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Performance of Groundnut (*Arachis hypogaea* L.) Varieties in Sokoto State, Nigeria

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ABSTRACT

The study evaluated the growth and yield of groundnut (*Arachis hypogaea* L.) as affected by varieties in dry land farm of Usmanu Danfodiyo University, Sokoto state during 2018 cropping season. The aim of the study is to evaluate the effects of variety on growth and growth components as well as yield and yield components of groundnut. The treatments comprised of six (6) varieties of groundnut. Four are improved varieties (Samnut23, Samnut24, Samnut25 and Samnut26) and two local varieties (Bahausa, and Yarmadani) and were laid out in a randomized complete block design (RCBD) replicated three times. Data on growth and yield parameters such as stand count, plant height, canopy spread, 50% flowering, Days to maturity, pod yield, grain yield, 100-seed weight, harvest index and haulm yield were taken and analyzed using the Statistical Package for Social Science (SPSSv22) software. Results of the analysis indicated that varieties differed significantly on growth and yield except for stand count at 3WAS. Samnut 24 recorded the highest mean stand count before harvest and highest mean pod yield while Samnut 25 recorded the highest canopy spread, least days to maturity and highest grain yield. Bahausa recorded the highest mean haulm yield and thus, the study concluded that Bahausa has the highest haulm yield per hectare with yield of 2166.7kg/ha and Samnut 25 possess highest grain yield of 117.80 kg/ha. It is therefore recommended that appropriate variety should be sown in the study area based on the interest of the farmer whether for grain or for haulm.

Keywords: Groundnut varieties, Semi-arid, growth, yield.

1.0 INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important oil seed crop of the semi-arid tropics (Tarimo, 1997; ICRISAT, 2008) that ranks thirteenth (13th) in importance among world crops (Hatam & Abbasi, 1994). It is a staple food in a number of developing countries much valued for its protein content and as source of income for small holder farmers (Peanut CRSP, 1990). It is also a good source of edible oil for humans, as well as a nutritive feed supplement for livestock (Abulu, 1978; Goldsworthy & Fisher, 1987).

Groundnut (*Arachis hypogaea* L.) also known as peanut, is an important source of edible oil and the seeds are reported to contain high quality edible oil (50%), easily digestible protein (25%) and carbohydrates (20%). The crop is a valuable source of Vitamins E, K and B (it is the richest plant source of thiamine (B1) and is also rich in niacin, which is

low in cereals). Groundnut cakes formed after the oil is extracted are a high protein animal feed (De Waele *et al.*, 2001; Basu *et al.*, 2008). Also its hay (haulm) is used as livestock feed and is a valuable source of cash for small scale farmers (Gibbons *et al.*, 2002; Musa *et al.*, 2012).

Nigeria is the largest groundnut producing country in West Africa, accounting for 51% of production in the region. The country contributes 10% of total global production and 39% that of Africa. Between 1956 and 1967, groundnut was the country's most valuable single export crop, exemplified by the famous Kano groundnut pyramids (Ajeigbe *et al.*, 2014).

It is a major source of edible oil as well as livelihoods for small-scale farmers in Northern Nigeria and as Nigerian population continues to grow, the demand for edible oil will also continue to grow. Groundnut will continue to be important in satisfying this

growing demand because it is adaptable to a wide range of environments from sandy soils of the Sahel to favourable irrigated areas (Abulu, 1978).

Most of the groundnut varieties sown by farmers in Sokoto state are of long duration type, susceptible to rosette virus disease (GRVD) as such leading to a low yield per unit area (Phillips, 1977). Similarly, Yayock *et al.* (1988) reported severe losses in Nigeria during 1975. Despite the immense importance of the crop, the yield obtained by farmers in Nigeria (FAOSTAT, 2005) is very low when compared to some other African countries. According to Food and Agricultural organization (FAO) groundnut production data (FAOSTAT 2008), yields of groundnut in Africa are much lower than the average world yield. These poor yields result from a cocktail of factors which include inappropriate varieties and sub-optimum plant population densities, infertile soils, weed problems, among others (Konlan *et al.*, 2013).

Ajeigbe *et al.* (2014) added that the poor productivity of Groundnut cultivation in African countries, particularly Nigeria may be attributed to a combination of factors such as use of low yielding varieties climate (unreliable rains), mostly poor irrigation techniques or non-irrigated nature of cultivation, traditional small scale farming with little mechanization and high labour inputs requirement for production of the crop as well as low market price, outbreaks of pests and diseases, nutrients deficiency, weeds infestation, increased and/or continued cultivation on marginal land, improper storage conditions, poor adoption of agronomic practices and limited extension services.

Evaluating the effects of varieties on growth and yield of groundnut is very important for it will go a long way to determine the variety which is early maturing. Also, one way the yield of groundnut could be improved is through the identification and cultivation of a more suitable variety (Musa *et al.*, 2012). Reddy *et al.* (1993) reported that the yield of groundnut can be increased up to 30-89% provided high yielding varieties are identified and cultivated. Before 1992, 20 groundnut varieties had been officially released in Nigeria. Most of these are medium- to late-maturing varieties, requiring more than four months to mature. But because of the

growing season in the savanna zone is short (90-100 days) and requires short-duration varieties, three varieties, SAMNUT 21 (UGA 2), SAMNUT 22 (M 572.80I), and SAMNUT 23 (ICGV-IS 96894) were formally released in 2001. Subsequently, early maturing varieties resistant to several biotic stresses were released: SAMNUT 24 (ICAR19BT) in 2011, and SAMNUT 25 and SAMNUT 26 in 2013. These varieties have minimized the incidence of groundnut rosette disease (GRD) which causes considerable annual yield losses, and are making a discernible difference in the lives of groundnut farmers in Nigeria (Ndjeunga *et al.*, 2013).

The main objective of this study is to evaluate the varieties that give maximum growth and yield of groundnut (*Arachis hypogaea* L.) in the study area (Sokoto). The specific objectives are to evaluate the effects of variety on growth and growth components of groundnut as well as to evaluate the effects of variety on yield groundnut.

2.0 MATERIALS AND METHODS

2.1 Study Area Description

Field experiment was conducted during the 2018 rainy season at Usmanu Danfodiyo University Dry land farm, Sokoto. Sokoto is located within latitude 13°1' N and longitude 5°15' E in the Dry Sudan Savannah of the north-west agro-ecological zone of Nigeria (Malami & Sama'ila, 2012). It has an average annual rainfall ranging between 550 and 750mm. The mean annual temperature is 32°C with the maximum of 41°C obtained mostly in April and minimum of 13°C obtained mostly in January (Mamman *et al.*, 2000). It is characterized by a long dry season of about 8months (October - June) and a short rainy season (June/July -September/October) with the peak in August. The highest humidity (76 – 80%) is recorded during the rainy season and the lowest (10 – 30%) is recorded in the dry season.

2.2 Treatments and Experimental Design

The treatments comprised of six (6) varieties of groundnut four (4) improved varieties (Samnut 23, Samnut 24, Samnut 25, Samnut 26) and two local varieties (Bahausa, and Yarmadani). The variety levels were denoted by V₁, V₂, V₃, V₄, V₅ and V₆ respectively. The treatments was laid out in a Randomised Complete Block Design (RCBD) and replicated three (3) times.

2.2.1 Field Layout

The experimental field layout was made up of three (3) replicates, each replicate consisting of six (6) experimental units (plot). Each plot measured 3m × 2m given a gross plot area of 6m² and at inter-row and intra-row spacing of 75 cm x 15 cm. A distance of 0.5m was left to separate plots within the replicates while a leeway of 1m was left between replicates.

2.3 Pre-planting and Post-planting Operations

2.3.1 Land preparation

This involved the removal of shrubs and debris from the experimental site and this was shortly followed by ploughing and levelling using hoe then the experimental plots were prepared following the outlined field layout.

2.3.2 Seed Procurement and Treatment

Seeds of Improved groundnut variety were procured from I.A.R., Samaru, Zaria while the two local varieties were obtained from Sokoto market. The seeds were dressed with Apron star (42 WS) powder at the rate of 2.5gkg⁻¹ of seed to protect it from fungal and insect attack in the field.

2.3.3 Seed Viability Testing

The seeds procured were subjected to seed germination testing in order to determine the viability of the seeds prior to sowing. This process was carried out at the Crop Science laboratory of Usmanu Danfodiyo University, Sokoto. The percentage viability of the seeds was determined using the formula below;

Percentage Viability

$$= \frac{\text{number of seeds germinated}}{\text{number of seeds used/sown}} \times 100$$

2.3.4 Sowing

Two (2) seeds were sown per hole at the depth of 2-3cm by dibbling method at inter and intra-row spacing of 75cm×15cm respectively. Supplying was done on the missing stands at 2 WAS.

2.3.5 Fertilizer Application

100kg NPK 15:15:15/ha and 150kg SSP/ha was applied basally at sowing.

2.3.6 Weed and Pest Control

First weeding was carried out manually by hand hoeing at three weeks after sowing and the second weeding at about eight weeks after sowing. This was carried out in order to control weed while regular visits were made to the experimental field to assess the occurrence of pest and disease and take the appropriate measure to control them.

2.3.7 Harvesting

The crop was harvested at 13 weeks after sowing. The harvesting operation was done manually using hoe to dig the crop from its root base.

2.4 Data Collection

Data were collected on growth parameters which include stand establishment count, canopy spread, plant height, number of leaves per plant, dead stand count, days to 50% flowering, stand count/net plot per harvest, days to maturity, Pods and Haulm yield, Shelling percentage and harvest index. Three representative plants were selected at random from each plot and were tagged using a black polythene bag. Measurement was taken at 3, 6, 9, 12 and 13 weeks after sowing (WAS).

2.5 Data Analysis

The data obtained from the growth and yield parameters were subjected to the one way analysis of variance (ANOVA) via Statistical Package for Social Science (SPSSv22) software and where there is significance difference between the treatment mean, Duncan Multiple Range Test (DMRT) at 5% level of significance was used to separate the treatment means (Gomez & Gomez, 1984).

3.0 RESULTS AND DISCUSSION

3.1 Growth Components of G/Nut Varieties

3.1.1 Stand Count

Result on groundnut stand count is presented in Table 1. The results indicated that there is no significant (P>0.05) difference between the groundnut varieties at 3WAS while stand count taken before harvesting showed a significant (P<0.05) effect of the varieties. Varieties Samnut 24, Yarmadani, Bahausa and Samnut 23 recorded greater mean stand establishment count of 30, 29, 28 and 28 plants/plot before harvesting with Samnut 26 recording the least

mean with 25 plants/plot. The differences between the varieties could be attributed to the genetic makeup of the varieties. In addition, Yarmandi and Bahausa are local varieties that have adapted to the ecology.

3.1.2 Canopy Spread

The mean canopy spread of the groundnut varieties is presented in Table 2. The results indicated a significant ($P<0.05$) effect of varieties on canopy spread at both 6 and 12WAS. Samnut 25 recorded the highest mean canopy spread at both weeks with 55.7cm and 63.87cm while Samnut 24, Bahausa, Yarmandani and Samnut 26 recording mean canopy spread of 50.10cm, 49.50cm, 46.13cm and 45.13cm respectively at 6WAS while at 12WAS, Bahausa, Samnut 24, Samnut 26 and Yarmandani recorded mean canopy spread of 61.40cm, 56.60cm, 50.47cm and 47.77cm respectively with Samnut 23 recording the least mean canopy spread at both weeks (32.30cm and 36.88cm). This result is in line with Patel *et al.* (2005) in his result of who indicated that spreading and semi-spreading groundnut varieties differ in their potential productivity.

3.1.3 Plant Height

Results in Table 3 indicated that there was significant ($P<0.05$) effect of groundnut varieties on plant height. Variety Samnut 25 recorded the tallest plant with a height of 28.93cm followed by Yarmandani (23.50cm) and Samnut 24 (21.53cm). Samnut 23 and Bahausa had the least mean plant height of 12.63cm and 11.83cm respectively. Anyanwu *et al.* (1986) reported that the erect types of groundnut are bunched and bushy like which grows about 15-30 cm above ground. Variation in plant height between the cultivars could as well be due to their genetic constitution.

3.1.4 Number of Days to 50% Flowering

Table 1: Mean Establishment Count of Different Groundnut Varieties Sown at Dry land Farm, Sokoto during 2018 Cropping Season

Treatments	Stand Count	Stand count before harvest
	3WAS	
SAMNUT 23	28	27.00 ^{ab}
SAMNUT 24	30	28.33 ^a
SAMNUT 25	26	24.67 ^{ab}
SAMNUT 26	25	22.00 ^b

Results in Table 4 showed a significant ($P<0.05$) effect on the number of days to 50% flowering between the groundnut varieties. Samnut 25 and 26 reached 50% flowering at 41 days after sowing followed by Samnut 24 and Samnut 23 with 43days and 45days respectively. The local varieties Bahausa and Yarmandani flowered late at 53days and 54days after sowing. Variation among the varieties in terms of 50% flowering is expected as the local varieties are usually late maturing type compared to the improved varieties. Also, the result of the study is in conformity with the findings of Philip *et al.* (1977) who reported that flowers appear 6 to 7 weeks from time of planting and reaches a peak of 65-70 days after planting.

3.1.5 Days to Maturity

The mean days to maturity of the groundnut varieties is presented in Table 5. The results indicated a significant ($P<0.05$) effect of varieties on days to maturity. Samnut 25 and 26 matured as early as at 84 days after sowing followed by Samnut 24 and Samnut 23 with 86days and 95days respectively. The local varieties Bahausa and Yarmandani on the other hand matured late at 110days and 111days after sowing. This result is in line with the findings of Oyewole, (2017) recorded shorter days to maturity for the same improved varieties i.e. early maturing (84-86 days) compared to local varieties that recorded between 107-112 days to maturity. Also, Ndjeunga *et al.*, (2013) recorded days to maturity of Samnut 23 to be 90-100 days, Samnut 24, Samnut 25 and Samnut 26 to be 80-90 days. Bahu *et al.* (2004) stated that number of days taken to attain maturity varied with varieties due to inherent genetic variation. The result is expected due to inherent genetic variation and most of the local cultivars are late maturing while the improved are expected to be early maturing.

BAHAUSA	28	27.00 ^{ab}
YARMADANI	29	27.00 ^{ab}
SEM	2.24	2.15
SIGNIFICANCE	NS	*

*=Significant at 5% level, NS=Not significant at 5% level.
SEM =standard error of mean

Table 2: Mean Canopy spread (cm) of Different Groundnut Varieties Sown at Dry land Farm, Sokoto during 2018 Cropping Season

Treatments	Canopy spread 6WAS	Canopy spread 12WAS
SAMNUT 23	32.30 ^c	36.88 ^d
SAMNUT 24	50.10 ^{ab}	56.60 ^{abc}
SAMNUT 25	55.73 ^a	63.87 ^a
SAMNUT 26	45.13 ^b	50.47 ^{bc}
BAHAUSA	49.50 ^{ab}	61.40 ^{ab}
YARMADANI	46.13 ^{ab}	47.77 ^c
SEM	4.28	4.83
SIGNIFICANCE	*	*

*=Significant at 5% level, NS=Not significant at 5% level.
SEM =standard error of mean

Table 3: Mean Plant Height (cm) of Different Groundnut Varieties Sown at Dry land Farm, Sokoto during 2018 Cropping Season

Treatments	Plant height 6WAS
SAMNUT 23	12.63 ^d
SAMNUT 24	21.53 ^b
SAMNUT 25	28.93 ^a
SAMNUT 26	17.43 ^c
BAHAUSA	11.83 ^d
YARMADANI	23.50 ^b
SEM	1.46
SIGNIFICANCE	*

3.2 Yields of G/Nut Varieties

3.2.1 Pod Yield (kg/ha)

The result in Table 6 shows the effect of varieties of groundnut on Pod yield. The results indicated a significant ($P < 0.05$) effect of varieties on pod yield. Samnut 24 had the highest mean pod yield with 1572.23kg/ha followed by Yarmadani, Samnut 25 and Samnut 26 with 1233.33kg/ha, 1200.00kg/ha and 972.20kg/ha respectively. Bahausa and Samnut 23 recorded the least mean pod yield with 533.30kg/ha and 505.53kg/ha respectively. This result is in contrast with the findings of Oyewole (2017) who recorded a non-significant effect of varieties of groundnut on pod yield. He added that the reason behind variation in the yield is as a result of the genetic makeup of the varieties.

*=Significant at 5% level, NS=Not significant at 5% level.
SEM =standard error of mean

Table 4: Mean Days to 50% Flowering of Different Groundnut Varieties Sown at Dry land Farm, Sokoto during 2018 Cropping Season

Treatment	Days to 50% flowering
SAMNUT 23	45 ^b
SAMNUT 24	43 ^b
SAMNUT 25	41 ^b
SAMNUT 26	41 ^b
BAHAUSA	53 ^a
YARMADANI	54 ^a
SEM	2.40
SIGNIFICANCE	*

*=Significant at 5% level, NS=Not significant at 5% level.
SEM =standard error of mean

Table 5: Mean Days to maturity of Different Groundnut Varieties Sown at Dry land Farm, Sokoto during 2018 Cropping Season

Treatments	Days to maturity
SAMNUT 23	95 ^b
SAMNUT 24	86 ^c
SAMNUT 25	84 ^c
SAMNUT 26	84 ^c
BAHAUSA	110 ^a
YARMADANI	111 ^a
SEM	2.00
SIGNIFICANCE	*

*=Significant at 5% level, NS=Not significant at 5% level.
SEM =standard error of mean

3.2.2 Haulm Yield (kg/ha)

The result in Table 6 indicated a significant ($P < 0.05$) effect of variety on haulm yield. The local variety Bahausa recorded the highest mean haulm yield of 2166.67kg/ha. Samnut 24, Samnut 25, Samnut 26 and Yarmadani recorded mean haulm yields of 1733.33 kg/ha, 1527.77 kg/ha, 1372.23 kg/ha and 1305.57kg/ha respectively. Samnut 23 recorded the least mean haulm yield of 655.57kg/ha. This result disagrees with the findings of Oyewole (2017) who recorded a non-significant effect of varieties of groundnut on haulm yield. (Wandahwa *et al.*, 2006) added that one of the important factors influencing the production of haulm in the tropics is as a result of soil fertility and the genetic makeup. The local variety having high haulm yield can be attributed to its adaptation to the local environment.

3.2.3 Grain Yield (kg/ha)

The results in Table 6 indicated a significant ($P < 0.05$) effect of groundnut varieties on Grain yield. The highest mean grain yield was produced by Samnut 25 (117.80kg/ha) followed by Samnut 24 (105.53kg/ha). Least mean grain yield on the other hand was recorded from the local varieties Bahausa and Yarmadani with 71.67kg/ha and 80.00kg/ha respectively. Difference in yield of the improved varieties when compared to the local varieties can be attributed to the individuals genetic makeup thus, Ndjeunga and Ibro (2010) added that improved varieties are early maturing, high kernel and haulm yield, good oil content etc. The yield was very low when compared with the average Nigerian yield of 550 kg/ha (FAOSTAT 2014). This could as well be attributed to poor establishment after planting. Also, poor establishment after planting can be as a result of birds feeding on the sown seeds.

3.2.4 100-Seed Weight

The result in Table 6 below showed a significant ($P < 0.05$) between the groundnut varieties on 100-seed weight with Samnut 24 and Samnut 25 with the highest 100 seed weight with mean of 75.00kg/ha and 74.47kg/ha. Bahausa has the lowest mean 100-seed weight of 55.00kg/ha. The result is in line with Langer and Hill (1981) who reported that weight of 100-seed are in the range of 35-100g, the weight of

Table 6a: Mean Yields (kg/ha) of Different Groundnut Varieties Sown at Dryland Farm, Sokoto during 2018 Cropping Season

Treatment	Pod Yield (kg/ha)	Haulm Yield (kg/ha)	Grain Yield (kg/ha)
SAMNUT 23	505.53 ^b	655.57 ^c	86.67 ^{ab}
SAMNUT 24	1572.23 ^a	1733.33 ^{ab}	105.53 ^{ab}
SAMNUT 25	1200.00 ^{ab}	1527.77 ^{ab}	117.80 ^a
SAMNUT 26	972.20 ^{ab}	1372.23 ^{bc}	90.57 ^{ab}
BAHAUSA	533.30 ^b	2166.67 ^a	71.67 ^b
YARMADA	1233.33 ^{ab}	1305.57 ^{bc}	80.00 ^b
NI			
SEM	310.01	320.71	15.62
Significance	*	*	*

*=Significant at 5% level, NS=Not significant at 5% level.
SEM =standard error of mean

the seed differs from one variety to the other because of the genetic makeup.

3.2.5 Shelling Percentage (%)

The results in Table 6 shows the shelling percentage of the varieties of groundnut sown in the study area. The results indicated a significant ($P < 0.05$) difference in the varieties with regards to the shelling percentage. Samnut 23 had the highest shelling percentage (17.20%) followed by Bahausa with 14.67%. Samnut 25 recorded a shelling percentage of 10.1 with the local variety Yarmadani recording the least mean shelling percentage (6.6%). The result obtained is however low when compared to standard average shelling percentage of 54%-73%. These differences could be attributed to several factors such as environmental, genetic makeup of the varieties, soil factor and management etc.

3.2.6 Harvest index (%)

The result (Table 6) showed a significant ($P < 0.05$) effect of the varieties sown on the harvest index. The highest index was recorded on Samnut 23 with 7.6%, followed by Samnut 25, Samnut 26 and Samnut 24 with 4.5%, 4.0% and 3.4% respectively. The local varieties Bahausa and Yarmadani on the other hand recorded the least mean harvest index of 2.9% and 3.2% respectively. High harvest index recorded with Samnut 23 variety is as a result if it being a bunch type.

Table 6b: Mean Yields (kg/ha) of Different Groundnut Varieties Sown at Dryland Farm, Sokoto during 2018 Cropping Season

Treatment	100-Seed Weight (kg/ha)	Shelling Percentage (%)	Harvest Index (%)
SAMNUT 23	67.77 ^{ab}	17.2 ^a	7.6 ^a
SAMNUT 24	75.00 ^a	9.1 ^{bc}	3.4 ^b
SAMNUT 25	74.47 ^a	10.1 ^{abc}	4.5 ^b
SAMNUT 26	60.00 ^{bc}	9.6 ^{bc}	4.0 ^b
BAHAUSA	55.00 ^c	14.67 ^{ab}	2.9 ^b
YARMADANI	63.33 ^{bc}	6.6 ^c	3.2 ^b
SEM	3.83	3.22	0.81
Significance	*	*	*

*=Significant at 5% level, NS=Not significant at 5% level.
SEM =standard error of mean

4.0 CONCLUSION

In conclusion, it could be said that of the entire collection of the varieties for the study, Bahausa has the highest haulm yield per hectare base with yield of 2166.7kg/ha while Samnut 25 possess high grain yield of 117.80 kg/ha. Bahausa excelled in haulm yield been a vigorous plant and been able to utilize soil nutrient efficiently due to its adaptability to the environment. Bahausa on the other hand had the least seed yield because many factors such its genetic makeup when compared to the improved varieties. Samnut 23 possess the least mean haulm yield. Samnut 24 showed a level of promise with haulm yield of 1733.33 kg/ha and grain yield of 106 kg/ha, this is however so because it is an improved variety with good genetic makeup and can adapt well to this environment. It is thus recommended based on the result obtained from this study that appropriate variety of g/nut should be sown based on the interest of the farmer whether for grain or for haulm.

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