Introgression of disease and pest resistance traits from wild species
For sustainable peanut improvement

PI: David Bertioli, University of Georgia, bertioli@uga.edu

Overview

The cost of controlling pests and diseases and the loss of yield they cause has been estimated at more than $160 million per year for peanut farmers in Georgia. Plant Protection Products are vital for peanut disease and pest management. However, their application not only increases the cost of peanut production but is under increasing regulatory pressure, is time consuming, and damaging to the environment. Development of disease and pest resistant cultivars is one of the most economical ways to control pests and diseases. This project utilizes the genetic diversity of wild peanut species, converting them into a tetraploid form that can be directly used in breeding programs. These wild species tetraploids are then used to develop new germplasm lines with much stronger resistances than available when breeding with cultivated peanuts of pure pedigree. This work makes full use of the advances in genetics made possible by the Peanut Genome project and, via germplasm release, will create a legacy resource for breeders consisting of new tetraploids and peanut lines with new wild species traits

Results

Twenty-four unique crosses were made with diploid wild peanuts in 2020. The diploid hybrids were confirmed with molecular markers and morphological traits, and thousands of cuttings were treated to induce chromosome doubling. So far thirteen distinct synthetic tetraploid wild peanuts were developed from these crosses, we are currently multiplying them and characterizing their pest and disease resistances, chromosome characteristics, DNA content and phenotypic traits, for germplasm release. In 2021, five previously new tetraploids were deposited in the USDA National Plant Germplasm System making them freely available to breeders and researchers. The production of new wild species-derived tetraploids will continue in 2022.

Previously produced synthetic tetraploid wilds and progeny from backcrosses with cultivated peanuts were planted and evaluated in Midville. Under extreme pressure from Late Leaf Spot in the 2021 season, numerous lineages showed better Late Leaf Spot resistance than the best of our elite pure pedigree peanut controls. These lineages will be advanced for further selection and genetic analysis in 2022

Some stages in the development of new wild species-derived tetraploids:
Left, a colchine treated diploid hybrid *A. cruziana* x *A. simpsonii* begins to produce larger tetraploidized flowers compared to diploid; **Middle**, from where the larger flowers were produced pegs emerge; **Right**, a transplanted tetraploid seedling, the first hybrid of its type. Seed is currently being multiplied for characterization of disease resistances and hybridization with cultivated peanut