Productivity of Sesame (*Sesamum indicum* L.) Varieties as Influenced by Seed Rate.

U.A. Umar, M.Sc. [1*]; A.H. Muntaqa, B.Sc.[1]; M.B. Muhammad, M.Sc.[2] and H.J. Jantar, M.Sc.[3]

[1]Agricultural Research Council of Nigeria (ARCN) Plot 223D, Cadastral Zone B6, Mabushi, Abuja, Nigeria.
[2]Samaru Collage of Agriculture, Ahmadu Bello University, Zaria, Nigeria.
[3]Department of Agronomy, Institute for Agricultural Research, Ahmadu Bello University, Zaria, Nigeria.

E-mail: umarabdullahi2003@yahoo.com*

ABSTRACT

A field trial was conducted during the dry season of 2013 at the Institute for Agricultural Research Institute (IAR) farm at Samaru latitude (11°11n, Longitude 7°38E and 686m above sea levels in the Northern Guinea Savannah) Ecological zone of Nigeria. The treatments consisted of three sesame varieties (E8, Pbtil, and Ex-Sudan) and three seed rates 2.0, 3.5, and 5.0kg/ha. The treatments were arranged in a Randomized Complete Block Design (RCBD) with three replications. The results showed that increase in seed rate from 2.0 to 5.0kg/ha decrease plant height, number of branches, and total dry matter per plant. A similar trend was observed for number of capsules, and grain yield per plant. However, grain yield per hectare was found to have increased with an increase in seed rate up to 3.5kg/ha. Further increases beyond this decrease the grain yield per hectare.

The results further showed that Pbtil produced significantly taller plants but showed a decreased number of branches and total dry matter compared to E8 and Ex-Sudan. The variety, Ex-Sudan, produced significantly higher number of capsules, grain yield per plant and grain yield per hectare compared to E8, which in turn performed better than Pbtil in these characters. Based on the results obtained in this trial, it can be concluded that Ex-Sudan planted at seed rate of 3.5kg/ha gave the highest grain yield of sesame; it is therefore more suited to Samaru ecology.

(Keywords: sesame, seed rate, variety, productivity)

INTRODUCTION

Sesame belongs to the family *Pedaliaceae*, genus *Sesamun* and three species namely *indicum*, *alatum* and *radiatum*. It is one of the oldest cultivated oil crops in the world. In Africa, sesame is known as benne. The word sesame is of semitic origin, reaching the English in the 15th century via Greek *Sesamon* and latin *Sesamum* (Kafiriti and Mponda, 2009). Sesame or benniseed is cultivated in almost all tropical and subtropical Asian and African countries for its highly nutritious and edible seeds (Iwo, *et al.,* 2002).

Sesame is described in the ancient medical text of India and China for preserving health, preventing disease and promoting general wellbeing, and it has been verified scientifically 20 years ago by a research team in Japan (Erbas, *et al*., 2009). The seeds serve as ingredients in soup and a source of oil, and the cake after oil extraction is used for livestock feed (Biswas, *et al.*, 2001). Sesame is grown mainly for its seeds that contain approximately 50% oil and 25% protein (Burden, 2005). The presence of some antioxidants (sesamum, sesamolin or sesamol) makes the oil to be one of the most stable vegetable oils in the world.

Sesame yield is highly variable depending upon the growing environment, cultural practices, and cultivars (Brigham, 1985). Genotypes vary in their adaptability to different growing conditions. The yield ability of sesame crop is determined by many yield components, all of which are substantially influenced by environmental conditions and agronomic practices (Adeyemo, *et al.*, 1991; Caliscan, 2004).

Farmers in Nigeria were reported to have not adequately adopted improved recommendations on seed rate, inter and intra row spacing or plant population densities, which have led to under or over population that ultimately result in low yield (Adebisi, *et al*., 2005). There are also serious discrepancies among researchers on suitable seed rates, plant populations, and inter- and intra-row spacing, which were attributed to wide genetic variability of the crop and its adaptability to many soils and climatic conditions (Adebisi 2004; Olowe 2004). The objective for the study is to determine the optimum seed rate for optimum growth and yield of sesame varieties and to determine the best variety suitable for cultivation under Samaru ecology.

MATERIAL AND METHODS

The field trial was conducted during the dry seasons of 2013 at the Institute for Agricultural Research (IAR) farm, Samaru latitudes (11^o11 N, Longitude 7^o38 E and 686m above sea levels in the Northern Guinea Savannah) ecological zone of Nigeria. The treatments consist of three sesame varieties (E8, Pbtil *and E*x-Sudan) and three seed rates (2.0, 3.5, and 5.0kg/ha). The treatments were arranged in randomized complete block design and replicated three times.

The gross plot size was 3.75m x 3.0m ($13.5m^2$) consisting of five rows, each measuring 3.0m in length and spaced 0.75m apart. The net plot size was 1.5m x 3.0m ($4.5m^2$) consisting of the two inner rows. A mixture of one part of sesame seed calculated base on the treatment mixed with two parts of river sand was sown manually at a shallow depth of about 1cm, by drilling on rows spaced 75cm apart. Sowing was done in the month of February 2013. Irrigation was done on a weekly basis until the crop reached four weeks. Thereafter irrigation was performed every five days until a week before harvest.

Fertilizer was applied at the rate of 50kgN/ha, 45kgP_2O_5/ha and 30kgK_2O/ha using urea (46%N), SSP (16%P_2O_5) and MOP (60%K_2O), respectively. P and K were applied at planting while N was applied in two equal split doses at planting and at five weeks after sowing. Weeds were controlled by hoe weeding at three and six weeks after sowing. There were no serious insect pests and diseases experiences during the period of the trial. The crop was harvested when the crop was fully matured. Threshing was done manually by gently beating the sacks with stick to separate the seeds from the capsules. Data was collected from five randomly sampled plants at 6 and 10 WAS and at harvest to determine the plant height, number of branches, total dry matter, number of capsules, grain yield per plant. The grain yield per hectare was determined from the harvest of the net plot. The data collected was analyzed for Analysis of Variance (ANOVA) using Statistical Analysis System software (SAS version 9.3). The means were separated using Duncan multiple range test (DMRT) Duncan, (1955).

RESULTS

The plant height, number of branches and total dry matter per plant responses of sesame varieties to seed rates is presented in Tables 1, 2, and 3, respectively. At both 6 and 10 WAS, increases in seed rate from 2.0 to 3.5kg/ha resulted in significant decreases in plant height, number of branches and total dry matter per plant. Further increases to 5.0 kg/ha also resulted in significant decreases in these characteristics. The plant height response of varieties to seed rates showed that Pbtill significantly produced taller plants compared to both E8 and Ex-Sudan, while Ex-Sudan in turn significantly produced taller plants than E8.

The number of branches response of varieties to seed rates showed that E8 and Ex-Sudan statistically produced the same number of branches which are significantly higher than Pbtill. The total dry weight per plant response of varieties to seed rates showed that, at 10WAS, Ex-Sudan significantly produced higher dry weight per plant compared to both E8 and Pbtill, while E8 in turn significantly produced more dry weight per plant than Pbtill. At 6WAS the three varieties produced relatively the same dry weight statistically.

The number of capsules and grain yield per plant response of sesame varieties to seed rates is presented in Tables 4 and 5. Increases in seed rates from 2.0 to 3.5 kg/ha resulted in significant decreases in the number of capsules and grain yield per plant. Further increases to 5.0 kg/ha also resulted in significant decreases of these characteristics. The number of capsules and grain yield per plant response of varieties to seed rates showed that, Ex-Sudan statistically produced higher number of capsules and grain yield per plant than Pbtill and E8, while in turn E8 significantly produced higher number of capsules and grain yield per plant than Pbtill.

The grain yield per hectare response of sesame varieties to seed rates is presented in Table 6. Increases in seed rate from 2.0 to 3.5 kg/ha resulted in significant increases in the grain yield per hectare. Further increases to 5.0 kg/ha resulted in significant decreases in grain yield per hectare. However, a seed rate of 2kg/ha produced significantly higher grain yield per hectare than 5.0kg/ha. The grain yield per hectare response of varieties to seed rates showed that, Ex-Sudan statistically produced higher grain yield per hectare than Pbtill and E8, while in turn E8 significantly produced higher grain yield than Pbtill.

Table 1: Effect of Seed Rate and Variety on Plant Height per Plant of Three Sesame Varieties during the 2013 Dry Season at Samaru (cm).

Seed rate (kg/ha)	**Weeks after sowing**	
	6 WAS	**10 WAS**
2.0	28.6a	67.8a
3.5	27.2b	65.4b
5.0	26.4c	61.8c
SE±	0.008	0.045
Variety		
E8	27.0c	64.2c
PBtill	27.8a	65.7a
Ex- Sudan	27.3b	64.9b
SE±	0.095	0.123

Means followed with different letter within each treatment are statistically different at 5% level of significance.

Table 2: Effect of Seed Rate and Variety on Number of Branches per Plant of Three Sesame Varieties during the 2013 Dry Season at Samaru.

Seed rate (kg/ha)	
2.0	4.9a
3.5	4.6b
5.0	2.9c
SE±	0.089
Variety	
E8	4.2a
PBtill	3.8b
Ex- Sudan	4.4a
SE±	0.089

Means followed with different letter within each treatment are statistically different at 5% level of significance.

Table 3: Effect of Seed Rate and Variety on Total Dry Weight per Plant of Three Sesame Varieties during the 2013 Dry Season at Samaru (g).

Seed rate (kg/ha)	Weeks after sowing 6WAS	10WAS
2.0	3.1a	8.6a
3.5	2.3b	7.5b
5.0	2.1c	7.1c
SE±	0.10	0.045
Variety		
E8	2.4	7.8a
PBtill	2.4	7.6b
Ex- Sudan	2.5	7.9c
SE±	0.032	0.045

Means followed with different letter within each treatment are statistically different at 5% level of significance.

Table 4: Effect of Seed Rate and Variety on Number of Capsules per Plant of Three Sesame Varieties during the 2013 Dry Season at Samaru.

Seed rate (kg/ha)	
2.0	56.9a
3.5	50.8b
5.0	39.7c
SE±	0.370
Variety	
E8	49.0b
Pbtill	45.6c
Ex- Sudan	52.8a
SE±	0.370

Means followed with different letter within each treatment are statistically different at 5% level of significance.

Table 5: Effect of Seed Rate and Variety on Grain Yield per Plant of Three Sesame Varieties during the 2013 Dry Season at Samaru (g).

Seed rate (kg/ha)	
2.0	6.5a
3.5	5.3b
5.0	4.3c
SE±	0.113
Variety	
E8	5.4b
PBtill	4.9c
Ex- Sudan	5.8a
SE±	0.113

Means followed with different letter within each treatment are statistically different at 5% level of significance.

Table 6: Effect of Seed Rate and Variety on Grain Yield per Hectare of Three Sesame Varieties during the 2013 Dry Season at Samaru (kg/ha).

Seed rate (kg/ha)	
2.0	670.9b
3.5	886.3a
5.0	643.1c
SE±	7.99
Variety	
E8	731.9b
PBtill	700.2c
Ex- Sudan	768.2a
SE±	7.99

Means followed with different letter within each treatment are statistically different at 5% level of significance.

DISCUSSION

The significant decrease of plant height and total dry matter at both sampling periods and number of branches at harvest could be due to high plant population associated with high seed rate. High plant population tends to exert pressure on scarce growth resources such as light, space, moisture and nutrients thereby leading to reduced growth. This agreed with finding of Caliskan, (2004). Reduced values for growth parameters due to increase in seed rate must have been responsible for the decrease in the number of capsules, capsules yield and grain yield per plant, which also may be attributed to higher competition between individual plants due to high plant population.

The grain yield per hectare increases with increase in seed rate from 2.0 to 3.5kg/ha signifies that the optimum seed rate could not have been reached. However, the decrease in grain yield per hectare when the seed rate was raised to 5.0kg/ha signifies that, this seed rate must have been beyond the optimum seed rate for good sesame productivity. This agreed with the finding of Adebisi, *et al.,* (2005).

The increased plant height for Pbtil at both sampling periods compared to E8 and Ex-Sudan may be attributed to its few branches and less total dry matter compared to the other two branches. Higher number of branches and total dry matter of Ex-Sudan and E8 must have been responsible for their higher number of capsules, capsules yield, grain yield per plant and grain yield per hectare compared with Pbtil. This phenomenon may be attributed to the genetic make of these varieties. A wide genetic variability of sesame varieties was earlier reported by Adeyemo, *et al.* (1991)

SUMMARY AND CONCLUSION

Increasing seed rate from 2.0 to 5.0kg/ha was found to have decreases plant height, number of branches and total dry matter. A similar trend was observed for number of capsules, capsules yield and grain yield per plant. However, grain yield per hectare was found to have increase with increase in seed rate up to 3.5kg/ha, further increase beyond this rate decreases grain yield per hectare.

The response of the varieties showed that, Pbtil significantly produces taller plants, but showed a decreased number of branches and total dry matter compared to E8 and Ex-Sudan. Variety Ex-Sudan significantly produces higher number of capsules, capsules yield, grain yield per plant and grain yield per hectare compared to E8, which in turn performed better than Pbtil. Based on the result obtained in this trial, it can be concluded that, Ex-Sudan planted at seed rate of 3.5kg/ha gave the highest grain yield of sesame; it is therefore more suited to Samaru ecology than E8 and Pbtill.

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