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Response of Groundnut (Arachishypogea L.) to Varying Into-Row Spacing and Variety in Bagauda, a Sudan Savannah Agro-Ecological Zone of Nigeria.

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Abstract: *The trial "Response of Groundnut (Arachis hypogea L.) tovarying intra-row spacing and variety at Bagauda, a Sudan savannah Agro-ecological Nigeria.) Was conducted at Bagauda (former ICRISAT Research station) (11° 39N, 08° 20E) during the 2012 wet season to determine the suitable variety and optimum intra-row spacing for groundnut (Arachis hypogea L) in the area. The treatments were combined and arranged in a randomized complete block design (RCBD) and was replicated 3 times. It consisted of five (5) varieties (SAMNUT 10, SAMNUT 22, SAMNUT 23, SAMNUT 24 and Mai Bargo, a local variety used as check) and three level of spacing (20cm, 25cm, 30cm).*
It was observed that variety and intra-row spacing significantly affects most of the studied characters. SAMNUT 22 out-yielded the other varieties while 30cm intra--row spacing produced the highest yield.
Key words: *Groundnut (Arachis hypogea L), Intra-row spacing, variety.*

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I. Introduction

Groundnut (Arachis hypogea L.), otherwise known as peanut is regarded as one pf the most important protein- rich crop and it occupies the fifth position as oil seed crop globally **(El sayed et al., 2001)**. It is an annual soil enriching, self-pollinated legume, cultivated widely in the arid and semi-arid regions of the world (40o N and 40o S), from warm temperate to equatorial climates. It is an important oilseed crop of the semi-arid tropics (Fletcher et al., 1992; Tarimo, 1997; ICRISAT, 2008). The crop ranks thirteenth (13th) in importance among world crops (Hatam and Abbasi, 1994). Groundnut shows high sensitivity to soil salinity, tolerating a wide range of pH values, but prefers neutral to slightly acidic soils (Tsigbey et al., 2003). Seed germination is inhibited if the temperature falls below 15°C or rises above 45°C. In the semi-arid tropics, optimum daylight temperatures for vegetative and reproductive growth and development in groundnut ranges from 25°C to 36°C and from 25°C to 26°C (Cox, 1979; Wood, 1968). Very low temperatures early or late in the growing period can lead to immature pods at harvest while high temperatures retard growth and may lead to moisture stress (Vara Prasad et al., 1998). Although groundnut is generally tolerant to drought, its sensitivity varies at different growth stages (ICRISAT, 1992, Boote and Ketring, 1990). Rainfall of 500-1000 mm per annum is normally enough for successful cash cropping if well distributed (Gram, 1958; Shilling and Gibbons, 2002). As a deep rooting legume enjoying symbiotic association with rhizobia and mycorrhizae, groundnut responds to starter nitrogen at the early stages but it is able to provide for its own nitrogen needs through symbiotic nitrogen fixation after six weeks of growth (Gibbons and Martin, 1980). Groundnut is also known to provide an equivalent of 60 Kg N ha-1 to the subsequent non-legume crop or cereal through biological nitrogen fixation (Ghosh et al., 2007; Rwamugira and Massawe, 1990). The crop also benefits its intercrop partner through nitrogen sparing and soil solubilisation (Ghosh et al., 2007; Nair et al., 1979). The additions of Phosphorus, Calcium, Potassium and Magnesium have been shown to improve yield performance (Peanut CRSP, 1997; Piggott, 1960). Several reports on groundnut research indicate that climate and plant spacing were related to growth habit with closer spacing giving higher pod yield (Patel, 1988; Piggott, 1960; Tarimo, 1997). Factors promoting vegetative growth such as high soil nitrogen, available soil moisture and low plant population density have all been found to greatly reduce pod yield (Bullock et al., 1998; Kang Young Kil et al., 1998; Tarimo, 1997).

Uses And Nutrition

Groundnut`s high content of edible oil (50%) and protein (25%) makes It a popular human food crops **(Razari et al., 2007).** It is consumed either as shelled nut as oil **(Razari et al., 2007)**after pressing of kernel or in range of other forms subject to various degrees of processing such as pea nut butter, sauces, confectionery items**(Razari et al., 2007).** Groundnut cake is valuable ingredient to the diet in the developing countries where diets often consist mainly of low protein cereals. Groundnut is a goodsource of minerals such as phosphorus(P), calcium(Ca), Magnesium(Mg), potassium(K), and vitamin E, K, and B complex. (**Mohsenin, 1980).**

Production Trend In Nigeria

Although groundnut is important in Nigeria, production has declined since the devastating diseases and pest records of 1965-1967 **(Freeman et al., 1999).** Several interrelated factors have been identified as cause of the decline in production, but the most important have been natural disasters such as critic rainfall, drought, and diseases. Other causes include completion from food crops for cash, late planting, inadequate fertilizer, and chemicals, unavailability of improved seeds etc.

Statement Of Research Problem

Despite the economic potential and importance of groundnut, little attention is documented toward improving the yield and growth of the country's economy and also improve the standard of living of its people through special initiative on the crop.

Objectives Of The Study

The present research will determine the most adapted variety to Bagauda, Kano, a Sudan savannah agro-ecological zone in terms of growth and yield. It will also determine the most optimal intra-row spacing for groundnut in the study area.

II. Materials And Methods

Field Experiment

The experiment was conducted at Bagauda research farm, former ICRISAT research station (11° 39N, 08° 20E).The crop varieties used in this experiment were SAMNUT 10. SAMNUT 22, SAMNUT 23, SAMNUT 24, and a local variety Mai Bargo which is used as check. The improved varieties werecollected from the Institute of Agricultural research Samaru, Ahmadu Bello University, Zaria, while Mia Bargo is commonly used as a local check in the experiment.

The treatments consisted of five varieties SAMNUT 10, SAMNUT, 22 ASMNUT 23, SAMNUT 24, and Mai Bargo and three different spacing 20cm, 25cm, and 30cm making fifteen treatments. Other materials used in the experiment include sensitive electronic scale, measuring tape, rope, pegs etc.The treatments were combined and arranged in a Randomized complete block design (RCBD) and replicated three times.The area of each plot consist of two rows of five meters long and 1.5m wide making 7.5m2 with a total of 45 plots.

Field Operations

The land was plough and harrowed which was followed by ridging. Ridges were remoulded at 6 WAS. After rain was fully was fully established, the seeds were sown on the same day (1^{st}July 2012). Two seeds were initially sown per hole. Thinning was later conducted leaving one plant per stand at 2 WAS. Weed control was supplemented manually at four and eight WAS.Fertilizer was applied using compound fertilizer SPP, first application was done at 2 WAS and second application was done at six WAS.

Harvesting was done manually and each plot was harvested separately and the yield aws packed separately plot by plot.

Data Collection

The data collection started at four WAS, six plants per plots were randomly selected for measurement and observation which was done fortnightly for plant height, stand count, number of branches, and canopy, spread as growth parameters. Number of filled pods per plant, number unfilled pods per plant, kernel yield per plot, shelling percentage, 1000 seed yield, dry biomass yield per plot, and dry matter yield per plots as yield parameters. The data were subjected to statistical analysis.

III. Results

Plant height (cm):

The effect of variety and intra-row spacing on plant height at different growth stages of groundnut is presented in table 1.The performance of the variety is significantly different ($p<0,01$) at all the growth stages of the crop. At four WAS SAMNUT 22 and SAMNUT 24 produced tallest plants SAMNUT 23 and Mai Bargo produces shortest plants. Spacing did not have any significant effect on plant at four WAS. At six WAS, SAM NUT 24 produces tallest plant while SAMNUT 10 produces shortest plant. Spacing 25 and 30cm produced tallest plants. At eight WAS, SAMNUT 24 produced tallest plant. There was no significant influence of spacing on plant height at eight WAS. The interaction variety and spacing was not significant.

Number of branches:

The effect of variety and intra-row spacing on number of branches at different growth stage is presented in table 2. At four WAS, the varieties performed similarly while at eight WAS SAMNUT 10 and 22 produced the highest number and the least number of branches. Intra-row spacing have any significant effect on number of branches.

Canopy Spread:

The effect of variety and intra-row spacing on canopy spread at different growth stage is presented in table 3.The performance of the varieties was significantly different ($p<0.05$) at all the growth stages crop. At four, six. And eight WAS, SAMNUT 24 produced widest canopy, while Mai Bargo produced least canopy spread. Intra-row spacing did not have any significant influence on canopy spread at all growth stages. The interaction was not significant.

Table 1. Effect of variety and intra row spacing on plant height.

Treatments	Weeks after Sowing (WAS)		
Variety	4	6	8
SAMNUT 10	18.22ab	24.78c	33.78b
SAMNUT 22	19.44a	28.11b	34.11b
SAMNUT 23	16.56b	25.67bc	34.22b
SAMNUT 24	19.78a	35.33a	49.00a
MAI BARGO	16.11b	24.67c	35.44b
SE±	0.83*	1.06**	1.43**
Spacing (cm)			
20	17.80	27.26ab	37.00
25	18.20	29.53a	37.47
30	18.06	26.33b	37.00
SE±	0.64	0.82*	1.11
Interaction (VxS)	NS	NS	NS

** = significant at 1%

*= significant at 5%

NS = not significant.

Table 2. Effect of variety and intra row spacing on number of branches.

Treatments	Weeks after Sowing (WAS)		
Variety	4	6	8
SAMNUT 10	6.89	8.56	12.89a
SAMNUT 22	7.00	8.89	12.33a
SAMNUT 23	6.22	7.67	10.11ab
SAMNUT 24	6.33	8.11	8.22b
MAI BARGO	6.44	8.22	13.11a
SE±	0.37NS	0.61NS	1.08*
Spacing (cm)			
20	6.40	7.93	10.60
25	6.53	8.66	12.40
30	6.80	8.26	11.00
SE±	0.640.29NS	0.47NS	0.84NS
Interaction (VxS)	NS	NS	NS

** = significant at 1%

*= significant at 5%

NS = not significant.

Table 3.Effect of variety and intra row spacing on canopy spread.

Treatments	Weeks after Sowing (WAS)		
Variety	4	6	8
SAMNUT 10	489.22b	1120.60b	1759.10b
SAMNUT 22	591.22ab	1427.60b	2161.10b
SAMNUT 23	444.56b	1124.00b	1725.10b
SAMNUT 24	688.56a	2660.90a	4182.70a
MAI BARGO	516.11ab	829.20b	2072.60b
SE±	60.52*	3392**	240.53**
Spacing (cm)			
20	519.13	1535.40	2240.10
25	605.13	1518.70	2578.50
30	513.53	1243.21	2321.70
SE±	46.88NS	303.95NS	186.31NS
Interaction (VxS)	NS	NS	NS

** = significant at 1%

*= significant at 5%

NS = not significant.

Number Of Filled Pods Per Plant:

Number of filled pods per plant, and number of pods per plant are presented in table 4. Variety had significant influence ($p<0.05$) on number of filled pods per plant. The highest number of filled pods was produced by SAMNUT 22 and SAMNUT 23 produced the least. The performance of the varieties was the same for number of unfilled pods. Intra row spacing significantly affected number of filled pods. The highest number of filled pods and pods per plants were recorded by 30cm. Table 4.

Nunber Of Pods Per Plant:

The number of pods per plot, kernel yield and number of pods plot was significantly ($p<0.05$) affected by variety. Local variety Mai Bargo produced highest number of pods per plot and SAMNUT 22 produced the least. The performance of varieties was the same for pod yield and kernel yield. Intra roe spacing did not have any significant influence on pod yield and kernel yield. Table 5.

Sheeling Percentage, Weight Of 1000 Seeds Yield, And Dry Biomass Per Plot:

The varieties performed significantly different for shelling percentage. The highest value of shelling percentage was recorded by SAMNUT 24 and SAMNUT 22, while the least value of shelling percentage was produced by local variety Mai Bargo. The performance of varieties 1000 seed weight was not significant. Dry biomass yield was significantly affected by variety. SAMNUT 24 produced highest dry biomass weight followed by Mai Bargo and SAMNUT 22 produced the least. Intra row spacing did not have any significant influence on shelling percentage, weight of 1000 seed and dry biomass yield per plot. The interaction between variety and spacing, shelling percentage, weight of 100 seed and dry biomass yield per plot were not significant as presented in Table 6.

Table 4. Effect of variety and intra row spacing on canopy spread.

Treatments	Weeks after Sowing (WAS)		
Variety	4	6	8
SAMNUT 10	22.22ab	17.33	39.56
SAMNUT 22	25.56a	17.44	43.67
SAMNUT 23	21.11b	17.56	36.11
SAMNUT 24	20.44b	17.56	38.00
MAI BARGO	23.11ab	19.55	42.67
SE±	1.37*	1.79NS	2.69NS
Spacing (cm)			
20	24.47a	19.47	43.93a
25	20.60b	17.46	37.46b
30	22.40ab	16.73	38.60ab
SE±	1.06*	1.39NS	2.08*
Interaction (VxS)	NS	NS	NS

** = significant at 1%

*= significant at 5%

NS = not significant.

Table 5. Effect of variety and intra row spacing on canopy spread.

Treatments	Weeks after Sowing (WAS)		
Variety	4	6	8
SAMNUT 10	302.44ab	312.67b	246.11
SAMNUT 22	222.00b	234.00	212.89
SAMNUT 23	298.00ab	295.11	190.22
SAMNUT 24	307.44ab	290.00	239.44
MAI BARGO	406.89a	372.33	239.56
SE±	55.01*	43.69NS	27.22NS
Spacing (cm)			
20	519.13	1535.40	2240.10
25	605.13	1518.70	2578.50
30	513.53	1243.21	2321.70
SE±	46.88NS	303.95NS	186.31NS
Interaction (VxS)	NS	NS	NS

** = significant at 1%

*= significant at 5%

NS = not significant.

Table 6. Effect of variety and intra row spacing on canopy spread.

Treatments	Weeks after Sowing (WAS)		
Variety	4	6	8
SAMNUT 10	81.49.a	1120.60b	1759.10b
SAMNUT 22	83.63ba	1427.60b	2161.10b
SAMNUT 23	78.03ab	1124.00b	1725.10b
SAMNUT 24	87.08a	2660.90a	4182.70a
MAI BARGO	67.00 b	829.20b	2072.60b
SE±	60.52*	3392**	240.53**
Spacing (cm)			
20	519.13	1535.40	2240.10
25	605.13	1518.70	2578.50
30	513.53	1243.21	2321.70
SE±	46.88NS	303.95NS	186.31NS
Interaction (VxS)	NS	NS	NS

** = significant at 1%

*= significant at 5%

NS = not significant.

IV. Discussion

It was observed that the varieties performed significantly ($p<0.05$) different at all the growth stages of the crop with respect to plant height. SAMNUT 24 produced tallest plant in all stages. This indicates that SAMNUT 24 responded more favourably to the growing condition of the study area.It was also observed that 25cm and 30cm produced taller plants than 20cm spacing. This is supported by the work of **Mukhtar (2005**) who observed that plant population significantly affect plant height.it was also observed that intra row spacing did not have significant influence on number of branches at all stages of growth as observed by Mukhtar (2005). Canopy spread in terms of variety performance significantly affected all growth stages with SAMNUT 24 producing the highest. Intra row spacing did not significant effect on canopy spread at all growth stages. The highest number of filled pods was produced byv30cm spacing. This explained the fact that he wider the spacing, the less the competition for nutrient, moisture, and light as observed by Chada (2006).

Even though SAMNUT 24 performed better in growth characters than the others, SAMNUT 22 performed better in terms of yield characters.

V. Conclusion And Recommendation

The result of the experiment showed that variety and intra row spacing significantly affected most of the growth and yield characters.SAMNUT 22 out yielded the other varieties while 30cm spacing produced highest yield. Based on the aforementioned, therefore, it can be concluded and reccome3nded that SAMNUT 22 is the most suitable variety and 30cm intra row spacing is the optimal spacing for groundnut production in the study area.

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