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A1-45
745
746
2009

Project Title: Starter Fertilizer
Fund No. 367362 302807 (APPA-RIA03-STARTER FERT-09)

The benefits of conservation systems have been documented across the Southeast, however, the widespread adoption of conservation systems for peanut (*Arachis hypogea* L.) lags behind other crops despite these benefits. Previous research has documented inconsistent peanut yields in conservation systems, especially for single rows, compared to conventional tillage peanuts. As a result, the possibility of reduced yields in conservation systems has concerned growers and limited the adoption of peanut production in conservation systems.

Starter fertilizers have been successfully adopted in conservation systems with other crops. A starter application supplies a small amount of soluble fertilizer near the root zone of young plants, which strengthens young root systems, enhances early season growth, protects the plants from unfavorable environmental conditions, and potentially decreases the susceptibility of plants to various pests throughout the growing season. The benefits associated with starter applications could also permit earlier planting dates with increased yields in conservation systems compared to conventional peanut production. However, limited research has investigated how peanut responds to starter fertilizer. Therefore, the objective of this research was to determine the interactive effects of various starter fertilizer combinations and placements for two planting dates across conventional and conservation tillage peanut production systems during the 2008 and 2009 growing seasons.

The experimental design consisted of a strip-split-plot with planting date (mid to late April and mid to late May) as the vertical plot and tillage system [conventional and strip tillage with a rye (*Secale cereale* L.) cover crop] as the horizontal plots and a 3x2 factorial combination of starter fertilizer (no starter, N starter alone at a rate of 30 lb N $ac^{-1}$, and N and P together applied at a rate of 30 lb N $ac^{-1}$ and 12.5 lb P $ac^{-1}$) and placement (2x2 and in the row behind the subsoil shank) as subplots. Individual subplot size was 12 X 40 feet. Each treatment was replicated four times for a total of 96 plots with one location in Headland, Alabama at the Wiregrass Research and Extension Center. Rye biomass averaged 400 lb/ac for the first planting date and 2400 lb/ac for the second planting date. The first planting date occurred on 4-20-09, while the second planting date was 6-1-09. With the exception of starter fertilizer applications, normal agronomic and pest management practices were administered to maximize peanut production. The first planting date was harvested on 9-22-09, and the second planting date was harvested on 11-2-2009. Data collection included yield, percent total sound mature kernels, and whole plant biomass samples approximately 4 weeks after planting to measure biomass. All data were analyzed separately within year with all fixed effects and interactions considered different if Pr > F was equal to or less than 0.1.

In 2009, the interaction between planting date and tillage systems was again observed for peanut yields, but the results were drastically different. Conventional tillage peanut yields from the second planting date were 20% higher compared to all other combinations. A clear explanation does not exist why the conventional peanuts were superior, but the 2009 growing season was extremely wet, which could have been detrimental for peanuts grown in a strip tillage system that typically retains more soil moisture than conventional tillage systems. Total sound mature kernels were also highest in conventional tillage peanuts from the second planting date with a difference over 1.5% compared to the other tillage and planting date combinations. Fertilizer source and placement also affected total sound mature kernels, but it appeared that deep tillage associated with deep placement resulted in the highest total sound mature kernels. Unfortunately, plant samples from the second planting date were not collected in 2009. As a result, the analysis of early season plant biomass was limited to the first planting date. Early season plant biomass from the strip tillage system was 14% greater than biomass from the conventional tillage system. It appears that the additional plant biomass did not translate into increased peanut yields, however, a complete analysis is not possible. N+P in a 2x2 band produced superior early season plant biomass compared to all other combinations.

The peanut cultivar (Georgia 03L) chosen for this experiment represents many of the new cultivars available to growers, however, Georgia 03L will no longer be commercially available. These new cultivars possess highly resistant disease packages compared to cultivars utilized in the past. As a result, expected benefits associated with starter fertilizers with earlier planting dates could have been overshadowed by the hardiness of the new cultivar. These findings do not provide strong evidence for the use of starter fertilizers in peanut production, but this summary only represents the findings at one location over two years.

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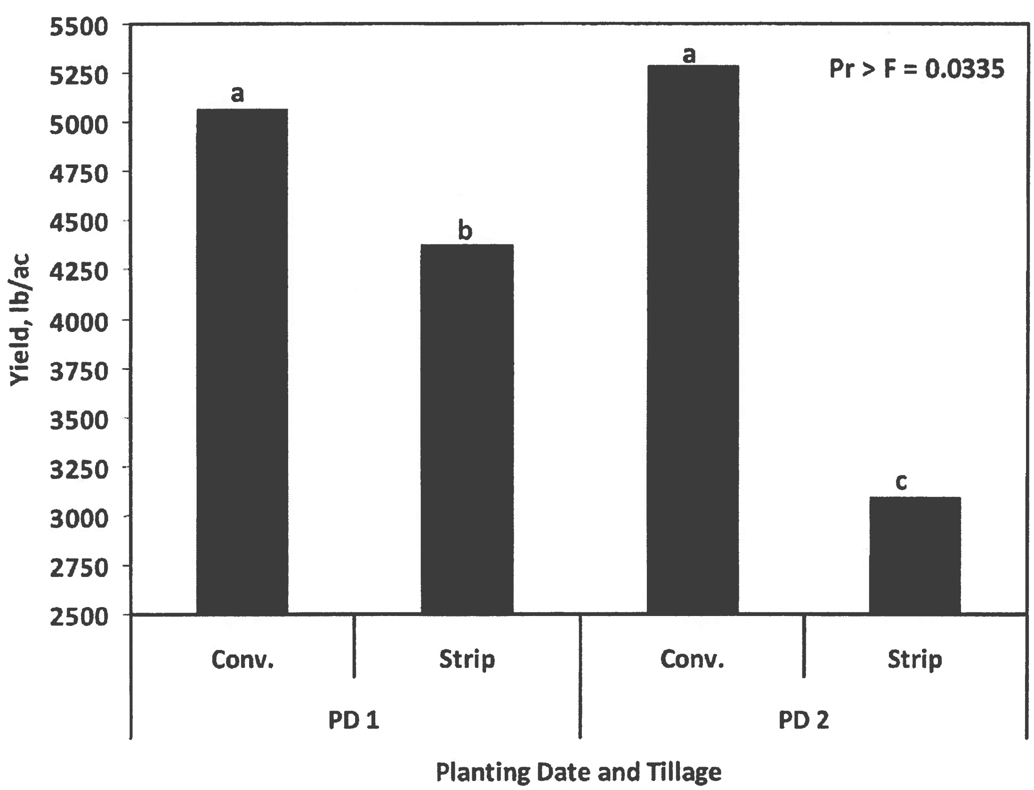
Report of Progress: Research plots were established in 2008 at the Wiregrass Research and Extension Center as part of a multi-state project under the leadership of Kris Balkcom, Principal Investigator. Individual plots were 12 X 40 ft. wide in a strip split plot design with four replications. Treatments consisted of planting dates, tillage systems, and starter fertilizer application. The first planting date occurred on 4-20-09, while the second planting date was 6-1-09. Tillage was either conventional tillage or strip tillage with a rye cover crop. Rye biomass averaged 400 lb/ac for the first planting date and 2400 lb/ac for the second planting date. Starter fertilizer treatments consisted of no fertilizer, N alone, or N+P. All fertilizer was applied in a 2x2 band beside the row at planting or as a deep placement behind the subsoil shank. Early season plant samples for nutrient content were collected from all plots approximately one month after planting. Plots were monitored during the season for insect, weed, and disease populations. The first planting date was harvested on 9-22-09. Disease counts were collected from all first planting date plots, prior to digging and immediately following digging. The second planting date was harvested on 11-2-2009. As with the first date, all disease counts were collected, prior to digging and immediately following digging.

The only major finding for 2009 was an interaction between planting date and tillage systems for peanut yield. Conventional tillage peanut yields were higher compared to strip tillage yields across both planting dates. The observed difference between tillage systems was greatest for the second planting date. A clear explanation does not exist for this difference, but the 2009 growing season was extremely wet, which could have been detrimental for peanuts grown in a strip tillage system that typically retains more soil moisture than conventional tillage systems.



gypsum application had more hollow and unfilled pods compared to the gypsum treatment (Fig. 1), and to Georgia Green with no gypsum application. However, there was no reduction in the size of the pods. Calcium analysis revealed that pods contain more calcium than seeds, and it remains unclear whether this partitioning was altered under the calcium treatments. Further analysis is being conducted.

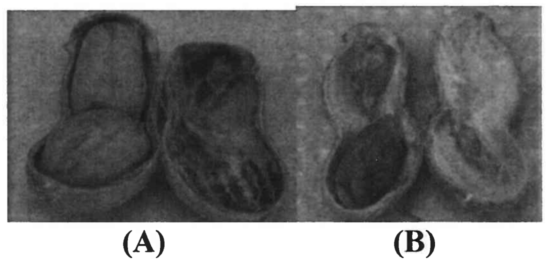



**Figure. 1: (A) mature pod and seed of C99R from the gypsum treatment, (B) mature pod and seed of C99R from the no added gypsum treatment.**

Initial results of CDPK analysis have shown that CDPKs are expressed in all stages of seed development (stages 1-4). Also, CDPKs were detected in pods early in development. The pattern of expression of CDPKs in all stages of pods and seed under the calcium treatments is underway.

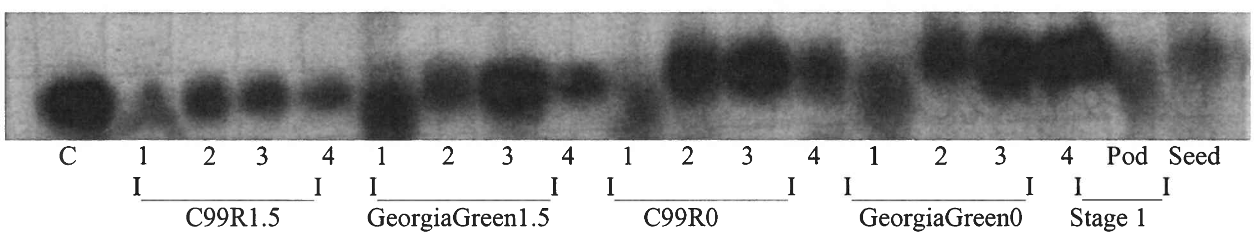



**Figure 2. CDPK Western blot on developing peanut seeds and pod with (1.5) and without (0) calcium application.**

EXPENDITURES: A Ph.D. candidate works on this project. Funds were also used for services, such as calcium analysis which was conducted by Waters Agricultural Laboratories, Inc. and supplies and chemicals used in the experiments including liquid nitrogen, extraction buffers, blot membranes, tubes, tips, membranes, etc.

EXECUTIVE SUMMARY:

Large-seeded cultivars are becoming increasingly popular among growers and will likely require more calcium than previous cultivars such as Georgia Green and Florunner, two dominant cultivars over the past 30 years. Application of gypsum to supply calcium for peanuts is costly for growers, but is critical in attaining maximum germination and seedling vigor. Therefore, it is important to understand the differences in calcium requirement between genotypes with large-seed and normal seed. Breeders need basic information on why cultivars differ in calcium requirements and methods to select for types with minimal calcium fertility requirement. This work investigated a class of proteins, CDPK's and will determine how they differ between cultivars. It also showed that the large seeded cultivar C-99R (the basis for seven of the most popular cultivars today) was more sensitive to calcium nutrition than was Georgia Green. This information will be valuable for grower in planning gypsum applications.