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P-FERTILIZER AND MANURE REQUIREMENTS OF GROUNDNUT IN THE SEMI-ARID NORTH-WESTERN NIGERIA

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ABSTRACT

Experiment was conducted in Sokoto during the 1998 and 1999 rainy seasons to determine the effect of Phosphorus and Manure on the growth and yield of groundnut (*Arachis hypogaea L.)* using RCBD. Growth as well as yield of groundnut (*Arachis hypogea* L.) was significantly ($P<0.05$) and positively affected by fertilizer–P and manure alone or in combination. An application of 40 kg P_20_5/ha was found adequate for optimum production of groundnut. The manure was found to increase groundnut production at all rate of its application. Based on the results of this investigation, a combination of 9 t/ha manure and 40 kg P_20_5/ha may be safely recommended for the groundnut production under the upland conditions in the semi-arid northwest Nigeria.

Key Words: Groundnut; Fertilizer-P; Manure; Growth and yield

INTRODUCTION

Phosphorus is a limiting nutrient in groundnut production in northern Nigeria as its application has been reported to increase the groundnut growth and yield at Maiduguri (Rayar, 1986) and Samaru, Zaria (Balasubramanian *et al*., 1980; Lombin and Singh, 1986). Similarly, the application of manure (FYM) singly or in combination with super- phosphate increased the groundnut production at Maiduguri (Rayer, 1986) and Samaru Zaria (Baker *et al*., 1973; Yayock, 1979). Complementary use of manures and fertilizers has proved a sound soil fertility management strategy in many countries including Nigeria (Agboola *et al*., 1981).

For the north-western Nigerian States of Kebbi, Sokoto and Zamfara, there is a paucity of literature on the complementary use of fertilizer-P and manure for crops in general and groundnut in particular. In fact, the peasant farmers in this zone use little or no phosphatic fertilizer despite the fact that the soils are low in available P, especially those around Sokoto (Singh and Babaji, 1989, 1990; Singh and Tsoho, 2002). Even the manure application is limited to small quantities of household refuse and farmyard manure. Therefore, this study was undertaken with the objective of determining the fertilizer-P and /or manure requirements of groundnut grown under the upland conditions prevalent in Sokoto as case study of north-west of Nigeria.

MATERIALS AND METHODS

During the 1998 and 1999 rainy seasons, field experiments were conducted at the Dryland Farm of Usmanu Danfodiyo University, Sokoto ($12^0 50'$N, 5^0 30′E) situated some 15km north of Sokoto Town in the semi-arid Sudan savanna zone. The initial soil analysis revealed that the soils were predominantly sandy (>94% Sand) in texture, moderately acidic (pH 5.2) in reaction and low in available P (2 mg/Kg) as well as in organic matter (3g/kg organic C, 0.2g/kg total N).

The treatments consisted of five rates each of fertilizer-P (0, 20, 40, 60 and 80 kg P_20_5/ha) as single superphosphate and manure (0, 3, 6, 9 and 12 ton/ ha as farm yard manure (FYM).Their possible combinations were laid down in a Randomized Complete Block Design (RCBD) and replicated thrice.Two Apron plus-treated seeds of groundnut (*Arachis hypogaea* L.) variety Bahausa (landrace ex-Sokoto) were sown per hill at 30cm inter-row and 50cm intra-row spacings.Only one plant per stand was maintained later. The required quantity of single superphosphate and/ or FYM was mixed well with the soil before planting.

Growth and yield parameters recorded were those contained in Tables 1 and 2. Plant spread (Measured as diameter roughly at 180^0 between two opposite branches) was measured on five labelled plants in each plot at two growth stages 4 and 8 weeks after planting (WAP).The labelled plants also provided data on number of leaves as well as pods per plant. An MSTAT package was employed to treat the data statistically.

RESULTS AND DISCUSSION

Effects of Fertilizer-P on Growth and Yield

Fertilizer-P had significant effect ($P<0.05$) on the growth and yield of groundnut as shown in Table 1. Plant spread generally increased with increasing rates. The maximum spread was due to 80 kg P_2O_5/ ha followed by 60 kg P_2O_5/ ha. Positive effect of applied phosphorus on the groundnut spread was reported earlier by Yayock (1979) from Samaru (Zaria). He argued that the superphosphate generally supports vigorous plant growth. Virtually a linear increase in the number of leaves per plant with increasing fertilizer-P rates was observed. Application of 80 kg P_2O_5/ ha produced an average of 304 leaves per plant against 232 from the unfertilized plants. Fertilizer-P application tended to reduce the number of days to 50% flowering, i.e., it hastened the flowering in groundnut.

The haulm yield was maximum from the 20 kg P_2O_5/ha rate; at par with 40 kg P_2O_5/ ha. The rates beyond 40 kg P_2O_5/ha appeared detrimental to the haulm production. This observation made under the Sokoto conditions is in disagreement with that made in Maiduguri by Rayar (1986). He observed that the increasing fertilizer-P rate increased the dry weight of haulm significantly indicating that phosporus encourages both root and shoot growth of groundnut.The number of pods per plant increased consistently with increasing rates of fertilizer-P application up to 80 kg P_2O_5/ha. A similar observation was made at Samaru (Zaria) by Lombin and Singh (1986) and Lombin *et al*. (1985). However, the pod yield per hectare was maximum due to 40kg P_2O_5/ha rate, which produced 1.07 t/ha and was at par with 1.05 t/ha by 80 kg P_2O_5/ ha.

Table 1. Effects of fertilizer-P on growth and yield of groundnuts at Sokoto.

Parameter		Fertilizer – P (kg P_2O_5/ha)				
	Year	0	20	40	60	80
Plant Spread (cm) 4 WAP	1998	16.6d	22.8b	20.8c	23.1 b	27.3 a
	1999	17.9d	24.3b	23.4c	25.0 b	27.8 a
8 WAP	1998	29.5d	35.9c	38.1b	41.4 a	42.2 a
	1999	30.7c	38.2b	39.0b	44.3a	45.2a
Number of leaves/plant	1998	234.7c	272.0b	271.9b	284.0ab	287.7a
	1999	232.9c	272.4b	267.1b	304.7a	291.1a
Days to 50% flowering	1998	30.6a	29.9a	28.6b	27.8b	27.9b
	1999	30.8a	29.7a	28.4b	28.2b	28.2b
Haulm yield (t/ha)	1998	1.09c	2.27a	2.23a	1.81b	1.89b
	1999	1.03c	1.96a	1.88a	1.75b	1.89b
No. of pods/plant	1998	21.3c	28.6d	38.4c	45.7b	50.6a
	1999	22.2c	28.3d	38.3c	45.7b	50.0a
Pod yield (t/ha)	1998	0.65d	0.91c	1.07a	0.99b	1.05ab
	1999	0.63b	0,91c	1.05a	0.96b	1.02a
100- kernel weight (g)	1998	42.1c	49.7b	50.5a	51.2a	52.9a
	1999	49.4c	51.4b	52.5a	51.7b	53.9a
Kernel yield (t/ha	1998	0.38d	0.58c	0.75a	0.67bc	0.69ab
	1999	0.31c	0.55b	0.67a	0.62a	0.68a

Means in a row followed by the same letter(s) within a year are not significantly different (P>0.05)

Effects of Manure on Growth and Yield

Like fertilizer-P, the FYM affected groundnut growth and yield significantly (P<0.05) as revealed by the value in Table 2. With increasing rates of P, the plant spread at 4 and 8 WAP increased consistently, and the number of leaves per plant showed a linear trend especially beyond 6 ton/ha manure application. Manure application hastened flowering in groundnut.

Every increment of the manure rate brought about an increase in the haulm yield from an average of 1.36 t/ha in un-manured to 2.09 t/ha in the 12 t/ha manured-plot. Effect of manure on the number of pods per plant was spectacular. An application of 12 t/ha manure increased the number of pods per plant by 144% over the control. Taufiq and Yono (1998) observed an increase in the number of groundnut pods per plant with increments in manure rates in Indonesia. The increase in pod yield per hectare was appreciable up to 6t/ha manure application but gradual at the rates higher than this. Positive effects of manure on the groundnut yield were also observed by Balasubramanian (1997) in India. The plots treated with 3t/ha manure produced heavier kernels than the control; higher rates led to non-significant increases.

By and large, growth and yield of groundnut increased progressively with increasing amount of manure application under the rain-fed upland conditions. The progressive effect

indicates that any amount of manure applied to the soil is bound to influence groundnut production positively under the semi-arid north-western Nigeria conditions. However, the amount to apply would largely depend upon its availability as well as costs involved in its transportation and application besides, of course, the quality of manure with respect to plant nutrients content.

Table 2. Effects of manure on growth and yield of groundnuts at Sokoto,

		Manure (t/ha)				
Parameter	Year	0	20	40	60	80
Plant Spread (cm) 4WAP	1998	14.5d	19.7d	22.7c	23.7 b	30.8 a
	1999	17.9a	24.3b	23.4c	25.0 b	27.8 a
8 WAP	1998	31.9d	35.2c	38.5b	40.6a	41.1
	1999	33.2d	36.5c	40.2b	43.7a	43.9a
Number of leaves/plant	1998	205.8d	251.8c	287.3b	294.1b	311.4a
	1999	232.9c	272.4b	267.1b	304.7a	291.1a
Days to 50% flowering	1998	30.3a	29.3a	28.6b	28.3b	28.3b
	1999	30.0a	29,5a	28.9b	28.8b	28.4b
Haulm yield (t/ha)	1998	1.48c	1.60c	1.99b	1.99b	2.13a
	1999	1.25a	1.56c	1.76b	1.95a	2.05a
Number of pods/plant	1998	23,3c	23.5c	41.0b	41.2b	55.7a
	1999	23.8c	22.5c	40.3b	40.6b	57.3a
Pod yield (t/ha)	1998	0.78c	0.82c	0.97b	1.01b	1.09a
	1999	0.76c	0.79c	0.95b	0.98b	1.09a
100- kernel weight (g)	1998	45.3b	50.3a	50.1a	50.1a	50.5a
	1999	50.9b	52.8a	52.3a	51.2b	51.5a
Kernel yield (t/ha	1998	0.51b	0.50b	0.64a	0.68a	0.74a
	1999	0.47c	0.43c	0.59b	0.64ab	0.68a

Means in a row followed by the same letter(s) are not significantly different (P>0.05)

Effects of Fertilizer–P and Manure Interactions on Growth and Yield

Fertilizer-P x manure interactions had significant effects on the growth and yield of groundnut. For instance, a combination of 60-80 kg P_20_5/ ha and 9-12 t/ ha manure resulted in the largest plant diameter of 39 cm at 4 WAP and 51cm at 8WAP; the smallest value of 8cm or 24cm was from unfertilized or unmanured plot. The least number of days to 50% flowering was due to 40 kg P_20_5/ ha and 12 t/ha manure against the highest value of 38 days for the control. The maximum haulm yield of 2.7t/ha was recorded when 40 kg P_20_5/ha was applied in combination with 9 t/ha manure. The largest number of pods per plant (81) was obtained with 80 kg P_20_5/ha plus 12t/ha manure. It was closely followed by 71 pods per plant due to 60 kg P_20_5/ha plus 12 t/ha manure. A combination of 40 kg P_20_5/ ha and 6-12t/ha manure rendered about the best yield.

CONCLUSION

Based on the above discussion, it may be safe to recommend an application of 40kgP_20_5/ha in combination with 6t/ha manure. Such combination of fertilizer–P and manure may lead to a increased level of groundnut production under the agro-climatic conditions prevalent in the north-west Nigeria.

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