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Subject: Project #00126301 quarterly report, Jan. 1 – Mar. 31, 2017

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Title: Foliar Fertilization to Increase Maturation in Peanut

Objectives: To determine effects of foliar fertilization on peanut maturity

Summary:
Anecdotal field evidence suggests that irrigated peanut that receive foliar fertilization may exhibit an earlier maturity profile. We hypothesized that timely foliar fertilization may increase pod set of early pods and thereby 'increase' the maturity profile of peanut. A four (foliar fertilization) x two (dig date) randomized complete block experiment was initiated at two sites (Jay, FL and Citra, FL) during 2016. Planting of GA-06G peanut occurred on May 27, 2016 into strip-tilled rye residue in Jay, FL and triticale residue in Citra, FL. Both sites received irrigation as needed. On July 7th the Jay site received either a foliar application of nitrogen (N), phosphorus (P) or boron (B), and was repeated on July 26th. In Citra, FL, foliar applications were made on July 12th and July 25th. The day after each application, foliar tissue samples were collected for nutrient concentrations. At each dig date, yield and the number of mature and immature pods were determined. Preliminary data indicate that foliar P applications significantly increased yield by 500 lbs/ac when dug early, but the mechanism of the increased yield was not likely due to increased maturation. Further analyses and research are required to verify or refute this result.

Methods:
The research was conducted at the West Florida Research and Education Center in Jay, FL (Red Bay sandy loam 0-2% slopes, fine-loamy, kaolinitic, thermic Rhodic Kandiudults) and at the Plant Science Research and Education Unit in Citra, FL (Candler sand, 0-5 percent slopes, hyperthermic, uncoated Lamellic Quartzipsamments). The design was a 4 (foliar application) x 2 (dig dates) factorial RCB with four replications. The foliar application treatments were a no foliar fertilizer control, 8.9 lbs N/acre, 0.9 lbs P_2O_5/acre, and 0.3 lbs B/acre, each applied at 20 gallons/acre spray volume twice during the season at first flower and two weeks later. Foliar applications occurred in Jay on July 7 and July 26. Citra applications were made on July 12 and July 25. The dig dates were approximately 2200 adjusted growing degree days (aGDD) and 2500 aGDD for Jay. For Citra the dig dates were approximately 2400 aGDD and 2600 aGDD.

Lime and other nutrients were applied before planting according to soil test recommendations. Gypsum was applied approximately four weeks after planting. Plots were eight rows wide x 25 feet long on 36" single-row rows. The cultivar GA-06G was strip tilled into rye residue in Jay, FL and triticale residue in Citra, FL with a final plant stand of 6 plants/ft. Weeds were controlled as needed. Field operations are listed in Table 1.

The first foliar application was done around first bloom at about 40 days after planting (DAP) with the next application approximately two weeks later. Twenty-four hours after each foliar application leaf tissue samples were collected. Leaf tissue samples consisted of the leaflets and petiole from the second fully developed node from a representative area in each plot outside the harvest area but at least two rows from a plot border. The aGDD was monitored using the PeanutFARM website to determine when to irrigate and dig the peanut. After digging, pods were blasted and classified into mature and immature pods using a peanut profile board. Brown and black pods were considered mature and white, yellow, and orange pods were considered immature. The percentage of mature and immature pods was determined by removing all pods from a plant one day prior to harvest from non-harvest rows until 180 to 220 pods were collected. Pods were blasted using a pressure washer to remove the exocarp and determine the maturity level and the percentage of immature pods from the total number of pods. Yield and moisture was also recorded.

The data were analyzed using PROC MIXED using SAS 9.4 at the 95% confidence level unless otherwise indicated. aGDD, Application, and their interactions were considered fixed effects. Replications and interactions with fixed effects were considered random effects. Multiple pairwise means separation tests were conducted using least significant differences at the 95% confidence level with the %PDMIX800 macro (Saxton, 1998) within SAS 9.4. Any analyses presented here are considered preliminary.

2017 research is underway. The field has been prepared and flagged. Soil sampling has been completed. Lime was applied and planting is anticipated by May 15.

Table 1. Field operations during 2016 at Jay, FL and Citra, FL.

Date	Operation
4/29/2016	Soil samples, 0-12"
5/25/2016	Fertilized in Jay: P205= 70 lb/ac, K20= 60 lb/ac, S= 5 lb/ac, B= 0.5 lb/ac, Zn= 3 lb/ac, Mn= 1 lb/ac, Cu= 0.18 lb/ac Fertilized in Citra: P205= 40 lb/ac, K20= 130 lb/ac, Mg= 20lb/ac, S= 5 lb/ac, B= 0.7 lb/ac, Zn= 3 lb/ac, Mn= 10 lb/ac, Cu= 0.4 lb/ac
5/27/2016	Planted on 36" rows, single-row
6/29/2016	Gypsum applied to both sites 0.5 tons/ac
7/7/2016	8.9 lbs N/ac, 0.9 lb P2O5/ac and 0.3 lb B/ac of liquid product were applied to the leaves in Jay
7/8/2016	The leaves were collected 24 hours after application
7/11/2016	8.9 lbs N/ac, 0.9 lb P2O5/ac and 0.3 lb B/ac of liquid product were applied to the leaves in Citra
7/12/2016	The leaves were collected 24hours after application
7/25/2016	8.9 lbs N/ac, 0.9 lb P205/ac and 0.3 lb B/ac of liquid product were applied for the second time to the leaves in Citra
7/26/2016	Leaf tissue samples collected 24 hours after application in Citra 8.9 lbs N/ac, 0.9 lb P205/ac and 0.3 lb B/ac of liquid product were applied for the second time to the leaves in Jay
7/27/2016	Leaf tissue samples collected 24 hours after application in Citra
9/16/2016	First dig date in Jay
9/30/2016	First dig date in Citra
10/04/2016	Second dig date in Jay
10/11/2016	Second dig date in Citra

Preliminary results and discussion:

Daily climate data are shown in Figure 1. Rainfall data are shown as a cumulative deviation from the 15-year normal (2001-2016). During the period from May 20 to Oct. 15, 2016, Citra received 540 mm rainfall, 137 mm below normal for the period. Jay received 635 mm rainfall, 70 mm below normal for the same period (Figure 1). Since irrigation was applied, rainfall deficits were not considered important. At Citra, average daily temperatures were higher than normal during the period around first flower (approximately July 8), but were near normal in Jay.

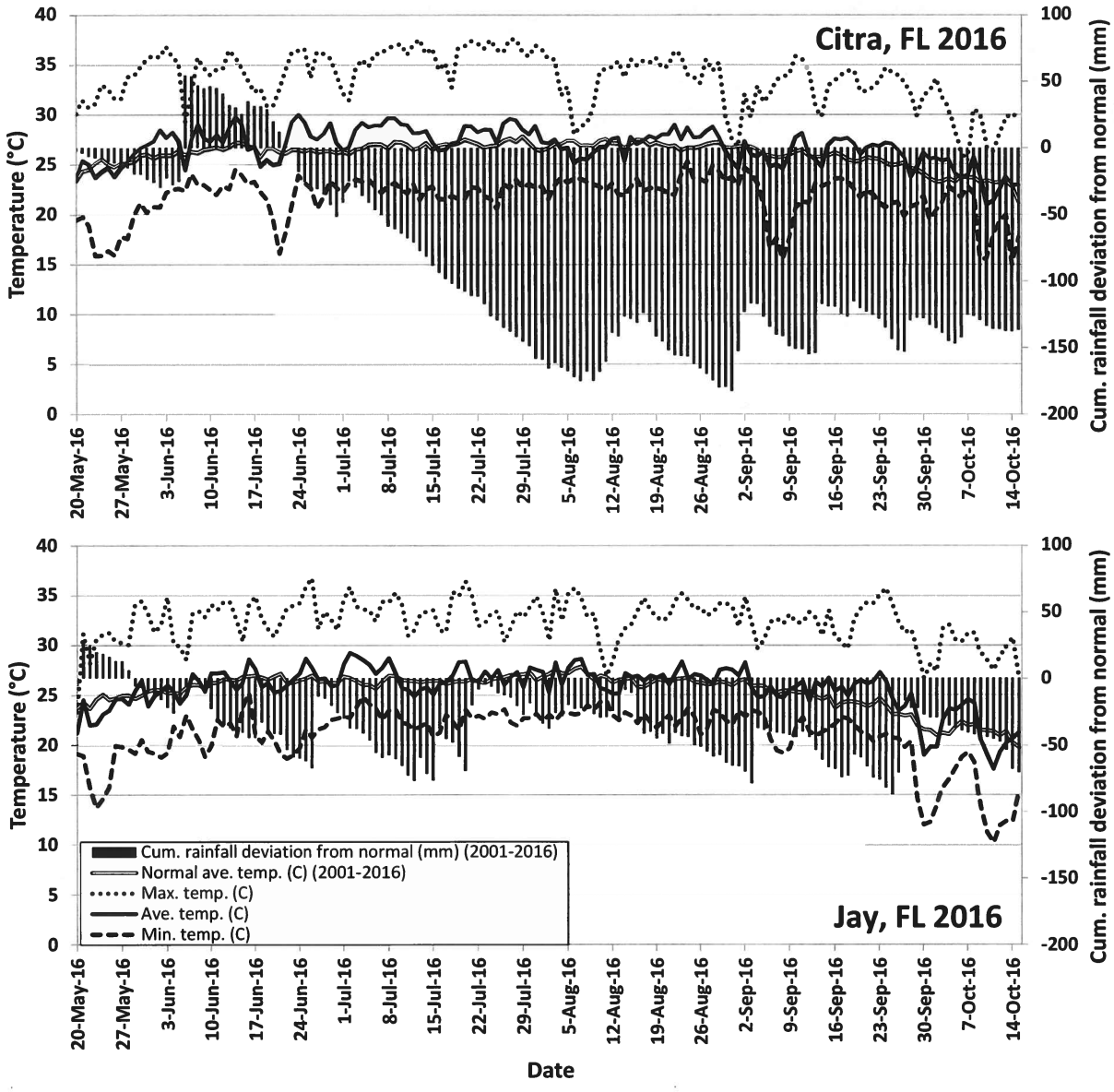

Figure 1. Daily climate data at Citra, FL (top) and Jay, FL (bottom) during the 2016 growing season. Rainfall data are shown as cumulative rainfall deviation from the 15 year normal (2001-2016).

N foliar treatments did not generally increase leaf N content compared to the control (Figure 2).

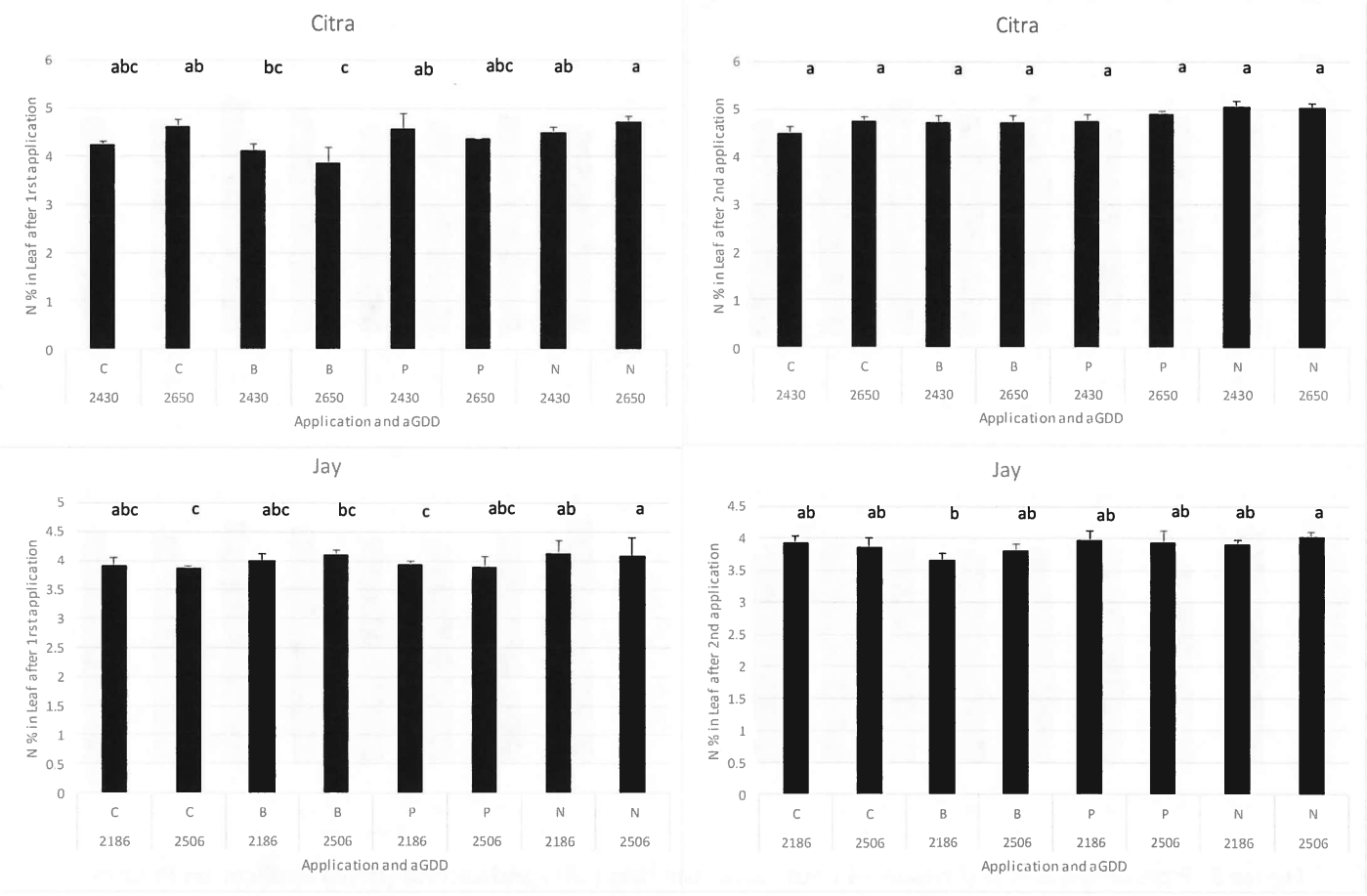

Figure 2. N percentage in leaf tissue 24 hours after the first (left) and second (right) application in Citra (top) and Jay (bottom) during 2016. Error bars represent standard errors of the means. Within a site and application time, different letters represent significantly different means (LSD, $p<0.05$).

Foliar P application generally did not increase leaf tissue P concentrations compared to the control (Figure 3).

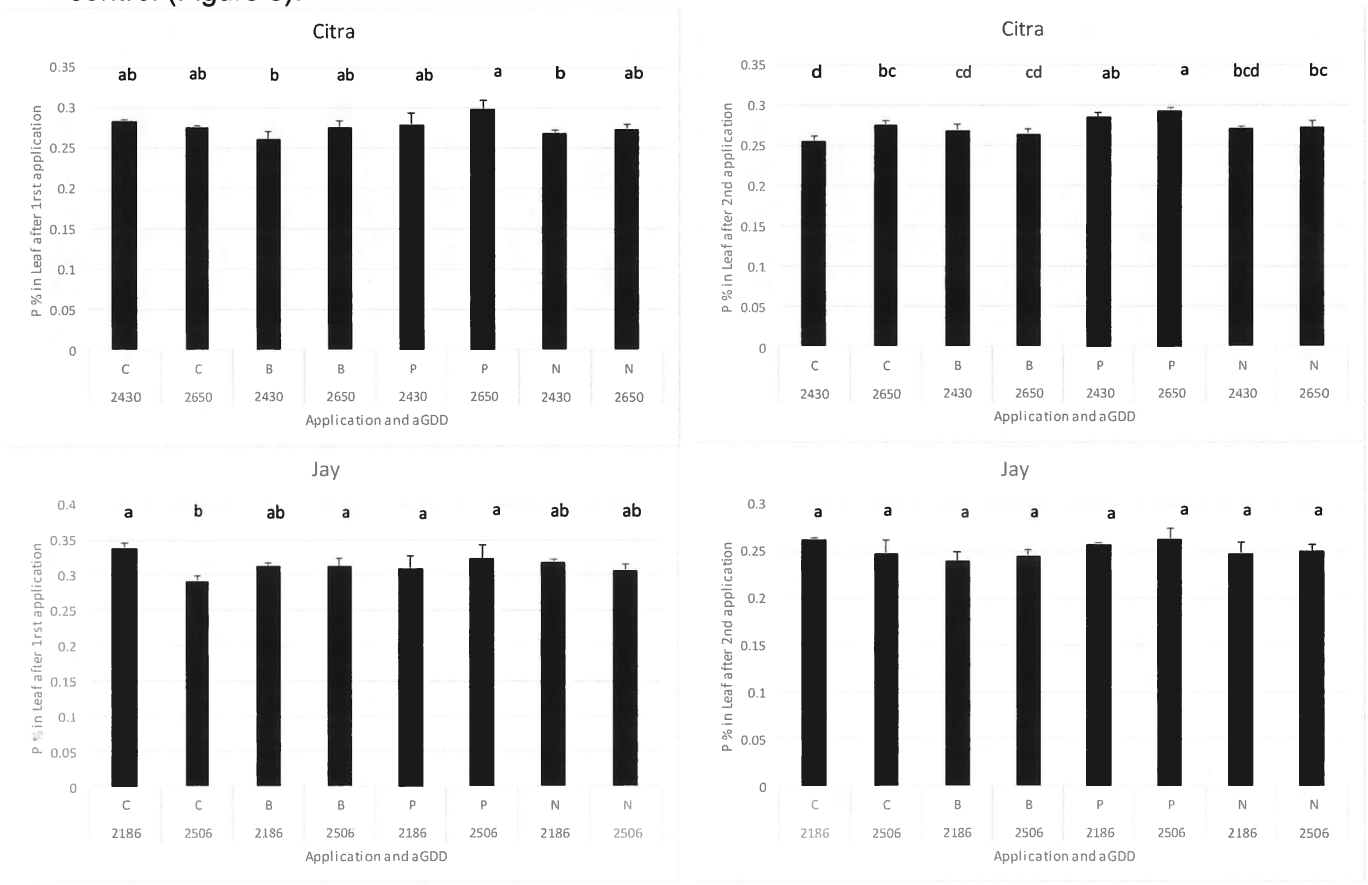

Figure 3. P percentage in leaf tissue 24 hours after the first (left) and second (right) application in Citra (top) and Jay (bottom) during 2016. Error bars represent standard errors of the means. Within a site and application time, different letters represent significantly different means (LSD, $p<0.05$).

B treatments generally showed a significant increase in leaf B content in both Jay and Citra after each application (Figure 4).

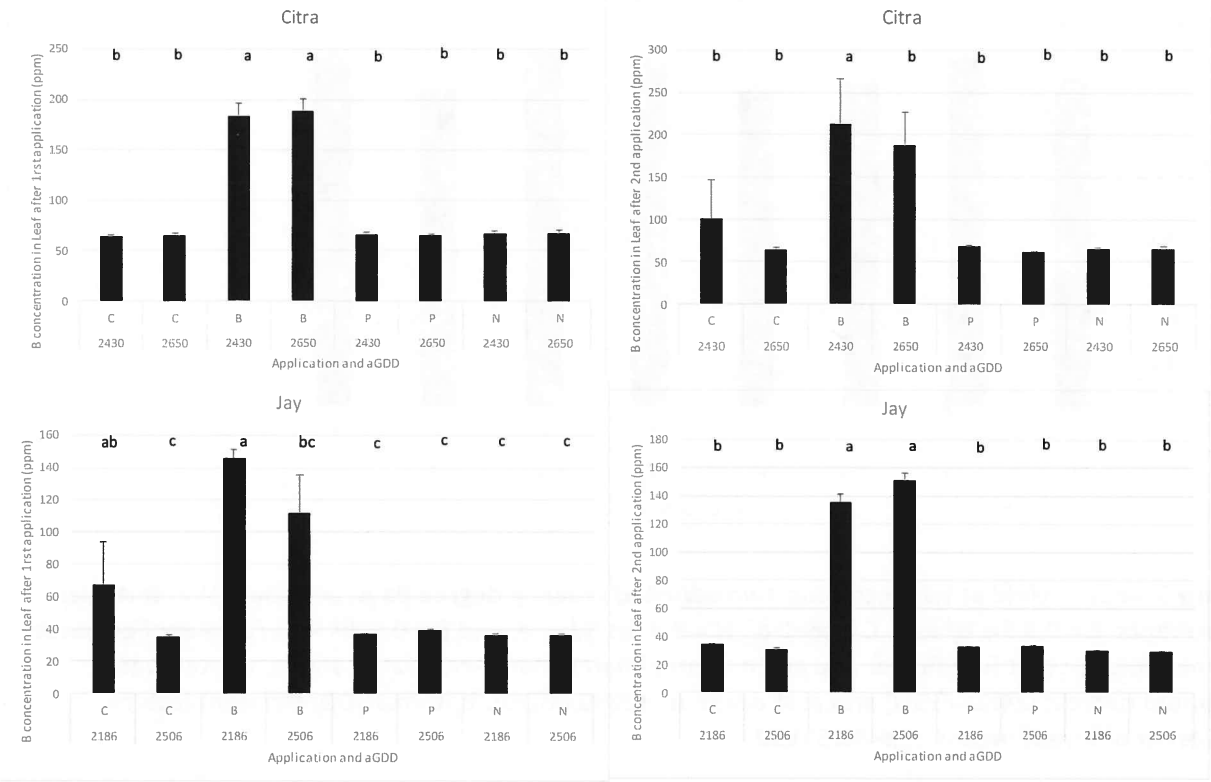

Figure 4. B concentration in leaf tissue 24 hours after the first (left) and second (right) application in Citra (top) and Jay (bottom) during 2016. Error bars represent standard errors of the means. Within a site and application time, different letters represent significantly different means (LSD, $p<0.05$).

Since Citra was harvested at optimum (2430 aGDD, 126 DAP) and past optimum (2650 aGDD, 137 DAP) harvest dates, all fixed effects and their interactions were not significant with respect to yield (Table 2, Figure 5). Jay was harvested at an early dig date (2184 aGDD, 112 DAP) and an optimum dig date (2504 aGDD, 130 DAP), resulting in lower yield during the earliest harvest date in Jay (p=0.0007, Table 2).

Table 2. ANOVA for foliar fertilization application effects on yield at each site and aGDD.

resp_name	site	Effect	NumDF	DenDF	FValue	ProbF
yield	Citra	gdd	1	16	1.14	0.3022
yield	Citra	application	3	16	1.17	0.3512
yield	Citra	gdd*application	3	16	0.36	0.7844
yield	Jay	gdd	1	16	17.77	0.0007
yield	Jay	application	3	16	0.28	0.8416
yield	Jay	gdd*application	3	16	2.25	0.1223

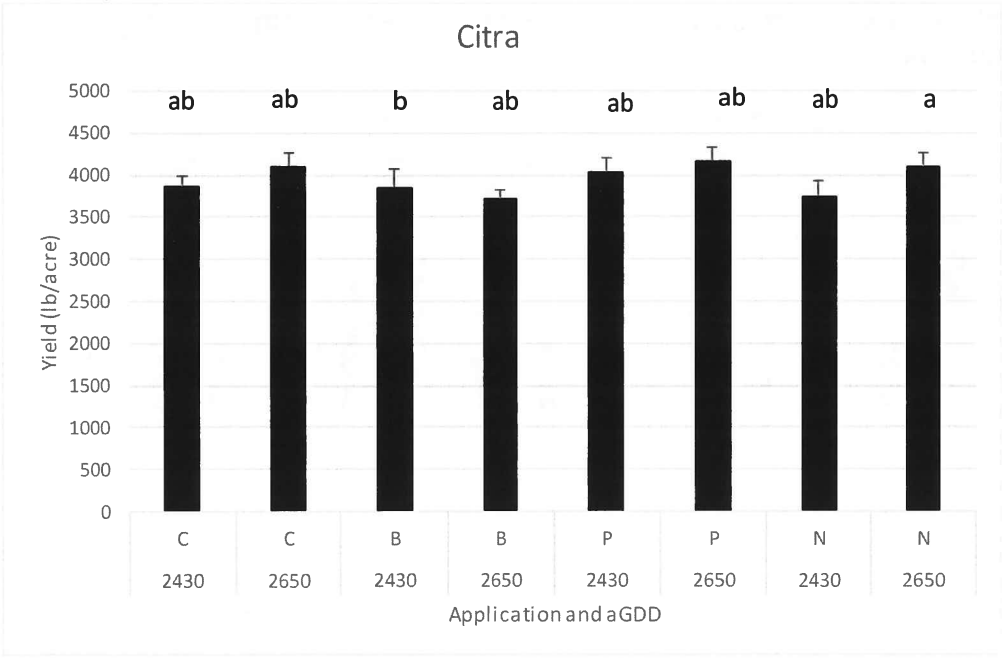

Figure 5. Peanut yield at two locations, two adjusted growing degree days, and four foliar fertilizer treatments. B = 0.3 lbs B/acre, C = control, N = 8.9 lbs N/acre, and P = 0.9 lbs P_2O_5/acre applied twice during the season at first flower and again approximately two weeks later. Harvest dates were optimum harvest (2430 aGDD) and past optimum (2650 aGDD). Within aGDD, different letters represent different means at $p<0.05$ (LSD).

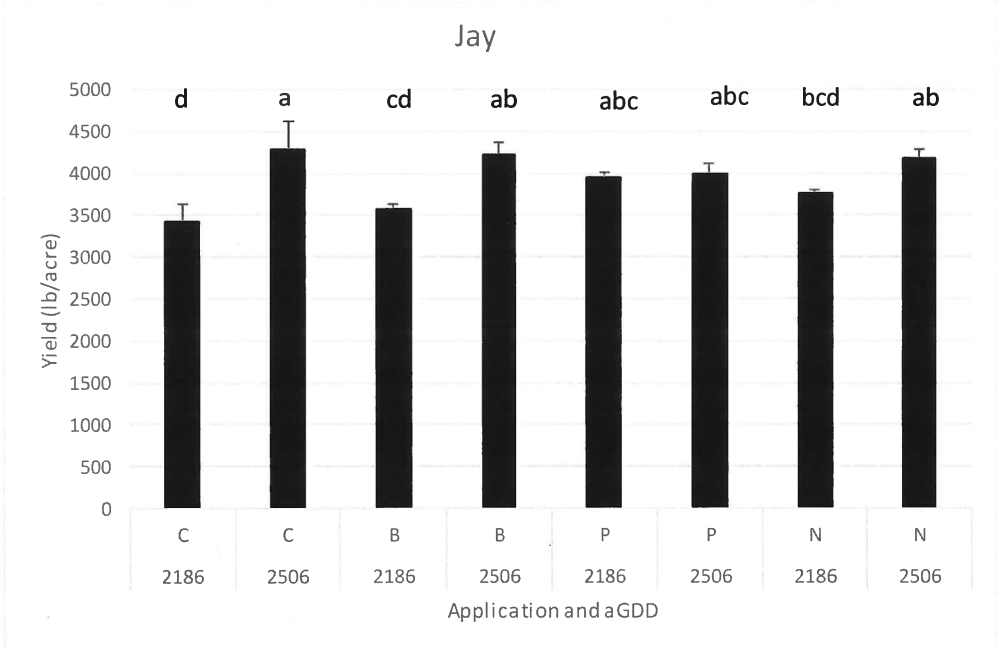

Figure 6. Peanut yield for Jay, two adjusted growing degree days, and four foliar fertilizer treatments. B = 0.3 lbs B/acre, C = control, N = 8.9 lbs N/acre, and P = 0.9 lbs P_2O_5/acre applied twice during the season at first flower and again approximately two weeks later. Harvest dates were early (2186 GDD) compared to optimum harvest (2506 GDD). Within aGDD, different letters represent differences in means at $p<0.05$ (LSD).

Given the preliminary nature of these results, a possible yield response to aGDD and foliar application interactions was noted in Jay (Table 2, p=0.12). Indeed, yield was significantly increased during the early dig date in Jay when foliar P was applied compared to the control, averaging over 500 lbs/ac (Figure 6). Foliar applications of B or N did not increase yield for any dig date, nor did P application when peanut was dug during an optimal time. This effect will be tested again during 2017 studies.

The percentage of mature and immature pods were not generally different by treatments at Citra (Figure 7, Figure 8), likely due to the fact that these pods were harvested at optimal and post-optimal times as previously mentioned. In Jay, while the percentage of mature pods increased when pods were dug at optimal timing compared to early digging, foliar applications did not increase the percentage of mature pods or decrease the percentage of immature pods at early digging (Figure 9, Figure 10).

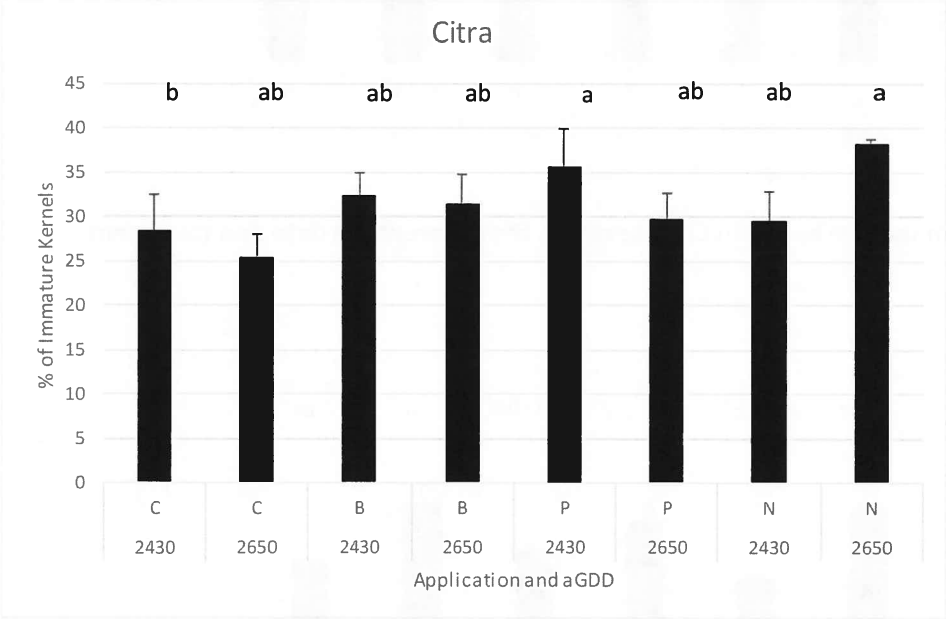

Figure 7. The percentage of immature kernel in Citra between the different dig date and treatment.

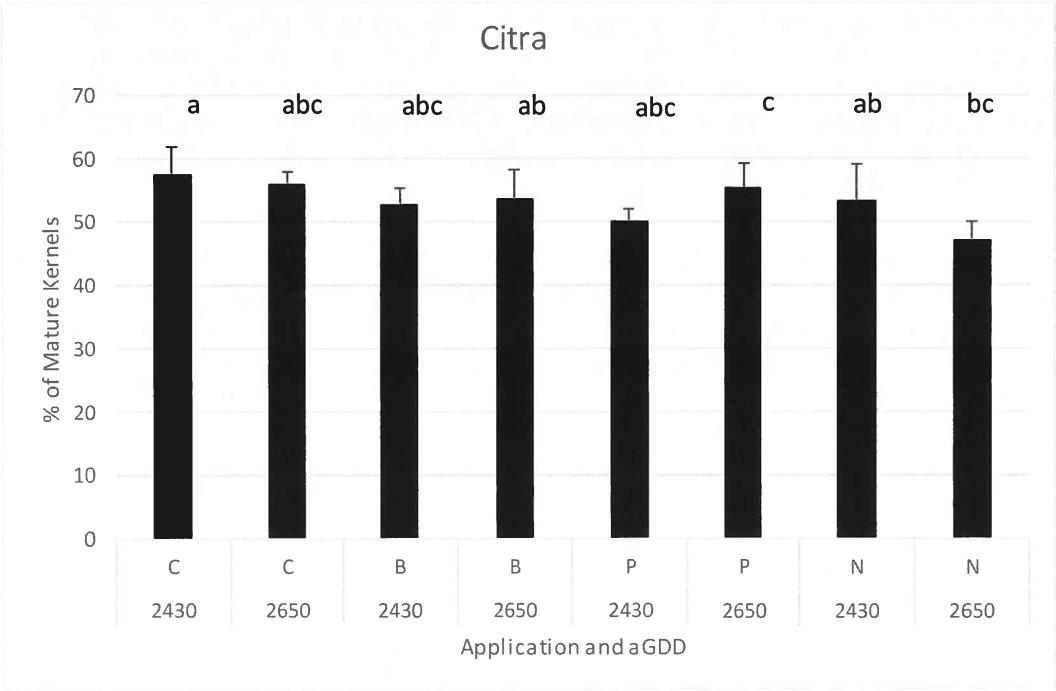

Figure 8. The percentage of mature kernel in Citra between the different dig date and treatment.

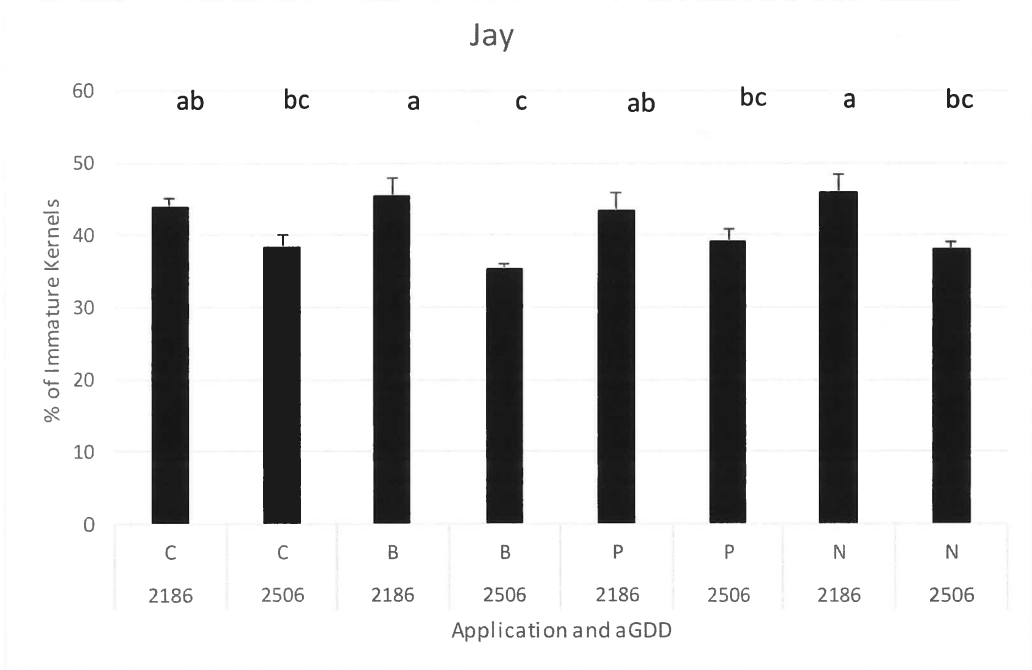

Figure 9. The percentage of immature kernel in Jay between the different dig date and treatment.

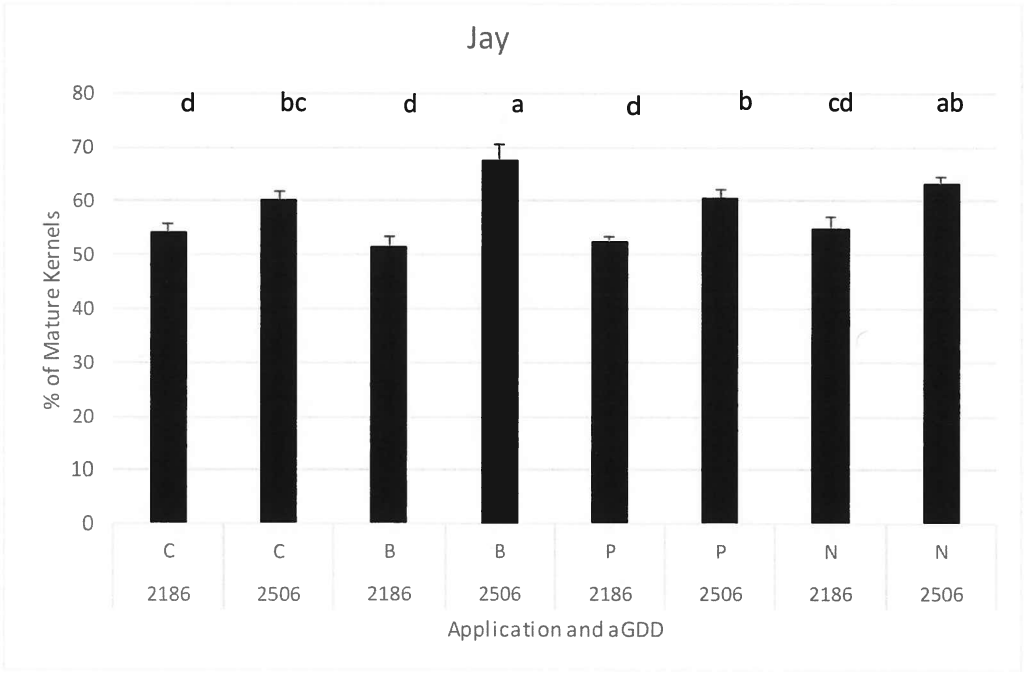

Figure 10. The percentage of mature kernel in Jay between the different dig date and treatment.

Preliminary conclusions:

Based on results from one site-year, foliar P applications significantly increased yield by 500 lbs/ac when pods were dug early. The effect was not likely due to increased peanut maturity.

References:

Saxton, A., 1998. A macro for converting mean separation output to letter groupings in Proc Mixed. Proceedings of the 23rd SAS Users Group International. SAS Institute Cary, NC, Nashville, TN, pp. 1243-1246.