Final - Summary

National Peanut Board Proposal for 2014 Funding Cycle

I. Identification

a. **Title:** Fertilization and Nutrient Management Trials in Peanut

b. **Funding Year:** 2014

c. **Principle Investigators**

Julie A. Howe, Auburn University
Glendon H. Harris, University of Georgia
Kris Balkcom, Auburn University
Nathan Smith, University of Georgia
Kip Balkcom, USDA-ARS National Soil Dynamics Lab

d. **Cooperating Personnel**

John P. Beasley, Jr., University of Georgia
James Bostick, Alabama Crop Improvement Association

e. **Total Funds Requested:** $52,000

f. **Location(s) where research will be performed**

Wiregrass and Gulf Coast Research & Extension Centers, Headland and Fairhope, AL
University of Georgia, Tifton and Camilla, GA

g. **New or Continuing Project:** Continuing (4th year)

II. Layman's Summary

Peanut producers have numerous questions with regard to proper calcium fertilization. The majority of these research questions seek to better understand when and how to apply calcium. Frequently asked questions include: Are all gypsum sources the same and which is the most economical? When is the most effective time to apply gypsum? Would split applications of gypsum be more effective than a single application? Does gypsum release calcium fast enough during peak pod fill? Can calcium be lost from the pegging zone due to high rainfall events? Do liquid calcium applications to the soil supply adequate calcium? Are calcium applications effective when applied as a foliar spray? Can calcium applied through irrigation pivots supplement gypsum/lime applications? This research seeks to provide research data to quantitatively answer these questions for growers. The specific objectives are to evaluate sources of calcium alone or as supplemental treatments, to assess the effectiveness of gypsum applied at various growth stages. Research is organized into three year field studies for each objective. This is the third year for the calcium source and timing study. Various sources of calcium, including two types of gypsum, soluble calcium applied through a center pivot, and foliar applied calcium will be evaluated alone or as supplemental treatments. Timing will include gypsum applications at approximately 45, 75, and 105 days after planting, as well as split application. Field plots will be established with Georgia-06G and Georgia Greener at irrigated and non-irrigated sites and evaluated for yield, grade, germination, and seed calcium. Leaching of calcium from the pegging zone, use of seed Ca as pre-season indicator of seed quality and late season fertilization needs, and the economics of calcium fertilization will also be considered.

III. Progress to April 2015

Various sources of Ca, including 1) gypsum (USG 500, PCS/Wetbulk, Agrical/Smokestack), 2) soluble Ca applied through a center pivot (calcium chloride and calcium thiosulfate), and 3) foliar Ca applied at approximately 1 qt/a, were applied alone or as supplemental treatments. Timing included gypsum applications at approximately 45, 75, and 105 days after planting, as well as split application. Randomized and replicated field plots were established at irrigated and non-irrigated sites. Mid-season peanut and soil samples were collected. Peanut harvest is completed along with final soil sampling. Peanut yields have been determined as well as grade for all trials except the ones at Gulf Coast Research and Extension Center (in progress).

Preliminary Results

This research was conducted at Wiregrass Research and Extension Center (WREC) in Headland, AL, under irrigated and non-irrigated conditions, and at Gulf Coast Research and Extension Center (GCREC) in Fairhope, AL, under non-irrigated conditions.

1. The initial soil pH at each site was between 5 and 6.
2. The initial soil Ca level at each site was close to or greater than 150 mg kg^{-1}, which is the critical value for supplemental Ca for peanut in Alabama.
3. Both sites at WREC had a >3 soil Ca/K ratio, but at GCREC, the Ca/K ratio was close to 1.
4. Compared to 10-yr average, the 2014 growing season was relatively dry.

Year	Site	Irrigation	Initial pH	Initial nutrients extractable by Mehlich 1			Rainfall (May - Oct)
				Ca	K	Mg	
				---------mg kg^{-1}---------			mm
2014	GCREC	No	5.5	521	460	119	843
	WREC	No	5.4	142	25	19	458
	WREC	Yes	5.3	217	84	17	458

Calcium Source Trial

Besides lime, Hi-Cal (liquid Ca fertilizer), and the three commercial types of gypsum (AgriCal, USG 500, and PCS Wetbulk), a new product, Topflow, which is a lime slurry, was also evaluated at WREC.

Yield

Effects of Ca sources on peanut yield was only observed at WREC under non-irrigated conditions. When applied at 1120 kg ha^{-1}, gypsum notably increased peanut yield compared to untreated control. However, no significant differences were observed among the three commercial types of gypsum. Lime did not significantly improved peanut yield, but there was no significant difference between gypsum and lime when applied at 1120 kg ha^{-1}.

When broadcasted, Topflow significantly increased peanut yield over the untreated control. However, the higher rate (94 L ha^{-1}) showed no benefits over the lower rate (47 L ha^{-1}). Banding treatment of Topflow did not notably improved peanut yield compared to the untreated control.

Ca source	Rate	Site		
		GCREC Non-irrigated	WREC Non-irrigated	WREC Irrigated
		Yield		
	kg or L ha^{-1}	---------- kg ha^{-1}----------		
Control	0	3890 a	1440 b	3720 a
AgriCal	560	3630 a	1990 a	3350 a
AgriCal	1120	3490 a	1820 a	3810 a
PCS Wetbulk	1120	4010 a	1870 a	3600 a
USG 500	1120	3560 a	1750 a	3710 a
Lime	1120	3430 a	1760 ab	3940 a
Topflow	47 (Broadcast)	--	1780 a	3880 a
Topflow	94 (Broadcast)	--	1780 a	3460 a
Topflow	47 (Banded)	--	1700 ab	3880 a
Hi-Cal	374	--	--	3420 a

Grade

Peanut grade was represented as percentage of sound mature kernels (SMK). Similar to yield, Ca source treatments showed no significant effect on peanut grade at WREC under irrigated conditions or at GCREC. When applied at 1120 kg ha^{-1}, PCS Wetbulk notably increased peanut grade compared to untreated control, whereas USG 500 and AgriCal did not. However, no significant differences were observed among the three commercial types of gypsum. Lime significantly improved peanut grade, but there was no significant difference between gypsum and lime when applied at 1120 kg ha^{-1}. Topflow did not significantly increased peanut grade over the untreated control.

Ca source	Rate	Site GCREC Non-irrigated	Site WREC Non-irrigated	Site WREC Irrigated
	kg or L ha^{-1}	SMK ---------- % ----------		
Control	0	63 a	35 b	62 a
AgriCal	560	61 a	46 ab	61 a
AgriCal	1120	61 a	43 ab	67 a
PCS Wetbulk	1120	63 a	47 a	63 a
USG 500	1120	64 a	43 ab	68 a
Lime	1120	63 a	48 a	64 a
Topflow	47 (Broadcast)	--	42 ab	65 a
Topflow	94 (Broadcast)	--	41 ab	65 a
Topflow	47 (Banded)	--	43 ab	63 a
Hi-Cal	374	--	--	63 a

Calcium Timing Trial

Effects of Ca sources on peanut yield were only observed at WREC under non-irrigated conditions. Application of 1120 kg ha^{-1} gypsum at planting notably increased peanut yield compared to untreated control, whereas application at early bloom did not. However, no significant differences were observed between the two timing. The two split application treatments notably improved peanut yield over the untreated control, but no advantage over a single application with equivalent rate were observed. Combined application of Lime and gypsum did significantly improved peanut yield, whereas a single application of lime did not.

Ca source	Rate	Timing	Site GCREC Non-irrigated	Site WREC Non-irrigated	Site WREC Irrigated
	kg or L ha^{-1}		Yield ---------- kg ha^{-1} ----------		
Control	0	-	3890 a	1440 b	3720 a
AgriCal	1120	Early bloom	3490 a	1820 ab	3810 a
AgriCal	1120	Planting	3500 a	1990 a	3630 a
AgriCal	560/560	Planting/Early bloom	3830 a	1870 a	3650 a
AgriCal	560/560	Early/Mid bloom	3730 a	1970 a	3210 a
Lime	1120	Planting	3430 a	1760 ab	3940 a
Lime/AgriCal	1120/560	Planting/Early bloom	3650 a	1880 a	3710 a
Hi-Cal	374	Early bloom	--	--	3420 a

AgriCal/Hi-Cal	1120/37	Early/Mid bloom	--	--	3880 a

Application of 1120 kg ha^{-1} gypsum at planting notably increased peanut grade compared to untreated control, whereas application at early bloom did not. However, no significant differences were observed between the two timing. Split applications of gypsum at planting/early bloom notably improved peanut grade over the untreated control, whereas split applications at early/mid bloom did not. Split applications showed no benefits over a single application with equivalent rate. Combined application of Lime and gypsum did not significantly improve peanut grade compared to a single application of lime.

Ca source	Rate	Timing	Site GCREC Non-irrigated	WREC Non-irrigated	WREC Irrigated
	kg or L ha^{-1}		SMK ----------%----------		
Control	0		63 a	35 b	62 a
AgriCal	1120	Early bloom	61 a	43 ab	67 a
AgriCal	1120	Planting	63 a	49 a	65 a
AgriCal	560/560	Planting/Early bloom	62 a	50 a	65 a
AgriCal	560/560	Early/Mid bloom	63 a	42 ab	58 a
Lime	1120	Planting	63 a	48 a	64 a
Lime/AgriCal	1120/560	Planting/Early bloom	64 a	43 ab	66 a
Hi-Cal	374	Early bloom	--	--	63 a
AgriCal/Hi-Cal	1120/37	Early/Mid bloom	--	--	62 a

Work in progress

Peanut germination

Samples have been sent to Georgia Department of Agriculture-Seed Laboratory. Analysis is expected to be completed by the end of June.

Peanut seed Ca

Our microwave digester, which is used to analyze peanut seed Ca, had a problem with the circuit board. The manufacturer has taken some time to diagnose and repair our unit (April 13-May 15, hopefully), so this has put us a little behind schedule. We will start analysis using EPA-3051A procedure next week. Analysis is expected to be completed by the end of June.

Hull scraped peanut

Hull-scraped peanut samples have been counted, weighed, dried, and ground. Samples collected at 2 wk before harvest and at harvest have been digested and seed Ca analyzed by the inductively coupled plasma. We will finish the remaining samples when the microwave digester is repaired. Analysis is expected to be completed by the end of June.