IRESPUB Journal of Agriculture, Food & Nutrition
ISSN: 2770-3665
Volume: 2 | Issue: 2 | MAR – APR 2022 | Available Online: www.irespub.com

Response of different groundnut (Arachis hypogaea) cultivars to different rates of NPK 15:15:15 in Igbariam environment of Anambra State, Nigeria

E.E. Okoli

Department of Crop Science and Horticulture,
Chukwuemeka Odumegwu Ojukwu University, P.M.B. 6059 Awka, Anambra State

ABSTRACT

This study was conducted to determine the effect of different levels of NPK 15:15:15 on three cultivars of groundnut (Kampala, Honey, Nwanyiocha). Levels of NPK 15:15:15 include 0kg, 0kg, 20kg and 30kg/ha were assigned to these three cultivars of groundnut. Parameters measured were number of leaves, number of branches, plant height, days to 50% flowering, Number of pods/plant, Pod weight, 100-seed weight, and Yield (t/ha). These data were then be subjected to analysis of variance (ANOVA) using GENSTAT release 10.3 statistical software. Results showed significance differences ($P<0.05$) amongst treatments in some parameters measured. Nwanyiocha at10kg/ha of NKP 15: 15: 15 produced the best growth and yield indices while kampala cultivar had the lowest growth indices. In the number of branches all cultivars had significant growth without the application of fertilizer. Honey cultivar had a favourable growth from 4 WAP to 8WAP unlike the kampalacultivar. I0kg of NPK 15:15:15 had the best effect on the three cultivars ofgroundnut compared to other levels ofNPK 15:15:15 that were applied. It is concluded that NPK 15: 15: 15 had significant effect on groundnut growth. The best cultivar with regard to yield was Nwanyiocha (1.6t/ha) and was therefore recommended for farmer in the research area with the fertilizer application of NPK 15:15:15 at 20kg per hectare.

KEYWORDS

groundnut cultivars, NPK 15:15:15, Igbariam environment, Anambra State.

CORRESPONDING AUTHOR*

E.E. Okoli

INTRODUCTION

Groundnut is the fifth largest oil crop cultivated in more than 100 countries around the globe between latitude 400 North and South of the equator (especially in Africa, Asia, North and South America) (Waliyar *et al.,* 2007). In 2015, groundnut was grown on a total area of 21.8 million hectares worldwide with an estimated production of 38.6 million tonnes (unshelled) ·at an average yield of 1.58 tonnes per hectare (Food and Agriculture Organization 2015).

Nigeria and Myammerr are the major producers of groundnut. Developing countries in Asia, Africa and South America account for over 97% of the world groundnut area and 95% of total production. Nigeria and Senegal are the largest producers in West and Central Africa with 45% Africa total production (International Crops and Research Institute for Semi Arid Tropics 2015). Groundnut is one of the most popular commercial crops in Nigeria. Nigeria produces 41 % of the total production in West Africa (Echekwu and Emeka 2005).

Groundnut seeds contain 40-60% oil, 20-40% protein and 10-20%carbohydrate.The crop has high nutritional value, possessing vitamin E, niacin, calcium, phosphorus, magnesium, zinc, iron, riboflavin, thiamine and potassium. It is mainly used for direct consumption, in the confectionary industry, for vegetable oil in cooking and also as a source for protein feed in the animal industry. These multiple uses of peanut make it an excellent cash crop for domestic as well as international trade (Manish *et al.,* 2012).

In West and Central Africa, it is an important food and cash crop: a major source of dietary oil and cash income for both urban and subsistence dwellers (Olorunju and Ntare 2001). As a legume, groundnuts improve soil fertility by fixing nitrogen and thereby increasing productivity of other crops in the semi-arid cereal cropping systems (Waliyar *et al.,*2007), and other ecological zones.

The productivity of groundnut is higher in well drained soils with pH between 6.0 - 6.5 particularly sandy loam soil, as it is light, thus, helps for easy penetration on of pegs and their development, hence, their harvesting (Larinde, 1999). Groundnut has been reported to respond better to residual fertility than to direct fertilization. This means if a well-fertilized crop precedes a groundnut crop, direct fertilization may not increase the yield or quality of the groundnuts. If fertilizer is needed, it is best to broadcast and incorporate it with the soil during the land preparation.

A soil test is the best way to determine whether fertilizer or lime is required in groundnut cultivation. Liming is necessary only when the soil pH is below 5.8. However, if soil test results are not available, the general fertilizer recommendation of NPK kg/ha is: 25 kg of N - 50 kg of P2O5 - 100 kg of K_2O. However, for practical purposes two bags of NPK 15:15:15 plus two bags of Single Super Phosphate (SSP) and a bag of Muriate of Potash (MOP) can be applied per ha. (The latter is not commonly found in Nigerian markets). If the groundnut crop follows a well-fertilized cereal crop, then two bags of SSP may be sufficient per ha. Application of 400 kg halgypsum at peak flowering/pegging stage both improves the seed filling and increases the oil content. It is still apparent that production of this crop in the eastern region of Nigeria is limited by more researchable problems. To some greater extent, these are negatively inducing arid influences household producer-behaviour. Most of these studies have been directed towards climatic factors and improved seeds, or pest and diseases; whereas other challenges like agronomic factors that tend to limit small holder production in proposed area of study which remains unstudied. These include factors like transportation facilities, access to credit, market bargain power and storage facilities, therefore, objective of this study is to determine the performance of different varieties of groundnut to different levels of NPK 15:15:15 fertilizer in Igbariam, Anambra State.

MATERIALS AND METHODS

The field experiment was conducted at the Teaching Research Farm of the Department of Crop Science And Horticulture, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State. Igbariam falls within the derived savannah zone of Nigeria and is located at the latitude of 6°23' 26.4'N and 6°56' and 38.7 E.

The experiment was a 3x4 factorial experiment laid out in Randomized Complete Block Design (RCBD) with four replications. The treatments consist of three varieties of groundnut (Kampala, Honey, and Nwanyiocha) and four levels of NPK 15:15:15 (0kg/ha, 10kg/ha, 20kg/ha, and 30kg/ ha) with the following treatment combinations:

i. kampala 0kg/haNPK
ii. kampala 10kg/haNPK
iii. kampala 20kg/haNPK
iv. kampala 30kg/haNPK
v. Honey 0kg/ha NPK
vi. Honey 10kg/ha NPK
vii. Honey 20kg/ha NPK
viii. Honey 30kg/ha NPK
ix. Nwanyiocha 0kg/ha NPK
x. Nwanyiocha 10kg/ha NPK
xi. Nwanyiocha 20kg/ha NPK
xii. Nwanyiocha 30kg/ha NPK

Weeding was done using cutlass and hoe on the experimental field and was free from weed throughout the period of the experiment. The fertilizer ·was applied two weeks after planting.

DATA COLLECTION AND ANALYSIS

Data was collected on growth and yield parameters as follows:

i. Number of leaves: This was measured by counting and was at time intervals of 4 and 8 weeks after planting.
ii. Number of branches: This was measured by counting and was at time interval of 4 and 8 weeks after planting.
iii. Plant height: This will be measured using measuring tape; it was measured at 4 and 8 weeks after planting.
iv. Days to 50% flowering: It was determined by recording the number of days it took half of the groundnut plant in plot to flower.
v. Number of pods/plant: this was determined by counting.
vi. Pod yield t/ha: This was measured in tons per hectare of groundnut harvested in each plot.

The data collected were then be subjected to analysis of variance (ANOVA) using GENSTAT release 10.3 statistical software. The means were separated using Fisher's least significant difference (F-LSD) as described by (Okoli and Nworji 2020).

RESULTS

Table 1 revealed the effect of three levels of NPK 15:15:15 on the number of leaves of three cultivars of groundnut at 4 and 8 weeks after planting (WAP). At 4WAP 10kg of NPK 15:15:15 had the highest mean value for number of leaves (136.7) while 30kg of NPK 15:15:15 had the lowest mean value for number of leaves (122.1) though these differences were not significant as shown in the analysis of variance table. Nwanyiocha at 10kg of NPK 15:15:15 had the highest number of leaves (184.2) which is significantly different from kampala at 20kg of NPK 15:15:15 which had the lowest number of leaves (70.3). The interaction between the NPK 15:15:15 and groundnut cultivars showed no significant different.

At 8WAP 20kg of NPK 15:15:15 had the highest mean value for number of leaves (177.7) while 0kg of NPK 15:15:15 had the lowest mean value for number of leaves (151.2) though these differences were not significant as shown in the analysis of variance table. Table 1 revealed that there were significant difference amongst the groundnut cultivars in terms of number of leaves at 8WAP Nwanyiocha had the highest mean value for number of leaves (216.4) while kampala had the lowest mean value for number of leaves (114.4). There was no significant difference between the NPK 15:15:15 and groundnut cultivars in terms of interaction (Table 1).

Table 2 showed that at 4WAP, the highest number of branches was observed in plots where no NPK 15:15:15 was applied with the mean value of 23.1 while the least was observed in the plots treated with 20kg NPK 15:15:15 (20.8), there was no significant difference amongst the NPK 15:15:15 treatments. Nwanyiocha had the highest number of branches (26.8) while kampala had the lowest number of branches at 4WAP (17.3).

There was no significant difference at 8WAP for the NPK 15:15:15, however, the highest number of branches was obtained in the plots treated with 10kg NPK 15:15:15 (32.2) while the lowest was observed in plots treated with 20kg NPK 15:15:15 (27.8). Nwanyiocha had the highest number of branches (36.2) while kampala had the lowest number of branches at 4WAP (23.1) and these differences were significant (Table 2).

The effect of three levels of NPK 15:15:15 on the plant height of three cultivars of groundnut is presented in table 3. At 4WAP 30kg/ha of NPK 15:15:15 and honey cultivar had the highest mean value. This implies that honey cultivar showed increase in height beyond other cultivars. Kampala showed the lowest growth in plant height with20kg/ha having the lowest value. Nwanyiocha was applied with l0kg/ha of NPK15: 15: 15 had a better growth after honey cultivar.

At 8WAP, 30kg/ha of NPK 15:15:15 and honey cultivar had the highest mean value for plant height. Kampala when applied with 10kg/ha of NPK 15: 15: 15 did not grow well meanwhile when applied with 30kg/ha of NPK 15:15:15 there was a tremendous growth which was significantly different from 0kg, 10kg, and 20kg of NPK 15:15:15.

Nwanyiocha when applied with l0kg/ha of NPK 15:15:15produced the tallest plant. The interaction between these varieties and NPK 15: 15: 15 in plant height is not significant (Table 3).

Table 4 revealed the effect of three levels of NPK 15:15:15 on the days to 50% flowering of three cultivars of groundnut at 4 and 8 weeks after planting. There was no significant difference with regard to days to 50% flowering, Nwanyiocha variety and 30kg/ha had the highest mean value when 30kg/ha was applied to Nwanyiocha it showed the longest days of flowering. When 20kg was applied to kampala it showed the shortest days of flowering. The interaction between these varieties and NPK 15:15:15 in days to 50% flowering showed no significant difference.

The effect of three levels of NPK 15:15:15 on the number of pods per plant, pod weight (g), 100-seed weight (g) and yield (t/ha) of three cultivars of groundnut is presented in table 5. There was no significant difference ($p>0.05$) with regards to number of pods per plant; however, Nwanyiocha had the highest number of pods in combination with 30kg NPK 15:15:15 (Table 5). There was a significant ($p \leq 0.05$) effect amongst the cultivars with respect to pod weight, 100-seed weight and yield while the effect of NPK 15:15:15 had no significant difference ($p>0.05$). The interaction between cultivars and NPK fertilizer also showed no significant difference (Table 5).

TABLE 1: Effect of NPK 15:15:15 on the number of leaves of three cultivars of groundnut at 4 and 8 weeks after planting

NPK FERTILIZER	VARIETY			Mean
	Kampala	***Honey***	***Nwanyiocha***	
	NUMBER OF LEAVES 4WAP			
0 kg	86.3	116.5	175.8	**126.2**
10 kg	77.2	148.5	184.2	**136.7**
20 kg	70.3	167.8	156.2	**131.4**
30 kg	110.3	106.2	149.8	**122.1**
Mean	**86**	**134.8**	**166.5**	
	NUMBER OF LEAVES 8WAP			
0 kg	96.5	141.5	215.8	**151.2**
10 kg	84.7	200.5	240.2	**175.2**
20 kg	123	208.2	201.8	**177.7**
30 kg	153.5	133.5	207.8	**164.9**
Mean	**114.4**	**170.9**	**216.4**	

	No of Leaves 4WAP	**No of Leaves 8WAP**
LSD (0.05) for Groundnut variety means	26.67	24.33
LSD (0.05) for NPK 15:15:15 means	N.S	N.S
LSD (0.05) for Groundnut variety x NPK 15:15:15 means	N.S	48.66

TABLE 2: Effect of NPK 15:15:15 on the number of branches of three cultivars of groundnut at 4 and 8 weeks after planting

NPK FERTILIZER	VARIETY			Mean
	Kampala	*Honey*	*Nwanyiocha*	
	NUMBER OF BRANCHES 4WAP			
0kg	15.8	22.2	31.2	23.1
10kg	15.8	24.5	28.2	22.8
20kg	12.5	25.8	24	20.8
30kg	25.3	19.5	23.5	22.8
Mean	**17.3**	**23**	**26.8**	
	NUMBER OF BRANCHES 8WAP			
0kg	18.5	34.3	40.8	31.2
10kg	27	31.5	38.2	32.2
20kg	16.5	32.8	34.2	27.8
30kg	30.2	26.8	31.5	29.5
Mean	**23.1**	**31.3**	**36.2**	

	No of Branches 4WAP	No of Branches 8WAP
LSD (0.05) for Groundnut variety means	5.03	5.92
LSD (0.05) for NPK 15:15:15 means	N.S	N.S
LSD (0.05) for Groundnut variety x NPK 15:15:15 means	N.S	N.S

TABLE 3: Effect of NPK 15:15:15 on the plant height of three cultivars of groundnut at 4 and 8 weeks after planting

NPK FERTILIZER	VARIETY			Mean
	Kampala	*Honey*	*Nwanyiocha*	
	PLANT HEIGHT 4WAP			
0kg	13.67	22.05	18.05	**17.92**
10kg	12.2	18.92	22.07	**17.73**
20kg	8.75	18.47	20.45	**15.89**
30kg	18.57	24.05	19.95	**20.86**
Mean	**13.3**	**20.87**	**20.13**	
	PLANT HEIGHT 8WAP			
0kg	18	28	24	**23.33**
10kg	16	26	29	**23.67**
20kg	17	28	27	**24.00**
30kg	24	28	25	**25.67**
Mean	**18.75**	**27.5**	**26.25**	

	Plant height 4WAP	Plant height 8WAP
LSD (0.05) for Groundnut variety means	2.51	N.S
LSD (0.05) for NPK 15:15:15 means	N.S	N.S
LSD (0.05) for Groundnut variety x NPK 15:15:15 means	N.S	N.S

TABLE 4: Effect of NPK 15:15:15 on the days to 50% flowering of three cultivars of groundnut at 4 and 8 weeks after planting

NPK FERTILIZER	VARIETY			Mean
	Kampala	*Honey*	*Nwanyiocha*	
	Days to 50% Flowering			
0kg	38.25	38.75	39.25	**38.75**
10kg	38	40.5	40.75	**39.75**
20kg	38.5	38.75	39.5	**38.92**
30kg	39.5	39.5	40.75	**39.92**
Mean	**38.56**	**39.38**	**40.06**	

	Days to 50% Flowering
LSD (0.05) for Groundnut variety means	1.10
LSD (0.05) for NPK 15:15:15 means	N.S
LSD (0.05) for Groundnut variety x NPK 15:15:15 means	N.S

TABLE 5: Effect of NPK 15:15:15 on the yield attributes of three cultivars of groundnut at 4 and 8 weeks after planting

Treatments	Number of pods/plant	Pod weight (g)	100-seed weight (g)	Yield (t/ha)
Varieties				
Kampala	15.4	255.7	31.4	1.3
Honey	16.5	321.3	26.2	1.1
Nwanyiocha	17.2	387	36.6	1.6
Mean	16.4	321.3	31.4	1.3
LSD (0.05)	NS	95.7	3.4	0.4
NPK 15:15:15				
0kg	14.9	281.8	29.2	0.9
10kg	15.7	284	29.4	1.1
20kg	16.2	298	30.3	1.2
30kg	16.4	326	31.3	1.2
Mean	15.8	297.5	30.1	1.1
LSD (0.05)	NS	NS	NS	NS
Variety X NPK 15:15:15	NS	NS	NS	NS

DISCUSSION

The suitable fertilizer rate is crucial for the production of the best groundnut variety in an area. The result of the experiment showed that NPK fertilizer had complimentary effect on growth of groundnut cultivars (kampala, Honey, Nwanyiocha) due to the increased plant height, number of leaves and number of branches observed, though the differences with regards to the NPK 15:15:15 levels were not significant. In line with this, previous studies indicated that increased application of NPK 15:15:15 had significant positive effect on the growth attributes of groundnut cultivars (Xiao-long *et al.*, 2018; Yadav *et al.*, 2015).

Days to 50% flowering had no change from 0kg/ha which is the control to 10kg, 20kg and 30kg.The cultivar with the most effective response to fertilizer was Nwanyiocha cultivar and the least response was the kampala cultivar. There was no interaction effect between the groundnut cultivars and the NPK 15:15:15 levels.

However, it is worthy to note that high moisture content that was available at the time of this experiment encouraged the high level of flowering observed across all the cultivated groundnut cultivars. This observation is in agreement with the findings of (Osei et al., 2014) who reported that increased rate of fertilization boost the flowering of groundnut cultivars under rain-fed production.

The significant variations in the weight of pods per plant observed in this experiment confirm the findings of (Elnaim *et al.*, 2010). The significantly higher weight of pods per plant with the groundnut cultivars could be due to differences in genotypes of varieties and their response to NPK 15:15:15. Although there were significant variations in yield (t ha^{-1}) in terms of groundnut cultivars, there was no significant difference between the groundnut cultivars and the NPK 15:15:15 levels. High soil moisture content during the vegetative phase generally improves flowering and maturity and also increases the crop growth and yield. In conclusion, this study further confirms that NPK 15:15:15 fertilizer had produced healthier groundnut cultivar. This can be attributed to additional nutrient derived from fertilizer. The result of the experiment suggested that applying fertilizer at appropriate rate will enhance the growth and yield of groundnut cultivars, however, Nwanyiocha variety in combination with NPK 15:15:15 at 20kg per hectare is recommended for farmers in Igbariam farm settlement of Anambra State.

REFERENCES

[1] Echekwu, C. A. and Emeka, I. (2005). Groundnut, Endoowing, The Groundnut /Rediscovery program in Nigeria. Opah Mission Abuja. pp18.

[2] Elnaim, A.M., M.A. Elduoma and A.E. Abdalla, (2010). Effect of weeding frequencies and plant density on vegetative growth characteristics of groundnut (*Arachis hypogea* L.) in North Kordofan of Sudan. Int. J. Appl. Biol. Pharm. Technol., 1: 1188-1193.

[3] FAO (2015). Food and Agriculture Organization of the United Nations, FAOSTAT database.

[4] ICRISAT (2015). Groundnut Crop, International Crops Research Institute for Semi Arid Tropics. www.icrisat.org/crop- groundnut.html.

[5] Larinde, M. (1999). Groundnut Seed Multiplication and constraints: FAO's experience in: Alhyu, A. and Nwafor, G.O. (eds). Restonng the Status of Groundnut in NationalEconomy. Proceedings of National workshop on Groundnut Rehabilitation inNigeria. FAO/FDA Kano, Nigeria 11 - 12 May, pp. 33 - 34.

[6] Manish, K. P., Emmanuel, M., Peggy, 0., Xuanquiang, L., Patricia, G., Shyan, N. N., Hari, D. U., Pasupuleti, J., Xin you, Z., Baozhu, G., Douglas, R C., David, J. B., Richard, M., Rajeev, K. V. (2012). Advances in Arachis Genomics for Peanuts Improvement. Biotechnology Advances , 30(3):639-65.

[7] Okoli, E.E. and Nworji M.J.(2020).Evaluation of the performance of 21 maize hybrids (Zea mays L.) for yield and other agronomic attributes in Owerri West, Southeastern Nigeria. International Journal of Science, Environment and Technology, Vol. 9, No 2, 136 – 147.

[8] Olorunju, P. E. and Ntare, B. R. (2001). Combating viruses and virus disease of groundnut through the use ofresistantvarieties: A case study of Nigeria.Plant virology in Sub-Saharan Africa.I89-202.

[9] Osei, D., S. Lamptey, C. L. Ayisi, and A. Apraku (2014). Effects of rhizobium inoculants and growth stages on shoot biomass and yield of soybean (*Glycine max* (L.) merril), *International Journal of Scientific and Technology Research*, vol. 3, no. 4, pp. 321–327.

[10] Waliyar, F., Kumar, P. L., MonyO, E., Nigam, S. N,, Reddy, A. S., Osiru, M. and Diallo, A. T. (2007). A Century ofResearch on Groundnut Rosette Disease and its Management. Technical

[11] Xiao-long, S., Z.M. Zhang, L.X. Dai, G.C. Zhang, D.W. Ci, H. Ding, and J.M. Tian. (2018). Effect of Calcium Fertilizer Application on Absorption and Distribution of Nutrients in Peanut under Salt Stress. Chinese Journal of Applied Ecology 29(10):3302-3310.