384/1408
2016

I. Identification

a. Project Title: **Valencia Peanut Breeding for Drought Tolerance-Year 1**

b. Funding Year: 2016

c. Principal Investigator(s): Naveen Puppala

d. Cooperating Personnel

e. Total Funds Requested: **$ 16,575; Balance amount $ 218**

f. Location(s) where research will be performed Clovis, New Mexico

g. New or Continuing Project: New

i. If continuing, how many years and amounts of previous NPB funding have been received? Briefly describe the progress and accomplishments to-date on the project.

Continuing from 2015. I received the funds $ 16,575 in 2016. Initiated crosses at Costa Rica winter nursery in August 2012. The parents were planted in August and crosses are being done for Valencia-C (female parent) with three drought tolerant lines (male parents) namely C76-16, ICGS-76 and ICGS-91114. The advance materials were grown as F4 material in New Mexico under limited water conditions using a center pivot irrigation. The nozzles were turned off in order to limit the irrigation.

ii. Will funds be required in subsequent years to complete the objectives? If yes, how many years do you anticipate requiring funding?

- Yes we need funds in 2017 to advance the populations.

iii. What other sources of funding are being requested, i.e. list States, Foundations, USDA, etc. Are these funds included in the total funds requested from NPB?

-Transcriptome analysis of the two parents were done using the funds from Hatch proposal to New Mexico Agricultural Experiment Station (AES). Support for a graduate student was provided from NIFA grants through University of Florida through grant number 6008_UFDSP00010021.

II. Layman's Summary

Water stress or Drought is a major limitation to peanut production in New Mexico. New Mexico is under semiarid climate where Valencia peanuts are grown under irrigation. Annual rainfall received is 18 inches per annum. Ogallala Aquifer that extends from South Dakota through West Texas and New Mexico is getting depleted and water is getting scarce and expensive. For this reason we need to develop varieties that are tolerant to drought and use water more efficiently.

III. Project Purpose

Drought is the major abiotic stress constraint affecting peanut productivity and quality in eastern New Mexico and west Texas. There is a pressing need to improve the water use efficiency of peanut production. Breeding varieties with higher water use efficiency is seen as providing part of the solution. The objective of this work is to develop a high yielding peanut that produces more peanuts per unit of water consumed.

IV. Hypothesis and Objectives

The primary goal of this proposal will be to develop a drought tolerant Valencia peanut. Drought stress for the last two years has resulted in significant yield losses in west Texas and eastern New Mexico. Development has been hampered by variable incidence of drought stress in the field, lack of means to measure drought stress response, and poor understanding of the nature of tolerance. This proposal addresses all three of these aspects.

1. **Develop Drought Tolerant Valencia Varieties:** We will cross Valencia-C (female parent) with three drought tolerant lines (male parents) namely C76-16, ICGS-76 and ICGS-91114.

2. **Determine phenotypic responses to drought stress response and other traits in an F_2 mapping population.** Other traits will include a limited characterization of drought stress response, and agronomic traits including yield, plant type, maturity, and seed size.

V. Progress made in 2016:

We selected 129 families from the F4 generation of a cross between Valencia-C X ICGS-91114. These families were replicated three times and planted in 2016 under center pivot irrigation system under grower's field at one location. Limited irrigation was given from planting until harvest. The analysis of variance was significant for all the lines that were tested at <0.0001. The coefficient of variation for the study was 17.86 with a least significant difference of 440.88. The yield of these 129 families ranged from 715 to 2200 pounds per acre under deficit irrigation system. We monitoring the soil moisture, leaf temperature and amount of water that is applied at each irrigation. We took some aerial pictures using Infrared camera mounted on a tower covering the entire study area (data not yet analyzed). The total amount of water applied was 15 inches including the rainfall during the growing season. All the lines were significantly different. Only seven lines

resulted in yield greater than 2000 pounds per acre. Under a good year with good rainfall and irrigation our average yields for this farm range from 3300 to 4000 pounds per acre. There was a 50% reduction in yield compared to full irrigation condition (25 to 30 inches of total water; rainfall and irrigation) even for the best seven lines that recorded above 2000 pounds. Our best yielding variety was 2200 pounds per acre (Line number 18). There were 64 lines that fell under the range of 1500 to 2000 pounds per acre and 51 lines that fell between 1000 and 1500 pounds per acre. There were seven lines that did not perform well and fell below 1000 pounds per acre. We will continue in 2017 from funds received from National Peanut Board.

We also collected DNA from both stress and irrigated plots of Valencia-C and C76-16 in 2015. We analyzed these samples for transcriptome sequencing to National Center for Genome Resources (NCGR) lab at Sante Fe, New Mexico. We used funds from other funding source to conduct this study. Data filtration and alignment of data was completed. The reads were mapped on both A and B-genome, separately. We completed with annotations of transcripts and pathway analysis. We designed SNP markers from the above and at present we are testing the markers and trying to screen in a set of germplasm having varied degree of tolerance to abiotic stresses and could will available for validating in a biparental population.

The analysis of variance for 129 mapping population is presented below:

The ANOVA Procedure

Dependent Variable: YIELD

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	130	38796383.20	298433.72	3.97	<.0001
Error	256	19246816.54	75182.88		
Corrected Total	386	58043199.74			

R-Square	Coeff Var	Root MSE	YIELDPA Mean
0.668405	17.86256	274.1950	1535.026

Source	DF	Anova SS	Mean Square	F Value	Pr > F
REP	2	696000.13	348000.06	4.63	0.0106
LINE	128	38100383.07	297659.24	3.96	<.0001

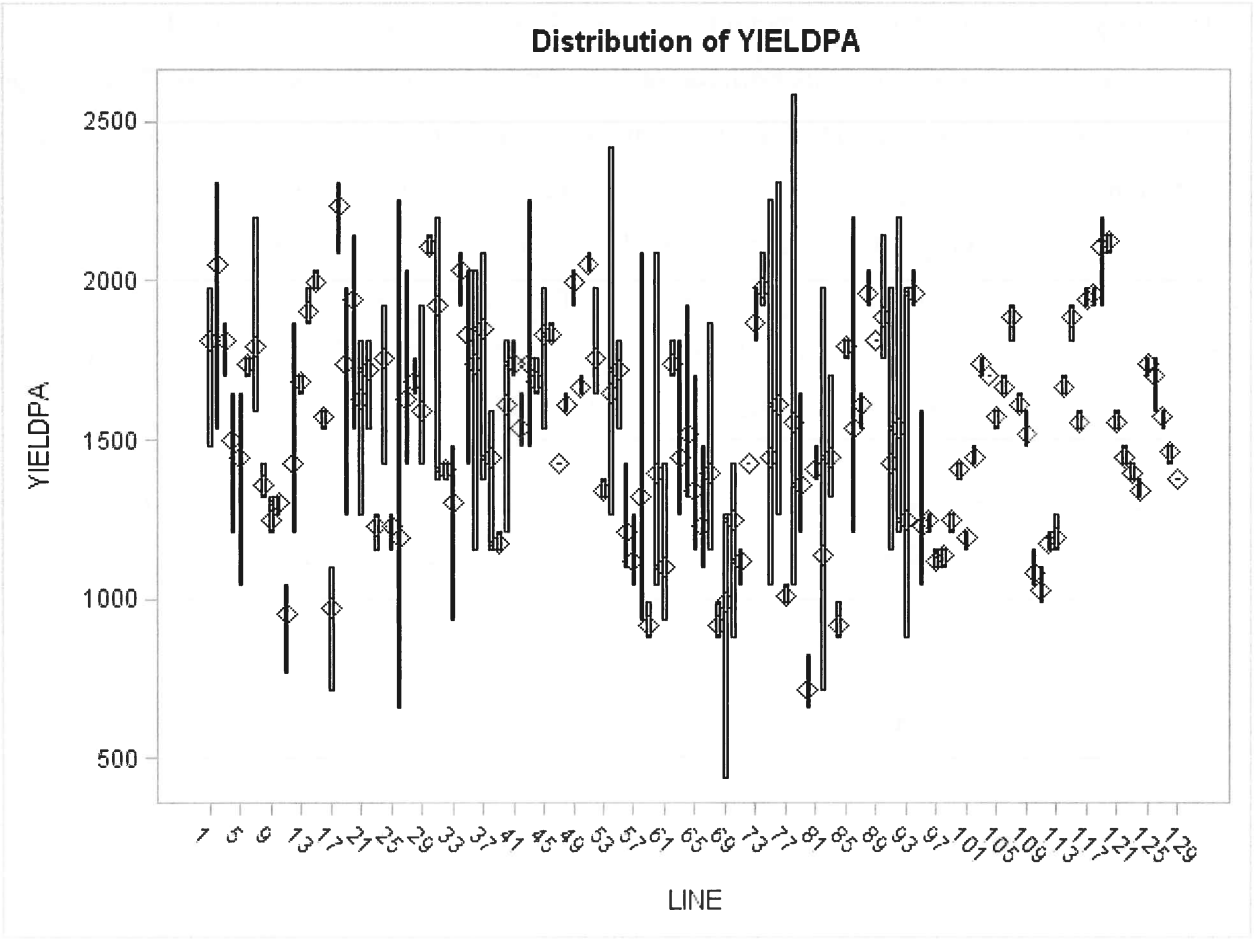

Fig. 1. Distribution of 129 mapping population lines to yield per acre in 2016.

The total number of SNP markers that were designed from the transcriptome analysis are presented below:

S.No	Treatment combination	Genome	# of SNP's
1	C76 stress vs C76 irrigated	B	3
2	C76 irrigated vs Val-C irrigated	B	23
3	C76 stress vs Val-C stress	B	39
4	C76 irrigated vs Val-C irrigated	A	36
5	C76 stress vs Val-C stress	A	15
6	Val-C irrigated vs Val-C stress	B	61
7	Val-C irrigated vs Val-C stress	A	30
	Total primers designed		207