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2014

National Peanut Board Check-Off Research
Quarterly Reports and Final Report- 2014

I. Identification
   a. Title: Breeding for Disease Resistance in Runner Peanuts for the Southeast
   b. Funding Year: 2014
   c. Principle Investigator: B.L. Tillman (btillman@ufl.edu), University of Florida, 3925 Hwy. 71, Marianna, FL 32446
   d. Cooperators: Tim Brenneman, Nicholas Dufault
   e. Total Funds Requested: $23,000
   f. Location: North Florida REC, Marianna, Florida
   g. New or Continuing (more than three years)- Continuing

II. Layman's Summary

The University of Florida Peanut Breeding Program is a continuous effort to develop and deploy peanut varieties with improved yield, grade and disease resistance. New cultivars are one of the most cost effective ways to improve the competitiveness of peanut with other crops. Increasing production costs as well as shifting disease patterns indicate the need for continued peanut breeding efforts. The ongoing University of Florida Peanut Breeding program is focused on developing varieties with disease resistance, high yield and good grades.

For 2014, we seek funding to continue the breeding effort with special emphasis on combining disease resistance to spotted wilt, white mold, and leaf spot with superior pod yield and grade. Tests will be conducted to determine resistance to white mold, spotted wilt and leaf spot in Marianna, Florida.

III. Project Purpose

Diseases can cause significant economic loss for peanut growers and resistant varieties are one very effective method of limiting losses from disease. New peanut germplasm and cultivars from the UF program have been identified to have superior resistance to TSWV as is the case with Florida EP^{TM} '113', and to white mold as is the case with 2000x2-2-B2-7-1-2 which lost 37% of its yield when challenged with white mold compared to 73% for Georgia-06G.

IV. Hypothesis and Objectives

1) Hypothesis: Peanut cultivars with improved disease resistance, coupled with high yield and grade can be produced by conventional breeding methods.
   Objective 1: Evaluate advanced breeding material for resistance to white mold, leaf spot, and spotted wilt. About 125 advanced breeding lines will be tested for reaction to these three diseases in Marianna, Florida in 2014. White mold tests will be planted in mid-May and will be inoculated with *S. rolfsii* when the middles are closed during mid to late July. Spotted wilt tests will be planted in mid-late April without Thimet. Tests for leaf spot will be planted in late May or early June and will not be sprayed with fungicides the entire season.
2) Hypothesis: Marker assisted breeding is a tool that can improve the breeding process and development of Recombinant Inbred Line (RIL) populations is a critical part of marker development.
   Objective 2: Begin process of increasing seeds of CAPS RIL populations.
   In 2013, we grew about 1600 $F_{2:5}$ lines from eight different RIL populations as part of the Peanut Genomics Initiative. A single plant was harvested from each line. In 2014, the single plant from two of the eight populations will be planted and bulk harvested and stored in the PGI cold room for later distribution as required.

V. Experimental Plan and Methods

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a. Objective 1 will be accomplished by manipulating the environment and/or the pathogen to create the best possible chance for disease to occur. In the case of leaf spot, plots will be planted in early June and will not be sprayed with fungicides. Tests for reaction to TSWV, plot will be planted in mid-April with 4 seeds per foot of row without in-furrow insecticides. White mold tests will be planted in mid-May and inoculated with *S. rolfsii* and irrigated several times to insure a moist, hot canopy. About 120 breeding lines will be evaluated for reaction to each of the three disease and replicated tests using commercial cultivar will be conducted for both white mold and leaf spot. Three replications will be used with 12-15 cultivars and advanced lines. Data to be collected includes reaction to disease (rated on a scale of 1-10) and pod yield.
b. Objective 2 will be accomplished by planting about 400 RILs in 2-row plots 15 feet long containing 25-30 plants. The entire plot will be harvested and stored in the shell for later shelling and distribution.

VI. Results

a. Objective 1:

Quarter 1

A total of 84 experimental lines were selected for evaluation in disease nurseries. A total of 84 experimental lines were evaluated for reaction to TSWV, white mold and leaf spot. In addition, twelve advanced lines and cultivars were selected for testing their reaction to white mold and leaf spot in controlled, replicated tests. During January through March, peanuts were shelled, counted and packaged for planting.

Quarter 2

TSWV (Tomato Spotted Wilt Virus)
Tests to evaluate reaction to TSWV were planted on April 28, 2014. To encourage disease development, tests were planted early, and did not use Thimet insecticide in furrow. Plant stands were adequate for all plots.

White Mold
Tests to evaluate for white mold reaction were planted on May 21, 2015. Plant stands were excellent. Planting in mid-May encourages rapid canopy growth and allows creates the potential for better disease expression. Tests to evaluate leaf spot reaction were planted on June 10, 2015. Late planting helps to create the conditions for leaf spot disease to become severe.

Quarter 3

During the summer months of July, August, and September, plots were maintained with appropriate fungicides and herbicides. No fungicides were applied to the leaf spot tests #1 and #2, and only chlorothalnil- based fungicides were used on the white mold tests. Gypsum was applied to all plots at a rate of 1200 lbs./Acre. During July, white mold plots were inoculated with *Scelrotium rolfsii* grown on sterilized oat groats provided by Dr. Tim Brenneman. Each row was inoculated with about 30 grams of inoculum mixture. The plots were irrigated about 0.25 inches on the day prior to inoculation, the day of inoculation and the day after.

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In the advanced breeding line and cultivar tests for white mold, genotypes were planted in paired plots and one plot was inoculated whereas the other was not. There were three fungicide programs in the advances lines/cultivar leaf spot tests, no sprays, 4 sprays and 8 sprays.

One or two days prior to digging, in September and October, plots were rated for disease reaction on a scale of 1 to 10 in which 1 means less than 10% of the plot diseased and 10 means at least 90% diseased. The scale is the same for white mold and TSWV, but the Florida 1-10 scale was used for rating leaf spot reaction. The TSWV plots were inverted, allowed to dry and were harvested for pod yield.

Quarter 4

During October, November, and December, the white mold and leaf spot tests were rated for disease reaction as described above and were inverted, allowed to dry to about 18% moisture and harvested for pod yield.

TSWV Results

Ratings ranged from 1 to 5 on the 1-10 scale in the first test and from 1 to 3 in the second test. Overall, TSWV pressure was relatively low in 2014 making evaluation difficult. However, the correlation between TSWV ratings in test 1 was -0.64 ($p<0.05$) indicating that TSWV was severe enough to impact yield in that test. However, there was no correlation between pod yield and TSWV ratings in the second test. A lack of TSWV pressure over the past several years (since 2010) has made selection for resistant types very difficult. Unfortunately, there is no reliable method of artificial inoculation in a field setting, so we are at the whims of nature and the thrips vector for epidemic development.

White Mold Results

Ratings of above-ground white mold symptoms ranged from 1 to 9. Ratings of below-ground-symptoms ranged from 4 to 10. In the first test, the correlation between above-ground white mold symptoms and yield was -0.46 ($p=0.001$) and the correlation between below-ground symptoms was -0.74 ($p<0.0001$). In the second test, the correlation between above-ground white mold symptoms and yield was -0.74 ($p<0.0001$) and the correlation between below-ground symptoms was -0.87 ($p<0.0001$). This indicates that we can effectively select for white mold resistance using the inoculation techniques described here. Several new genotypes were identified which had good levels of resistance to white mold.

Figure 1 shows the results of the replicated and inoculated advanced breeding line/cultivar test. The results show a range of reaction to white mold with some genotypes exhibiting tolerance and others susceptibility. This information was shared with growers and industry representatives during winter meetings in January through March 2015.

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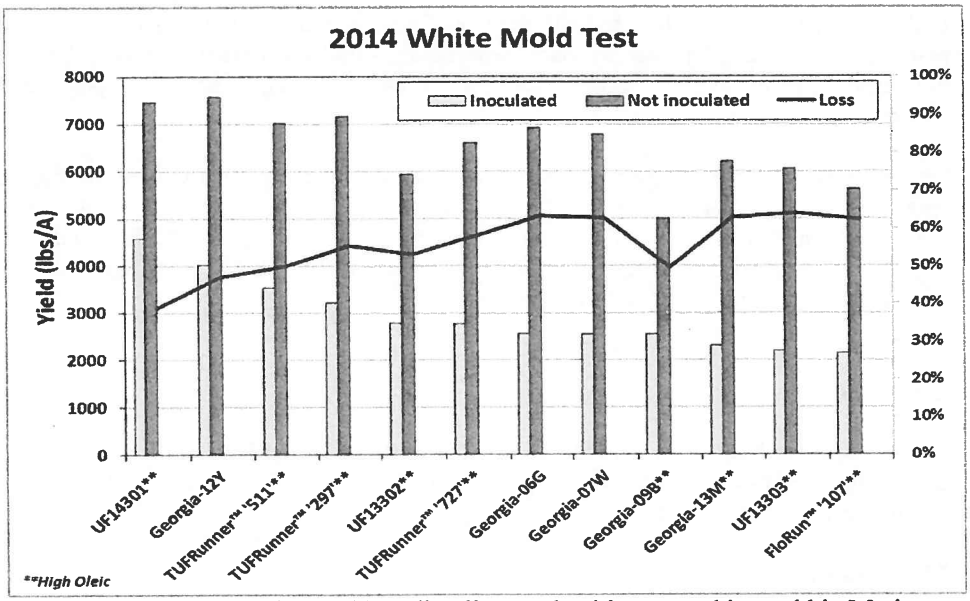

Figure 1. Response of advanced breeding lines and cultivars to white mold in Marianna, Florida in 2014.

Leaf Spot Results

Ratings of leaf spot ranged from 1 to 10 on the Florida 1-10 scale. The correlation between pod yield and leaf spot ratings was -0.80 ($p<0.0001$) in both tests. These results show that we can effectively discriminate among experimental lines based on their reaction to leaf spot. Several new lines were identified with good resistance to leaf spot.

Figure 2 shows the pod yield results from the advanced breeding line/cultivar test in which there were three fungicide programs: no sprays, 4 sprays and 8 sprays. Leaf spot was severe in the test and reduced pod yield of the susceptible genotypes considerably. Several genotypes with tolerance were identified and this information was shared with growers during winter meetings in January through March, 2015.

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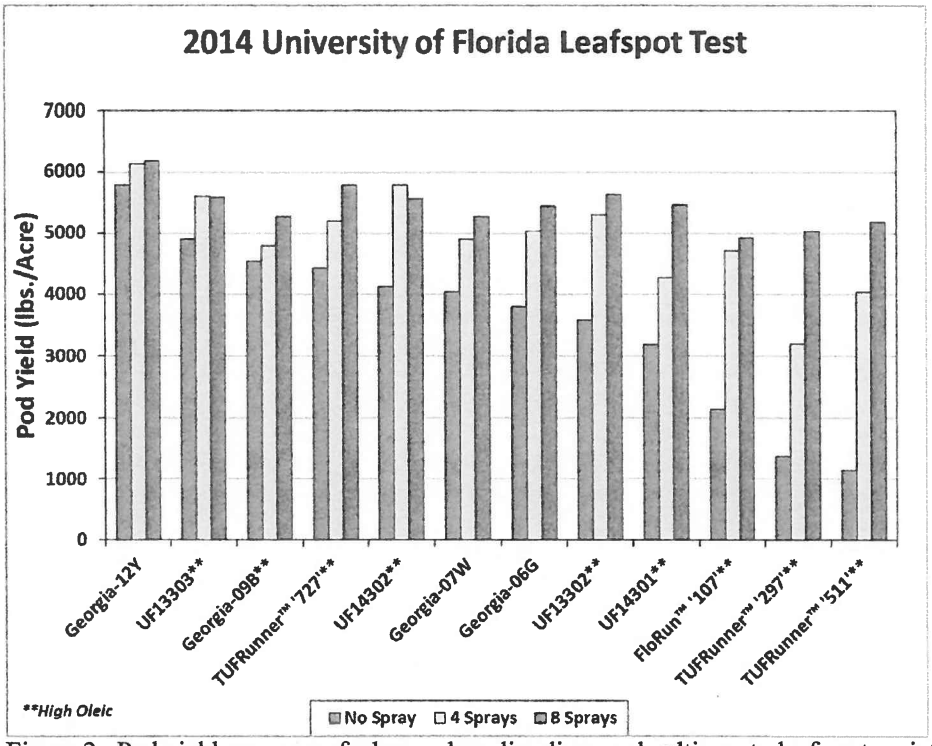

Figure 2. Pod yield response of advance breeding lines and cultivars to leaf spot variation brought about by three different fungicide programs in Marianna, Florida in 2014.

Final Report/Summary

Tests designed to evaluate peanut breeding lines and cultivars for their reaction to three major diseases, leaf spot, TSWV, and white mold were established in Marianna, Florida in 2014. Results showed that breeding can successfully identify and select for genotypes with resistance to these diseases. This suggests that we could breed cultivars with resistance to all three diseases which would provide growers with tools to better manage their farms and their fungicide budgets.

b. Objective 2:

Quarter 1-4 and Final reports

Beginning in January 2014, pods were shelled and seeds were packaged for planting. About 300 $F_{6:7}$ lines were planted in Marianna Florida on June 11, 2014. The lines were all from the same cross between Florida-07 and Florunner and are part of the "CAPS" populations being developed under the Peanut Genomics Initiative. The goal of the project was to harvest the entire plot to generate enough seed so that the Recombinant Inbreed Line population could be used to phenotype and genotype for traits of interest. In late October, 2014, each plot was hand harvested to insure seed purity and has been stored in a climate-controlled facility awaiting further use.

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