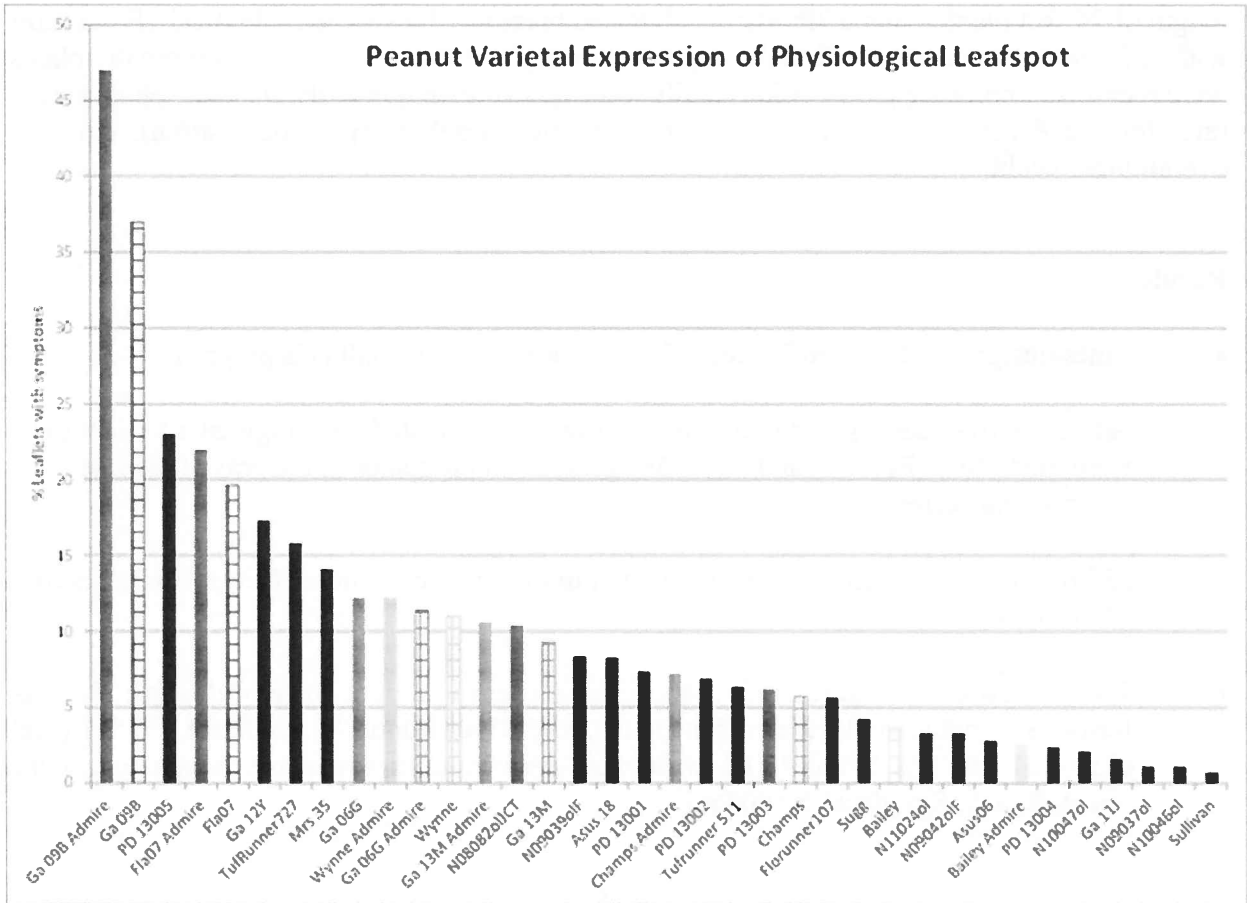
**Table 3. Yield, canopy closure and disease ratings of runner –\_type varieties, Blackville, SC 2014.**

Description Rating Date Rating Type Rating Unit	Yield 2014/Oct/9 YIELD LB/AC	TSWV 2014/Sep/16 %	TSWV 2014/Aug/26 %	Phys. Leaf Spot 2014/Aug/22 leaf. w les %	TSWV 2014/Jul/31 %	Canopy Closure 2014/Jul/15 %	TSMK %
Trt Treatment No. Name							
5 Tufrunner 511	5293 a	2.1 a	0.3 a	5.9 ef	0.1 a	71.6 bc	74.8 a
6 Ga 09B	4897 ab	4.4 a	1.6 a	36.4 a	0.0 a	77.4 ab	74.5 a
8 Florunner107	4779 abc	5.4 a	0.0 a	4.9 ef	0.0 a	72.0 abc	73.5 ab
4 Ga 06G	4656 bc	1.1 a	0.1 a	11.8 b-e	0.1 a	69.4 bc	72.7 ab
1 Ga 12Y	4611 bc	0.3 a	0.1 a	16.3 bc	0.0 a	68.8 bc	68.7 cd
2 Tufrunner 727	4593 bc	4.9 a	1.7 a	14.9 bcd	0.1 a	69.4 bc	74.3 a
3 Ga 13M	4353 cd	0.8 a	0.5 a	8.0 c-f	0.1 a	77.0 ab	70.0 cd
9 Fla07	4272 cde	4.3 a	1.9 a	19.3 b	0.1 a	80.4 a	71.1 bc
25 Asus06	4049 def	3.2 a	3.2 a	2.7 f	0.1 a	70.2 bc	68.3 d
34 PD 13003	3917 def	1.7 a	0.7 a	5.5 ef	1.8 a	52.0 d	67.7 d
23 Asus 18	3773 ef	2.9 a	0.1 a	7.5 def	0.1 a	68.0 c	68.7 cd
24 Mrs 35	3693 f	3.8 a	1.6 a	11.6 b-e	0.0 a	67.0 c	69.3 cd
LSD (P=.05)	530.1	0.46t	8.27t	7.87t	4.31t	5.92t	2.57
Standard Deviation	367.1	0.32t	6.47t	6.16t	3.37t	4.63t	1.78
CV	8.33	58.48	135.15	31.86	203.42	8.09	2.5
Replicate F	1.449	0.668	0.415	2.224	1.031	3.448	0.932
Replicate Prob(F)	0.2475	0.5776	0.7967	0.0822	0.4024	0.0157	0.4364
Treatment F	7.025	1.988	1.218	7.517	1.904	4.726	9.012
Treatment Prob(F)	0.0001	0.0629	0.3049	0.0001	0.0657	0.0001	0.0001

**Table 4. Yield, canopy closure and disease ratings of Virginia –\_type varieties, Blackville, SC 2014.**

Description Rating Date Rating Type Rating Unit	Yield 2014/Oct/9 YIELD LB/AC	TSWV 2014/Sep/16 %	TSWV 2014/Aug/26 %	Phys. Leaf Spot 2014/Aug/22 leaf. w les %	TSWV 2014/Jul/31 %	Canopy Closure 2014/Jul/15 %	ELK %	TSMK %
Trt Treatment No. Name								
31 N10047ol	4955 a	1.4 bcd	0.0 a	1.9 def	0.2 a	73.1 b-e	47.7 ab	67.0 a-d
14 Bailey	4840 ab	4.1 ab	0.7 a	2.9 def	0.0 a	81.3 ab	44.2 a-d	69.7 ab
30 N10046ol	4840 ab	0.0 e	0.0 a	0.9 f	0.1 a	66.3 efg	46.8 abc	66.3 bcd
12 Sullivan	4829 ab	0.6 cde	0.7 a	0.6 f	0.0 a	72.3 b-e	44.6 a-d	66.9 a-d
26 N08082olJCT	4823 ab	7.1 a	1.7 a	10.2 b	0.0 a	72.1 b-e	44.1 a-d	67.5 a-d
29 N09042olF	4786 ab	8.9 a	1.4 a	2.8 def	0.1 a	77.1 a-d	45.1 a-d	67.8 a-d
15 Sugg	4754 ab	4.1 ab	0.5 a	4.1 cde	0.4 a	70.4 c-f	48.9 a	70.4 a
32 N09039olF	4622 abc	0.3 de	0.6 a	7.9 bc	0.1 a	64.6 e-h	36.9 ef	65.9 cd
35 PD 13004	4545 a-d	7.1 a	0.8 a	2.1 def	0.4 a	67.0 d-g	44.1 a-d	69.2 abc
11 Champs	4513 a-d	7.3 a	4.0 a	5.1 cd	0.1 a	83.6 a	43.8 a-d	68.8 abc
10 Ga 11J	4416 a-d	4.1 ab	3.2 a	1.5 ef	0.5 a	78.5 abc	42.2 b-e	66.0 cd
13 Wynne	4251 bcd	1.9 bc	0.6 a	10.1 b	0.3 a	68.3 c-g	38.9 def	64.6 de
27 N09037ol	4083 cde	0.4 cde	0.0 a	1.0 f	0.2 a	54.6 h	41.0 c-f	67.1 a-d
28 N11024ol	4060 cde	1.4 bcd	0.3 a	2.7 def	0.0 a	58.1 gh	35.4 f	61.6 e
7 PD 13001	3613 e	1.7 bcd	2.7 a	7.1 bc	2.0 a	59.6 fgh	25.5 g	64.6 de
LSD (P=.05)	609.7	0.35t	7.33t	0.88t	4.67t	6.76t	6.63	3.56
Standard Deviation	426.6	0.24t	5.80t	0.69t	3.69t	5.34t	4.63	2.49
CV	9.5	48.18	111.98	31.79	162.45	9.44	11.04	3.72
Replicate F	0.480	5.483	1.630	3.232	2.510	2.082	1.648	1.888
Replicate Prob(F)	0.6982	0.0027	0.1805	0.0191	0.0527	0.0961	0.1944	0.1480
Treatment F	3.415	7.392	1.779	10.019	1.606	4.862	6.496	3.294
Treatment Prob(F)	0.0012	0.0001	0.0633	0.0001	0.1037	0.0001	0.0001	0.0017

**Fig. 1.**



## **Project II. Breeding for High Yielding, High-Oleic Lines with Multiple Disease Resistance.**

### **Objectives:**

1. Evaluate early generation segregating populations for disease resistances in field tests at PDREC with no fungicidal treatments for single plant selections.
2. Evaluate the agronomic performance of advanced breeding lines for yield and disease resistances under different cultural practices.
3. Understand the mechanisms involved in drought tolerance (not conducted).
4. Produce new F<sub>1</sub> hybrid seeds by making crosses in greenhouses at PDREC to develop populations for future field evaluations.
5. Identify chromosome numbers in progenies of an interspecific hybrid population derived from Gregory x *Arachis diogenii* (GKP 10602). *Arachis diogenii* is a diploid wild species with very high levels to immunity to Tomato Spotted Wilt Virus.

### **Procedures:**

All research experiments to fulfill the objectives were conducted in Florence. The unsprayed field tests didn't have any fungicides applied to control late leaf spot nor in-furrow application to control thrips. Early generation segregating populations were evaluated in unreplicated progeny rows to make individual plant selections. Plots consisted of 2-rows of 28-seeds/row with row length of 24 feet planted and a 7ft alley. Advanced breeding lines were evaluated in Blackville with reduced disease control. In late August and early October, % TSWV symptomatic plants were recorded among the plots. Additionally, prior to harvesting in early October, plots were rated for late leaf spot (1-9 scale where 1=no defoliation and 9=complete defoliation), and overall plant health.

### **Results:**

- Lines designated as PD in Tables 1-2 above are from Dr. Tallury's program.
- A total of 1086 early generation progeny rows were planted and single plant selections were made from F<sub>4</sub> (776) and F<sub>6</sub> (1359) generation progenies in unsprayed disease selection nurseries.
- 250 of the F<sub>4</sub> plant selections were planted in Puerto Rico Winter Nursery for generation advancement.
- Twelve new crosses were made in the greenhouses to produce F<sub>1</sub> hybrid seeds. Parents for crosses included Florunner (for flavor), Red River Runner (high-oleic), FL 511 (high-oleic), GP-NC WS 16 and 17 (*A. cardenasii*-derived multiple disease resistant germplasm lines), Bailey, Sugg, and N10046ol.



- Hybrid seeds were planted in Puerto Rico Winter Nursery for generation advancement.
- Chromosome numbers were estimated using flow cytometric analysis in an interspecific hybrid population derived from Gregory x *Arachis diogeni* (GKP 10602) and all analyzed plants were tetraploid.
- Field test (no chemical control for thrips) of the Gregory x *Arachis diogeni* (GKP 10602) population demonstrated 30% TSWV infection in test plots versus 70% in Gregory.
- Additionally, 103 whole plots (F<sub>7</sub> generation) were selected based on desirable agronomic performance in unsprayed field tests.