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Fertilizer Phosphorus Applications for Peanut Production in Southwest Mississippi

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Abstract

Phosphorus (P) efficiencies in field plots are affected by the amount applied, method of application, degree of deficiency in the soil, among other soil characteristics. The uptake by crop is generally low because of its ability to change from 100% water soluble to less available forms. A field experiment was used to determine the effect of five levels (20, 40, 60, 80, and 100 Kg/ha) of single superphosphate (P 2 O 5) on the growth, yield, and quality of "Alcorn Pat" peanut *(Arachis hypogaea L.)* cultivar. The study was conducted on Memphis silt loam soil in Southwest Mississippi. Fertilizer applications did not influence plant fresh and dry weights, number of branches, and plant leaf surface area. Marketable pod weight per plant generally increased with increase in the level of P applications. Treatment did not affect marketable pod number per plant and pod weight. Both number and weight of immature and diseased pods generally increased with increase in the level of fertilizer application. Leaf micronutrients generally decreased with increase fertilizer treatment except for zinc.

Keywords: Peanut, Phosphorus level, Growth and yield components, Elemental contents

1.0 Introduction

Peanut is a popular garden crop grown in a monocropping system in Mississippi (Burnham, 1986). It is considered important as such garden favorites as southern peas, okra, tomatoes and lima beans. The "Alcorn Pat" peanut cultivar used in this study has excellent taste when boiled fresh in salt or roasted when dry. It has an average seed fresh weight range of 1.4 to 2.4 g per seed. Producers on small family farms could add as much as $2,500.00 to their income annually by growing an acre of recommended peanut cultivar and dispensing them raw and/or boiled in salt (Patton, 1987).

The production of groundnuts depends on proper selection of variety, fertilizer management and other management practices (Lourduraj, 1999). Proper fertilizer doses of nitrogen, phosphorus, calcium and boron have vital effect on the yield of groundnuts (Subrahmaniyan *et al.*, 2000). Dusting peanuts with 3.25 metric tons of gypsum or basic slag per hectare at pegging time is more effective for peanut production when compared to application of these treatments during land preparation (Igbokwe *et al.*, 1986). Application of gypsum at 2,000 Kg/ha at the time of sowing showed a nominal increase of about 4% over the application of gypsum at 1,000 Kg/ha at the time of flowering (Cheema *et al.*, 1991). A definite trend towards higher productivity of peanut was obtained when gypsum was applied at the early flowering stage as compared to earlier application (Hallock and Allison, 1980a).

Inadequate Phosphorus is probably the most common nutrient deficiency of peanut, which could be corrected by application of a phosphate-containing fertilizer (Bennett, 1993). The most obvious effect of P is in plant root system. The requirement of P in nodulating legumes is higher compared to non-nodulating crops as it plays a major role in nodule formation and fixation of atmospheric nitrogen (Brady and Colwell, 2002). This study was therefore designed to determine the effect of single superphosphate application on the yield and quality of "Alcorn Pat" peanut cultivar.

2.0 Purpose and Objectives

The specific objective of this study is to determine the impact of fertilizer phosphorus applications on growth and yield potential of "Alcorn Pat" peanut grown on a fertile soil in Southwest Mississippi.

3.0 Materials and Methods

A field experiment was used to determine the effect of five rates (20, 40. 60, 80 and 100 kg/la) of single superphosphate applications on growth, yield, and quality of "Alcorn Pat" peanut *(Arachis hypogaea L.)* cultivar. The study was conducted on Memphis silt loam soil in southwest Mississippi. Initial soil fertility was medium for potassium, high for phosphorus and calcium, and very high for magnesium. Soil acidity was 7.1 and with organic matter of 0.85%.

Field preparation was limited to single disking and row preparations. Inoculated seeds were hand planted on raised beds, 20 feet long and 3.5 feet wide at within-row spacing of 4 inches. Each row of treatment was replicated 4 times in a randomized complete block (RCB) experimental design. Recommended rates of Lasso®, Bravo®, Sevin®, and Furadan® were used for weed, disease, insect, and nematode control, respectively. Plants were dusted with gypsum at the rate of 500lb/acre when flowering was initiated. Mature leaves from main stem were harvested at early bloom stage and used for elemental analysis. The leaves were therefore washed, oven dried at 70^{0}C for 48 hours, ground in Wiley mill to pass 0.5 mm mesh stainless steel screen and used for the elemental analysis.

Peanuts harvested 135 days from the seeding date were used for data collection on plant fresh and dry weights, number of branches, leaf surface area, marketable and non-marketable pods, and kernel size. All Data were analyzed by the analysis of variance and means separated by the Least significant difference (LSD) test procedure.

4.0 Results and Discussion

Single superphosphate applications did not influence plant fresh weights, plant dry weights, branches per plant and leaf area (Table not included). Treatment effect on marketable yields (Table 1) showed a general increase in pod weight with increase in rates of phosphorus applications. Both pod number and Kernel size were not affected by treatments. Treatment effect on non-marketable yields (Table 2) were different for both number and weight for immature and diseased pods. The values generally increased with increase in fertilizer treatment. Treatment effect on leaf mineral compositions was different for micronutrient contents (Table 3) but not for macronutrients (Table not included). For the micronutrients, Leaf iron, manganese, and copper contents generally decreased as the treatment increased. The zinc content was not affected by treatment. The inability of the treatment to influence both peanut growth and marketable yields could be due to initial high P level and overall soil fertilize. The comparable plant growth and yield for the control and treated plots seem to suggest that "Alcorn Pat" peanut has the potential for utilizing residual soil nutrients if planted on a fertile soil in Southwest Mississippi. The increase in immature and diseased pods with increase in single superphosphate levels suggest that excess phosphate – containing fertilizer in field plots could also delay the maturity of "Alcorn Pat" peanut.

Table 1: "Alcorn Pat" peanut cultivar marketable yield components.

Treatment P_2O_5 (Kg/ha)	Marketable Pods (#/ Row)	Marketable Pods[X] (Lbs/Row)	Marketable Kernel[Y] (Gm/Kernel)
0.0	512.9	7.8	1.6
20.0	567.2	8.9	1.6
40.0	555.2	7.2	1.5
60.0	579.3	9.5	1.7
80.0	585.3	8.6	1.8
100.0	597.4	9.5	1.5
LSD, 5%	NS	2.6	NS

[X]Values represent Lbs weight per row.
[Y]Values represent average fresh weight per kernel

Table 2: "Alcorn Pat" peanut cultivar nonmarketable yield components

Treatment P_2O_5 (Kg/ha)	Nonmarketable Pods[X]			
	Immature (#/ Row)	Diseased (#/Row)	Immature (Lbs/Row)	Diseased (Lbs/Row)
0.0	856.8	211.2	3.4	1.6
20.0	1,430.1	144.8	6.6	1.5
40.0	1,381.8	253.4	6.6	1.6
60.0	1,309.4	295.7	6.6	2.0
80.0	1,375.8	313.8	6.4	1.6
100.0	1,188.7	259.5	6.0	1.8
LSD, 5%	422.4	162.9	2.2	0.4

[X]Values represented number and weight of immature and diseased pods per 708q.ft. rows.

Table 3: "Alcorn Pat" peanut leaf micronutrient compositions.

Treatment	Leaf Mineral Contents[X]			
P_2O_5 (Kg/ha)	Fe (ppm)	Zn (ppm)	Mn (ppm)	Cu (ppm)
0.0	153.3	24.8	28.3	7.0
20.0	134.0	25.0	29.0	7.8
40.0	112.3	25.0	27.8	8.5
60.0	105.8	25.3	26.3	7.5
80.0	97.3	22.8	27.5	6.0
100.0	116.8	23.5	23.8	5.0
LSD, 5%	22.7	NS	3.0	1.7

[X]Leaf samples were taken at flower initiation.

5.0 Conclusions

On a fertile soil high in phosphorus:

i. Application of additional phosphate – containing fertilizer will not enhance "Alcorn Pat" peanut growth, marketable pod number and Kernel size.

ii. Marketable pod weight will increase with increase in single superphosphate fertilizer applications.

iii. Prolonged flowering period could result in increase in number and weight of immature and diseased "Alcorn Pat" peanut pods for a given growing season.

iv. Maturity period for "Alcorn Pat" Peanut cultivar could be beyond 135 days from the seeding date in southwest Mississippi.

v. Additional P applications may increase leaf micronutrient contents but not leaf macronutrients for "Alcorn Pat" grown on a Memphis Silt loam high in available soil P in Southwest Mississippi.

vi. Peanut growers may not need additional fertilizer phosphorus application for a profitable production of "Alcorn Pat" peanut grown on a fertile Memphis silt loam soil, if other production practices are not limiting.

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