

Annual

Final Report 2013 (4th quarter ending Dec. 31, 2013)

(i)Development of Peanut Cultivars with Resistance to Diseases and Improved Water Use Efficiency; and (ii)Development and Distribution of Recombinant Inbred Line (RIL) Populations for Use in Genomic Projects to Develop Molecular Markers for Marker Assisted Selection

C. C. Holbrook et al.

PROGRESS REPORT:

The first part of this proposal (Dev of Peanut with Resistance to Disease and Drought) is a continuing breeding program. 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 assess their tolerance to drought, yield, and grade. These lines were planted in replicated studies in our field at the Gibbs Farm that has ten rain out shelters, and in our field at the Bowen Farm that has three 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 have relatively high yield and relatively low aflatoxin were identified.

The second major objective for 2013 was the development and distribution of recombinant inbred line (RIL) populations for use in genomics projects to develop molecular markers for marker assisted selection. Parents for the RIL populations were selected to maximize genetic diversity while meeting practical breeding objectives. First, two modern runner cultivars were selected as common parents because runner cultivars account for about 80% of the production in the U.S. Second, the eight unique parents were selected to supply diversity across market classes and botanical varieties and are donors of favorable alleles for enhancing drought tolerance and resistance to most important disease of peanut in the U.S. The 16 populations were advanced using summer and winter nurseries. Input for multiple disciplines has resulted in a prioritized list of populations and traits that should be examined. In 2013 seed for several hundred lines were produced in Tifton, and then distributed to projects in North Carolina, Georgia, Florida, Alabama, and Texas for phenotyping efforts. These data will then be combine with the genetic data for these line. This should result in markers that can be deployed by breeding programs for the development of improved cultivars.

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I.

Abstract

Project Title: (i) Development of Peanut Cultivars with Resistance to Diseases and Improved Water Use Efficiency; and (ii) Development and Distribution of Recombinant Inbred Line (RIL) Populations for Use in Gnomics Projects to Develop Molecular Markers for Marker Assisted Selection

Project Investigators:

- Dr. C. Corley Holbrook, Peanut Breeder and Geneticist, USDA-ARS, Tifton, GA
- Dr. Albert C. Culbreath, Plant Pathologist, University of Georgia, Tifton, GA
- Dr. Peggy Ozias-Akins, Molecular Geneticist, University of Georgia, Tifton, GA
- Dr. Tim Brenneman, Plant Pathologist, University of Georgia, Tifton, GA
- Dr. Tom Isleib, Peanut Breeder, NCSU, Raleigh, NC
- Dr. Baozhu Guo, Plant Pathologist, USDA-ARS, Tifton, GA
- Dr. Patty Timper, Nematologist, USDA-ARS, Tifton, GA

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 assess 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, and in our field at the Bowen Farm that has three 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.

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 increase seed and begin to distribute these populations to other research groups for phenotyping. This includes phenotyping for resistance to early and late leaf spot, and for resistance to TSWV and white mold. These populations will also be phenotyped for yield and grade. These data, along with genotyping data will be analyzed to identify QTLs that can be used in marker assisted selection.

II. Main Body of Report

Project Title: : (i) Development of Peanut Cultivars with Resistance to Diseases and Improved Water Use Efficiency; and (ii) Development and Distribution of Recombinant Inbred Line (RIL) Populations for Use in Gnomics Projects to Develop Molecular Markers for Marker Assisted Selection

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Objectives:

- 1 – Develop high yielding peanut germplasm with resistance to biotic and abiotic stresses.
- 2 – Develop populations that can be used to identify additional genetic marker for valuable traits in peanut.

Procedures:

- 1) Crosses have been made and progeny were evaluated for resistance to leaf spot, tomato spotted wilt virus, white mold, and *Cylindrocladium* Black Rot. 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 developed. Seed were increased and distributed for research to phenotype and genotype for economically significant characteristics.

Results and Discussion:

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

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