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ANNUAL

PROGRESS REPORT
TO
NORTH CAROLINA PEANUT GROWERS ASSOCIATION, INC.

TITLE: **Support for Peanut Wild Species Breeding and Germplasm Maintenace at NCSU**

LEADER(S): **Ryan J. Andres and Jeffrey C. Dunne**

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

REPORT:

The diploid wild species freezer collection remains in good working order. Outside of Dr. Hsuan Chen's project, we anticipate continuing to move away from direct involvement with diploid wild species to focus on material already at the tetraploid level, which offers a much higher probability of near-term success. This includes de-emphasizing the *A. correntina* x VA-98R hexaploid material, which continues to be difficult to work with due to poor germination, flowering rate, and seed set.

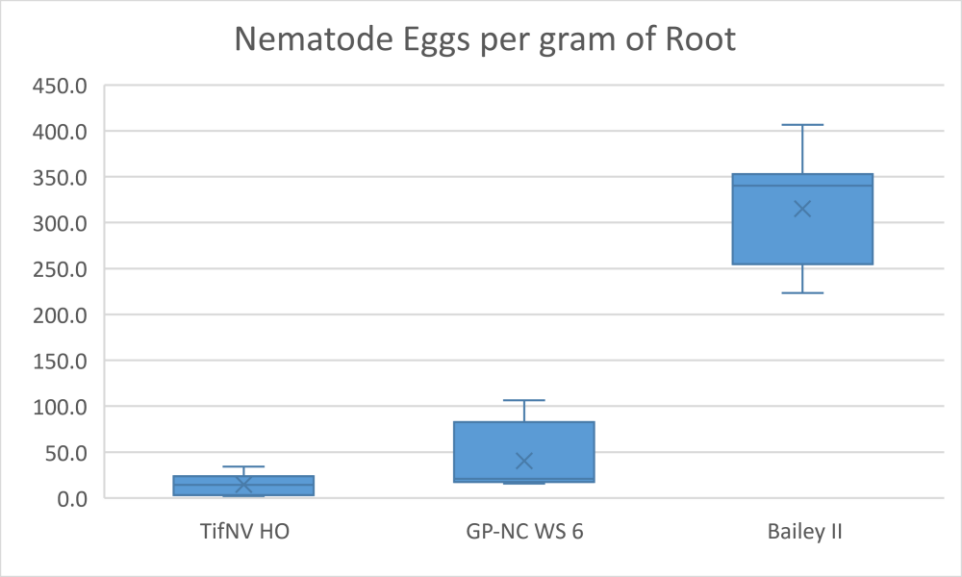
As part of this emphasis on tetraploid material, crosses were made between Bailey 2 and four synthetic allotetraploids (*A. batizocoi x A. stenosperma*, *A. gregoryi x A. stenosperma*, *A. ipaensis x A. stenosperma*, and *A. ipaensis x A. correntina*) received from the University of Georgia in the summer of 2023. Crosses were also made between eight *A. cardenasii* derived breeding lines and the obsolete, highly susceptible cultivar Phillips. All eight of these breeding lines contain *A. cardenasii* introgressions of unknown function discovered in 2021. Molecular markers to track these introgressions were developed in 2022. Philips was chosen as a parent for this population to better determine the disease resistance effects of these new introgressions, independent of resistance genes already present in current cultivars.

In addition to traditional wild peanut species, NCSU has maintained a collection of 741 tetraploid landrace accessions. While significantly improved compared to wild species, landraces often serve as excellent sources of disease resistance but generally lack the genetic uniformity and elite yields of modern cultivars. In summer 2022, 122 South American landraces were included in a preliminary leaf spot resistance screen. Thirty-six well-adapted landraces with moderate leaf spot resistance were seed increased in Puerto Rico over winter 2022-2023. These 36 were then re-tested in a replicated trial in Lewiston in summer 2023. Only one landrace (#33) showed leaf

spot scores as good as the most resistant breeding lines in our program (N13031, N16034, and SPT 10-12). Landrace 33 will be incorporated into the cultivar development-crossing program to breed for improved leaf spot resistance.

Preliminary greenhouse trials indicate GP-NC WS 6 is significantly more resistant to root-knot nematode (RKN) that Bailey II but not quite as resistant as TifNV HiOL (Figure 1). RKN-resistant progeny from the cross of Bailey II x GP-NC WS 6 have been advanced to the F_4 generation and are currently being grown in the greenhouse over the winter. In addition, 40 plants show promise in identifying the gene causing the RKN-resistance. Identification of this gene will help future work to identify additional RKN-resistance genes.

Figure 1 – Cultivar Response to Greenhouse RKN Infection



Previous research identified IL-29, IL-49, and IL-58 as the most leaf spot resistant *A.diogoi* introgression lines and HTS 16-03, 16-04, and 16-06 as the most leaf spot resistant improved *A. cardenasii* lines. Therefore, 3-way crosses were initiated between these six lines. This material has been advanced to the F_3 generation and 60 molecular markers associated with the leaf spot resistance developed to select for improved leaf spot resistance in this population. The F_4 generation will be planted over winter 2023-2024 and the populations have been transferred to the marker-assisted selection segment of the cultivar development program.

IMPACT STATEMENT

Since project inception, five different wild species populations have been transferred to the cultivar development program. Four of these offer improved leaf spot resistance, while the fifth carries RKN resistance. Ideally, these resistances will quickly be combined with high yield potential in new cultivars for the peanut farmers of North Carolina. The planting of resistant cultivars is the most economical and environmentally friendly way to combat pathogens as they offer the potential to reduce input costs while seed prices remain relatively constant. Current work with synthetic allotetraploids, landraces, and the eight *A. cardenasii* introgression lines represent potential populations to transfer to the cultivar development program in the near future.