Effect of Single Super Phosphate (SSP) Fertilizer on The Growth And Yield of Bambara Groundnut (*Vignasubterranea L. Verdc*) in Jos North L.G.A of Plateau State.

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ABSTRACT

The field experiment was conducted in the Federal College of Forestry, Jos Plateau state demonstration farm to determine the effect of single super phosphate (SSP) fertilizer on the growth and yield of Bambara groundnut. A Randomized Complete Block Design (RCBD) was used involving 5 treatments; T_1 (60kg/ha SSP as control), T_2 (100kg/ha SSP), T_3 (80kg/ha SSP), T_4 (40kg/ha SSP) and T_5 (20kg/ha SSP). Each treatment was replicated 3 times. Analysis of variance (ANOVA) was used in analyzing the result and where significance was decalred, Fisher LSD method was used to separate the means. Data was collected on plant height, leaf count, leaf area, branch count and yield. Significant difference was obtained between the treatments for the growth and yield of Bambara groundnut. The result indicates that the highest plant height of 27.05cm and leaf area of 25.28cm^2 were obtained at T3 respectively. The highest leaf count and branch count of 114.85 and 38.24 were observed at T1. T2 has the highest (32.40) flower count. The highest yield of 11.37Kg/m^2 was obtained at T1. Therefore, the result is an indication that T_1 level is adequate for the growth and yield of Bambara groundnut. Therefore, famers can go into Bambara groundnut production as it has low level of fertilizer intake due to its nitrogen fixing ability, drought tolerant, and hasvery low effect from pest and diseases and it serve as a protein supplement.

Keywords: Single Super Phosphate, Fertilizer**,** Growth, Yield, Bambara Groundnut

INTRODUCTION

Bambara groundnut (*Vignasubterranea (L.)Verdc*), formerly known as *Voandzeia subterranea (L.)*, is an indigenous African legume which plays an important socio-economic role in semi-arid regions of Africa (Massawe *et al.*, 2005). It serves as a cheap source of protein to a large proportion of the population in poor countries of the tropics (Linnemann and Azam-Ali, 1993; Azam-Ali *et al.*, 2001). It is ranked the third most important legume in many parts of Africa after groundnut (*Arachis hypogea*) and cowpea (*Vignaunguiculata*) (Rachie and Silvestre, 1977). In most places in Africa, Bambara groundnut is produced by female subsistence farmers (Linnemann and Azam–Ali, 1993). As a result, its germplasm preservation has been mostly left to women. The fact that its production is mostly done by women means that very few resources are allocated to its production. This has resulted in the crop being classified as a neglected and underutilised crop due to limited research available on it as well as the fact that its production is limited. This is despite the fact that Bambara has been reported to be a drought tolerant crop, with much potential for enriching diets of people living in marginal areas (Massawe *et al.*, 2005).

Protein intake could be supplemented with vegetable proteins from legumes such as Bambara groundnut. The seed of this crop has been found useful in many diets. It can be mixed with maize or plantain and boiled, the seed may be ground into flour and used to prepare porridge or pre-soaked and ground into a paste which is used to prepare fried or steamed dishes and maize flour for traditional preparation can be enriched by the addition of Bambara groundnut (Brink *et al*, 2002). Thus the crop produces a balanced food, high protein content and source of plant protein in human body for the digestive system application (Okito *et al*, 2004, Embays, 2006). This crop has the potential of improving the nutrition of the people and less costly than animal protein. This crop has been found to improve soil conditions because of its nitrogen fixation. Jonah (2012) reported that immature Bambara Groundnut seeds could be boiled soft in salt water and eaten as a snack or used in the production of milk and other fermented products.

Bambara Groundnut can improve soil fertility prevailing low soil fertility limit N fixation by legumes and the overall growth and yield of legumes grown on many smallholders farm, phosphorus deficiency is one often important factor.(Whitehead *et al.*, 2004). The crop has the potential to contribute to food security in view of its ability to withstand drought. However, the performance of crops such as Bambara groundnut is dependent on the availability of nutrients. It is possible to generalize about the response of plants to limited amount of most nutrients (Vanlauwe *et al.*, 2002). Recent reports have shown that in many subsistence crop production systems, soil nutrient mining, especially of soil organic matter, is a common phenomenon (Fraga and Salcedo, 2004). Improved agronomic practices are lacking in Bambara groundnut production. This needs urgent attention if farmers are to reap some greater benefit from cultivating the crop. Another problem is related to soil fertility especially single super phosphate due to its ability to fix nitrogen in the soil. There might be need to examine the soil fertility state in relation to Bambara groundnut production. Hence, there is need for supplementary fertilizer application to boost the performance of the crop. The broad objective of this study is to determine the effect of different level of single super phosphate on the growth and yield of Bambara groundnut (*Vignasubterranea (L.) Verdc*).

MATERIALS AND METHODS

Experimental Site

The field experiment was conducted in the Federal College of Forestry, Jos Plateau state. It is located in the northwest of Plateau state. It is a region of the middle belt in Nigeria, which is located between latitude 7° and 11° North, longitude 7° and 25° East with an altitude of about 1200km above the sea level. The topography of the area lies between south of guinea savanna of Nigeria with mean annual rainfall of 1460mm and temperature between 10°C and 32°C. (Pam, 2009).

Materials

Seed (Bambara groundnut), Fertilizer (Single Super Phosphate), Measuring tape, Metre rule, Line or rope, Cutlass, Auger bit, Shovel, Rake, Wheelbarrow, Bucket or watering can, and Hoe. The seed was sourced from Bukuru market (Building material). The variety name is called “NAV RED” (RED LANDRACE).

Method

Soil Analysis

Soil Sample were collected from different locations before planting, the samples were taken at two depths (0-15cm and 15-30cm) with the aid of augar bit, hand trowel and polythene bag to store the sample which was later dried under room temperature, it was then taken to ASTC (Agricultural Service and Training Centre) to carry out the analysis. The data was collected and recorded in order to know the amount of available nutrients present in the soil.

Experimental Design

A Randomized Complete Block Design (RCBD) was used involving 5 treatments; T_1 (60kg/ha SSP as control), T_2 (100kg/ha SSP), T_3 (80kg/ha SSP), T_4 (40kg/ha SSP) and T_5 (20kg/ha SSP). Each treatment was replicated 3 times.

Data Collection

The data was collected on;

Plant height: The plant height was measured from the base of the plant to tip or apex of the plant with the aid of meter rule in cm.

Leaf count: Number of leaves was counted per plant at 2 weeks interval.

Leaf Area: The area of the leaf was measured by placing a thread at the base of the leaf to the tip for the length and width.

Branch counts: Number of branches was counted per plant at two (2) weeks interval.

Yield: The yield was obtained from harvest in each plot then per treatment which was weighed using weighing balance to obtain data for analysis.

Data collected was subjected to analysis of variance (ANOVA) at 5% level of significance using SPSS 23 and where significance was declared, Fisher LSD method was used to separate the means.

RESULTS AND DISCUSSIONS

Results

Soil analysis: The result of soil analysis from Table 1 was found to be relatively deficient in major plant nutrient elements. According to the soil fertility criteria by Ibedu *et al*; (1988), soil containing less than 0.20% N, 25.0 ppm P, exchangeable K of 0.40 meg/100g exchangeable Mg of 3.0 meg/100 is regarded as being low in these nutrients. In the post-soil analysis, there was slight increase of nitrogen in the soil as the crop has the ability to fix nitrogen into the soil.

Table 1: Shows the Pre soil analysis (before planting)

Sample cm	P^H	N %	P ppm	K ppm	Ca ppm	Mg ppm	O.M %	H^+ ppm	Al^{3+} Ppm	Clay %	Silt %	Sand %	Texture class
0-15	5.78	0.033	6.2	79	534	102	1.15	15.70	Nil	10.88	12	77.12	Sandy loam
15-30	5.93	0.023	5.6	78	590	113	0.79	16.20	Nil	11.88	12	76.12	Sandy loam

Table 2: Effect of Single Super Phosphate (Ssp) Fertilizer on the Growth of Bambara Groundnut

Treatment	Plant Height (cm)	Leaf Area (cm^2)	Leaf Count	Branch Count	Flower Count
T1	26.50[ab]	24.25[ab]	114.85 [a]	38.24 [a]	23.24[c]
T2	26.58[ab]	24.62 [ab]	112.24 [a]	37.85 [a]	32.40 [a]
T3	27.05[a]	25.28[a]	110.37 [a]	37.25 [a]	28.58 [b]
T4	26.44[ab]	24.68 [ab]	111.67 [a]	36.71 [a]	27.80 [b]
T5	26.12[b]	23.24 [b]	95.65[b]	31.92 [b]	19.96[d]
LS	*	*	*	*	*

Means within a column having same letters are not significantly different at $P \leq 0.05$.
LS = level of significance
* = Significantat 0.05

Plant Height: The result from table 2 indicates that significant difference exist between the treatments at 5% level of probability. The highest mean plant height was observed at T3 (27.05cm). Although no significant difference was observed between T1, T2 and T4, a mean plant height of 26.58cm was obtained at T2 followed by T1 with 26.50cm, T4 with 26.44cm and the least obtained at T5 having a mean plant height of 26.12cm.

Leaf Area: A significant difference was observed from table 2 for leaf area between the treatments. T3 exhibits the highest (25.28cm^2) leaf area followed by T4 (24.68cm^2), T2 (24.62cm^2) and T1 (24.25cm^2) respectively. T5 has the least mean leaf area of 23.24cm^2.

Leaf Count: The highest leaf count from Table 1 was obtained at T1 (114.85) followed by T2 (112.24), then T4 (111.47) and T3 (110.37). even though the results was not statistically significant at 5% level of probability. The lowest leaf count was obtained at T5 with 95.65 leaves.

Branch Count: Table 1 reveals that significant differences exist between the treatments at 5% level of significance but T1, T2, T3 and T4 were statistically not significant. The highest branch count of 38.24 was obtained at T1, 37.85 at T2, 37.25 at T3 and 36.71 at T4. The least number of branches at T5 was 31.92.

Flower Count: The result obtained from Table 1 reveals that T2 has the highest (32.40) flower count, then T3 with 28.58 flowers, T4 has 27.80 flowers, T1 is having 23.24 flowers and T5 has the lowest with 19.96 flowers. This shows that significant differences exist between the treatments.

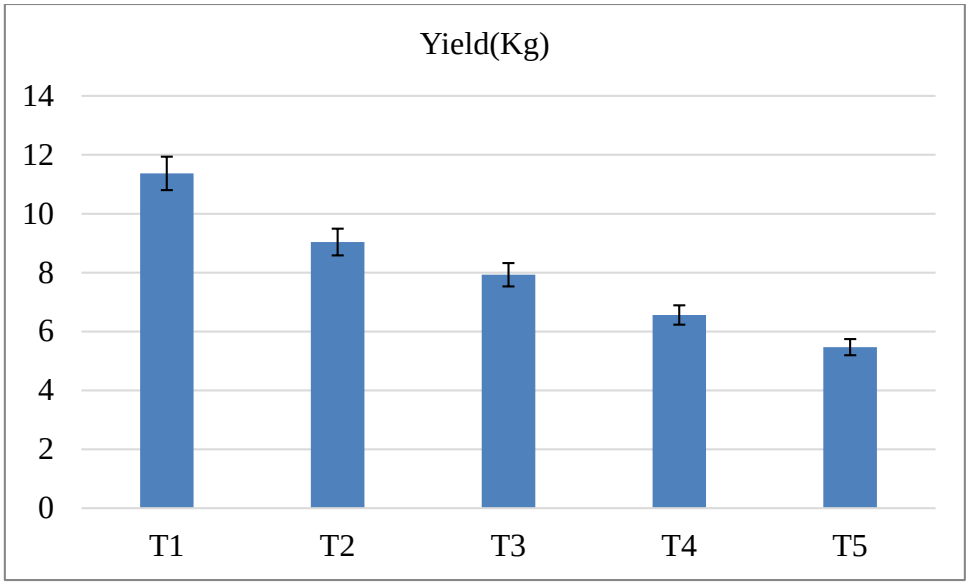

Figure 1: Effect of Single Super Phosphate (Ssp) Fertilizer on the Yield of Bambara Groundnut

Yield: The result form figure 1 indicates that the mean yield for T1 is 11.37Kg, T2 has 9.04Kg, T3 has 7.93Kg, T4 has 6.56Kg and T5 is having 5.47Kg. This shows that T1 has the highest yield.

Discussions

The plant height, leaf area, branch count and leaf count of Bambara groundnut were observed to have been increased significantly by all level of applied SSP in line with the standard level of applied SSP. This is an indication that SSP application at different level of SSP application increases the vegetative growth of the Bambara groundnut and that Bambara groundnut responded to different level of SSP nutrient supplements. Buah and Mwinkaara (2009) made similar observation when they reported that Bambara groundnut responds to different type of nutrients supplements and such nutrients should be replenished. The result indicated that the flowers increases with increase in the level of phosphate fertilizer, this is in line Baryeh, (2001) who reported that flowering start 28 days after germination and may not cease before the end of the life of the plant. While Or *et a*l, (1992) maintained that flowering in Bambara groundnut is species defendant and depend on germination date, seasonal temperature profile as well as photo thermal response of the plant.The significant increase observed in these parameters in terms of P application could be explained by nitrogen and phosphorous interaction in the root zone of soil because availability of P Increases N uptake of plant (Benedyeka *et al*,1992) and Shaheem *et al*, (2007) reported that nitrogen is relevant for the enhancement of vegetative growth as it provides the basic constituent of protein and nucleic acid. In deed nitrogen availability in the studied soil must be increased due to release of N from symbiotic nodules and dead root of legumes.

The yield result (weight of pod) is evident that Bambara groundnut responded well to all the levels of P applied in this study, which shows that phosphorous plays an important role in many morphological and physiological processes that occur within the Bambara groundnut that translate into the kind of yield result obtained. The results indicated that the inorganic P application exerts strong influence on the Bambara groundnut growth development and yield. This influence might be linked to the environmental condition such as temperature and moisture, rate of fertilizer applied, method of application. As Tisdale *et al*., (1993) suggest band method increase the efficiency of P utilization by crop grown on low P soil as it reduces the contact between the soil and fertilizer, with a subsequent reduction in P adsorption (fixation) in soil.

Conclusion

The T_1 shows significant difference in the yield performance of the Bambara groundnut with respect to all the levels of P applied, but in all the parameters assessed in this trial each of the treatment shows significant difference in the vegetative growth of Bambara groundnut. Therefore, the result is an indication that T_1 level is adequate for the growth and yield of Bambara groundnut. Therefore, famers can go into Bambara groundnut production as it has low level of fertilizer intake due to its nitrogen fixing ability, drought tolerant, and hasvery low effect from pest and diseases and it serve as a protein supplement.

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