https://dx.doi.org/10.4314/dujopas.v9i2b.12
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 9 No. 2b June 2023*

Effect of Soil Types and Sowing Methods on Growth and Yield of Some Varieties of Sesame (*sesamum indicum* L.) Grown in Dutse, Jigawa State.

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Abstract
A field trial on the effect of soil types and sowing methods on growth and yield of some varieties of sesame (sesamum indicum L.) was conducted at school farm Federal University Dutse Jigawa state (latitude 11.00˚N to 13.00˚N and longitude 8.00˚E to 10.15˚E) during the 2019 rainy season. The treatments used were three soil types (Clay, loam, sand) and two sowing methods (drilling and dibbling). Two varieties of sesame namely EX-Sudan and E8 were used. A split-split plot design was used. Result showed that the number of leaves, number of capsules per plant 1000 seed weight and seed yield per plant were significantly affected by sowing method with drilling method producing the highest seed yield per plant and variety had significant effect on number of leaves per plant, days to 50% flowering and maturity and seed yield per plant with EX-Sudan manifesting the highest yield per plant. The interaction between varieties were only significant on number of capsules/plant while between sowing method and variety was only significant on seed yield per plant. Interaction between variety and soil type showed that V1S1 (EX-Sudan and Loamy soil) had the highest influence on plant growth parameters while V2S2 (E8 and Sandy soil) had the lowest. The results indicated that drilling is the best sowing method, loamy soil is the best soil type for growing sesame while the variety EX-Sudan produced the highest seed yield and seed quality of sesame more than the E8 variety. Thus, farmers could be recommended to adopt these agronomic practices using EX-Sudan for increased sesame production in the Sudan savanna ecological zone of Nigeria.
Keywords: Dibbling, EX-Sudan, Sesame, Soil, Variety.

INTRODUCTION
Sesame (*sesamum indicum L.*) is an oil crop that belongs to the family of pedaliaceae and genus sesamum. The genus consists of about 36 species of which 19 species are indigenous to Africa Sesame (sesamum indicum L.) is a diploid species (2n = 26), a member of the family Pedaliaceae . Known as Beniseed, Gingelly, Sim-sim and Til. It is grown throughout the tropic and sub-tropic from 25°N to 25°S (Ashri, 1998). The origin of sesame is Africa, and from there spread through West Africa to India, China and Japan which themselves become secondary distribution centres (Ramanathan, 2004). Sesame is one of the most important oilseed crops in Sudan, both for local consumption and for export (Ahmed, 2008). It is widely grown under rain fed conditions; it ranks third after sorghum and millet area wise. In 2008, the World production was about 3,603,006 tons produced from 7,534,201 ha. Higher Producers are India

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(666,000 MT), Myanmar (620,000 MT), China (586,408 MT) and Sudan (350,000 MT) covering about 61.7% of the total World production (FAOSTAT, 2009).

In Nigeria it is known as "Ridi" by the Hausa's, "Etuku" by the Yoruba's and "Isasa" by the Igbo's. Sesame is a broad leaf of crop of pedaliaceae family with bell shape flowers that ranges from white, pink and mauve colour. The leaves are borne opposite; it is an annual plant, erect and its height can reach up to 1-2_m when planted under high moisture condition. It is indeterminate in growth habit (Onweme and Shinha, 1991) it has a high heat and light requirements and sensitive to low temperature of about 27^oC, its usually grown in area with an annual rainfall of 500-1100_{mm} it can tolerate short period of drought once established, but it does not tolerate high weed competition especially at early stage of growth, water logging and excessive rain fall. Sesame was domesticated in Ethiopia and later spread to India and other parts of the world (Onweme and Sinha, 1991; Ndarubu 1997). The crop is now grown in the sub-tropical and tropical regions of Asia and Africa. The major sesame growing countries includes China, India, Mexico, Sudan, Russia, Nigeria, Australia and South America (Onweme and Sinha 1991; Raemakers 2001). In Nigeria the crop is mostly cultivated in the derived and Guniea savanna and the Arid and Sahel zones with large positions in Jigawa, Kaduna, Katsina, Taraba, Benue, Kogi, Nasarawa, and Abuja (Philips 1997; Busari *et al*., 1998 and Olam, 2008).

In Nigeria, sesame production is low due to a number of constraints which include among others, farmers access to improve varieties, appropriate agronomic practices, drought and low soil productivity. However, research on varietal performance, sowing methods have been scanty particularly in Sudan savannah. Thus, there is need to identify suitable varieties and appropriate sowing method for high production of sesame in Nigeria. This research is undertaken in order to determine the effect of sowing and soil types on growth and yield of sesame using two varieties of sesame. In Nigeria sesame production is low due to a number of constraints which include among others, farmers access to improve varieties, appropriate agronomic practices, drought and low soil productivity. In spite these problems however, the crop has a lot of potentials to replace Groundnut especially in the drier north where climatic conditions are favorable for crop growth. Currently, groundnut production in the predominant Kano and Jigawa states has seriously declined due to drought and incidence of the groundnut rosette virus (Haruna, 2010) and this necessitated the need to promote an alternative vegetable oil crop such as sesame At present studies on sesame agronomic practices in Nigeria, are mostly on plant population, fertilizer rate, sowing dates, row spacing's in the Guinea savannah zone. However, research on varietal performance, sowing methods have been scanty particularly in Sudan savannah. Thus, there is need to identify suitable varieties and appropriate sowing method for high production of sesame in Nigeria.The implication of this study indicated that drilling is the best sowing method, EX-Sudan out yielded E8. Thus, farmers could be recommended to adopt these agronomic practices using EX-Sudan for increased sesame production in the Sudan savanna ecological zone of Nigeria.

MATERIALS AND METHODS

Study site

The experiment was conducted at the School farm of Federal University Dutse, Department of Biological Sciences. Dutse is located in a semi-arid environment characterized by Sudan and Guinea savanna vegetation. Rainfall in the region is unimodal, starting from May to September and a dry season starting from October through April. The average temperature is

around 42°C during the hottest period and 32°C during the coldest period, January. The site lies within the Sudan savannah ecological zone of Nigeria.

Experimental treatments

The treatments used were two sowing methods (dibbling and drilling) and three types of soil. Two varieties of sesame (EX-Sudan and E8) were used. The experiment was randomized and laid out in a split-split plot design with three replications. The sowing method was assigned to the main plot the variety to sub-plot and was allocated to the sub-plot. Two varieties of sesame (EX Sudan and E8) were procured from Jigawa State Agricultural Supply Company (JASCO) and the three soil types from Federal University Dutse botanical garden and the soil analysis was carried out at the Department of Soil Science Federal University Dutse.

Soil preparation

The three types of soil were collected from School farm using polythene bag, the sowing was carried out by using two methods: Dibbling: by making a hole and Drilling: by scratching the soil.

Sowing

Seeds of two varieties were weighed using sensitive balance, the different seed rates weight were sown using the two sowing methods according to treatment and randomization.

Data collection

Data was collected on the following:

Plant Height, Number of Leaves per Plant, Number of branches per plant, Number of branches per plant, Number of capsules per plant, Days To 50% Flowering, Days To 50% Maturity, Days To 50% Maturity, 1000-Seed Weight and Seed Yield per Plant

Statistical analysis

Data was collected and was subjected to analysis of variance (ANOVA) using SAS system for windows Duncan multiple range test (DMRT), Correlation analysis was carried out to determine the degree of associations between yield and growth.

RESULTS

Germination test

The result of germination test is presented in t Table1 (EX-Sudan and E8,) showed no significance difference at $p > 0.05$ on the effect of soil types on the two varieties of sesame at eight days after germination. Both varieties of sesame (EX-Sudan and E8) which were planted on clay soil were the first to germinate on the sixth and seven days after planting, the same two varieties that were planted on loamy soil germinated seven days after planting. Lastly the same two varieties that were planted on sandy soil were those that germinated on the seventh and eight days after planting and were the last to germinate among the three varieties of soil. The result showed no difference among the two varieties of sesame (EX-Sudan and E8) at $p > 0.05$ but showed little significance difference on soil types as stated above.

Table 1: Days to germination after planting with total and percentage germination rate

T/C	6 days	7 days	8 days	Total	Percentage
V1S1	6	0	0	6	66.7%
V1S2	0	7	0	7	57.1%
V1S3	0	7	0	7	57.1%
V2S1	0	7	0	7	57.1%
V2S2	0	7	0	7	57.1%
V2S3	0	7	0	7	57.1%
V3S1	0	7	0	7	57.1%
V3S2	0	0	8	8	50%
V3S3	0	0	8	8	50%

The result in table 1 showed no significant difference on the effect of soil types on germination of the two varieties of sesame plant because (p> 0.05).

Comparison between soil types and variety of sesame on Plant height

The effect of soil types and variety of sesame is given in Table 2. Throughout the sampling period soil types did not affect plant height. Only at 4 WAS variety had effect on plant height where E8 was taller than EX-Sudan. Planting at 2.4kg had produced shorter plants while the other treatments were at par. The interactions between M × V or V × S were significant at (p> 0.05). It was observed that V1S2 (EX-Sudan and Loamy soil) had the highest influence followed by V2S3 (E8 and Sandy soil) with the lowest plant height.

Table 2: Effect of soil types on heights of the two varieties of sesame plants (cm)

T/C	WK 1	WK 2	WK 3	WK 4	WK 5
V1SI	1.5	4.2	9	14.2	23.2
V1S2	1.2	3.3	5.5	7.3	12.7
VIS3	1.5	2.2	4.5	5.1	9.4
V2S1	1.3	4.1	8.7	14.3	25.03
V2S2	1.7	3.6	6.3	8.8	16.1
V2S3	1.5	2.7	4.8	6.9	12.2
V3S1	1.4	4.8	11.3	17.1	23.7
V3S2	1.5	3.7	6.9	10.6	16.7
V3S3	1.1	3.5	4.7	7.1	11.4

Comparison between sowing method and variety on plant height of sesame

The effect of sowing method and variety on plant height is given in Table 3. There was significant difference at (p> 0.05) between dibbling and drilling method at 10 and 12 weeks after sowing, where drilling method recorded the highest plant height with 95.21cm and 199 cm respectively. With regards to the variety, E8 recorded the highest plant height at 4,6,8 and 10 weeks after sowing with 7.81cm, 27.44cm, 45.3 cm and 94.60cm respectively more than the EX-Sudan and the difference was significant at (p> 0.05).

Table 3: Effect of sowing method and variety on plant height of sesame

Treatment	Plant height (cm) at				
	4 WAS	6 WAS	8 WAS	10 WAS	12 WAS
Sowing method (M)					
Dibbling	7.81	25.02	43.70	91.03	130.0
Drilling	7.32	25.67	41.0	95.21	199.0
S.E±	0.11	1.85	2.23	2.40	7.00
Variety (V)					
EX- Sudan	6.45	24.00	38.0	90.5	110.1
E8	7.81	27.44	45.3	94.60	110.3
S.E±	0.30	1.713	2.75	2.70	6.00

Means followed with the same letter (s) within a treatment are not significantly different at 5% level of probability using Duncan multiple range test (DMRT).

Comparison between sowing method and variety on number of leaves/plant

The effect of sowing method and variety on number of leaves/plant is presented in Table 4. Sowing method had effect on number of leave/plant at 10 and 12 WAS where drilling method produced lower number of leaves/plant than dibbling. Variety had significant effect on number of leave/plant at 4 to 10 WAS with E8 being superior to EX-Sudan. However at 12 WAS both varieties had similar number of leaves per plant. There was no significant effects on number of leaves per plant across the sampling stages.

Table 4: Effect of sowing method and variety on number of leaves/plant of sesame

Treatment	**Number of leaves/plant**				
	4 WAS	**6WAS**	**8WAS**	**10WAS**	12WAS
Sowing method (M)					
Dibbling	6.872	21.61	33.5	128.4a	99.8a
Drilling	7.211	21.11	31.3	101.0b	98.9b
S.E ±					
Variety (V)					
EX-Sudan	6.500	15.43b	30.7b	115.5b	99.9b
E8	7.577a	25.7a	23.2a	133.0a	211.2
S.E ±					

Means followed with the same letters (s) within a treatment are not significantly different at 5% level of probability using Duncan multiple range test (DMRT).

Comparison between sowing method and variety on days to flowering, maturity, number of branches and capsules of sesame

The effect of sowing method and variety on number of days to flowering and maturity, number of branches and capsules of sesame is given in Table 4. Only variety had effect on number of days to flowering and maturity in which E8 flowered and matured later than EX-Sudan. Number of branches per plant was not affected by sowing method and variety. Similarly, variety had no significant effect on number of capsule per plant. Drilling method produced statistically similar and superior number of pod per plant compared with dibbling method.

Table 5: Effect of sowing method and variety on phenology and yield of sesame.

Treatment	No. of days To flowering	No. of days to maturity	No. of branches per plant	No. of capsules per plant
Sowing method (m)				
Dibbling	60	81	3.56	75.1a`
Drilling	61	81	3.86	44.6b
S.E ±	0.88	0.96	0.45	4.75
Variety (V)				
EX- Sudan	54.1b	72.0b	4.45	70.7a
E8	64.0a	88.0a	5.52	66.7b
S.E ±	0.65	0.65	0.63	3.15
				N

Means followed with the same letter (s) within a treatment are not significantly different at 5% level of probability using Duncan multiple range test (DMRT).

Comparison between sowing method and variety on 1000 Seed weight, yield/plant

The effect of sowing method, variety on 1000-seed weight yield per plant is presented on Table 6. Dibbling method produced significantly heavier seeds compared with Drilling method. However, the difference between dibbling and drilling methods were not significant.

Variety and seed rate had no significant effect on 1000-seed weight where dibbling produced heavier 1000-seed weight which was statistically similar to drilling method. All interactions on 1000 seed weight were not significant sowing method and variety had no significant effect on seed yield per plant. Drilling method produced the highest seed yield followed by dibbling. However, the difference between drilling and dibbling was not significant variety EX Sudan was superior in term of seed yield per plant compared to E8.

Table 6: Effect of sowing method and variety on seed yield per/plant and 1000 seed weight of sesame

Treatment	1000 seed Weight (g)	Seed yield per plant (g)
Sowing method (m)		
Dibbling	3.524a	6.25
Drilling	3.21ab	5.42
S.E ±	0.065	0.53
Variety (v)		
EX-Sudan	3.343	6.46
E8	3.411	6.48
S.E ±	0.084	0.53
		N

Means followed with the same letter (s) within a treatment are not significantly different at 5% level of probability using Duncan multiple range test DMRT.

DISCUSSION

The taller plants and greater number of leaves/plant observed dibbling in both sites could be attributed to inter and intra plant competition associated with dibbling method which made the crops to compete more for growth factors compared to other methods. These agreed with the findings of Weiss (1983) that dibbling method of sowing produced taller plants and higher dry matter production when compared with drilling method. However, with regards to number of branches per plant, dibbling and drilling gave significantly ($p \leq 0:05$) higher and similar number of branches per plant in three soil types compared to dibbling. This must be connected to the fact that the crop vie for space, light and nutrients more critically in dibbling method compared to other sowing methods. This coincides with earlier assertions by Olowe and Busari (1994) that number of branches per plant increase linearly with increase in inter and intra row spacing.

Similarly, the higher number of capsule/plant observed on drilled plots in both sites, were influenced by larger number of branches per plant associated with the two methods as observed in the present study. This is in line with earlier notation made by Imoloame *et al.,* (2007) that greater number of capsules/plants was obtained with drilling method of sowing compared to dibbling method.The seed yield per plant were significantly higher with drilling method compared to dibbling method. This is linked with recent findings similar to this study that drilling methods gave higher number of capsules per plant. The higher number of capsules and the green colour of the capsules symbolized the presence of chloropyll in the capsules that made the capsules to produce assimilates as well as storing it and subsequently contributing to the yield of sesame. The interaction between sowing method and variety on seed yield is an indication of the differential response of the varieties to environmental conditions. Although both recorded highest yield with drilling, the yield of variety E8 was similar with drilling, showing its superior adaptability to growing conditions.

The differences in plant height between the two varieties could be genetic as a similar report was made by Riaz. *et al.,* (2002) on two different sesame varieties (TS_3 and 92001). Thus genetic variability among the two sesame varieties could have explained the differences among them in respect of number of leave/plant, number of branches, capsules/plant and other characters in both locations. Variety was found to have been affected in days to 50% flowering and maturity of sesame. EX- Sudan attained 50% flowering and maturity earlier than variety E8 at both sites. This is in line with the report of Fathy and Mohammed (2008) in which they found that Saudi local cultivar flowered later than Shadaweel cultivar. Similar observations were reported by Abdurrahman et al., (2007) on number of branches and flowers per plant. The significant difference in number of capsules/plant in both sites could be due to variation in growth habit between the two varieties. This is in line with earlier assertion by Adeyemo and Ojo (1993) that variety has significant effect on number of capsules/plant. Variety EX- Sudan excelled variety E8 in terms of yield in both sites despite higher number of leaves and branches per plant recorded with variety E8 in both sites. This must be connected to genetic variability of the two sesame varieties. This agreed with findings of Fathy and Mohammed (2008) had a similar report that seed yield of Saudi local variety was superior to the yield of other two varieties.

CONCLUSION

In conclusion the results indicated that drilling is the best sowing method for sesame, loamy soil is the best soil type for growing sesame while the variety EX-Sudan produced the highest seed yield and seed quality of sesame more than the E8 variety.

Farmers could be recommended to adopt the drilling method of sowing and loamy soil type for growing EX-Sudan variety so as to increase sesame production in the Sudan savanna ecological zone of Nigeria.

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