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I. Abstract

Project Title: Development of Peanut Cultivars with Resistance to Diseases and Improved Water Use Efficiency and Development and Use of Molecular Markers for Marker Assisted Selection

Project Investigators:

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Dr. Peggy Ozias-Akins, Molecular Geneticist, 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, 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 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 molecular markers for resistance to the peanut root-knot nematode, and molecular markers for both genes controlling the high oleic acid trait in peanut. We are actively using these markers to enhance our breeding efficiency. We are also developing segregating populations that should be useful in developing molecular markers for several other important traits in peanut.

II. Main Body of Report

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Objectives:

1) Development of peanut cultivars with resistance to diseases.
2) Development of peanut cultivars with improved water use efficiency.
3) Development and use of molecular markers for marker assisted selection.

Procedures:

1) Crosses were made and progeny were selected 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 were made and progeny were selected 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 are being developed and will be phenotyped for economically significant characteristics.

Results and Discussion:

Sources of resistance to disease and sources of improved drought tolerance were crossed with breeding lines and cultivars that have more acceptable agronomic characteristics. The resulting breeding populations are advanced using single seed descent to the F_4 generation when individual plants are harvested. Selection for disease resistance, drought tolerance, and improved agronomic characteristics begins in the F_5 generation. Table 1 and 2 (Below) shows the performance of late generation breeding lines selected using this procedure.

For the past several years we have been actively involved in the development of several late generation Recombinant Inbred Line Populations (RILs). The parents for these populations were selected to provide populations containing a wide range of segregation for several economically important traits in peanut. We have begun to phenotype these populations, and other groups will soon begin to genotype these populations. The resulting data will be used to attempt to develop molecular markers and quantitative trait loci (QTLs) that can be used to improve the efficiency and effectiveness of peanut cultivar development.

Table 1. Test 12

Entry	LFSPT1	LFSPT2	Entry	Yield lb/ac
FLA 07	4.0	8.3	Tifguard	3090
C740-1-87-2-R	2.5	7.3	FLA 07	3063
C740-2-10-3-R	1.8	7.3	GA 06G	3011
C740-2-10-3-T	1.5	7.3	C740-2-10-3-T	2860
C740-1-85-5-T	3.5	7.3	Georganic	2709
C740-1-51-5-R	2.3	6.8	C740-2-10-3-R	2632
C740-1-51-5-T	2.0	6.8	C740-1-86-1-R	2495
C740-1-46-5-T	2.0	6.5	C740-1-51-5-T	2484
GA 06G	2.0	6.5	C740-1-87-2-R	2441
C740-1-43-5-T	1.5	6.3	C740-1-85-5-T	2353
C740-1-86-1-R	2.0	6.3	C740-1-45-4-T	2339
C740-1-52-3-T	2.3	6.3	C740-1-43-5-T	2214
Tifguard	1.8	6.3	C740-1-51-5-R	2186
C740-1-45-1-R	2.0	6.0	C740-1-45-1-R	2138
C740-1-45-4-T	2.3	5.5	C740-2-12-4-R	1882
C740-2-49-2-R	1.5	5.5	C740-2-49-2-R	1866
C740-2-12-4-R	1.5	5.3	C740-1-52-3-T	1835
Georganic	1.0	5.0	C740-1-46-5-T	1514
LSD 0.05	1.1	0.8		438

Table 2. Test 57

Entry	ID	Yield lb/ac	Entry	ID	LFSPT 2	LFSPT 1
13	FLA 07	3158	13	FLA 07	7.7	2.7
5	0910	2705	14	GA 06G	6.8	2.2
8	1050-31	2612	8	1050-31	6.8	2.5
10	B013-7	2548	9	1050-119	6.2	2.3
9	1050-119	2497	5	0910	6.0	2.3
12	Tifguard	2458	2	0670-1	5.8	2.2
7	0925bp-6	2388	12	Tifguard	5.8	2.0
14	GA 06G	2298	1	648m	5.7	1.7
1	648m	2261	3	0701m	5.0	1.7
2	0670-1	2171	10	B013-7	4.8	2.3
6	0925bp-4	2129	4	0906	4.0	1.0
4	0906	2108	11	Georganic	3.8	1.0
3	0701m	2002	7	0925bp-6	3.7	1.3
11	Georganic	1086	6	0925bp-4	3.7	1.0
LSD 0.05		373			1.3	1.0