



RESPONSE OF TWO SESAME (*Sesamum indicum* L.) VARIETIES TO NITROGEN FERTILIZER IN WUKARI, TARABA STATE

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ABSTRACT

The productivity of any crop plant depends on its ability to grow fast and produce good yield. Nitrogen removal by crops under intensive cultivation and neglect of nitrogen replenishment contributed to widespread nitrogen deficiencies in arable soils. Study was conducted between July and September (rainy season) in 2019 and 2020 at the Teaching and Research Farm of Faculty of Agriculture and Life Sciences, Federal University Wukari, Taraba State, Nigeria to compare the growth and seed yield of two sesame (*Sesamum indicum* L.) varieties to nitrogen fertilizer application rates. The study involved two sesame Varieties (EX-SUDAN and local variety) and four nitrogen fertilizer rates (0, 50, 100 and 150 kg ha⁻¹) was laid out in 2 x 4 factorial arrangements fitted into a randomized complete block design (RCBD) and replicated three times. Data were collected on growth and at harvest on seed yield components. Results showed that both varieties had similar growth characters except the number of branches per plant which was higher in plants arisen from the local variety. Nitrogenous fertilizer had significant effect on growth characters. Plant height, number of branches and leaves increased with increasing nitrogenous fertilizer application rate. Higher number of capsules was observed on plants produced from local variety while plants from Ex-Sudan variety had higher 1000-seed weight. However, both varieties had comparable seed weight and yield. Nitrogenous fertilizer application enhanced seed yield components. The application of nitrogen fertilizer at 150 kg ha⁻¹ had the highest seed yield but comparable with the application rates of 50 and 100 kg ha⁻¹. The Local variety is suggested for sesame farmers due to higher number of branches and capsules fertilized with 50 kg N ha⁻¹ for sustainable production of the crop in Wukari.

Keywords: Fruit yield components; growth characters; nitrogenous fertilizer

INTRODUCTION

Sesame (*Sesamum indicum* L.) a member of Pedaliaceae family usually cultivated in the savannah zone for its nutritious and edible seed (Iwo *et al.*, 2002). All parts of the plant are useful. Leaves are used in preparation of vegetable soup while the seeds are consumed

when fried and mixed with sugar in most African countries and the stems are used in making paper, fuel wood and source of potash after burning. Excellent oil of quality can be extracted from the seed and utilized in the preparation of food, cosmetics, perfumes, insecticides, lubrication, and medicine (Babaji *et al.*, 2006). Due to the importance of this seed to human development, its demand is huge, yet its productivity in Nigeria is low being an average of about 0.421 t ha⁻¹ compared to 1.96 t ha⁻¹ in Venezuela, 1.083 t ha⁻¹ in Saudi Arabia, 0.517 t ha⁻¹ in Ivory Coast and 0.51 t ha⁻¹ in Ethiopia (Abubakar *et al.*, 1998). The low productivity could have been caused mainly due to low nutrient status of most tropical soils and the use of unimproved varieties among other factors.

The productivity of the crop could be raised by screening of the appropriate variety and augmenting the soil fertility through nitrogen application. Nitrogen application not only improved the yield but also improved the quality of crops (Tiwari and Gupta, 2006). Leaf area, crop growth rate, net assimilation rate index and yield components (number of capsules per plant, seeds per capsule, and 1000 seed weight) were improved with nitrogen fertilizer in sesame (Thakur and Patel, 2004). This study was to compare the growth and seed yield of two sesame varieties in response to nitrogen fertilizer application rates in Wukari, Taraba State, Nigeria.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Teaching and Research Farm of the Faculty of Agriculture and Life Sciences, Federal University, Wukari, Taraba State situated between latitudes 7.850⁰ and 7.51⁰ N and longitudes 9.47⁰ and 9.783⁰ E. It falls within the Northern guinea savannah. It is located within the Guinea savannah with annual rainfall and temperature range of 1200 -1800 mm and 28 and 30⁰C, respectively. Its characteristic alfisol soil is clay enriched with subsoil that has relatively high native fertility suitable for the cultivation of many crops (Franke and Rufino, 2011).

Experimental Design and Treatments

The study involved two sesame varieties (EX-SUDAN and local variety) and four nitrogen fertilizer rates (0, 50, 100 and 150 kg ha⁻¹) laid out in 2 x 4 factorial arrangements fitted into randomized complete block design (RCBD) and replicated three times. Each of the subplots measured 2 x 2 m (4 m²) with a spacing of 0.5 m apart between plots and 1 m space between blocks. Soil collected from the experimental field was made into composite soil sample and was air-dried and sieved through a 2 mm mesh and analyzed for its physical and chemical properties. The soil on the laboratory analysis had pH, organic carbon, total nitrogen, exchangeable Ca, Mg, K, Na and exchangeable acidity of 7.70, 23.00 g kg⁻¹, 0.18 g kg⁻¹, 3.06 mg kg⁻¹, 2.07 cmol kg⁻¹, 0.70 cmol kg⁻¹, 0.24 cmol kg⁻¹ and 0.18 cmol kg⁻¹ respectively.

Cultural Practices

The seeds were mixed with fine soil in 1:4 proportion and sown at a spacing 30 x 30 cm inter and intra row, a plant population of 111,111 per hectare. Two weeks after sowing,

they were thinned down to one plant per stand. Four levels (0, 50, 100 and 150 kg ha⁻¹) of Nitrogen fertilizer were applied in form of urea to the designated plots as per treatment in two equal splits two and five weeks after sowing by drilling method. Weeding was carried out manually with hoe, first at four weeks after sowing and subsequently as at when due.

Data Collection and Analysis

Five tagged plants were selected randomly from each plot for the data collection. Data were collected on growth characters (plant height, number of leaves and numbers of branches) at 10 weeks after sowing (WAS). At harvest, data were collected on seed yield components (number of capsules per plant, 1000 seed weight, seed weight per plant and seed yield). Analysis of variance was carried out on growth and yield component data recorded for each year of study, followed by combined analysis over two years. Least significant differences (LSD) test was used for detecting significant differences between treatments at 0.05 level of probability using Genstat statistical programme.

RESULTS

Growth of Sesame

The effect of nitrogenous fertilizer on the growth of sesame variety is presented in Table 1. Significant ($P < 0.05$) effect was only observed on number of branches for variety, while nitrogenous fertilizer application had significant effect on all growth characters as plants without its treatment had the lowest values for all the growth attributes. The growth characters increased with increase in its application rate and peak at the highest rate. Variety had no significant effect on plant height. The tallest plants were observed in plants treated with 150 kg N ha⁻¹. The local variety produced plants with the higher number of branches than Ex-Sudan plants. Only plants fertilized with 100 and 150 kg N ha⁻¹ had more branches than plants without fertilizer treatment.

Local and Ex-Sudan varieties gave rise to plants with comparable number of leaves. Only plants which received 100 and 150 kg N ha⁻¹ had higher number of leaves than plants without N fertilizer treatment.

Fruit Yield Components of Sesame

The results of the effect of nitrogenous fertilizer on seed yield components of sesame variety are presented in Table 2. The Local variety produced plants with higher number of capsules but less 1000-seed weight than plants produced from Ex-Sudan variety. However, both varieties had plants with similar seed weight and yield.

Nitrogenous fertilizer application influenced fruit yield components positively. Plant without nitrogenous fertilizer treatment had the lowest values in all the yield characters. The yield characters increased with increase in fertilizer rate. Plants which received 50 kg N ha⁻¹ had number of capsules similar with control plants. 150 kg N ha⁻¹ fertilized plants had the highest number of capsules but similar with plants which received 100 kg N ha⁻¹. Only plants treated with 150 kg N ha⁻¹ had higher 1000-seed weight than unfertilized plants. Plants treated with N fertilizer rates of 50 – 150 kg ha⁻¹ had similar seed weight but significantly higher than unfertilized plants. This trend was also repeated for seed yield.

Table 1: Effect of nitrogenous fertilizer application on the growth of sesame variety in July – September (rainy season) of 2019 and 2020

Treatment	Plant height (cm)			Number of branches			Number of leaves		
	FC	SC	Combined	FC	SC	Combined	FC	SC	Combined
Variety									
Local	156.80	159.50	158.10	10.92	12.08 ^a	11.50 ^a	258.50 ^a	274.00	266.00
Ex-Sudan	157.90	158.90	158.10	10.08	6.42 ^b	8.25 ^b	218.40 ^b	310.00	264.00
LSD _(0.05)	ns	ns	ns	ns	1.216	0.815	25.830	ns	ns
Rate of N fertilizer application (N kg ha ⁻¹)									
0	143.00 ^c	145.40 ^c	144.20 ^c	9.33 ^b	7.78 ^b	8.58 ^b	184.50 ^b	178.00 ^b	182.00 ^b
50	154.40 ^b	155.50 ^{bc}	154.90 ^b	10.17 ^{ab}	8.83 ^b	9.50 ^b	225.50 ^b	222.00 ^b	223.00 ^b
100	159.50 ^b	159.50 ^b	159.50 ^b	11.00 ^{ab}	9.50 ^{ab}	10.25 ^{ab}	246.80 ^b	492.00 ^a	370.00 ^a
150	172.60 ^a	175.30 ^a	174.00 ^a	11.50 ^a	10.83 ^a	11.17 ^a	297.00 ^a	275.00 ^b	286.00 ^{ab}
LSD _(0.05)	12.700	13.540	8.600	1.668	1.720	1.152	36.520	175.700	87.700
Interaction	ns	ns	ns	ns	ns	Ns	ns	ns	ns

ns - Not significant at 0.05 level of probability, FC - First cropping, SC - Second cropping

Table 2: Effect of nitrogenous fertilizer application on the yield components of sesame variety in July – September (rainy season) of 2019 and 2020.in July – September (rainy season) of 2019 and 2020

Treatment	Number of capsules			1000-seed weight (g)			Seed weight (g)			Seed yield (t ha ⁻¹)		
	FC	SC	Combined	FC	SC	Combined	FC	SC	Combined	FC	SC	Combined
Variety												
Local	55.70	62.40 ^a	59.00 ^a	2.48 ^b	2.50 ^b	2.49 ^b	6.98	6.80	6.92	0.77	0.75	0.76
Ex-Sudan	51.80	49.20 ^b	50.50 ^b	3.40 ^a	6.20 ^a	4.80 ^a	7.34	6.75	7.04	0.81	0.79	0.80
LSD _(0.05)	Ns	13.400	6.750	0.145	2.670	1.334	ns	ns	ns	ns	ns	Ns
Rate of N fertilizer application (N kg ha ⁻¹)												
0	45.80 ^b	46.70	46.20 ^b	2.74 ^b	2.70 ^b	2.72 ^b	6.03 ^b	5.45 ^b	5.74 ^b	0.66 ^b	0.60 ^b	0.63 ^b
50	50.80 ^b	52.20	51.50 ^b	2.95 ^a	3.00 ^b	2.98 ^b	7.33 ^a	7.26 ^{ab}	7.30 ^a	0.81 ^a	0.80 ^a	0.80 ^a
100	57.20 ^{ab}	59.20	58.20 ^{ab}	2.99 ^a	3.10 ^b	3.05 ^b	7.54 ^a	7.55 ^a	7.54 ^a	0.83 ^a	0.83 ^a	0.83 ^a
150	61.00 ^a	65.20	63.10 ^a	3.07 ^a	8.70 ^a	5.87 ^a	7.73 ^a	6.96 ^{ab}	7.35 ^a	0.85 ^a	0.86 ^a	0.85 ^a
LSD _(0.05)	8.64	ns	9.55	0.205	3.78	1.887	0.62	1.641	0.834	0.069	0.116	0.063
Interaction	ns	ns	ns	ns	ns	Ns	ns	ns	ns	ns	ns	ns

ns - Not significant at 0.05 level of probability, FC - First cropping, SC - Second cropping

DISCUSSION

Varieties used in this study showed differences in number of branches, number of capsules and 1000-seed weight. This observation agrees with Oplinger *et al.* (1990) who stated that sesame varieties significantly differ in seed yield, plant characteristics, and oil content as their fertilizer requirements and genotype differ. The differences between the two varieties could have arisen as a result of genetic factor. The higher number of branches accrued to plants arisen from the Local variety over the Ex-Sudan variety could be an advantage as it minimizes lodging and erosion. The higher number of branches can help to prevent direct impact of the rain drop on the soil surface than few number of branches thereby minimizing run-off.

The higher number of capsules exhibited by Local variety plant could probably be as a result of higher number of branches than Ex-Sudan variety. Since 1000-seed weight observed on Local variety was lower than those plants produced by Ex-Sudan, it implies that seeds obtained from the local variety plants were lighter than those produced from Ex-Sudan plants. However, both varieties had similar seed weight and yield. This is contrary to the finding of Nath *et al.* (2003) who indicated that sesame varieties were significantly different in seed yield.

The positive response of most of the measured growth and yield characters to applied N fertilizer was expected. This observation has earlier been reported by Kathiresan (2002). This is due to the fact that crop is known to respond positively to N fertilizer in soil with low N content as is the case in the present study where the soil total N content is less than the critical level. N plays a key role in the plant metabolism and synthesis of essential oil (Ajai-Singh *et al.*, 2000). It is also required for development of plant cell resistance and drought hardiness (Patel and Shelke, 1995) and constituent of a number of organic compounds (Shamina and Imamul, 2003), oil storage organs particularly oil glands (Jaggi *et al.*, 2000) and vitamin B₁ (Thirumalaisamy *et al.*, 2001). Nitrogen is a constituent of chlorophyll, nucleic and amino acid and thus play an important role in photosynthesis; the process that produce assimilates use for the development of different plant organ and hence result in increased growth (Das, 2009).

The increased growth is manifested in taller plants with higher number of branches and leaves which probably gave rise to higher seed yield components of the fertilized plants over unfertilized plants. The higher number of branches is a precursor to higher capsules after the pollination and fertilization of the flowers. The leaf is a photosynthetic organ and hence an organ of assimilates production. Higher number of leaves will enhance greater production of assimilates for onward translocation to the storage organ. Hence higher 1000-seed weight, seed weight and yield.

CONCLUSION

The study was conducted to determine the comparative growth and seed yield of two sesame (*Sesamum indicum* L.) variety to nitrogen fertilizer application rate. Both two varieties produced plants that had similarities in heights, number of leaves, seed weight and yield but differ in number of branches and capsules and 1000-seed weight.

Sesame plants responded very well to the nitrogen fertilizer application in terms of growth and yield. Nitrogenous fertilizer rate of 150 kg ha⁻¹ had the highest seed yield but comparable with rates of 50 and 100 kg ha⁻¹. Based on the results obtained in this study, it

can be concluded that application of 150 kg N ha⁻¹ gave the optimum seed yield per hectare of sesame in Wukari, Taraba State. Based on these findings, Local variety and nitrogenous application rate of 50 kg ha⁻¹ are thereby suggested for sesame farmers in Wukari environs for profit maximization and sustainable production of the crop.

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