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

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Overview

The cost of controlling pests and diseases and the loss of yield they cause has been estimated at more than $160.0 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 have been made with diploid wild peanuts. The diploid F_1 hybrids were confirmed with molecular markers and morphological traits, and thousands of cuttings were treated to induce chromosome doubling. So far five distinct synthetic tetraploid wild peanuts were developed and confirmed by cytological analysis, molecular markers and phenotypic traits. After the large scale colchicine treatments done in the latter half of 2020, we expect several new tetraploids to be produced in 2021.

Previously produced synthetic tetraploid wilds were used to make backcrosses with cultivated peanuts. Progeny were planted and evaluated in Midville. Under extreme pressure from TSWV, 25 lineages derived from the first back cross showed a very promising combination of yield and disease resistance. These lineages will be advanced to genetic analysis and field trials 2021.

Fig. 1 Left hand size: the larger flower of a new wild species tetraploid hybrid derived from *Arachis ipaensis* and *A.* aff. *helodes* compared to its smaller diploid form. The collection of aff. *helodes* was made more than 50 years ago in South America, only now has it been incorporated into form which can be directly used in peanut breeding. Right hand side: Field selections at Midville of lineages derived from TifNV and the tetraploid ValSten (derived from the wild species *Arachis valida* and *A. stenosperma*). The field had no fungicide sprays during the whole season, and was under intense disease pressure from TSWV. Multiple lineages showed very promising combinations of productivity and disease resistance.