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PROGRESS REPORT
TO
THE NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.
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TITLE: **Utilizing ARACHIS SPECIES FOR IMPROVING DISEASE RESISTANT CULTIVARS**

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DEPARTMENT(S): **Crop Science**

REPORT:

***Arachis cardenasii* lines evaluated in field for leaf spot resistance and yield potential**

Twenty two advanced generation *A. cardenasii*, four Gregory x *A. diogoi* lines, and the cultivated checks Bailey, VA 98R, Perry and NC 3033 were evaluated at Lewistion, NC in a replicated leafspot test. The disease was extremely severe during the fall, 2017 and evaluations were made on September 25 and October 5, 2017. Both early and late leaf spots were observed in the field. Pod size was also recorded for each entry. On a 1 = no leaf spot to 9 = 100% defoliation scale for the October evaluations when leaf spot was more severe, the cultivated checks ranged from a rating of 6 for NC 3033 to 8.5 for VA 98R as compared to a range of 4 to 6.5 for the *A. cardenasii* lines and 3.25 to 4.7 for the *A. diogoi* lines. The four *A. cardenasii* lines and four *A. diogoi* lines will be tested for yield and grade during the coming year to evaluate potential for releasing them as germplasm lines.

Selected *A. cardenasii* lines were hybridized with Emery and Bailey in an attempt to increase yield potential. Progenies from 57 crosses were tested in a non-replicated leaf spot test. All of the Emery lines were 60 to 80% defoliated and the Bailey lines had 40 to 50% defoliation. The Emery crosses will be discarded and the Bailey materials reevaluated during 2018 in replicated field tests. In addition, 24 Bailey x allotetraploid hybrids with *A. ipaënsis* and *A. stenosperma* in their pedigrees were evaluated in the same experiment and all entries had 60 to 70% defoliation and will be discarded.

Six *A. cardenasii* lines were tested for yield potential in disease-free and no leaf spot control tests. One of the lines had yield potentials significantly higher than any cultivar grown in NC in disease-controlled plots. This line was also highly resistant to peanut diseases. The line will be retested in 2018 and if sufficient numbers of seeds are available, the line will be placed in the multi-state yield tests for potential cultivar release.

Arachis diogoi interspecific hybrid evaluations for early and late leaf spot

Eighty five Gregory x *A. diogoi* interspecific lines were evaluated in the field at Lewiston, NC and Dawson, GA for leaf spot resistance. In Lewiston there was a predominance of early leaf spot, but also significant amounts of late leaf spot and the reverse trend was observed in Dawson. Leaves were collected for all plots at both locations and the average number of early and late leaf spot lesions were recorded for each entry at both locations. There was a large amount of variation among lines for susceptibility to either early or late leaf spot, where a line had mostly early leaf spot and others had mostly late leaf spot. Several lines had a nearly equal distribution of both pathogens on leaves. Defoliation was also recorded multiple times between the 2nd week of September and the 2nd week of October when disease incidence was extremely severe on non-sprayed plots. A scale of 1 = no evidence of disease to 9 = complete defoliation was used for ratings. At the last rating on October 10, *A. diogoi* (the highly resistant diploid species parent) had an average defoliation rating of 3.3 whereas the other parent in the cross averaged 8.3. Defoliation ratings of seven NC cultivars ranged between 7.3 and 9.0. The range in the interspecific lines was from 4.0 to 9.0. Nine lines had an average rating less than 5.0. As a comparison, on September 25 there were 39 lines with ratings of 1 to 2 and the disease exponentially increased after this date.

The 85 lines were also evaluated for leaf spot resistance in Dawson, GA where there was an early epidemic of leaf spot diseases. Only one rating was performed during the 2nd week of September. *Arachis diogoi* did not have visible leaf spot symptoms and was rated as 1. NC cultivars had ratings of 5.0 to 7.3, Georgia cultivars ranged between 4.7 and 6.7, and Gregory averaged 7.7. The range of leaf spot ratings for the interspecific lines was 2.0 to 8.0, and a total of 12 lines averaged 4.0 or less. Only four lines rated as resistant in NC were the same as those with the highest levels of resistance in Georgia. These lines have significance because there is likely different strains of the leaf spot pathogens. The most resistant lines to leaf spots will be used in a leaf spot crossing program in 2018.

Arachis diogoi interspecific hybrid evaluations for tomato spotted wilt virus (TSWV) resistance

The 85 interspecific hybrids and cultivated checks were evaluated for TSWV resistance at the experiment stations at Lewiston and Rocky Mt. and in Dawson, GA. When plants had symptoms that were not clearly due to TSWV, then roots were used to run Elisa tests (which consist of an antibody that positively identifies plant tissue specifically for the virus). The parent *A. diogoi* did not express TSWV symptoms at any location while Gregory averaged 45% of the plants infected. Seven NC cultivars ranged from 11 to 57% infection, with the lowest incidence on Sullivan and the highest on Phillips. Six germplasm lines were also evaluated in the experiment and they had a range of 8 to 63% TSWV infection; the *A. cardenasii* introgression line SPT-06-06 had the lowest incidence of 8%. The range of TSWV infected plants in *A. diogoi* introgression lines was 0 to 45%, where 28 lines had 10% or less TSWV incidence (four did not express symptoms in NC and two had 2% incidence). The four lines were also highly resistant in Georgia. There were very likely due different TSWV strains present in NC and GA, so this is believe to be a major breakthrough for identifying TSWV resistant germplasm in peanut.

When comparing TSWV and leaf spot ratings for the 85 germplasm lines, the four lines with no TSWV in the field had leaf spot ratings on October 10 ranging from 5 to 5.7. Two entries with 2% incidence had ratings of 4.3 and 5.0. The lines will be evaluated again in

2018 and also put into a crossing program because both TSWV and leaf spot incidence on the plants was significantly less than any other materials tested.

Developing new tetraploid introgression lines

During 2016 another individual derived from cross Gregory x *A. diogoi* was discovered. Progenies were harvested and planted at Lewistion in 2017. Seed was harvested on an individual plant basis and they will be evaluated for leaf spot resistance during 2018. Plants of other crosses, in particular *A. hypogaea* x *A. correntina* hexaploids were grown at the Sandhills Research Station and seeds harvested from field plots. However, they remain at the hexaploid chromosome level.

To generate new introgression lines and avoid the sterility expressed when cultivated peanut is hybridized directly with diploid species, an attempt is being made to make crosses between diploid species with an A and B genome (analogous the AB genomes of cultivated peanut) and then double the chromosome number to $2n = 40$ before hybridizing the species with cultivars. In 2016, more than 2000 colchicine treatments were performed on more than 100 diploid hybrids and about 800 cuttings were planted in space isolated plots at the Sandhills Research Station during 2017. Individual plants were dug by hand and seed harvested. Seeds were obtained from hybrids using four species combinations. The seeds will be grown at Sandhills again in 2018 to increase seed numbers for disease testing. An additional 1500 cuttings were colchicine treated during the summer, 2017 and the surviving materials are being maintained in pots in the greenhouse. Seeds will be harvested during the winter and summer, 2018.

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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 and high yield potentials.