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Final Report for CY 2016

**Project Title:** Development of Peanut Cultivars with Resistance to Diseases and Improved Water Use Efficiency, and Identification of Genetic Markers for Marker Assisted Selection.

## Project Investigators:

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Dr. Albert C. Culbreath, Plant Pathologist, University of Georgia, Tifton, GA
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**Summary:**

Previous progress from this project has resulted in the development of peanut genotypes with relatively high yield and relatively low aflatoxin contamination when grown under drought and heat stress conditions. Continued breeding efforts are needed to improve the yield and grade to develop drought tolerant peanut cultivars. During this year we continued these breeding efforts and conducted numerous field tests containing breeding lines that we are evaluating to access their tolerance to drought, yield, and grade. These lines were planted in replicated studies at our field at the Gibbs Farm that has ten rain out shelters. The shelters were then used to impose heat and drought stress for the 40 days immediately prior to harvest. Plots were visually rated for drought stress, and the yield and aflatoxin contamination were measured. Breeding lines that had relatively high yield and relatively low aflatoxin were identified.

We have also continued our breeding efforts to develop peanut cultivars that have resistance to late leaf spot and/or the peanut root-knot nematode. These effort span the gamut from making crosses to yield trails to evaluate late generation breeding lines for potential release as cultivars.

Molecular markers are widely used in other crops to improve breeding efficiency and effectiveness. Use of molecular marker assisted selection (MAS) in peanut breeding has lagged other crops because of a lack of molecular markers for important traits. We have recently developed and genotyped eight RIL populations that are segregating for many important traits. We have also phenotyping these populations for resistance to early and late leaf spot, and for resistance to TSWV and white mold. We have also phenotyped these populations for yield and grade. These data, along with genotyping data were analyzed and we have identified QTLs that can be used in marker assisted selection. In our breeding program we are currently using MAS for nematode resistance, high O/L ratio, and resistance to late leaf spot.

## I. Main Body of Report

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**Objectives:**

1 – Identify high-yielding, disease-resistant peanut lines.
2 – Develop drought tolerant peanut germplasm with high yield.
2 – Identify molecular markers for disease resistances.

**Procedures:**

1) Crosses have been made and progeny were evaluated for resistance to leaf spot, tomato spotted wilt virus, and white mold. Late generation breeding lines were evaluated for yield and disease resistance in replicated field studies.
2) Crosses have been made and progeny were evaluated for drought tolerance. Late generation breeding lines were grown under late season heat and drought stress, and evaluated for yield and pre-harvest aflatoxin contamination.
3) Recombinant inbred line populations were phenotyped and genotyped, and data were analyzed to evaluate associations between genetic markers and disease resistance.

**Results and Discussion:**

Continued breeding program to combine resistance to leaf spot with high yield and grade and high oleic acid content. This included continued hybridization and generation advance for breeding populations involving over 40 cross combinations. Material is first advanced to the $F_4$ generation when MAS is used to identify individual plants for harvest. This material is grown the following year with no fungicide sprays. Progeny that show resistance and high yield are selected. These selections are then tested in replicated yield trials. We have several late generation breeding lines that have a high levels of resistance to leaf spot and good yields when grown with no fungicide sprays.

Previous progress from this project has resulted in the development of peanut genotypes with relatively high yield and relatively low aflatoxin contamination when grown under drought and heat stress conditions. Continued breeding efforts are needed to improve the yield and grade to develop drought tolerant peanut cultivars. During this year we continued these breeding efforts and conducted numerous field tests containing breeding lines that we are evaluating to access their tolerance to drought, yield, and grade. These lines were planted in replicated studies at our field at the Gibbs Farm that has

ten rain out shelters. The shelters were then used to impose heat and drought stress for the 40 days immediately prior to harvest. Plots were visually rated for drought stress, and the yield and aflatoxin contamination were measured. Breeding lines that had relatively high yield and relatively low aflatoxin were indentified.

Molecular markers are widely used in other crops to improve breeding efficiency and effectiveness. Use of molecular marker assisted selection (MAS) in peanut breeding has lagged other crops because of a lack of molecular markers for important traits. We have recently developed and genotyped eight RIL populations that are segregating for many important traits. Part of the work supported by this proposal was to phenotype some of these populations for resistance to early and late leaf spot, and for resistance to TSWV and white mold. These populations were also phenotyped for yield and grade. These data, along with genotyping data were analyzed to identify QTLs that can be used in marker assisted selection. In our breeding program we are currently using MAS for nematode resistance, high O/L ratio, and resistance to late leaf spot.