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Sesame (*Sesame indicum* L.) Growth, Yield, Yield Components and Weed Infestation as Influenced by Different Sowing Methods and Seed Rates in a Sudano-Sahelian Savanna Agroecology of Nigeria II

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Abstract: Trials were conducted during year 2001 and 2002 rainy season to determine the influence of sowing method and seed rate on sesame growth, yield and yield components and weed infestation at Ngala, Borno State, Nigeria. Results showed that broadcast method of sowing produced taller plants and higher number of pods and flowers per plant compared with drilling method both in year 2001and 2002 and the average of the two years. However, drilling method produced lower weed dry matter and weed cover compared with broadcast method in the two years and average of the two years data. The number of pods/plant and plant height increased with increase in seed rate reaching a peak at 6 kg ha^{-1} seed rate and thereafter these characters declined. The number of flowers produced per plant also declined with increase in seed rate. Seed yield per hectare increased with increase in seed rate, reaching a peak at 6 kg ha^{-1} and then declined in 2001and the average of the two years data. There was no interaction between sowing method and seed rate.

Key words: Sesame production, sowing methods, seedrates, weed control, seed yield

INTRODUCTION

Sesame (*Sesamum indicum* L.) is a crop of great antiquity and probably one of the most ancient oil seed crops under cultivation (Weiss, 1983). The major sesame growing countries are China, India, Mexico and Sudan (Onwueme and Singha, 1991; Sigmund and Gustav, 1991). Apart from Benue and Kogi States of Nigeria where Sesame is mainly produced, Ingawa *et al.* (1986) reported that most of the north eastern parts of Nigeria are also involved in the production of sesame. Sesame crop is grown as sole crop in some of these parts of Nigeria and in others; it is grown as a mixture with sorghum (*Sorghum bicolor* (L.) Moench) and millet (*Pennisetum glaucum* L.) R.Br, the two popular cereals in this ecological zone.

Sesame is a very useful crop as its oil is used for the manufacture of margarine, salad oils, cooking oils among other things (Ryu *et al*., 1992). In the sesame growing areas of Nigeria, the seeds and leaves are useful for the preparation of soaps (Van Rheenen, 1973). Furthermore, sesame has been reported to be an effective trap crop for controlling *Striga harmonthica* in both sorghum and millet in the Sudano-Sahelian agroecology of Nigeria (Hudu and Gworgwor, 1998; Gworgwor *et al.,* 2001). However, sesame seed yield is the lowest among the oil seed crops in the world. This is because the crop is still grown as a minor crop in poor soils and without an appropriate production package (Desai and Gloyal, 1981).

Research carried out on sesame revealed that yield per hectare increased with increasing plant population until a level is reached which is hardly exceeded as density increased further (Bleasdale, 1966; Menon, 1967; Gerakis and Tsangerakis, 1969; Gupta, 1982) and that of Weiss (1971) who reported the superiority of row planting over broadcasting in controlling weeds as a lone factor which leads to considerable yield increases.

Although, a lot of work has been done on sesame in the Guinea savannah agro ecology of Nigeria, no research has been carried out on it as a sole crop in the Sudano-sahelian agro ecology of Nigeria. Also, there is no production package for sesame in the Sudano-sahelian agro ecology that will help farmers to optimize their yields. It becomes imperative therefore to carry out this research with the objective of determining the influence of sowing method and seed rate on sesame growth, yield and yield components and weed infestation in Ngala in the Sudano-sahelian zone of Nigeria.

MATERIALS AND METHODS

The experiment was conducted during the 2001 and 2002 rainy seasons (July-October) on the Regional

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Table 1: Physico-chemical characteristics of the soil from experimental sites at Ngala, in 2001 and 2002

Soil characteristics	2001	2002
%Sand	72.60	55.30
%Silt	19.65	26.20
%Clay	17.95	18.50
Textural class	Sandy loam	Sandy clay loam
Chemical properties		
pH (in H_2O)	5.54	5.9
Carbon (%)	0.39	0.57
Organic matter (%)	0.67	0.08
Available $P_2$05(p.p.m)	136.5	98
Total nitrogen (%)	0.062	1.0
Exchangeable cations meq per 100g soil		
Ca	1.65	4.78
Mg	1.08	1.73
K	0.27	0.28
Na	4.40	1.20
C.E.C	8.22	8.95

Agricultural Training School Farm Ngala, Borno State (120 20'N;140 11'E). The physico-chemical analysis of the soil of the experimental site is presented in Table 1. The total amount of rainfall received for 2001and 2002 were 572.0 and 481.0 mm, respectively.

The experiment consisted of 10 treatments, which included 2 sowing methods (Broadcast and Drilling at 90 cm inter-row) and 5 seed rates (3, 6, 9, 12 and 15 kg ha^{-1}). The experiment was laid out in a split plot design replicated 3 times, where the method of sowing was allocated to the main plot and the seed rate was allocated to the sub-plots. The experimental site was harrowed, levelled properly using a hand hoe and marked out. The size of each sub-plot measured 6×8 m leaving a distance of 1 m between replications and 0.5 m between main and sub plots. Fertilizer at the rate of 75 kg N ha^{-1} and 50 kg P ha^{-1} was applied to each plot in two equal split doses, first at planting and second dose at 6 WAS plots with broadcast seeds, while it was placed 15 cm away from the stand in a continuous band in the drilled plots. Sesame variety Gwoza local was sown on 27 and 31 July, 2001 and 2002, respectively. Weeding of the plots was carried out at 3 and 6 WAS, using a simple hand hoe, while thinning was not done.

Four inner rows of each plot in the drilled method of planting were harvested, first and last rows of each drilled plots were discarded while in the broadcast plots a margin of 1.65 m was left on either side of each plot and the inner crop was harvested. Data taken included plant height, number of flowers $plant^{-1}$, number of pods per plant, weed cover per plot and seed yield per hectare. All data were subjected to Analysis of Variance (ANOVA) and the Duncan's Multiple Range Test (DMRT) was used to compare means at 5% level of probability according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The soil of the experimental site (Table 1) was sandy loam to sandy clay loam with low organic matter. It was slightly acidic with low exchangeable bases and CEC. Drilling method of sowing produced taller plants in 2001 compared to broadcast method. However, in 2002 and the average of the two years data, broadcast method of sowing produced taller plants though the difference was not significant in all cases (Table 2). This could be due to greater inter and intra-plant competition for nutrients and moisture in broadcast plots compared with drilled plots. However, with lower amount of rainfall in 2002, the competition for moisture and nutrients was more critical in drilled plots, hence the shorter plants in the drilled plots compared to the broadcast crop (Weiss, 1983; Ndarubu, 1997; Imoloame, 2004).

Plant height increased with increase in seed rate up to 6 kg ha^{-1} and thereafter declined with further increases in seed rate in 2001, 2002 and the average of two years data. However these differences in plant height was not significant This could result from higher inter and intra plant competition for growth resources of light, moisture, space and plant nutrients (Weiss, 1983; Ndarubu, 1997; Imoloame, 2004). The interaction between seed rate and sowing method on sesame plant height was also not significant (Table 2).

Broadcast method of sowing produced higher number of flowers per plant compared with drilling method in 2001, 2002 and that of 2 years data, although, the difference in the number of flowers between the 2 sowing methods was not significant at 10WAS (Table 2). This could be attributed to higher intra plant competition for plant nutrient, moisture and space in the drilled crop compared with the broadcast crop (Imoloame, 2004).

The number of flowers decreased with increase in seed rate. The 3 kg seed rate produced the highest number of flowers per plant in 2001, 2002 and the average of two years data. This could be due to inter and intra plant competition for growth resources. The interaction between seed rate and sowing method on number of flowers per plant was not significant (Table 2).

In 2001, 2002 and average of two years data, broadcast method produced higher weed cover and weed dry matter compared with the drilling method at harvest. However, the difference was only significant in 2002 (Table 3). This could be due to the difficulty associated with weeding under the broadcast plot and the easier and more effective weeding in the drilled plot (Imoloame, 2004). Also, the higher plant population in the drilled plot could have facilitated effective canopy closure in the drilled plot compared with the broadcast

Table 2: Influence of sowing method and seed rate on plant height at harvest and number of flowers per plant at 10WAS at Ngala, 2001 and 2002

	Plant height (cm)			Number of flowers per plant at 10 WAS[1]		
Treatment	2001	2002	Mean[2]	2001	2002	Mean
Sowing Method(SM)						
Drilling	115.8a	136.3a[3]	124.0a	73.2a	32.7a	52.9a
Broadcast	113.6a	139.4a	124.4a	82.5a	39.5a	61.0a
SE (±)	8.94	2.77	7.29	11.53	3.31	5.43
Seed Rate (SR) kg ha^{-1}						
3	114.2a	136.5a	123.9a	92.2a	35.4a	63.78a
6	118.4a	141.1a	127.7a	74.6a	33.7a	54.15a
9	115.6a	139.8a	126.7a	78.8a	38.8a	58.78a
12	120.3a	137.0a	124.5a	73.2a	31.9a	52.57a
15	104.9a	134.8a	118.8a	70.4a	40.6a	55.53a
SE(±)	7.95	3.80	4.79	15.39	6.03	9.3
Interaction						
SM×SR	NS[4]	NS	NS	NS	NS	NS

1 = Weeks after sowing. 2 = Average of two years data. 3 = Means followed by the same letter(s) within a column are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT). 4 = Not significant

Table 3: Influence of sowing method and seed rate on weed cover scorer and total weed dry matter at Ngala, 2001 and 2002

	Weed cover score[1]			Total weed dry matter (Kg ha^{-1})		
Treatment	2001	2002	Mean[2]	2001	2002	Mean
Sowing Method (SM)						
Drilling	4.0a[3]	1.7b	2.80a	224.0a	0.22a	112.1a
Broadcast	4.6a	3.5a	4.0a	230.4a	0.36a	115.4a
SE (±)	0.93	0.20	0.37	57.60	0.18	28.84
Seed Rate (SR) kg ha^{-1}						
3	4.5a	3.2a	3.8a	273.3a	0.43a	136.90a
6	5.5a	2.2a	3.8a	165.5a	0.18a	82.84a
9	3.8a	2.2a	3.0a	223.9a	0.29a	112.10a
12	32.a	3.2a	3.1a	156.7a	0.23a	78.50a
15	4.3a	2.2a	3.2a	306.5a	0.18a	153.34a
SE (±)	1.47	0.54	0.79	123.48	0.18	59.68
Interaction:						
SM×SR	NS[4]	NS	NS	NS	NS	NS

1 = On a scale of 0 to 10 where 0= no weed cover and 10 complete weed cover. 2 = Average of two years data. 3 = Means followed by the same letters within a column are not significant at 5% level of probability using Duncan's Multiple Range Test (DMRT). 4 = Not significant

plot which could have further suppressed the weeds, (Imoloame, 2004). Both weed cover and weed dry matter decreased with increase in seed rate in 2001, 2002 and the average of two years data. However, the observed difference was not significant (Table 3). This could have been due to the fact that higher seed rate resulted in higher plant population which facilitated earlier and effective canopy cover which helped in smothering the weeds. This is in agrees with Dougherty (1969) who proposed that shading of weeds by quickly formed canopy of soybean planted in narrow rows account for more efficient weed control than in wide rows. The highest weed dry matter produced at 15 kg ha^{-1} seed rate could be due to the difficulty associated with weeding at that rate, coupled with the slow growth rate of crop which delayed closure of canopy, encouraging weed competition with the crops.

In 2001, the drilling method produced higher number of pods per plant, than that of broadcast method. In 2002 and the average of the two years data, however, broadcast method of sowing produced higher number of pods per plant compared with drilling method, although it was only in 2002 that the difference was significant (Table 4). This could have resulted from the intra plant competition that existed under the drilling method compared with broadcast method of sowing for growth resources of moisture, nutrients and space. This agrees with Imoloame (2004) who reported higher number of pods per plant produced under broadcast method compared with drilling method due to intra-plant competition under drilling method. In 2001, the number of pods decreased with increase in seed rate. However, in 2002 and the average of the two years data, the number of pods per plant increased with increase in seed rate up to 6 kg ha^{-1} and there after the number of pods per plant declined with 15 kg ha^{-1} seed rate producing significantly the least number of pods per plant (Table 4). This could be as a result of intra and interplant competition for growth resources at higher seed rates (Imoloame, 2004). The interaction between seed rate and sowing method on number of pods plant^{-1} was not significant.

Drilling method produced higher seed yield per hectare compared with broadcast method in 2001, 2002 and the average of the two years data. However, the

Table 4: Influence of sowing method seed rate and on the number of pods per plant at 12WAS and grain yield kg ha^{-1} at Ngala 2001 and 2002 cropping seasons

	Number of pods per plants			Seed yield kg ha^{-1}		
Treatment	2001	2002	Mean[2]	2001	2002	Mean
Sowing Method (SM)						
Drilling	122.2a[2]	55.8b	88.9a	174.7a	455.7a	315.2a
Broadcast	118.9a	88.3a	103.6a	155.0a	322.6b	238.8b
SE(±)	1.21	2.90	9.42	37.53	15.24	30.25
Seed Rate (SR)kg ha^{-1}						
3	137.1a	82.5a	109.8ab	162.2a	378.6b	270.4a
6	125.9a	97.0a	111.4a	156.7a	557.0a	356.8a
9	110.6a	64.4a	87.50bc	182.4a	329.3b	255.8a
12	124.5a	59.1b	91.80bc	193.7a	375.7b	284.7a
15	104.7a	57.3bc	81.0c	129.1a	305.2b	217.2a
SE(±)	20.27	11.0	11.50	41.60	77.49	47.83
Interaction:						
SM×SR	NS[3]	NS	NS	NS	NS	NS

1 = Average of two years data. 2 = Means followed by the same letter(s) is not significant at 5% level of probability. 3 = Not significant

difference in yield between the two sowing methods was only significant in 2002 and average of the two years data (Table 4). This could be due to the higher plant population under drilling method compared with the broadcast method. Also, the lower weed infestation in the drilled plot compared with the broadcast plot might have contributed to the less amount of growth resources available to the broadcast crop (Imoloame, 2004). In 2001 and 2002 and the average of the two years data, seed yield per hectare decreased with increase in seed rate with 6 kg ha^{-1} seed rate producing the higher grain yield compared with higher seed rates in 2002 and the average of two years data. 6 kg ha^{-1} seed rate produced significantly higher grain yield compared with other tested seed rate (Table 4). This could have resulted from the higher inter and intraplant competition for growth resources beyond the 6 kg ha^{-1} seed rate. This is in agreement with Imoloame (2004), who reported that 6 kg ha^{-1} seed rate produced the highest sesame seed yield in the semi-arid region and beyond this rate the yield declined. The interaction between seed rate and sowing method on grain yield was not significant.

CONCLUSION

The results revealed that drilling method of sowing and 6 kg ha^{-1} seed rate were the best treatments for Ngala situated in the Sudano-sahelian region of Nigeria.

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