



PRODUCTIVITY OF GROUNDNUT (*Arachis hypogaea* L.) AS INFLUENCED BY VARIETY AND SPACING IN NINGI LGA, BAUCHI STATE, NIGERIA

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ABSTRACT

The experiment was conducted at Ningi during dry season of 2021 and 2022 to evaluate the effect of variety and spacing on the growth and yield of groundnut (*Arachis hypogaea* L.). The treatments consisted of two groundnut varieties (Samnut 21 and Samnut 24) and four intra-row spacings (10, 15, 20 and 25 cm); these were factorially combined to give eight treatment combinations and laid out in a randomized complete block design (RBCD) with three replications. Data were collected on plant height, number of leaves, 100 grains weight and grain yield. Data collected were subjected to analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT) was adopted in separating the means. The result of the experiment showed that, there was a significant difference ($P=0.05$) in both years on all the parameters observed. The results further indicated that, spacing of 15x50 cm produced statistically ($P=0.05$) similar result with 20x50 cm, however the two treatments were better than the other spacing used. Varieties on the other hand, Samnut 24 proved to be significantly ($P=0.05$) better than Samnut 21 on most of the parameters observed. Considering year of study however, 2021 was found to be statistically ($P=0.05$) better than 2022 in all the parameters observed. Based on the results, growing Samnut 24 at a spacing of 15 x 50cm can be adopted by farmers for groundnut production in the study area.

Keywords: Experiment, Groundnut, Variety, Spacing, Yield.

INTRODUCTION

Groundnuts (*Arachis hypogaea* L.) known as peanuts, earthnut, monkey nuts and groundnut are edible crop which can be eaten raw or processed into oil, cake or snack foods. It is a legume plant that is cultivated throughout the tropical, Sub-tropical and the warm temperate climatic zones in nearly 100 countries of which over 90% are developing countries on nearly 24.6 million hectares of land, with a production of 41.3 metric tons and productivity of 1,676 kg/ha (Ahmed, 2009). Groundnut is a staple food and valuable cash crop for millions of households. The "nuts" are high in oil content between 40-50% and protein content between 25-32%, and also a good source of essential vitamins and minerals (Ahmed, 2009).

Groundnut improves soil fertility through nitrogen fixation, thereby increasing the productivity of other crops when used in rotation or in a cereal cropping system. It was estimated that on average, groundnut contributes to about 60 kg nitrogen per hectare (Ahmed, 2009; Hakeem *et al.*, 2019). However, China, India, Nigeria, USA and Myanmar are the leading groundnut producing countries in the world. Nigeria is the largest groundnut producing country in West Africa, accounting for 51% of production in the region and contributing about 10% of total global production and 39% to that of Africa. Nigerian groundnut production has been increasing at a growth rate of 8% per annum resulting from area expansion of 6% and increased productivity of 2% (Hakeem *et al.*, 2019; Tukur *et al.*, 2020).

The year-round demand for groundnut means farmers can increase production without any fear of market glut. Since 1984 production has been increasing at an estimated growth rate



of 8%, resulting both from area expansion (6%) and increase in productivity of 2% (Hakeem and Candidus, 2015). Groundnut is produced in almost all the thirty-six (36) states of Nigeria. However, it is predominantly produced in 19 States namely; Adamawa, Bauchi, Benue, Borno, Jigawa, Kaduna, Kano, Katsina, Kebbi, Kogi, Kwara, Nasarawa, Niger, Plateau, Sokoto, Taraba, Yobe, Zamfara and FCT (Abuja). The main agro-ecological zones for groundnut production in Nigeria are the Sahel, Sudan, Northern Guinea, Most parts of southern Guinea and Derived Savannah. (Sunusi and Aishatu, 2019).

Yield of 1.5 - 4.00 tons of unshelled pods of groundnuts for both rainfed and irrigated, if planted on fertile soil. Dry season groundnut production should be done where there is a steady and reliable source of water for irrigation. Depending on soil type and climatic condition, an irrigation interval of 7-10 days can sustain plant growth. Usually, furrow and basins irrigation are practiced, but sprinkler irrigation can also be used to ensure more crops coverage per drop of water. (Hakeem *et al.*, 2019; Tukur *et al.*, 2020). This research is therefore carried out to study the effects of variety and spacing on the growth and yield of irrigated groundnut in the study area.

MATERIALS AND METHODS

A field experiment was conducted at Ningi (Latitude 11.0793 and Longitude 9.5704 and altitude 380 meter above the sea level) in Ningi Local Government Area of Bauchi State to study the effects of variety and intra-row spacing on the growth and yield of groundnut. The warmest month of the year in the study area is April on average temperature of 34.5°C and lowest of 27.5°C in the month of January, while the mean annual rainfall of the area is about 600-850mm. The wet season in and around Ningi area commences in around June and ends in October. While dry season lasts for about seven months that is between November and May. The treatments consisted of two groundnut varieties (Samnut 21 and Samnut 24) and four intra-row spacings (10, 15, 20 and 25 cm), these were factorially combined to give eight (8) treatment combinations and laid out in a randomized complete block design (RBCD) with three replications. Data were collected at an interval of three weeks from 10 randomly tagged plants on plant height, number of leaves, 100 grains weight and grain yield. All data collected were subjected to analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT) was adopted in separating the means. Improved groundnut varieties Samnut 24 and Samnut 21 were used for the study. The varieties were released and registered between 1992 and 2011. It was developed by international research institute for semi-arid tropics (ICRISAT) and institute of Agricultural Research (IAR). The varieties are early maturing (90-110 days), high yielding, resistance to drought, resistance to early leaf spot and late leaf spot and rosette and medium seed sizes (Hakeem, 2020).

RESULTS AND DISCUSSION

Plant Height (cm)

The significant difference observed in this study in which Samnut 24 significantly ($P \leq 0.05$) produced tallest plants than Samnut 21 indicated the importance of variety in groundnut production. The variation in terms of plant height between the two varieties could be due to genetic variability among the varieties used. It could be equally be due to better adaption of Samnut 24 to the environmental condition than Samnut 21. The result of this finding is in line with the findings of Chiezey (1989) who reported that plants grow taller at high density so that they can intercept enough sunshine. Mazingo and steel (1987) who reported that in the study of five varieties of groundnut and observed that plant height ranges from 32.9 to 42.7 cm at higher plant population. Spacing of 10×50 cm was found to produce statistically



($p \leq 0.05$) tallest plant than the other spacing considered. Plant population has significantly affected at 200,000 plants ha^{-1} were significantly taller than those at the 100,000 plants ha and 50,000 plants ha . The result of this finding is in line with John (2010) who reported that plant density significantly increased plant height. The taller plant observed at closest spacing could be attributed to overcrowding and strong competition for environmental factors especially sunlight, which usually promote vertical growth. For the year 2021 produced significantly ($p \leq 0.05$) taller plant than 2022, this can be due to environmental factors affecting groundnut production such as rainfall and temperature. This finding is on conformity with Hakeem (2019) the optimal temperature for good germination and vegetative growth is 27°C – 30°C and 24°C – 27°C for reproductive growth. Also, Tukur (2018) the warmer the environmental, the faster the plant grow and reaches the reproductive phase.

Table 1: Effects of variety, spacing and year on plant height (cm) of irrigated groundnut

Treatments	WAS			
	3	6	9	
Variety				
Samnut 24	12.44 ^a	24.58 ^a	39.86 ^a	56.35 ^a
Samnut 21	8.35 ^b	17.50 ^b	23.83 ^b	40.33 ^b
L S	**	**	**	**
SE \pm	0.31	0.85	1.08	1.39
Spacing (cm)				
10x50	10.83	21.46	33.24	52.11 ^a
15x50	10.36	19.91	31.50	43.45 ^c
20x50	10.23	21.64	31.97	46.53 ^b
25x50	10.15	21.15	30.66	51.28 ^a
L S	NS	NS	NS	**
SE \pm	0.44	1.20	1.53	
1.97				
Year				
2021	12.48 ^a	26.94 ^a	34.83 ^a	62.36 ^a
2022	8.30 ^b	15.14 ^b	28.85 ^b	34.33 ^b
L S	**	**	**	**
SE \pm	0.31	0.85	1.08	1.39
Interaction				
V x S	NS	**	NS	NS
V x Y	NS	NS	*	*
S x Y	NS	NS	NS	*
Vx SxY	*	**	NS	NS

Means followed by different letter (s) within a column are significantly different using Duncan Multiple Range Test (DMRT), * = Significant at 0.05, ** = Significant at 0.01, LS = Level of significance, SE \pm = Standard Error, NS = Not significant.



Table 2: Interaction of variety, spacing, and year on plant height (cm) of irrigated groundnut at 3 and 6 WAS.

Treatment		Spacing (cm)							
		3WAS				6WAS			
		10	15	20	25	10	15	20	25
Variety	Year								
Samnut 24	2021	15.77 ^a	12.57 ^b	15.60 ^a	14.57 ^b	35.70 ^a	34.33 ^a	22.77 ^b	31.23 ^a
	2022	9.40 ^e	11.73 ^c	9.13 ^e	10.73 ^d	21.57 ^b	15.60 ^d	17.20 ^c	18.20 ^c
Samnut 21	2021	10.77 ^d	11.73 ^c	10.13 ^d	9.37 ^e	16.90 ^d	18.67 ^c	33.80 ^a	22.10 ^b
	2022	7.37 ^f	6.07 ^f	6.07 ^f	5.93 ^g	11.67 ^f	11.03 ^f	12.80 ^e	13.07 ^e
L S			*					**	
S E ±			0.88					2.39	

LS = Level of Significance, SE± = Standard Error, * = Significant at 0.05, ** = Significant at 0.01

Number of Leaves

The significant differences observed in this study in which Samnut 21 produced significantly ($p \leq 0.05$) higher number of leaf than Samnut 24 indicated the importance of variety in groundnut production. The variation observed between the varieties could be as a result of attributed to differences in their genetic composition and also the genotype and environmental interaction. This finding is in line with the finding of Muktar (2011) the varieties used in this experiment exhibited significant differences in their growth characters such as plant height, canopy spread, number of branches. These attribute differences in their genetic composition and also the genotype and environmental factors. Spacing of 25×50 cm was found to produced statistically ($p \leq 0.05$) higher number of leaves than other spacing used in week 12 only. Table 3 results is in conformity with Sabo *et al.* (2017) who reported that vegetative growth increase with the increased in row spacing that reduced plant population. However, Shu'aibu *et al.* (2019) who reported that no significant differences were observed among spacing of irrigated groundnut. Considering year of the study, 2021 produced statistically ($p \leq 0.05$) higher number of leaves than 2022, this could be due to environmental factors affecting groundnut production such as temperature, rainfall, sunlight and relative humidity. The result is in conformity with (Weiss *et al.*, (2000) The favorable climate for groundnut is a well distribute rainfall of at least 500 mm during growing season, and with warm abundance sunshine and relatively warm temperature. Weisset.al; (2000) reported that temperature in the range of 25-30°C is optimum for plant development.



Table 3: Effect of Variety Spacing and Year on Plant number of Leaves of Irrigated groundnut

Treatments	W A S			
	3	6	9	12
Variety				
Samnut 24	124.02 ^b	232.00 ^b	339.17 ^b	553.49 ^b
Samnut 21	176.80 ^a	344.40 ^a	634.15 ^a	865.07 ^a
L S	N S	**	**	**
SE ±	31.19	21.48	23.79	30.13
Spacing (cm)				
10 × 50	219.32	310.48	502.47	601.26 ^c
15 × 50	133.49	264.41	444.80	758.97 ^a
20 × 50	123.52	262.18	530.00	691.72 ^b
25 × 50	123.52	285.71	469.38	767.17 ^a
L S	NS	NS	NS	*
SE±	44.12	30.37	33.64	42.61
Year				
2021	162.30	421.15 ^a	667.90 ^a	1004.74 ^a
2022	138.52	155.15 ^b	305.43 ^b	904.74 ^b
L S	NS	**	**	**
SE±	31.48	21.48	23.78	30.13
Interaction				
V × Y	NS	NS	NS	NS
V × S	NS	NS	*	NS
S x Y	NS	NS	NS	NS
V x S x Y	NS	NS	NS	NS

Means followed by different letter (s) within a column are significantly different using Duncan Multiple Range Test (DMRT), * = Significant at 0.05, ** = Significant at 0.01, LS = Level of significance, SE± = Standard Error, NS = Not significant.

Table 4: Interaction of spacing and year on the number of leaves of irrigated groundnut at 9 WAS

Treatment	Year	
	2021	2022
Spacing (cm)		
10 × 50	700.05 ^a	304.88 ^d
15 × 50	612.55 ^b	277.05 ^e
20 x 50	785.67 ^a	274.34 ^c
25 x 50	573.33 ^c	365.43 ^d
LS	*	
SE ±	47.57	

LS = Level of significance, SE± = Standard Error, * = Significant at 0.05 level of probability

100 Grain Weight

There is non-significant observed in this study in which both varieties Samnut 21 and Samnut 24 didn't produced any significantly ($p \leq 0.05$) differences in the 100 grains weight. The similarities are due to adaptation to the environmental factors. This finding is line with



finding of Annadurai *et al.* (2009). It is a well-established fact that adoption of an improved variety alone can increase the yield by about 20% and also Angadi *et al.* (2009) non availability of suitable varieties for specific situation is one of the major causes for low productivity of peanut in India. For the spacing there is non-statistically ($p \leq 0.05$) differences in 100 grains weight in the spacing used. The higher values of yield recorded under Sel-7-9-5 was due to higher values of yield attributing characters Viz, number of pods per plant, weight of pods per plant and 100 pod weight. The finding is in conformity with finding of Kawure *et al.* (2018) who observed that at the widest spacing, sufficient moisture and lesser competition led to efficient dry matter partitioning in rice. And also finding of Kathirvelan and Kalaiselven (2007). The highest pod and grain weight recorded by the closet spacing could be due to the optimum plant population per unit area, less crop-weed competition and a better ground cover leading to highest moisture conservation as observed. For the year 2021 produced significantly ($p \leq 0.05$) higher 100 grains weight than 2022. This finding is line with finding of Bandopadhyay *et al.* (1998). Compared the performance of TG 194, JL 24, TAG 24 and TGS 1 peanut varieties during Kharif season of 1991 and 1992.

Grain Yield

The non-significant differences in this study in which both varieties produced non significantly ($p \leq 0.05$) grain yield indicated the attributed of the genetic composition and genotype adaption to the environmental factors. However, the yield superiority of these two genotypes was not reflected in their ancessors characters. Tanimu *et al.* (1998). This is attributed to difference in their genetic composition and also the genotype and environment interaction. Spacing of 10×50 cm was found to produced statistically ($P \leq 0.05$) grain yield than the other spacing used. However, the highest grain yield was associated with widest and the intermediated spacing. This could be due to sufficient space between rows, less inter plant competition for resources which resulted in an efficient dry matter partitioning leading to heavier individual seed size and weights. The highest pod and grain yield recorded by the closest spacing could be due to the optimum plant population per unit area, less crop-weed competition and better ground cover leading to highest moisture conservation. The result of this finding is in line with Tanimus *et al.* (1998) who reported that yield increased from 10.5 to 15.9% by increased in plant population Yayock (1978) reported yield increase of 13.9, and 6 % of three varieties of groundnut achieved by raising the population density from 57,000, to 86,000 plant per hectare. Agasimani (1989), Pannu *et al.* (1089) observed that 22.5×10 cm spacing gave the highest grain yield compared to 15×15 cm spacing. Higher yield of peanut is contributed by two factors and those are yield per plant and number of plants per unit area. Ramesh and Sabale (2001) observed that the plant population of 0.33 million plants per hector 30×7.5 cm significantly increased number of pods per plant 14.1, nodules plant per hector 70.6, dry pod yield 24.91 per hector, then of 0.4 and 0.50 million plants. Per hector 25×10 cm and 20×10 cm respectively. For the year 2021 produced significantly ($P \leq 0.05$) grain yield than 2022, this can be due to crops made better utilization of available space and light. It also means that there are more reproductive units per unit area of land. The result is in conformity with Bandopadhyay *et al.* (1998) compared the performance of TG 194, JL 24, TAG 24 and TGS 1 peanut varieties during Kharif season 1991 and 1992. The result showed that TG 194 had significant higher number of pod yield, shelling percentage and grain yield per hectares as compared to other varieties.



Table 5: Effect of variety, spacing and year on 100 Grains weight and Grains yield of irrigated groundnut.

Treatment	Parameters	
	100 Grain weight	Grain Yield
Variety		
Samnut 24	35.05	1.08
Samnut 21	35.47	1.06
LS	NS	NS
SE±	0.41	0.42
Spacing (cm)		
10 x 50	35.81	1.34 ^a
15 x 50	35.02	1.19 ^a
20x 50	35.87	0.93 ^b
25 x 50	34.36	0.82 ^b
LS	NS	**
SE±	0.57	0.60
Year		
2020	36.37 ^a	1.19 ^a
2021	34.16 ^b	0.95 ^b
LS	**	**
SE±	0.41	0.42
Interaction		
VxS	NS	*
VxY	NS	NS
SxY	NS	NS
VxSxY	NS	NS

Means followed by different letter (s) within a column are significantly different using Duncan Multiple Range Test (DMRT), * = Significant at 0.05, ** = Significant at 0.01, LS = Level of significance, SE± = Standard Error, NS = Not significant.

Table 6: Interaction of variety and spacing on grain yield of irrigated groundnut

Spacing (cm)	Variety	
	Samnut 24	Samnut 21
10x50	1.32 ^a	1.37 ^a
15x50	1.30 ^a	1.08 ^b
20 x50	1.00 ^b	0.87 ^c
25x50	0.70 ^c	0.93 ^c
L S		*
SE±		0.84

LS = Level of significance, SE± = Standard Error, * = Significant at 0.05 level of probability

CONCLUSION AND RECOMMENDATION

In conclusion however, spacing of 20 x 50 cm gave significantly higher growth and yield characters. In terms of variety on the other hand, SAMNUT 21 over perform SAMNUT 24 in most of the characters measured. Based on the result of this study, growing SAMNUT 21 at a spacing of 10 x 50 cm can be adopted by farmers for increased groundnut production in the study area.



REFERENCES

- Agasimani C. A. (1989). *Indian J Agron.*, **34**; 135-137.
- Ahmed S. A. (2009). *Indian J Agron.*, **31** (3): 248-251
- Annadural, K., Naveen P., Sangu A., and Masilamani P. (2009). Agronomic Management Technologies for Peanut Production. *Agric. Rev.* 30(4): PP 235-261.
- Chiezey, U. F. (1989). Effect of plant density and p fertilization on the yield and yield component of groundnut. PhD. Thesis, Department of Agronomy, A.B.U.Zaria.
- Hakeem A. A., Waliyar F., Echekwu, C. A., Ayuba K., Motagi B. N., Enjayeju D. and Inuwa A. (2019). A farmer's guide to groundnut production in Nigeria. PP 36.
- Hakeem A. A., Abubakar, H. I., Tukur, A. and Abdullahi, R. (2020). Improved Groundnut Production Practices 29.
- Kawure, S. (2018). Productivity of Rice as Influenced by Season and Sowing Method in Zigau, Bauchi State, Nigeria. Pp 1-85.
- Muktar, A. A. (2011). Intensifying groundnut production in the Sudan Savanna Zone of Nigeria. *Pakistan Journal of Biological Sciences*, **14** (22):1028-1030
- Mozingo, R. W. and Steel, J. L. (1987). Intra row seed spacing effect on five peanut cultivars. Proceedings of the American peanut Research and Education Society, meeting, July 14-17, 1987, Orlando. Florida
- Shuaibu, Y. M., Kawure, S. and Rashida, A. B. (2019). Effect of season, variety and phosphorus fertilizer on growth and yield of groundnut in Bauchi State Nigeria. *Journal of Horticulture and Plant Research* **6** (2) 20-26.
- Sunusi, M. G. and Aisha, A. (2019) Groundnut enhancement program report PP 1-2.
- Tanimu. B. B., Abdullahi, P. E. and Ibrahim, R. (1998). Effect of inter and intra row spacings on growth and yield of groundnut in the northern guinea savanna of Nigeria. *Plant Sci.*, 1:69-82.
- Tukur, A., Hakeem, A. A., Abubakar, H. I. and Abdullahi, R. (2018). Improved Groundnut Production Practices. PP 29.
- Tukur, A., Hakeem A. A., Michael B. V., Abubakar H. I., and Folurunso M. A. (2020). Hand book on improved Agronomic Practices of Groundnut Production in North East Nigeria. PP 28.
- Yayock, J. Y. (1978). Yield and yield characters of certain varieties of groundnut (*Arachis hypogaea* L.) as affected by plant population and fertilizer levels. Nigeria. Ph.D. Thesis, Postgraduate School A.B.U. Zaria.