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Performance of Two Varieties of Sesame (*Sesamum indicum*) as Affected by Intra-Row Spacing and Nitrogen Levels

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ABSTRACT

The experiment was conducted at the Teaching and Research Farm of the Abubakar Tafawa Balewa University, Bauchi (Lat: 10° 17'N and 9° 49' E and 609m above sea level) during the 2008 and 2009 wet season. The treatments consisted of two varieties (Ex-Sudan and Ex-530), three intra-row spacing (10, 15 and 20cm) and three nitrogen rates (0, 30 and 60kg/ha). The experiment was laid out into a split plot (2x3x3 factorial) design with three replications. Parameters observed were number of leaves per plant, leaf area, number of flowers and number of capsules. The variety Ex-Sudan produced significantly (P≤0.05) higher number of leaves of sesame plant than Ex-530 in both years of the experiment. Similarly, the use of 10cm intra-row spacing produced significantly (P≤0.05) higher number of leaves than all other intra-row spacing in the 2009 season. The variety Ex-530 produced significantly (P≤0.05) higher leaf area than did variety Ex-Sudan in 2009 season at 6 and 10 WAS. However, at 8 WAS the variety Ex-Sudan produced significantly (P≤0.05) higher leaf area than Ex-530. The variety Ex-530 was found to be significantly (P≤0.05) higher in number of capsules per plant and yield than Ex-Sudan. The interaction effects among sesame variety, Nitrogen levels, and intra row spacing factors were not clearly understood, and the development at this stage should require further investigation. However, based on the results of present study maximum number of flowers and number of capsules per plant were observed in favour of variety Ex-530, and this variety, can thus, be recommended for cultivation by farmers in Bauchi area.

KEYWORDS: Performance, spacing, Nitrogen, variety

INTRODUCTION

Sesame is an important edible oil seed crop. The seeds contain all the essential amino acids and fatty acids and is a good source of vegetable oil, vitamins and minerals, and also an important nutrient for livestock feed (Balasubramaniyan and Palanlapan, 2001). The crop was first grown in the middle belt of Nigeria in the late 1940's (Idowu, 2002) and is now cultivated in about 15 states of Nigeria and areas across the Sudan and Guinea Savanna agro-ecologies (Ingawa *et al*., 1986). Although the crop was not given adequate attention in terms of cultural management practices as was done to other crops in the past, it has now gain wide recognition and acceptance among farmers for the economic importance of its oil in the international market (Weiss, 1983; Coote, 1998). Sesame growth and yield is highly variable depending upon the growing environment, cultural practices and cultivars (Brigham, 1985).

The yielding ability of sesame crop is determined by many yield components all of which are substantially influenced by variety, environmental conditions and agronomic packages. However, improved and high yielding varieties of sesame can give 15-40% more yield than the local cultivars (Anonymous, 1996). Osman (1993) found that sesame genotypes varied in yield and yield components as well as their response to nitrogen application. Similarly Wakjira *et al*. (1993) reported that improved sesame cultivars like Adi, Argane and Sarkam produced significantly higher yield than local cultivars. Shinde *et al*. (1994) substantiated that new sesame cultivars gave 14-34% more seed yield than the local cultivars. Abdulrahman *et al.* (2007) reported a significant difference in the number of capsules, number of branches number of flowers, 1000 seeds weight and seed yield among sesame genotypes, and attributed the differences to the genetic constitution of the varieties tested.

The effect of plant spacing on the growth and yield of sesame varieties varies significantly from place to place and is considered as an important factor for obtaining profitable and sustainable crop yield. There are also many sesame cultivars with different growth habit which are grown in the Northern Guinea Savanna and these cultivars may respond differently to spacing which may be unique to each genotype. Many contrary results were observed by many researchers as regards the effect of intra-row spacing on the growth and yield of sesame (Rahnama and Bakhshandeh, 2006; Nandita *et al.,* 2009) that due to proper spacing plants can gain sufficient sunlight, water and nutrients from soil which can influence crop yield. Nandita *et al.* (2009) reported that yield and yield attributes of sesame varied significantly with spacing. They reported that the narrower spacing produced lower number of capsules. On the other

hand, maximum number of capsules was obtained at wider spacing which could be attributed to less inter and intra-row plant competition. Similar trend in the number of capsules in sesame was also reported by Wahhab *et al*. (2002).

The use of fertilizer is considered as one of the most important factors to increase crop yields per unit area. The application of nitrogen to sesame has been reported to increase number of capsules per plant, seed per capsule, 1000-seed weight, seed yield, plant height, number of branches and protein content (Malik *et al*., 1990; sinharary *et al*., 1990; Jadhav *et al*., 1992; Rawar, *et al*., 1993; Ishwar *et al*., 1994; Mankar *et al*., 1995). Also, Osman (1995) found that sesame genotypes varied in yield and yield components as well as in response to nitrogen application.

The objective of this study is to evaluate the performance of two varieties of sesame as affected by different intra row-spacing and nitrogen rates.

MATERIALS AND METHODS

The study was conducted at the Teaching and Research Farm of the Abubakar Tafawa Balewa University, Bauchi, during the 2008 and 2009 wet season. Bauchi is located in the Northern Guniean Savanna agro-ecological zone of Nigeria (Kowal and Knabe, 1972) on Lat: 10° 17'N and 9° 49' E, and on altitude of 609m above sea level. The treatments consisted of two varieties (Ex-Sudan and Ex-530), three intra-row spacing (10, 15 and 20cm) and three nitrogen rates (0, 30 and 60kg/ha). The treatments were administered in main plots (varieties) and sub-plots (intra-row spacing; Nitrogen levels) respectively in a 2x3x3 split-plot factorial design with three replicates.

The experimental site was ploughed and harrowed twice to obtain a fine tilth in both years. The field was then marked out into plots of 2x3m ($6m^2$). A working path of 1m was allowed between replications and 0.5m between plots. The gross and net plot areas were $6m^2$ and $1.5m^2$, respectively. The seeds of the different sesame varieties were obtained from Bauchi State Agricultural Development Programme and were sown according to treatment in July of each year at the seed rate of 15kg/ha. After germination, the seedlings were thinned to obtain the prescribed intra-row spacings, and also to maintain one seedling per stand. Single super phosphate (19% P_2O_5) was applied, while one-half of the nitrogen (Urea, 46%) was also applied to the experimental plot during sowing and the other half at 6 weeks after sowing (WAS) according to the treatments. Weeding (using hand hoe) was carried out at 4, 6 and 8

WAS, to obtain a weed free site. Pest control was achieved following standard chemicals, notably, Cymbush Super EC EC (Cypermethrin) at the rate of one litre per hectare at the pre- and post-flowering stages at fortnightly intervals. Fifteen plants from two middle rows of each of the 36 plots were randomly selected and tagged for data collection on parameters assessed which included plant height, number of flowers, number of capsules, and total yield.

The collected data were analyzed statistically using the ANOVA and F test techniques by Steel and Torrie (1981). Least significant difference (LSD) was used to separate the significantly different means and their interactions.

RESULTS AND DISCUSSION

Number of leaves and Leaf area (cm)

The effect of variety, spacing and nitrogen rates on the number of leaves of sesame during the 2008 and 2009 wet seasons are presented in (Tables 1a and 1b). The effect of variety was found to be significant on the number of leaves of sesame at 6 WAS in both 2008 and 2009 seasons. The variety Ex-Sudan produced significantly ($P \leq 0.05$) higher number of leaves of sesame plant than did variety Ex-530 in both years of the experiment. However, at 4, 8 and 10 WAS, the number of leaves was not significantly affected by variety in both 2008 and 2009 seasons. Similarly, at 6 WAS, in the 2009 season the effect of intra-row spacing was found to be significant on the number of leaves of sesame (Table 1b).

The 10cm intra-row spacing produced significantly ($P \leq 0.05$) higher number of leaves than all the other intra-row spacing levels in the 2009 season. Tables 2a and 2b show the effect of variety, spacing and nitrogen rates on leaf area during the 2008 and 2009 wet seasons. Variety's effect on the leaf area of sesame was found to be significant at 6, 8 and 10 WAS in 2009 season only (Table 2b), whereby at 6 and 10 WAS, variety Ex-530 produced significantly ($P \leq 0.05$) higher leaf area than did variety Ex-Sudan in 2009 season (Table 2b). However, at 8 WAS the variety Ex-Sudan produced significantly ($P \leq 0.05$) higher leaf area than did variety Ex-530. On the other hand, the effect of variety was not significantly felt on the leaf area of sesame in the 2008 wet season (Table 2a). Similarly, the effect of spacing and nitrogen rates did not significantly affect the leaf area of sesame in both 2008 and 2009 Wet seasons (Table 2a and 2b). The data on the number of leaves per plant, and on the leaf area seem to be fluctuating which could be attributed to the fact that the varietal differences did not contribute to the crop's performance of the parameters measured. However, it is observed in this study that the

increasing levels of intra-row spacing regardless of nitrogen level positively affected vegetative growth and yield of the sesame crop.

Table 1a: Effect of Variety, Spacing and Nitrogen levels on the Number of leaves of Sesame at various growth stages during the 2008 rainy season

Treatments	Weeks after sowing			
Varieties	**4**	**6**	**8**	**10**
Ex-sudan	9.72	14.82a	40.6	51.2
Ex-530	8.23	12.12b	42.7	41.3
LS	NS	*	NS	NS
LSD (0.05)	-	2.27	-	-
Spacing (cm)				
10	9.78	14.67	37.9	48.0
15	8.28	13.00	41.8	46.0
20	8.87	12.74	45.3	44.8
LS	NS	NS	NS	NS
LSD (0.05)	-	-	-	-
Nitrogen (kg/ha)				
0	9.16	13.88	43.7	48.6
30	9.13	13.85	43.6	44.3
60	8.65	12.71	37.6	45.9
LS	NS	NS	NS	NS
LSD	-	-	-	-

N*S =Not significant; * = Significant at 5 and 1% level of probability;*
LS =Level of Significance

While these findings were in contrast to those by Tiwari *et al*, (1990), they agreed with those by Gamanmarty (1988) who reported maximum number of leaves and leaf area of sesame with intra row spacing of 20cm.

Number of flowers per plant and Number of capsule per plants

The effect of variety on the sesame number of flowers in 2008 season was significant (Table 3). The variety Ex-530 produced significantly ($P \leq 0.05$) higher number of flowers than variety Ex-Sudan only at 6 WAS in 2009.

However, the effects of spacing and nitrogen rates were not significant in affecting the number of flowers in both years of the experiment. Differences in number of flowers among varieties of sesame could attributed to the genetic constitution of the different genotypes (Abdulrahman et al, 2007). The effect of variety spacing and nitrogen rates on the number of capsules per plant and total seed yield of sesame during the 2008 and 2009 wet seasons are presented in Table 4.

The effect of variety was not significant on the number of capsules during the 2008 wet season. The number of capsules was significantly (P≤0.05) affected by sesame variety at 10 WAS during the 2009 wet season. The variety Ex-530 was found to have significantly higher number of capsules than the Ex-Sudan variety.

Table 1b: Effect of Variety, Spacing and Nitrogen levels on the Number of leaves of Sesame at various growth stages during the 2009 rainy season

Treatments	**Weeks after sowing**			
Varieties	**4**	**6**	**8**	**10**
Ex-Sudan	71.2	16.11a	47.0	44.9
Ex-530	12.5	14.68b	44.6	51.3
LS	NS	*	NS	NS
LSD(0.05)	-	3.78	-	-
Spacing (cm)				
10	8.1	29.25a	47.4	48.5
15	8.4	13.86b	44.5	43.3
20	13.0	13.09b	45.5	52.5
LS	NS	*	NS	NS
LSD(0.05)	-	4.87	-	-
Nitrogen(kg/ha)				
0	9.5	14.53	38.7	48.1
30	8.3	14.02	48.7	47.0
60	11.7	17.65	49.9	49.2
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-

N*S =Not significant; * = Significant at 5 and 1% level of probability;*
LS =Level of Significance

Table 2a: Effect of Variety, Spacing and Nitrogen levels on the Leaf Area of Sesame at various growth stages during the 2008 rainy season

Treatments	Weeks after sowing			
Varieties	**4**	**6**	**8**	**10**
Ex-Sudan	25.0	28.8	28.3	19.08
Ex-530	20.7	23.7	28.0	17.97
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-
Spacing (cm)				
10	24.2	27.5	31.1	18.21
15	22.5	26.5	24.8	18.62
20	21.9	24.7	28.5	18.75
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-
Nitrogen(kg/ha)				
0	23.5	26.3	30.5	18.96
30	21.8	24.8	28.7	16.35
60	23.3	27.7	25.3	20.27
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-

N*S =Not significant; * = Significant at 5 and 1% level of probability;*
LS =Level of Significance

Number of capsules, however were not significantly affected by spacing and nitrogen levels during the period of the experiment. Differences in in number of capsules has been attributed to the genetic background of the crop as published by Abdulrahman *et al*, (2007) and Fathy *et al*. (2009) who reported significant differences on number of capsules per plant among different varieties of sesame.

Table 2b: Effect of Variety, Spacing and Nitrogen levels on the Leaf Area of Sesame at various growth stages during the 2009 rainy season

Treatments	Weeks after sowing			
Varieties	**4**	**6**	**8**	**10**
Ex-Sudan	28.1	30.6b	34.1a	17.5b
Ex-530	33.5	42.7a	31.5b	23.9a
LS	NS	*	*	*
LSD(0.05)	-	7.00	7.56	6.04
Spacing (cm)				
10	34.8	42.3	32.7	22.2
15	30.8	36.1	32.9	19.7
20	26.8	31.4	32.8	20.4
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-
Nitrogen(kg/ha)				
0	27.5	32.9	32.7	19.6
30	35.3	42.2	31.6	20.6
60	29.6	34.7	34.1	22.0
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-

N*S =Not significant; * = Significant at 5 and 1% level of probability; LS =Level of Significance*

Table 3: Effect of Variety, Spacing and Nitrogen levels on number of flowers of Sesame during the 2008 and 2009 rainy season

	Number of flowers per plant			
Treatments	**2008**		**2009**	
Varieties	**4WAS**	**8WAS**	**6WAS**	**8WAS**
Ex-Sudan	5.67	14.40	2.73b	16.40
Ex-530	4.17	12.90	5.25a	12.80
LS	NS	NS	*	NS
LSD(0.05)	-	-	1.92	-
Spacing (cm)				
10	4.83	13.00	3.81	15.70
15	4.79	12.50	4.59	14.10
20	5.13	14.50	3.54	14.00
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-
Nitrogen(kg/ha)				
0	5.65	15.30	3.69	13.70
30	4.66	11.20	3.89	14.90
60	4.44	14.50	4.35	15.20
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-

N*S =Not significant; * = Significant at 5 and 1% level of probability; LS =Level of Significance*

Table 4: Effect of Variety, Spacing and Nitrogen levels on number of capsules of Sesame during the 2008 and 2009 rainy season

	Number of capsules per plant			
Treatments	**2008**		**2009**	
Varieties	**8WAS**	**10WAS**	**8WAS**	**10WAS**
Ex-Sudan	8.81	26.5	12.5	26.8b
Ex-530	11.03	21.6	13.1	37.8a
LS	NS	NS	NS	*
LSD(0.05)	-	-	-	6.24
Spacing (cm)				
10	9.46	23.4	15.2	39.0
15	9.19	24.7	12.0	29.7
20	11.11	24.0	11.2	28.2
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-
Nitrogen(kg/ha)				
0	10.27	22.9	13.6	30.4
30	10.56	25.0	12.0	36.4
60	8.92	24.2	12.7	30.1
LS	NS	NS	NS	NS
LSD(0.05)	-	-	-	-

N*S =Not significant; * = Significant at 5 and 1% level of probability; LS =Level of Significance*

CONCLUSION

The results of this study, aimed to assess the effects of variety, intra-row spacing, and levels of Nitrogen fertilizer application, appeared to be devoid of interaction effects; and the effects due to the main factors were not significant across most of the parameters tested and displayed. Therefore, it would be pertinent to state that further research should be contemplated to factor in sources such as location and season or to adopt other analytical options which could facilitate the highlighting of the interaction among sesame variety, Nitrogen rate, and intra row spacing levels. In the meantime, it is recommended that based on the present findings, the variety Ex-530 with better yield attributes (number of flowers and number of capsules per plant) should be the better choice for cultivation of the crop by farmers in Bauchi.

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