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PROGRESS REPORT
TO
NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.

TITLE: **Developing High-Oleic Peanut Varieties with Multiple Disease Resistance**

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DEPARTMENT(S): **Crop Science**

REPORT:

NCSU has long maintained a "wild species" peanut genetics program, *i.e.*, one designed to bring useful characteristics from the numerous diploid ($2n=2x=20$) South American wild peanut species (*Arachis* spp.) into the tetraploid ($2n=4x=40$) cultivated species, *A. hypogaea*. Notably, it has been the aim of the program to transfer high levels of disease resistance into the large-seeded virginia-type cultivars of *A. hypogaea* grown in North Carolina. The highly successful cultivar Bailey is the product of this effort: the original interspecific cross that gave rise to Bailey was made in 1963 using *A. cardenasii*, a wild species highly resistant to leaf spots (the early leaf spot pathogen *Cercospora arachidicola* and the late leaf spot pathogen *Cercosporidium personatum*), as one parent. With the emphasis currently placed on disease resistance in the NCSU peanut breeding program, the frequency of species-derived breeding lines in the program has increased. Approximately 30% of the lines currently in the program trace to wild species, and the crosses to species immune to tomato spotted wilt virus (TSWV) have yet to become available. Because almost all of the wild species have half the number of chromosomes as the 40-chromosome cultigen, it is necessary to use one or another avenue to get back to the tetraploid chromosome level following an interspecific cross. It is very common to find (1) that in addition to the desired improved levels of disease resistance, the tetraploid products of interspecific hybridization have agronomically deleterious traits derived from the wild parent, *e.g.*, low yield, long fragile pegs, late maturity, or small or misshapen pods or seeds, or (2) that the level of resistance in the wild parent is reduced in the tetraploid.

There were 12 species-derived lines from Dr. Tallury's program entered in the NCSU Advanced Line Disease Test (ALD) series and the Disease Advanced Line Test (DAT) series. Each of these test series comprises four separate disease trials: (1) a two-replicate trial for leaf spot resistance grown at the NCDA Peanut Belt Research Station (PBRS) at Lewiston in Bertie County, NC, where no leaf spot fungicide is applied during the season, (2) a three-rep trial of Cylindrocladium black rot (CBR) resistance grown on infested soil at the NCDA Upper Coastal Plain Research Station (UCPRS) near Rocky Mount in Edgecombe County, NC, with no pre-plant fumigation of the soil with metam sodium, (3) a three-rep trial for Sclerotinia blight resistance grown on infested soil at UCPRS, and (4) a trial for TSWV resistance grown at PBRS with 20-inch spacing between seeds and no insecticide applied to the plots in order to promote feeding by thrips, the insect vector of TSWV. Performance of these lines is compared with virginia-type cultivars in Table 1. We saw no symptoms of CBR in the 2013 plots at UCPRS in spite of having cool, wet conditions that one would think would promote CBR. A similar failure of CBR to develop occurred in 2012, so there is limited data for the species-derived lines for that disease. Likewise, we have not yet recorded the plot yields for the yield trials conducted at

PBRS, including the leaf spot trials, so there is no yield data for some species-derived lines that were in our yield trials for the first year in 2013.

Note that the mean defoliation score and incidence of CBR and TSWV was lower for the species-derived lines than I was for the cultivars. Mean incidence of Sclerotinia blight was not different. Pod yield of unsprayed plots was less for the species-derived lines than it was for the cultivars in spite of the superior leaf spot resistance exhibited by the species-derived lines. Two high-oleic species derived lines, SPT 10-05ol and SPT 10-14ol, had good arrays of resistance to leaf spot, Sclerotinia blight, and TSWV. In addition to continuing to test the agronomic performance of those lines, we also will be using them as parents in making further crosses. They do not have quite the yield potential of some of the advanced all-hypogaea lines in the breeding program, but they are a big improvement over previous species derived lines, and they are high oleic.

Separate two-rep trials were conducted at PBRS for leaf spot and TSWV reactions for 52 additional preliminary species-derived breeding lines and four check cultivars.

Table 1. Disease reactions of wild species-derived peanut breeding lines compared with existing NCSU large-seeded virginia-type cultivars.

Type / line	Fatty acid genotype	Leaf spot		Cylindrocladium black rot (CBR)	Sclerotinia blight (SB)	Tomato spotted wilt
		Defoliation score	Pod yield without fungicide			
		rating (1= none to 9=complete)	*lb/A*	*incidence(0 to 1)*		
Species-derived lines		**3.75±0.22$^{\alpha}$**	**2934±209^{ns}**	**0.073±0.073$^{\alpha}$**	**0.483±0.048^{ns}**	**0.230±0.043$^{\alpha}$**
SPT 06-06	+ +	2.83±0.22^{a}	2654±225^{c}	0.156±0.076^{ab}	0.348±0.050^{bc}	0.164±0.040^{ab}
SPT 07-01	+ +	3.66±0.23^{bcd}	2957±266^{bc}	0.103±0.098^{a}	0.433±0.055^{cde}	0.237±0.045^{abc}
SPT 10-02	+ +	3.81±0.44^{bcd}	2830±591^{abc}	-0.041±0.167^{a}	0.566±0.096^{de}	0.285±0.085^{a-d}
SPT 10-05ol	+ +	4.13±0.62^{b-e}	--	--	0.491±0.136^{b-e}	0.265±0.121^{a-d}
SPT 10-10	+ +	3.54±0.35^{abc}	3302±419^{abc}	--	0.590±0.077^{e}	0.311±0.068^{a-d}
SPT 10-12ol	ol ol	4.06±0.44^{bcd}	2861±591^{abc}	--	0.411±0.096^{b-e}	0.396±0.085^{b-e}
SPT 10-14ol	ol ol	3.32±0.36^{ab}	3002±419^{abc}	--	0.590±0.096^{de}	0.359±0.085^{a-e}
SPT 13-01	+ +	4.13±0.62^{b-e}	--	--	0.502±0.136^{b-e}	0.153±0.121^{ab}
SPT 13-02	+ +	3.63±0.62^{a-d}	--	--	0.569±0.136^{b-e}	0.189±0.121^{abc}
SPT 13-03	+ +	3.63±0.62^{a-d}	--	--	0.702±0.136^{e}	0.116±0.121^{a}
SPT 13-04	+ +	3.63±0.62^{a-d}	--	--	0.702±0.136^{e}	0.163±0.121^{ab}
SPT 13-05ol	ol ol	4.63±0.62^{b-f}	--	--	-0.110±0.136^{a}	0.128±0.121^{ab}
Cultivars	**+ +**	**5.08±0.05$^{\beta}$**	**3103±63^{ns}**	**0.235±0.019$^{\beta}$**	**0.391±0.014^{ns}**	**0.329±0.010$^{\beta}$**
Bailey	+ +	4.61±0.12^{de}	3667±141^{a}	0.136±0.039^{a}	0.311±0.027^{b}	0.207±0.021^{abc}
Gregory	+ +	5.59±0.11^{f}	2695±125^{c}	0.276±0.036^{ab}	0.404±0.032^{cd}	0.368±0.017^{b-e}
NC-V 11	+ +	5.75±0.12^{f}	2704±129^{c}	0.385±0.040^{c}	0.436±0.033^{cde}	0.428±0.019^{cde}
Perry	+ +	5.36±0.10^{ef}	2718±112^{c}	0.319±0.034^{bc}	0.335±0.030^{bc}	0.524±0.017^{e}
Phillips	+ +	5.56±0.12^{f}	2793±130^{c}	0.410±0.040^{c}	0.498±0.034^{e}	0.464±0.022^{de}
Sugg	+ +	4.75±0.13^{def}	3412±150^{ab}	0.127±0.046^{a}	0.357±0.030^{bc}	0.336±0.024^{a-d}
Sullivan	ol ol	4.30±0.20^{cde}	3570±244^{ab}	0.086±0.076^{a}	0.334±0.055^{bc}	0.147±0.038^{ab}
Wynne	ol ol	4.70±0.19^{def}	3263±269^{abc}	0.143±0.077^{a}	0.456±0.048^{cde}	0.161±0.035^{ab}
Mean		4.66	3028	0.269	0.462	0.351
CV (%)		12.2	18.4	59.0	26.9	31.3

$^{\alpha,\beta}$ Type means followed by the same lower-case Greek letter are not different by t-test (P<0.05).
^{a,b,c} Line means followed by the same lower-case Roman letter are not different by t-test (P<0.05).
^{ns} Denotes traits for which the F-test of variation between types or among lines within types was not significant (P<0.05).
+ + Denotes lines with normal oleic fatty acid content in the seed oil.
ol ol Denotes lines with elevated fatty acid content in the seed oil.

IMPACT STATEMENT

Two high-oleic species derived breeding lines, SPT 10-05ol and SPT 10-14ol, were identified as having improved yield potential and superior disease resistance. It remains to be seen of these lines have a future as cultivar releases, but they can certainly serve as parents for additional crosses hat will give rise to new releases.