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Effect of Different Fertilizer Combinations on the Growth and Yield of Groundnut (*Arachishypogeae*l.) in Mubi

[1]Oyebanji E. O.,[2]Zakawa N. N.and [3]Bala, U.

[1]Department of Biological Sciences, Mountain Top University, Ogun State Nigeria.
[2]Department of Botany, Adamawa State University, Mubi Adamawa State Nigeria
[3]Department of Botany, Federal College of Forestry, Kaduna
*Corresponding Author's email/phone number: nzakawa@gmail.com/+2348108044965

ABSTRACT

The research was carried out to determine the effect of different fertilizer combination on the growth and yield of groundnut (SAMNUT 22) at the Department of Crop Science, Faculty of Agriculture, Adamawa State University Mubi Teaching and Research Farm,GidanMadara during the 2019 rainy season. Seven fertilizer treatment (T_1=SSP 288g/plot, T_2=cow dung 720g/plot, T_3=poultry dropping 480g/plot, T_4=SSP + cow dung 360g/plot, T_5=SSP + poultry dropping 240g/plot, T_6=SSP + cow dung + Poultry 159.9g/plot and T_7=the control with no fertilizer) which were replicated three times and laid down in a randomized complete block design. Two viable seeds were sown with a plant spacing of 20 cm x 35 cm between plant and within rows. Data was collected on the plant height, number of leaves, number of branches, immature pods, matured pods, 100 seed weight and seed yield in kg/ha from five randomly selected plants at two weeks' interval starting from one week after the application of the fertilizers. Data collected were subjected to analysis of variance (ANOVA) using MINTAB computer software program and significant means were separated using Duncan Multiple Range Test (DMRT) at $P < 0.05$. Pearson correlation was used to determine the relationship between seed yield and other related characters. From the result obtained there was a significant difference for number of leaves at 7 WAS with T_5 (SSP + PD) having the highest (246.00), yield in kg/ha also showed significant difference with T_5(SSP + PD) having the highest (679.3) and positive correlation was recorded between seed yield in kg/ha and the number of leaves at 9 WAS (0.577731*) and 100 seed weight (0.999949**).
Keywords: *Arachishypogeae,* Cow Dung, Fertilizer,Poultry Droppings and Seed

INTRODUCTION

Groundnut (*Arachis hypogea* L.) belongs to Family: Fabceae, Sub-Family:Papilionaceae, Genus: Arachis and Species: hypogaea. *Arachishypogaea*, is native to South America, Mexico and Central America[1,2,3]. It is an annual herbaceous plant growing to 30 to 50cm tall [4,5]. The leaves are opposite, pinnate with four leaflets (two oppositepairs; no terminal leaflet), each leaflet I to 7 cm long and I to 3 cm broad. The flowers are a typical pea flower in shape, 2 to 4cm (3/4 to 11/2 inch) across, yellow with reddish veining [6,7,8]. The production of groundnut varies from 3,500 kg/ha in the United States of Americato 2,500kg/ha in the South America, 1,600 kg/ha in Asia, and less than 800 kg/ha in Africa [9,10,11].

This variation is due to various abiotic and biotic constraints [12,13]. Among the vegetable oil sources, groundnut can play an important role as it contains the highest amount of oil (48% in seed) with the highest yield compared to other oil seed crops of Nigeria. Groundnut is animportantannuallegumeintheworld mainly grown for oil seed, food and animal feed [14; 15]. The world's average groundnut productionis 1.49 tonnes [16]. Groundnut is the second important oilseed crop that covered a considerable

area in Nigeria. An adult needs about 37g of fats and oil/day, but the people are getting about 12.8g of which 4.2 are coming from vegetable sources [17,18]. In Nigeria, cultivated area under groundnut cultivation is about 1.0 to 2.5 millionhectares annually and yield in the range of 500-3000 kg/ha. The seed yield in northernNigeria is about 3000 kg/ha [16]. Groundnut is produced in almost all the Northern States of Nigeria, the leading producing states include: Niger, Kano, Jigawa, Zamfara, Kebbi, Sokoto. Katsina, Kaduna, Adanuawa,Yobe, Plateau, Bauchi, Borno, Taraba, Gombe and Nassarawa[10]. Commercial production of groundnut in Nigeria isconcentrated in the Northern parts of the country particularly in areas between the Northern Guinea and Sudan Savanna zone [10]. However, due to the high commercialvalue and the attendant high demand, the crop is now gaining popularity as a cash crop for peasant farmers in the Southern parts of Nigeria. But unlike in Northern Nigeria where recommendations have been made for plant densities and phosphorus fertilization for guaranteed stable yields of' groundnut [10], such authentic and vital information are yet to be made available in the humid parts of Nigeria where the prospect for commercial cultivation of the crop is high.

The decline in soil fertility and productivity are the matter of nutrient imbalance which is recognized as the one of the most important factor that limits the crop yield [3]. The present emphasis on the production and promotion of fertilizers containing N, P and K has to be modified to include Farm Yard manure (FYM) which contained Sulphur as the fourth major plants nutrient [7]. Sulphur is an important nutrient and affects photosynthetic efficiency indirectly by improving the nitrogen use efficiency. Butincreased use of S free fertilizers and using of high yielding varieties which depletes themaximum soil nutrients, has led to S deficiency in many regions [17]. The urgency for higher agricultural production and the greed for higher profits have made nutrient applications in agriculture, unscientific with more wastage leading to pollutionof soil, water and air [15]. Identification and exploitation of positive nutrient interactions holds the key for increasing returns in terms of crop yield, produce quality and nutrient use efficiency.

MATERIALS AND METHODS

Experimental Site

The research was carried out at the Department of Crop Science, Faculty of Agriculture, Adamawa State University Teaching and Research Farm at GidanMadara, Mubi South Local Government Area, Adamawa State during the 2019 rainy season. Mubi is located between latitude 10°10' and 10°30' North of the Equator and between longitude 13°10' and 13°30' East of Greenwich meridian at an altitude of 696m above sea level. The annual mean rainfall of Mubi is 965mm per year, and a minimum temperature of 12.48°C during hamatan period and 38.27°C maximum in June.

Sources of Materials

The seeds (SAMNUT 22) for the experiment was purchased from Mubi market and was tested for viability using floating method before planting. Single Sulphur Phosphate (SSP) fertilizer was purchased from Gombi main market, while cowdung and poultry dropping were obtained from the Gidan Madara Agricultural Research Farm.

Land Preparation/Experimental Layout

The land (15 x 7 m^2) was disc ploughed and harrowed to a fine tiled. The land was then divided into sub plots of 4m^2 (2x2)m^2.

Table1: Experimental Layout

T1	T3	Control
T2	T5	T6
T3	Control	T2
T4	T2	T5
T5	T6	T1
T6	T1	T4
Control	T4	T3

Sowing

Two viable seeds were sow per hole at depth of2cmand later thinned to one per stand at 2 weeks after sowing.

Treatments Allocation

The treatment consisted of the following fertilizer combination

T l = SSP
T2 = cowdung
T3 = poultry dropping
T4 = SSP + cowdung
T5 = SSP + poultry dropping
T6 = SPP + Poultry dropping + cowdung.
T7 = Control (No treatment)

Weed Control

Weed was controlled manually using hoe wherever they emerged.

Fertilizer Application

The different fertilizer combinations were then applied 3 weeks after sowing at thefollowing rate at after sowing at the following rates:

Treatment one (T1) consist of SPP applied at 288g per plot and 5.76g per plant,

Treatment two (T2) consist of cow dung was applied at 720g per plot and 14.40g per plant,

Treatment three (T3) consists poultry dropping applied at 480g per plot and 9.60g per plant.

Treatment four (T4) consist SSP + cow dung applied at 360g per plot and 7.20g per plant,

Treatment five (T5) consist of SPP + poultry dropping applied at 240g per plot and 4.80g per plant,

Treatment six (T6) consist of SPP + cow dung + poultry dropping applied at 159.9g per plot and 3.20g per plant and the control treatment no fertilizer applied.

Data Collection

Data were collected from five randomly selected plants from each treatment on the following character:

Plant height

Starting at 5weeks after sowing, the plant height was measured at week interval until harvest using ruler from the base of the plant to the tip of the main branches in each treatment.

Number of primary branches

Starting at 5 weeks after sowing number of primary branches was counted at week interval until harvest from selected plants in each treatment at harvest.

Number of leaves

Starting at 5 weeks after sowing number of leaves per plant was counted at week interval until harvest from the selected plants in each treatment.

The number of Immature and matured pod per plant

The number of immature and matured pod per plant were counted from five randomly plant in each treatment.

100 seed weight

100 seed weight was obtained from each treatment after drying and was taken to the laboratory and was weighed using electronic balance.

Seed yield in kgha^{-1}

The seed yield in kgha^{-1} was then computed from the seed yield per plot.

Data analyses

The data collected was subjected to Analysis of Variance (ANOVA) and correlation computed using MINITAB computer software program. Significant means were separated using Duncan Multiple Range test (DMRT) at P> 0.05. Correlation was done to know the relationship between seed yield and other related character in groundnut.

RESULTS

Physico-chemical Compositions of the Experimental Site

The soil of the experimental site is a sandy soil with 70% sand with pH 8.0, which is slightly basic. The soil is lacking in major nutrients like nitrogen 0.048%, phosphorus 0.035% and potassium 0.9%. The soil has a high percentage of zinc, about 43.54 mg/kg. These are presented in Table 2.

Table 2: Physico-chemical Composition of the Soil from Experimental Site, 2019 (0-20cm depth)

Physical properties	(%/Mg/Kg)
Sand	70
Silt	9
Clay	21
Chemical Properties	
Parameters	**Value obtained**
Soil Ph	8.00
Sodium (Na)	0.13
Magnesium (Mg)	1.12
Total Potassium (K)	0.90
Available Calcium (Ca)	1.15
Copper (Cu)	12.66
Iron (Fe)	17.13
Zinc (Zn)	43.54
Phosphorus (P)	0.035
Nitrogen (N)	0.048
Carbon (C)	1.18
Conductivity NS/cm	875.15

Effect of Fertilizer Treatment on Plant Height. The Analysis of Variance showed that no significantly difference for plant height at P < 0.05 05 as shown in table 3 below

Table 3: Effect of Fertilizer Treatment on Plant Height

Treatment	5 WAS (cm)	7 WAS (cm)	9 WAS (cm)
T_1 (SSP)	17.20[a]	27.07[a]	30.87[a]
T_2 (CD)	17.33[a]	30.33[a]	32.07[a]
T_3 (PD)	17.40[a]	28.27[a]	27.33[a]
T_4 (SSP+CD)	16.67[a]	27.77[a]	29.60[a]
T_5 (SSP+PD)	17.50[a]	28.07[a]	31.60[a]
T_6 (SSP+CD+PD)	17.87[a]	31.73[a]	32.82[a]
T_7 (Control)	15.57[a]	27.33[a]	24.53[a]
Significant	NS	NS	NS
SE±	0.44	0.69	3.79

Means followed by the same superscript in the same column are not significant different at P ≤ 0.05 (DMRT)

Key

WAS = Weeks After Sowing

SSP = Single Super Phosphate

CD = Cow Dung

PD = Poultry Dropping

NS = Not Significant

SE = Standard Error

Effect of Fertilizer Treatment on Number Branches (NB)

The analysis of variance showed no significance difference for number of branches per plant at P < 0.05 as shown in table 4 below.

Table 4: Effect of Fertilizer Treatment on Number Branches (NB)

Treatment	NB 5	NB 7	NB 9
T_1 (SSP)	6.53[a]	8.20[a]	9.80[a]
T_2 (CD)	6.47[a]	9.73[a]	9.33[a]
T_3 (PD)	5.60[a]	7.87[a]	7.53[a]
T_4 (SSP+CD)	5.53[a]	7.27[a]	7.80[a]
T_5 (SSP+PD)	6.73[a]	9.20[a]	10.20[a]
T_6 (SSP+CD+PD)	6.07[a]	8.73[a]	9.13[a]
T_7 (Control)	6.40[a]	7.50[a]	8.77[a]
Significant	NS	NS	NS
SE±	0.20	0.30	0.30

Means followed by the same superscript in the same column are not significant different at P ≤ 0.05 (DMRT)
Key
WAS = Weeks After Sowing
SSP = Single Super Phosphate
CD = Cow Dung
PD = Poultry Dropping
NS = Not Significant
SE = Standard Error

Effect of Fertilizer on the Number of Leaves

The analysis of variance showed no significant different for number of leaves at 5 weeks after sowing (WAS) and 9 WAS. There is significant different for number of branches at 7 WAS at P < 0.05 with T_5 having the highest number of leaves (246), followed by T_6 (241.53) while T3 (178.87) had the least number of leaves.

Table 5: Effect of fertilizer on the Number of Leaves

Treatment	NL 5	NL 7	NL 9
T_1 (SSP)	122.93[a]	180.60[a]	278.13[a]
T_2 (CD)	157.80[a]	221.13[ab]	269.86[a]
T_3 (PD)	122.27[a]	178.87[a]	220.70[a]
T_4 (SSP+CD)	116.73[a]	178.93[a]	184.00[a]
T_5 (SSP+PD)	149.73[a]	246.00[b]	286.20[a]
T_6 (SSP+CD+PD)	148.13[a]	241.53[b]	237.80[a]
T_7 (Control)	131.13[a]	203.00[ab]	216.47[a]
Significant	NS	S	NS
SE±	5.58	7.53	5.85

Means followed by the same superscript in the same column are not significant different at P ≤ 0.05 (DMRT)
Key
WAS = Weeks After Sowing
SSP = Single Super Phosphate
CD = Cow Dung
PD = Poultry Dropping
NS = Not Significant
SE = Standard Error

Effect of Fertilizer Combination on Immature Pod, Matured Pod, 100 Seed Weight and Seed Yield in kg/ha. The analysis of variance showed no significant different for immature, matured pod and 100 seed weight at P < 0.05. There is significant difference for seed yield in kg/ha with T_5 producing the highest seed yield in Kgha-1 (679.55) followed by T_1 (672.23) while T_4 (404.67) gave the least as shown in table 6 below:

Table 6: Effect of Fertilizer Combination on Immature Pod, Matured Pod, 100 Seed Weight and Seed Yield in kg/ha

Treatment	IP	MP	100SW	SY in kg/ha
T_1 (SSP)	15.53[a]	15.53[a]	268.93[a]	672.23[b]
T_2 (CD)	18.60[a]	18.60[a]	261.87[a]	657.67[b]
T_3 (PD)	15.07[a]	15.07[a]	244.93[a]	612.33[ab]
T_4 (SSP+CD)	10.27[a]	10.27[a]	161.87[a]	404.67[a]
T_5 (SSP+PD)	16.40[a]	16.40[a]	271.73[a]	679.33[b]
T_6(SSP+CD+PD)	20.60[a]	20.60[a]	170.27[a]	425.67[a]
T_7 (Control)	12.53[a]	12.53[a]	243.33[a]	608.33[ab]
Significant	NS	NS	NS	S
SE±	1.26	1.26	30.09	41.99

Means followed by the same superscript in the same column are not significant different at P ≤ 0.05 (DMRT)

Key
IP = Immatured Pod
MP = Matured Pod
100SW = 100 Seed Weight
SY = Seed Yield

Table 7: Matrix for correlation coefficient of some growth and yield parameters of groundnut in Mubi, Adamawa State

	PLH5	*PLH7*	*PLH9*	*NL5*	*NL7*	*NL9*	*NB5*	*NB7*	*NB9*	*NMPod*	*NIPod*	*100SW*
PLH5	1											
PLH7	0.677069*	1										
PLH9	0.569397*	0.527779	1									
NL5	0.586797*	0.672604*	0.513352	1								
NL7	0.380129	0.53501	0.475003	0.772311	1							
NL9	0.562374	0.32501	0.608207	0.530399	0.503496*	1						
NB5	0.565504*	0.626403*	0.568143	0.690433*	0.549536*	0.558335*	1					
NB7	0.455123	0.618831*	0.592857	0.618129*	0.599599*	0.579937*	0.578197*	1				
NB9	0.273701	0.270246	0.412452	0.432871	0.567087*	0.8069	0.522381*	0.591639*	1			
NMPod	0.789725	0.778672*	0.497904	0.600013*	0.510358*	0.612023*	0.58202*	0.708228*	0.515893*	1		
NIPod	0.125495	-0.024	0.332112	0.108893	0.102953	0.389515	0.355968	0.173273	0.426079	0.005835	1	
100SW	0.038901	-0.07205	0.223327	-0.03379	0.091458	0.577393*	0.215114	0.188059	0.413182	0.017835	0.292246	1
SYKGha	0.041427	-0.0713	0.2253	-0.02985	0.092841	0.577731*	0.217465	0.190432	0.410845	0.018521	0.292014	0.999949**

Plant height at 7 WAS is significantly correlated at 0.672604* with number of leaves at 5 at P ≤ 0.05. Plant height at 7 WAS is significantly correlated at 0.53501* with number of leaves at 7 at P ≤ 0.05. Plant height at 7 WAS is significantly correlated at 0.626403* with number of branches at 5 at P ≤ 0.05. Plant height at 7 WAS is significantly correlated at 0.618831* with number of branches at 7 at P ≤ 0.05. Plant height at 7 WAS is significantly correlated at 0.778672* with matured pods at 5 at P ≤ 0.05. Plant height at 9 WAS is significantly correlated at 0.513352* with number of leaves at 5 at P ≤ 0.05. Plant height at 9 WAS is significantly correlated at 0.608207* with number of leaves at 9 at P ≤ 0.05. Plant height at 9 WAS is significantly correlated at 0.568143* with number of branches at 5 at P ≤ 0.05. Plant height at 9 WAS is significantly correlated at 0.592857* with number of branches at 7 at P ≤ 0.05. Number of leaves at 5 WAS is significantly correlated at 0.690433* with number of branches at 5 at P ≤ 0.05. Number of leaves at 5 WAS is significantly correlated at 0.618129* with number of branches at 57 at P ≤ 0.05. Number of leaves at 5 WAS is significantly correlated at 0.600013* with matured pods at 5 at P ≤ 0.05. Number of leaves at 7 WAS is significantly correlated at 0.549536* with number of branches at 5 at P ≤ 0.05. Number of leaves at 9 WAS is significantly correlated at 0.599599* with number of branches at 7 at P ≤ 0.05. Number of leaves at 9 WAS is significantly correlated at 0.510358* with number of matured pods at 5 at P ≤ 0.05. Number of leaves at 9 WAS is significantly correlated at 0.510358* with number of matured pods at 5 at P ≤ 0.05. Number of branches at 5 WAS is significantly correlated at 0.612023* with number of matured pods at 5 at P ≤ 0.05. Number of branches at 7 WAS is significantly correlated at 0.58202* with number of matured pods at P ≤ 0.05. Number of branches at 9 WAS is significantly correlated at 0.708228* with number of matured pods at 5 at P ≤ 0.05. Seed weight in kg/ha is significantly correlated at 0.999949* with number of matured pods at 5 at P ≤ 0.01.

DISCUSSION

Research on the effect of different fertilizer combination on the growth and yield of groundnut was conducted in the rainy season (May to October, 2019). From the result obtained there was no significant effect for plant height, number of branches, matured and immature pods and 100 seed weight. However, there was significant effect for number of leaves at 7 WAS in which the treatment with the combination of SSP and PD give the highest number of leaves, followed by the combination of SSP, CD and PD, poultry droppings only gave the least number of leaves. Seed yield in kg/ha also gave statistically significant different at P < 0.05. SSP and PD gave the best seed yield in kg/ha, followed by SSP. This result is in partial agreement with the works of [14] who stated that phosphorus application significantly increase plant height, leaf number and total dried weight of groundnut, while application of calcium increased number of branches. Phosphorus is known to help in the development of non-extensive root system [4] and this enable plants absorb more water and nutrients from the depth of the soil. Similar results have been reported by [6] and [1]. [11] also reported that the SSP application produced highest seed yield.

There was a high positive correlation between seed yield in kg/ha and 100 seed weight. This agrees with the findings of [9] who reported positive correlation between grain yield weight in Bambaranut, soybeans and groundnut respectively. Similarly, some growth characters gain positive correlation with yield characters such as number of matured pod, 100 seed weight and seed yield in kg/ha. This also agrees with the result of [8] who reported positive correlation between growth characters and yield such as number of pods per plant, shelling percentage and 100 kernel weight.

CONCLUSION

It is clear from this study that fertilizer combination of SSP+PD and SSP+CD+PD had better growth and yield character compared to other fertilizer combination. Fertilizer combination had no effect on plant height, number of branches, immatured pods, matured pods and 100 seed weight. But fertilizer combination had effect on number of leaves at 7 WAS and seed weight in kg/ha.

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