Calcium Uptake in Irrigated and Non-Irrigated Runner Peanut

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Introduction

Calcium (Ca^{2+}) is often a limiting nutrient to runner peanut (*Arachis hypogaea* L.) in the southeastern USA. Therefore, Ca^{2+} is the main fertilizer used in peanut. The main sources of Ca^{2+} are gypsum ($CaSO_4$) and lime ($CaCO_3$). Calcium is absorbed in the cation form of Ca^{2+}. In peanut, Ca^{2+} is needed in the pods to fully develop seed. Since Ca^{2+} is immobile in the phloem, Ca^{2+} needs to be available in the pegging zone (0-8 cm). UGA recommends adding Ca^{2+} when soil Ca^{2+} levels are below 560 kg ha^{-1} and a Ca^{2+} to potassium (K^+) ratio is less than 3:1, unless growing peanut for seed, which always requires a Ca^{2+} application.

Objective

Determine whether gypsum, lime or both increase Ca^{2+} uptake, peanut yield, and grade (% Total Sound Mature Kernels [TSMK]) with or without irrigation.

Materials and Methods

- Site: Tifton, GA
- Soil Type: Tifton loamy sand
- Cultivar: Georgia-06G
- Planting Date: 2 June 2016
- Single Row Pattern
- Split Plot Design
  - Main Effect: Irrigation (+ or -)
  - Sub Effect: Ca^{2+} Treatments
    - Gypsum and Lime
    - Gypsum
    - Lime
    - Non-treated Check
- 8 replications (yield), 4 replications (nutrient analysis)
- Sampling: soil (0-8cm), leaf, and pod
- Statistical analysis: SAS PROC MIXED

Materials and Methods Cont.

Figure 1. Dolomitic Lime (897 kg Ca^{2+} ha^{-1}) applied day after planting

Figure 2. FGD Gypsum (330 kg Ca^{2+} ha^{-1}) applied 35 days after planting (first flower)

Figure 3. Lateral Irrigation system

Figure 4. Picking peanuts

Results

pH	Ca^{2+} (kg ha^{-1})	K^+ (kg ha^{-1})	Mg^{2+} (kg ha^{-1})
5.53	776	112	85

Figure 5. Average soil conditions at planting

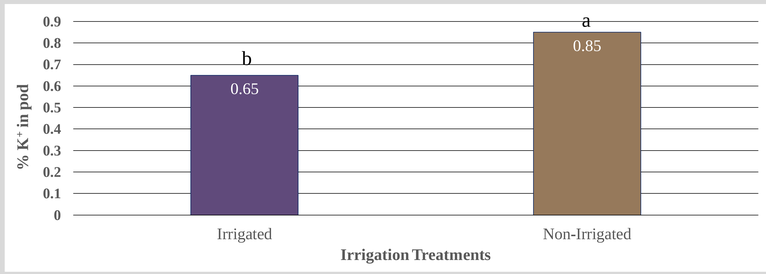

Figure 6. Effect of irrigation treatments on K^+ concentration in peanut pods. Data is combined across Ca^{2+} treatments.

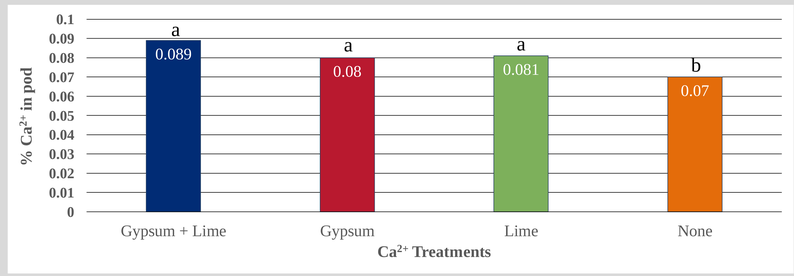

Figure 7. Effect of Ca^{2+} treatment on Ca^{2+} concentration in peanut pods. Data is combined across irrigation treatments.

Results Cont.

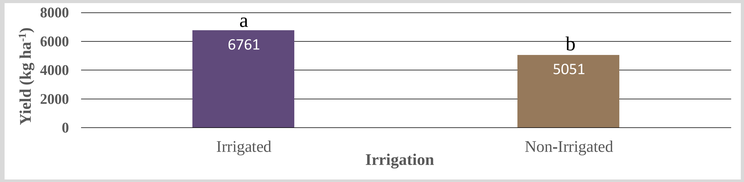

Figure 8. Effect of irrigation treatment on peanut yield. Data is combined across Ca^{2+} treatment.

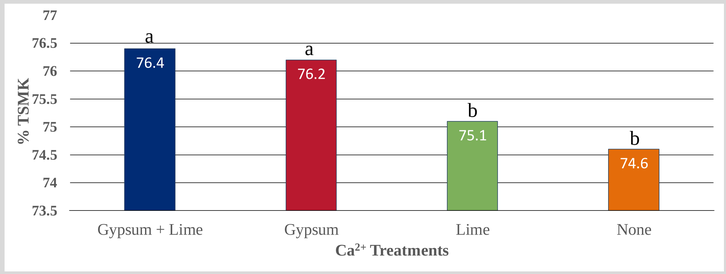

Figure 9. Effect of Ca^{2+} treatment on % Total Sound Mature Kernels (TSMK). Data is combined across irrigation treatments.

Conclusions

- Irrigated treatments have less K^+ in pods possibly from other cations competing with K^+ uptake (Fig. 6)
- Addition of gypsum, lime, or a combination results in a greater concentration Ca^{2+} in peanut pods than non-treated pods (Fig. 7)
- Irrigation improves yield over non-irrigated peanut (Fig. 8)
- Gypsum plus lime and gypsum result in improved TSMK (Fig. 9)
- The use of irrigation and the correct Ca^{2+} source can produce a large quantity of high quality peanuts when soil Ca^{2+} concentration is above 560 kg ha^{-1}

References

Harris, G.H. 2013. Soil Fertility Update. In: J.P. Beasley, 2013 Peanut Production Update. University of Georgia, Tifton, GA. 27-31.

Howe, J.A., R.J. Florence, G.H. Harris, E. van Santen, J.P. Beasely, J.P. Bostick, and K.B. Balkcom. 2012. Effect of Cultivar, Irrigation, and Soil Calcium on Runner Peanut Response to Gypsum. Agronomy J. 104, 1312-1320.