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COMPARATIVE ANALYSIS OF DIFFERENT VARIETIES OF GROUND NUT (*Arachis hypogea* L) YIELD TO DIFFERENT ROW SPACING IN BICHI AND TSANYAWA LOCAL GOVERNMENT AREAS OF KANO STATE NIGERIA

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Abstract

The research was conducted at two different research locations Tsanyawa Local Government, Agriculture and Natural Resources Department Research and extension Farm Harbau (Latitude 12° 18' 0"*N, and Longitude* 7° 59' 0"*E)* (www.maplandia.com/nigeria/kano*, and (Federal College of Education (Technical) Bichi Agriculture Education Research farm, Latitude (12°23'42''N) and Longitude (8°24'04''E)* (www.maplandia.com/nigeria/kano*, during the 2021 rainy season, with a view to determine the response of different varieties of Ground nut (Arachis hypogea L.) to different row spacing and arrangements so as to equip and enlighten farmers with technical knowledge on the best row spacing and arrangements to be adopted by farmers on the Sudan savanna agro-ecology. Three row spacing of 40cm, 50cm, and 60cm, and four varieties of Ground nut (Arachis hypogea L.) RRB, RRR, Ex-Dakar, and SAMNUT 24 were investigated, data and records were taken on days to 50% flowering, 90% maturity, plant height (canopy height), leaf area index (LAI), leaf and stem weight, harvest index (HI), grain weight, pod weight and fodder weight. Significant differences were recorded among the varieties tested where SAMNUT-24 and Ex-Dakar had a superior growth and yield parameters. The interaction between row spacing of 50cm yielded better on all the four varieties. This research results showed that row spacing had no significant effects on two parameters. The research and recommends that varieties SAMNUT-24 and Ex-Dakar, and row spacing of 50cm could be adopted by groundnut farmers in the Sudan Savanna agro-ecology for good crop and better yield, high income as well as fodder yield for feeding livestock.*

KEY WORDS: Row spacing, arrangements, SAMNUT, RRB. RRR, Ex-Dakar.

Introduction

Groundnut which is botanically known as *Arachis hypogea* is a native of South America and originated in Brazil. (Food and Agriculture Organization (F.A.O. (2017). It was introduced into Nigeria in the 16th century. It is produced in every states in Northern Nigeria, the bulk of the crop is produce in Kano, Borno, Bauchi, Sokoto, Kaduna, Katsina and Adamawa states. (Food and Agriculture Organization Corporate Statistical Database (FAOSTAT. 2014).

It grows well in rich light sandy loam soil and preferably loose for easy pegging, the rainfall should be evenly distributed throughout the growing period with adequate sunshine. Ground nut can succeed where ever the wet season is sufficiently. It requires

an optimum temperature of between 24°c - 33°c, it grows well on a wide range of soil with a pH of 5.8 – 6.2 provided nutrients are available in balanced supply with a well distributed rainfall.

It is an annual crop with a well-developed tap root system with many adventitious root from hypocotyl. It grows to a height of about 30- 60cm and produce angular, hairy stems with spreading or erect branches. The central stem is erect in runner types, the lateral stems are prostrate while in bunch types the lateral stems are more or less erects in young plants, but tends to be prostrate at a later stage. It has a relatively light green foliage. The leaves are hairy, flowers are small yellow and grow singly or in clusters, and usually self-pollinated. The fruit is a pod and consist of a shell containing from one to three seeds occasionally up to six. (Philip and Ganiyu (2010).

Groundnut is highly nutritious food and contains approximately 25% protein, and very rich in oil. Groundnut oil is primarily used as cooking oil and in the manufacture of vegetable oil, groundnut seed contains about 45% oil which is highly digestible. Ranga V, and Nigam N. (2010), also said it is a good sources of B vitamins except B12, the kernels can also be consumed either roasted or fried and salted. The groundnut seed cake obtained after the extraction of the oil serve as a livestock feed. It can also be used as manure as it's contain 7-8% nitrogen, 1.5% phosphorus and 1.5% potassium. Agronomically it is effective in crop rotation system, it builds up the soil fertility by fixing nitrogen through the root nodules and also an efficient cover crop for lands exposed to soil erosion. (Chidda, Prem, and Rajbir, (2014).

Groundnut require high phosphate and calcium application for good fruit development. It need direct contact with calcium at the pod development stages. The application of single super phosphate before land preparation is essential, 94 -100 kg (2 bags of 50kg) per hectare of single super phosphate will improve yield. (Kano Agricultural and Rural Development Authority (KNARDA) 2012).

Different varieties have been introduced in various groundnut growing states in Nigeria for commercial cultivation such as Tamil Nadu Bihar (T.N.B.), GAUGHI, Shalimbana, Amber, Rosette low Bihar (RLB), etc. Resistant Red Bulk (RRB), Red Rosette Resistant (RRR), These varieties are highly resistant to rosette disease and also have high oil content and matures in about 100 - 110 days than the local variety which matures in about 150- 175 days. (KNARDA (2012). (Philip and Ganiyu (2010).

However, despite the adoption of good seeds, the production of Groundnut continues to dwindle. This brings about low income to farmers as well as shortage of material to vegetable oil companies, since several factors have observed to be responsible for the dwindling groundnut production, among which is the seed spacing techniques employed by farmers.

Seed spacing refers to the distance between two or more stands in planting. It is one of the determinants of good yields. Currently, farmers in Kano use indiscriminate seed distance (xh). This situation leads to larger spaces between crops and or shorter spaces. The duo in the spacing have great implications to yields. Hence, this study explores the most suitable spacing for better yield.

Problem statement

It has been observed that farmers in Kano state, especially in Bichi and Tsanyawa ecological zone are experiencing a decline in the performance of groundnut in terms of yield especially among common varieties such as Samnut-24, RRB, RRR and Ex-Dakar cultivated in the area. Some attributed to poor yield being experienced to poor land preparation, such as poor spacing, pests and diseases infection among others. Interactions with extension officers revealed that poor spacing and not compliance with guideline in the utilization of these improve varieties are responsible to the low yield, therefore, this research is intended to investigate the performance/ response of these different varieties in response to different spacing's methods in the areas with a view to properly guide the local farmers, hence, this study.

The main objectives of this study therefore is to investigate the response of different row spacing in Bichi and Tsanyawa Local Government Areas of Kano State. Specifically, the study will:

1. Identify the variety that is suitable for cultivation in the area.
2. Identify the most suitable row spacing for growing the species in the area.

Research questions

The following research questions will guide the study:

1. What is the response of four different varieties (RRB, Samnut-24, RRR, and Ex-Dakar) of groundnut to different row spacing?
2. What is the groundnut variety with high yielding that is most suitable for cultivation?
3. What is the most appropriate row spacing suitable for growing groundnut in the area of the study?

Hypothesis

1. There is no significant difference in the yield of the various Groundnut specie planted in Tsanyawa &Bichi Local Government Area.
2. There is no significant difference in the yield quantity of Groundnut varieties cultivated under different spacing areas.

Area of the study

The research experiment was conducted in 2021 rainy season at two locations, the Agricultural Education research farm of Federal College of Education (Technical) Bichi, Latitude (12°23'42''N) and Longitude (8°24'04''E), and the Tsanyawa Local Government, Agriculture and Natural Resources Department Research and extension Farm Harbau (Latitude 12° 15' 42'N, and Longitude 8° 0' 29'E), during 2021 rainy season, with an elevation of 519m (1703ft) above sea level, , the mean annual rainfall is 168-778mm, the mean minimum annual temperature ranges between 17° and mean maximum annual temperature of 36°. The two research stations (sites) lies within the Sudan Savanna Agro-Ecological Zone of Nigeria.

Materials and methods

The materials used during this research consist of four improved varieties of groundnut namely RRB, Samnut-24, Ex-Dakar and RRR obtained from obtained from Kano Agricultural and Rural Development Authority (KNARDA), other materials includes two ox-drawn plough, mould board plough, hand plough, cutlass, seeds, insecticides, hoes, sacks, sticks, measuring tapes, pegs, weighing scale, and head pan.

Experiment procedure/ research design

The experimental research consist of two plot row spacing of 40, 50 and 60cm consisting of the 5 (five) ridges per plot/treatments, each research plot consist of 300m² divided into five ridges of 40meters long and 2 ridges discard with two pathway. Ridges were replicated three times in a randomized block design.

Three seeds were sown per hole at 2.50 – 3.00 cm soil depth at the two locations. Weeding was done at two and six weeks after sowing and the weeding was done manually using hand hoe. A single super phosphate (18% P2 O5 was applied at planting time because phosphate fertilizers are long passive at the rate of 40 kg P2 O5/ha^{-1}. Management of pest and disease was observed in the two fields (locations). Harvesting was done when the majority of the pods have reached maturity, at the maturity the inside of the shell becomes darkened and outside become less spongy and the surface ribs hardens and are more pronounced. The harvesting was done by lifting the whole plant with a hoe and were taken to shade and spread on the ground floor where the pods were picked and spread out in the mats in the sun to ensure rapid drying. The hay were chopped into pieces and sun dried and later bagged and weighted. The pod and the hay were weighted using manual weighing scale and electronic digital scale model (333).

Groundnut crop data were collected from the plant within the net plot (two middle rows). The observation and management procedures for the parameters of each plots, tagged, measured and then recorded. The growth and yield parameters assessed include 50% Germination, Crop plant height, Numbers of leaves per plant, Numbers of branches per plant, Days to 50% flowering, Numbers of pod per plant, Number of grains per plant, Leaf area index were observed at 2weeks, 4weeks, 6weeks and 8weeks after sowing. While the yield parameters such as Numbers of pods per plant, Numbers of grains per pod, 100 grain weight, Grain yield per treatment, Grain yield per replication, Grain yield per plot, Grain yield per hectare, Harvest index, Stover yield were observed at harvest on each treatment. Also among the parameters recorded were Identification of weeds on the plots and the Weeds cover score was also monitored and recorded on each research plot.

Analysis of Data and results discussions.

The data collected for all the measured variables were subjected to two way analysis of variance using the general linear model of SAS (2011). Significant treatment means were compared using Duncan Multiple Range Test (DMRT). Relationship between the characters evaluated were also established using pearsons correlation analysis in SAS.

Results presentations

a. Federal College of Education (Technical) Bichi Agriculture Education Research farm

PARAMETERS	VARIETIES											
	RRB			SAMNUT 24			EX-DAKAR			RRR		
	ROW SPACING			ROW SPACING			ROW SPACING			ROW SPACING		
	40	50	60	40	50	60	40	50	60	40	50	60
Days to 50% germination	5days	5days	5days	4days	4days	4days	5days	5days	5days	5days	5days	5days
Days to 50% flowering	54.11	54	55	53	53	52	53	53	53	55	56	57
Canopy height (cm)	67	72	67	66	69	71	65	68	72	62	66	71
Leaf area index (cm)	4.81	5.78	6.81	4.92	5.11	4.32	4.89	5.26	5.99	5.00	5.83	5.73
Days to maturity (ripe)	121	120	125	100	100	100	115	115	115	123	124	121
No of Pod per ridges	295	329	289	307	341	339	309	332	317	281	322	316
Pod weight(g)	434	451	429	439	452	475	442	446	435	428	453	441
Leaf and stem weight (g)	21.8	19.7	19.2	24.6	24.9	27.4	24.6	23.0	24.1	21.1	21.5	22.0
Grain yield weight (kg/h^{-1})	2782	2895	2862	2941	3237	3120	2867	3105	2996	3007	2783	2829
Fodder yield weight	211.0	210.1	231.4	243.2	269.9	253.9	236.7	253.8	265.1	221.6	225.4	230.1

b. Tsanyawa Local Government, Agriculture and Natural Resources Department Research and Extension Farm Harbau

	VARIETIES											
	RRB			SAMNUT 24			EX-DAKAR			RRR		
	ROW SPACING			ROW SPACING			ROW SPACING			ROW SPACING		
	40	50	60	40	50	60	40	50	60	40	50	60
Days to 50% germination	5days	5days	5days	4days	4days	4days	5days	5days	5days	5days	5days	5days
Days to 50% flowering	54	54	55	57	62	59	55	54	55	54	53	52
Canopy height (cm)	67	73	69	66	71	71	65	68	72	62	66	71
Leaf area index (cm)	4.21	5.95	5.81	4.92	5.71	5.32	4.89	5.96	5.91	4.73	5.73	5.13
Days to maturity (ripe)	121	120	125	100	102	100	105	105	105	123	124	121
No of Pod per ridges	281	310	292	304	342	331	317	339	296	289	300	316
Pod weight(g)	424	449	439	432	475	488	424	450	438	422	443	411
Leaf and stem weight (g)	21.2	19.6	19.4	24.8	25.1	27.6	24.9	23.4	24.4	21.8	21.2	22.0
Grain yield weight (kg/h^{-1})	2770	2873	2881	2976	3129	3022	2871	3106	2947	3027	2775	2832
Fodder yield weight	212.0	211.1	232.4	244.2	257.9	237.7	228.9	257.2	265.6	222.2	224.4	235.4

The major findings of the study is as follows:

1. Samnut-24 germinated earlier than other varieties.
2. RRB and Samnut-24 had less days to 50% flowering in 50 cm row spacing
3. Variety Samnut-24 and RLB had higher PAR value of canopy height in 50 cm row spacing
4. Samnut-24 had higher leaf area index in 50 cm spacing
5. Samnut-24 had shorter maturity days than other varieties in 50 cm row spacing
6. Samnut-24had higher numbers of grains per ridges in 50 cm row spacing
7. Samnut-24 had higher pod weight in 50 cm spacing
8. Samnut-24 had higher stem and leaf weight in 60 cm row spacing

9. Samnut-24 had higher grain yield weight in 50 cm spacing
10. Ex-Dakar had higher fodder weight in 60 cm row spacing.
11. The major findings of the study

The major findings reveals that ground nut crop especially the improved variety performed better at a row spacing of 50cm, in terms of optimum germination, early days to flowerings and higher fodder output. The research also conclusively revealed that variety Samnut-24 had a superior growth output and higher yield in grains, higher numbers of pods, higher pod weight, higher grain weight and higher fodder weight and yields alongside with variety Ex- Dakar. The findings is in line with the results from KNARDA (2019).

Also similar research was carried out in 2018 by Madawaki (2018) with other varieties and results revealed that variety Samnut-24 had all the above qualities compared to other varieties.

Mean rating of the effect of different varieties and different row spacing on the four samples of the groundnut.

Responses on days to 50% germination: There were no significant differences between the row spacing for the four varieties of groundnut but a significant difference was recorded among the varieties where Samnut-24 had earlier germination period (4 days) than other varieties, at the two experimental locations.

Responses on Days to 50% flowering: The results show that statistically there were no significant differences observed among the three row spacing evaluated at Bichi research farm and Tsanyawa research farm numerically row spacing of 50cm had the least number of days to flowering when compared to others. From the varieties evaluated, there were significant differences observed in the two areas where RRB and RRR varieties had a prolonged days of 53 days to flowering than Samnut-24 and Ex-Dakar varieties with 53 days at the two locations. Also the interaction was however not significant, at the two experimental locations.

Responses on Canopy height: The results of the study also showed significant differences among the three row spacing at Bichi. Row spacing of 50cm had higher value of PAR then closely followed by 40cm row spacing. There were some significant differences observed variety Samnut-24 and variety RRB had higher PAR compared to others at both locations.

Responses on Leaf area index: Significant differences were recorded among the row spacing 50cm had higher Leaf area Index and it is followed by 40cm row spacing. It is observed that a significant differences were recorded, Samnut-24 and RRB varieties had higher leaf area index compared to other varieties in the two locations. There was no any recorded interaction between varieties.

Responses on Days to maturity (ripe): Significant differences was recorded among the varieties where variety Samnut-24 had shorter maturity days than others, it is followed by variety RRB. Also 50cm row spacing had given appreciable maturity ripeness of pod and nut in the pod.

Responses on Numbers of pod per ridges: Among the four varieties evaluated a significant differences was observed and recorded at the two locations the variety Samnut-24 had a higher numbers of pods per ridges within the two locations, row spacing of 50cm had higher numbers of pods per ridges whereby it is much higher in Bichi research location.

Responses on Pod weight: A significant differences was observed among the three row spacing, 50cm row spacing had higher pod weight than others, it is also noted that variety Samnut-24 had higher pod weight in 50cm row spacing in Bichi research farm while in Tsanyawa research farm Samnut-24 variety gives higher yield in 6ocm row spacing as seen in the table.

Responses on Leaf and stem weight: It is observed that 60cm row spacing had higher leaf and stem weight and also variety Samnut-24 had higher leaf and stem weight when compared to both row spacing and varieties in all the two locations. However, there were no interaction in any of the research locations. This is all followed by variety Ex-Dakar.

Responses on Grain yield weight: It is observed and recorded that there were significant differences between the varieties whereby Samnut-24 variety had higher grain yield weight at 50cm row spacing in all the two locations. Significant differences were observed between the locations and row spacing, it is then followed by Ex-Dakar in both row spacing and locations.

Responses on Fodder weight: A significant differences were observed on the fodder weight in varieties and row spacing evaluated in both Federal College of Education (Technical) Bichi Agriculture Education Research farm and Tsanyawa Local Government, Agriculture and Natural Resources Department Research and Extension Farm Harbau, where Samnut-24 and Ex-Dakar variety in 50cm produce a considerable fodder yield, this due to the fact that fodder is influenced by a wider row spacing, as in IITA (2015).

Conclusion

From the research results it is observed that there was a significant difference among the four varieties in the two areas of study, also significant differences were observed among the three row spacing. It is concluded that variety Samnut-24 proved to be superior to other varieties the 50cm row spacing exhibited more canopy height, leaf and stem weight, fodder weight than other row spacing significantly affected growth and yield characters of the four varieties studied. Two varieties Samnut-24 and RRB were identified with higher yield while Variety Ex-Dakar had higher fodder, leaf and stem weight at 60 cm row spacing in all the two locations this is in line with KNARDA (2012), followed by variety Ex-Dakar with all the above attributes (quality).

Recommendations

1. Based on the experiment conducted at the two different research areas (Federal College of Education (Technical) Bichi Agriculture Education Research farm and Tsanyawa Local Government, Agriculture and Natural Resources Department Research and Extension Farm Harbau,) during 2021 rainy season, on the Response

Of Different Varieties of Ground Nut (*Arachis Hypogea* L) Yield To Different Row Spacing In Sudan Savanna Agro-Ecological Zone of Northern Nigeria, has shown that Variety Samnut-24 at 50cm row spacing gives better yield of groundnut, therefore it may be recommended that Variety Samnut-24 at 50cm row spacing could be cultivated by the ground nut farmers in the study areas (Bichi and Tsanyawa) for good better, and higher crop yield, higher oil content, high income as well as fodder yield for feeding livestock and would be beneficial to farmers in the Sudan Savanna, in order to maximize the production of groundnut, and where in its absence the variety Ex-Dakar could be used.

2. Groundnut farmers in Bichi local government area of Kano State should be enlightened to take to the cultivation of Samnut-24 and Ex-Dakar varieties for better growth and productivity.
3. Government should always make the seeds of these two varieties of groundnut Samnut-24 and Ex-Dakar available to farmers before the commencement of rainy season as this will discourage the use of other varieties.
4. As the benefit of Groundnut production amongst others includes high income, food security, foreign exchange earnings, therefore groundnut production should be encouraged so as to cope with challenges of unemployment that have plagued the country.

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