Breeding for drought resistance in Georgia peanut

Cristiane Pilon[1], and Nino Brown[1]

[1]Faculty, Crop and Soil Sciences Department, University of Georgia (UGA) Tifton Campus

Rational and Significance of Research. Peanut (*Arachis hypogaea* L.) is a relatively drought tolerant crop; however, more frequent and intense drought episodes coupled with high temperatures caused by climate change are impairing growth and productivity of peanuts grown in Georgia. Breeding for drought resistance is quite challenging as drought conditions in the field are difficult to replicate from year to year and resistance to drought involves multiple traits. Identifying physiological and metabolic traits that contribute to resistance can be used as more reliable screens for drought resistance. Combining several traits from many parental genotypes or cultivars requires large population sizes and the ability to evaluate large numbers quickly and accurately. Therefore, having a more accurate, repeatable, and detailed screen could accelerate genetic gain for drought resistance in peanut.

Objective. Our objectives with this research are to identify physiological processes that contribute to drought resistance and further develop a more accurate and detailed screen to accelerate gain for drought resistance in peanut.

Procedures. Peanut genotypes were planted on May 30, 2024 under field conditions at UGA, Tifton Campus. Fully irrigated and drought-stress blocks were planted on the same day in the same field. Rainout shelters were used to cover approximately 5.5 m (18 ft) of the dry plots when forecast predicts a rain event from 70 to 112 days after planting (DAP). During sunny days, drought blocks were not covered with the shelters. The untreated control received irrigation as needed throughout the season. Other field management practices followed UGA Extension recommendations. Measurements were taken from all plots at five different timings: 1) a day prior to the onset of the drought stress, 2) one week of drought stress, 3) two weeks of drought stress, 4) three weeks of drought stress, and 5) one week after the end of drought stress. Physiological measurements included gas exchange and fluorescence. Metabolic measurements included amino acid accumulation, activity of enzymes involved in the cellular defense pathway, and reactive oxygen species. Yield and grade data were collected from the plots at the end of the season.

Results. Preliminary results indicate differences in net photosynthesis between the water regimes only at 89 DAP, except for RBS-131 which showed differences in net photosynthesis at 82 DAP. All genotypes recovered to near irrigated levels after recovery. TVS-10-13-10 showed similar net photosynthesis between water regimes at all measurement dates. GA-14N, RBS-125, and RBS-202 showed significantly greater biomass production in drought-stress plots compared to irrigated group. At 112 DAP, all genotypes recovered producing biomass comparable between water regimes. A significant increase in biomass production in drought-stressed plants was only observed for GA-14N. RBS-131 and TVS-10-13-10 upregulated most photosynthetic parameters under drought stress. GA-14N and RBS-125 showed a noticeable increase in photosynthetic parameters relative to the control group after recovery. In summary, all breeding lines, except for RBS-202, showed ability to recover from drought stress. RBS-131 and TVS-10-13-10 maintained the photosynthetic process during drought stress, indicating potential drought tolerance. Biochemical analyses are currently being conducted in the laboratory. Additional studies are needed to further understand the intricate traits associated with drought tolerance in peanut. This research will be repeated in 2025.