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ANNUAL PROGRESS REPORT
TO
NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.

TITLE: **Utilizing *Arachis* Species for Improving Disease Resistant Cultivars**

LEADER(S): **H. Thomas Stalker**

DEPARTMENT(S): **Crop and Soil Sciences**

REPORT:

Thirty lines derived from advanced interspecific hybrids were retested in replicated experiments at Lewiston, NC and compared to susceptible cultivar checks for early leaf spot and tomato spotted wilt virus resistances. No fungicides were applied to the plants. Based on low defoliation scores, plant and pod characteristics, five entries were selected for early leaf spot resistance with defoliation scores of 1.5 to 2.0 as compared to the check NC cultivars which ranged from 5.5 to 8 (1 = no leafspot and 9 = completely defoliated). The same lines were evaluated for TSWV resistance and several lines were also highly resistant. Nine of the lines tested in 2014 and 2015 were hybridized with cultivars Bailey and Emery, F_1 hybrids obtained. During 2016, the F_1 hybrids were grown in the field and F_2 seeds collected for testing next year.

During the summer of 2013, 5 of Dr. Isleib's highest yielding and disease resistant lines were hybridized with 7 interspecific hybrid selections with multiple, high levels of disease resistance to leaf spots, Sclerotinia blight, and CBR in the greenhouse. First generation seeds were grown in a winter nursery in Puerto Rico for seed increase and 90 second generation lines were planted at Lewiston in a leaf spot selection nursery during 2014. Selections were made and progeny rows grown in a replicated field test during 2015 to evaluate leaf spot resistance and pod traits. Thirty 30 lines were selected for leaf spot resistance and good agronomic traits. Six lines had both a defoliation score of 1 or 2 (were 1 = no disease) and no disease was evident for TSWV or soil-borne pathogens. These lines will be evaluated in the greenhouse for multiple diseases during the winter, 2016-17 and in replicated field tests next year.

Hexaploid crosses Gregory x *Arachis diogoi* (10602) and Gregory x *A. correntina* (9530) were advanced to the next generation at Sandhills Experiment Station. One line was discovered with 40 chromosomes and a large number of seed was harvested. Seeds were increased and 89 lines of an *A. diogoi* hybrid were evaluated in non-replicated field tests for TSWV and leaf spot resistances. Thirty six of these lines did not have TSWV incidence in the field and they will be tested in greenhouse inoculation tests in the greenhouse and again in replicated field tests during 2017. Fifty eight lines were also tested in non-replicated field tests for leaf spot resistance and 19 entries had very low defoliation scores. The 86 lines need to be retested in replicated experiments to confirm the high levels of resistance in the interspecific hybrids.

Seeds were collected from interspecific A x B genome hybrids and colchicine treated during the winter, 2014-15 in order to double the chromosome number to equal the 40 chromosomes of cultivated peanut. 40-chromosome sectors identified, but plants were weak and no seeds were recovered. Thus, a second crossing program was developed between diploid A-genome species

with extremely high levels or resistance to early and late leaf spot, tomato spotted wilt virus, and many other disease and insect pests (*A. diogoi, A. stenosperma, A. correntina*, and *A. cardenasii*) and the three species with B genomes (*A. ipaensis, A. magna, and A. batizocoi*). More than 6,000 pollinations were made resulting in 109 hybrids (Table 1). Rather than treat seeds, the hybrid plants were grown to maturity, more than 2,000 vegetative cuttings were colchicine treated, rooted in sand, and plants were transplanted into plots in the greenhouse. Pegs are being identified on plants and seeds will be harvested during the winter, 2016-17. The cuttings will be transplanted into the field at the Sandhills Research Station during the summer, 2017 in order to obtain tetraploid seeds. These seeds will then be used as parents with NC cultivars to incorporate high levels of disease resistance into peanut breeding materials.

Table 1. Results of diploid crossing program during 2015 to obtain synthetic polyploids after making 6,049 pollinations.

B-genome	A-genome	No. hybrids
Arachis ipaensis	*A. diogoi*	26
	A. stenosperma	11
	A. correntina	20
Arachis magna	*A. diogoi*	5
	A. stenosperma	11
	A. cardenasii	6
Arachis batizocoi	*A. diogoi*	21
	A. stenosperma	8
	A. cardenasii	1

Several synthetic polyploids were obtained during 2015, including *A. ipaensis* x *A. villosa, A. correntina,* and *A. duranensis; A. batizocoi* x *A. stenosperma* and *A. duranensis;* and *A. gregorii* x *A. stenosperma.* More than 1,000 pollinations were made onto cultivars Gregory and Emery and hybrids were obtained for each combination. The first generation progenies were self-pollinated during 2016 and progenies will be hybridized with NC cultivars.

IMPACT STATEMENT

Early leafspot (ELS) and Tomato Spotted Wilt Virus (TSWV) have been the most persistent disease problems that the peanut growers have to confront annually in North Carolina. Although commercial cultivars available in the V-C production area have moderate levels of resistance to ELS and TSWV, stable resistance is lacking in these cultivars. Many diploid *Arachis* species have exhibited very high levels of resistance to ELS and TSWV with some also resistant to CBR and Sclerotinia blight. As a result, development of genetic resistance by transferring resistance genes from diploid *Arachis* species into *A. hypogaea* will help growers reap good quality peanuts with less input costs. It is anticipated that the selections resulting from the interspecific breeding materials will provide lines with high levels of multiple disease resistance with good quality pods.