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Research Article

Yield Performance of Sesame (*Sesamum indicum* L.) Varieties as Influenced by Sowing Dates and Intra-Row Spacing in the Sudan Savanna, Nigeria

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ABSTRACT
Bilocation trials were conducted in 2023 wet season to investigate the productivity of sesame varieties as influence by varieties, sowing date and intra-row spacing at the Teaching and Research Farm of Federal University Dutsin-Ma and College of Agriculture, Hassan Usman Polytechnic, Katsina. The treatments were 3 sesame varieties (EX-SUDAN, KENANA-4 and E8), 3 sowing dates (First, second and third weeks of July), and 4 intra-row spacings (10cm, 15cm, 20cm and 25cm). Using a split plot design with sowing dates and intra-row spacing as main plot treatments and variety as sub-plot treatment and replicated 3 times. EX-SUDAN was better than other varieties in term of number of capsules, number of seeds per capsule, 1000 seed weight, seed yield per plant and seed oil yield. Additionally, EX-SUDAN produced more seeds per hectare in Dutsin-Ma (659.19 kg ha^{-1}) and Katsina (596.44 kg ha^{-1}). Second week of July had higher seed output per hectare in Dutsin-Ma (696.31 kg ha^{-1}) and Katsina (608.31 kg ha^{-1}) compared to the first and third weeks of July, However, seed oil and crude protein were higher during the first week of July,.There was a remarkable increase from the lower spacing of 10 cm (612.19 Kg ha^{-1}) to the higher spacing of 25 cm (671.33 Kg ha^{-1}), and from (504.78 Kg ha^{-1}) to (663.56 Kg ha^{-1}) in Dutsin-Ma and Katsina respectively. In conclusion, EX-SUDAN variety seeded in second week of July with Intra-row spacing of 25 cm is suggested at the study area for a higher yield.

Keywords: Intra-row spacing; Parameters; Sowing date; Variety; Yield

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INTRODUCTION

Sesame (*Sesamum indicum* L.) commonly known as Benniseed is one of the cultivated oil seed crops in the world. Sesame is ranked sixth in the world's production of oil seeds and eighth in the world's vegetable oil production (FAO, 2018). World production in 2018 was 6 million metric tons, with Myanmar, Sudan, and India as the largest producers (FAOSTAT, 2020). Benniseed was introduced in Nigeria after World War II and cultivated as a minor crop in Northern and Central Nigeria until 1974, when it began to gain prominence as a major crop (Madina, 2020). In Nigeria, Sesame is widely grown in the Middle Belt, Northern, and Central Nigeria as a minor crop. It became a significant cash crop in many northern states, including Benue, Jigawa, Nasarawa, and Taraba, which are among the largest producers in the country. Other major producers include Borno, Gombe, Kano, Katsina, Kogi, Plateau, and Yobe States (Arora, 2024). Nigeria produces over 580,000 tonnes of Sesame Seeds every year. Sesame Seeds have now become Nigeria's largest exported agricultural product as at the end of the year 2018, with the potential to generate over $4 billion US dollars in

revenue on a yearly basis by the activities of sesame seeds exporters in Nigeria (Stan, 2020).

The potentials for sesame production in Nigeria were high. This has led to the growth in demand for sesame and its products both at the national and international levels and is considered the queen of oil seeds for its high oil content and quality (Olawuyi *et al*., 2023).

The reason for the popularity of sesame seeds is due to its numerous health and industrial benefits. Also, the seed has a higher oil content compared to other oilseed crops. Sesame oil which is extracted from the seeds is useful in the cosmetic industries for producing body lotions and creams. Sesame oil contains both insecticidal and anti-fungal properties, that were added to formulations to help coat plant surfaces and used as a surfactant (Yahaya, 2023).

The performance of the crop is affected by factors such as climatic, nutrients, water availability, inter and intra-specific competitions, pest and diseases, as well as socio-cultural and socioeconomic factors among other things. Usman *et al*. (2021) further reported that traditional sesame growers rarely use improved varieties to increase the yield, studies have shown that the crop performs well with improved varieties. According to Eifediyi *et al*. (2018), cultivating the crop early in the season predisposes it to vegetative growth and pest invasion. In addition, Muhammad *et al*., (2020) further reported that using the appropriate sowing date, planting method and variety gave the highest mean values. It has been reported that inadequate spacing obstructs or shrinks rhizosphere and photoshere available for the plant to explore and exploit for growth, invariably decreases full expression of growth parameters and thereby hinders accumulation of dry matter (Adesoji e*t al*., 2020).

maximizing sesame productivity is crucial for enhancing agricultural profitability and addressing food security challenges. Understanding the influence of varieties, sowing date and intra-row spacing on sesame productivity will enable farmers to adopt appropriate cultivation practices and optimize yields. Maximum light interception is realizable when optimum plant space is made available beginning from early stage of growth of the plant (Rajesh *et al*., 2017). To improve sesame yield in the study area, the use of suitable varieties, appropriate sowing dates and adequate spacing must be adopted. In order achieve this, the research was conducted to determine the yield performance of sesame varieties as affected by sowing date and intra-row spacing in the Sudan Savanna of Nigeria

MATERIALS AND METHODS

Experimental Site and Soil

The Experiment was conducted during the 2023 wet season at two different locations: Research and Teaching Farm of Faculty of Agriculture, Federal University Dutsin-Ma permanent site (11^0 68'N, 8^0 36'E and 443m above sea level) and the Research and Teaching Farm of College of Agriculture, Hassan Usman Katsina Polytechnic, Katsina ($11^0$49`N, $7^0$ 23`E and 428 m above sea level). The annual rainfall of the study duration was 422.4 and 388.1mm for Dutsin-Ma and Katsina, respectively. The 30cm top soil samples of the experimental sites were taken before planting and analysed for physical and chemical analysis following the standard procedures. The textural class of the experimental sites was sandy clay and sandy loam for Dutsin-Ma and Katsina, respectively.

The treatments consisted of three different sesame varieties (EX-SUDAN, KENANA-4 and E8), three sowing dates (1st week of July, 2nd week of July and 3rd week of July), and four intra-row spacings (10cm, 15 cm, 20 cm and 25 cm). The treatments were out laid out in a split plot design with sowing dates and intra-row spacing at main plot and variety at the sub-plot treatment and replicated three times.

Agronomic Practices

The land for the experiment was cleared, harrowed and ridged. It was divided into twelve main plots and three sub-plots. The plot made of six (6) ridges where the gross plot was 4m x 4.5m long ($18m^2$) and the net plot was 4m x 3m ($12m^2$). The sesame seeds were sown as per treatment basis. The fertilizer was applied using side placement. Each plot was given N.P.K 15:15:15 fertilizer at 60:30:30 kg ha^{-1}. A basal application of the NPK fertilizer at 30:30:30 kg ha^{-1} was applied at 3 weeks after sowing (WAS) and the remaining 30 kg N ha^{-1} at 6 WAS as suggested by (Bassam, 2024). The hoe weeding was done using at 3, 6 and 9WAS. The earthen-up operation was done at 6WAS. Harvesting was done manually, when the leaves and stems changes color from green to yellow, using cutlass by cutting the plants at the base, tightening it with rope upside down and hanging it on

top of taupaline, allowed to dry for two weeks to minimize shattering of the pods.

Data Collection

Data on number of capsules, number of seeds per capsule, 1000 seed weight, seed yield per plant and seed yield per hectare were collected. From the harvested materials 20g seed samples was collected from each plot and subjected to laboratory analysis for extraction of oil and crude protein contents as described by AOAC (2012), the result obtained were recorded as percentage seed oil and protein content.

Data Analysis

Data on yield parameters were recorded and subjected to statistical analysis of variance (ANOVA) as described by Gomez and Gomez (1984) using SAS package version 9.0 of statistical analysis (SAS, 2002) and the differences among treatment means were separated using Duncan's Multiple Range Test (DMRT) (Duncan, 1955) at 5% level of probability.

RESULTS

Soil Sampling and Analysis

Table 1 presents Data on the physicochemical properties of soil in two studied areas (Dutsin-Ma and Katsina). The result shows that the textural class of the soil at the experimental sites sandy clay and sandy loam for Dutsin-Ma and Katsina, respectively. The result for the chemical properties shows that soil pH was 6.30 and 6.28 at Dutsin-Ma and Katsina, respectively, which indicates the soil was slightly acidic at the two studied areas. Total nitrogen and organic carbon were higher in Dutsin-Ma. For exchangeable cations, amounts of K, Ca, Na and CEC were higher at Dutsin-Ma except Mg, which was higher at Katsina.

Table 1: Result of the soil analysis from the experimental sites of Dutsin-Ma and Katsina during the 2023 growing season

Soil Parameters	Dutsin-Ma	Katsina
Clay	230	180
Silt	175	170
Sand	540	570
Textural class	Sandy clay	Sandy loam
pH in water	6.30	6.28
Organic Carbon (g kg-1)	4.60	4.10
Total N (g kg-1)	0.76	0.30
Available P (mg kg-1)	11.20	6.50
K (cmol kg-1)	0.76	0.70
Mg (cmol kg-1)	2.41	2.60
Ca (cmol kg-1)	4.95	4.30
Na (cmol kg-1)	0.54	0.45
CEC (cmol kg-1)	2.73	2.50

Analysis was done at analytical laboratory of Soil Science Department, Bayero University, Kano, Nigeria

Number of Capsules per plant

The varietal treatment was significant ($P<0.05$) at Dutsin-Ma; EX-SUDAN produced highest number of capsules followed by KENANA-4 and E8 which were at par (Table 2), at Katsina; EX-SUDAN was significantly ($P<0.05$) higher than other varieties. Sowing date treatments were significant ($P<0.05$) at both locations; second week of July was significantly ($P<0.05$) higher than other sowing dates. The influence of intra-row spacing was significant ($P<0.05$) on number of capsules at both locations, sowing of sesame at intra row spacing of 25cm gave significantly higher than other levels of intra row spacings

Significant Interaction between variety and sowing date on number of capsules per plant at Katsina in 2023 growing season was recorded (Table 3). The result showed, EX-SUDAN sown in third week of July produced one hundred and eleven number of capsules per plant which was the highest, followed by KENANA-4 sown in third week of July with one hundred and five number of capsules and the lowest number of capsules per plant was produced by E8

sown on first week of July (fifty-seven number of capsules).

Capsule length

Influence of variety, sowing date and Intra-row spacing on capsule length of sesame varieties at Dutsin-Ma and Katsina is Presented in Table 2, the varietal treatments were significant (P<0.05) in both locations, at Dutsin-Ma; EX-SUDAN and E8 were at par followed by KENANA-4 while at Katsina, EX-SUDAN was significantly (P<0.05) higher than other varieties. Impact of sowing date treatment was significant (P<0.05) at both locations. In Dutsin-Ma, second and third weeks of July were at par and significantly (P<0.05) higher than first week, in Katsina, second week was significantly (P<0.05) higher than first and third weeks of July which were at par (Table 2). The influence of intra-row spacing was significant (P<0.05) on capsule length at both locations (Table 2), sowing sesame at intra row spacing of 25cm was significantly (P<0.05) higher than other levels of intra row spacings.

Number of seeds per capsule

Influence of variety, sowing date and Intra-row spacing on number of seeds per capsule of sesame in 2023 growing seasons at Dutsin-Ma and Katsina is Presented in Table 2. The varietal treatment was not significant (P>0.05) at Dutsin-Ma but significant (P<0.05) in Katsina, EX-SUDAN was significantly (P<0.05) higher than other varieties. Sowing date treatments was significant (P<0.05) in Dutsin-Ma, second week was significantly (P<0.05) higher than first and third weeks of July (which were at par). Influence of intra-row spacing treatment was significant (P<0.05) in Katsina where 25 cm produced higher number of seeds than other levels of intra row spacings although 10 and 15 cm were statistically at par.

1000 seed weight (SW)

Response of 1000 SW of sesame to Influence of variety, sowing date and Intra-row spacing in 2023 growing seasons at Dutsin-Ma and Katsina is Presented in Table 4. The varietal effect was significant (P<0.05) at both locations; EX-SUDAN was significantly (P<0.05) higher than other varieties. Sowing date was significant (P<0.05) at both locations where sowing sesame at the 2nd week of July was significantly (P<0.05) higher than other sowing dates (Table 4). The influence of intra-row spacing was significant (P<0.05) on 1000 SW at both sampling stages and locations (Table 4). At both locations, sowing of sesame at intra row spacing of 25cm was significantly higher than other levels of intra row spacings.

Seed Yield plant^{-1} (g plant-^{1})

Seed yield per plant response to variety, sowing date and Intra-row spacing in 2023 growing seasons at Dutsin-Ma and Katsina is presented in table 4. The varietal effect was significant (P<0.05) at both locations; EX-SUDAN produced significantly (P<0.05) higher seeds per plant than other varieties. Sowing date was significant (P<0.05) on Seed Yield per plant^{-} at both sampling stages and locations where sowing sesame at the 2nd week of July was significantly (P<0.05) higher than other sowing dates. Influence of intra-row spacing was significant (P<0.05) on seeds per plant at both locations (Table 4). At both locations, sowing of sesame at intra row spacing of 25cm was significantly higher than other intra row spacings.

Seed Yield per hectare (kg ha-^{1})

Seed yield per hectare of sesame responded to variety, sowing date and Intra-row spacing 2023 at Dutsin-Ma and Katsina is Presented in Table 4. The varietal effect was significant (P<0.05) at Dutsin-Ma and EXSUDAN was significantly (P<0.05) higher than other varieties. Sowing date was significant (P<0.05) on seed yield per hectare at both sampling stages and locations where sowing sesame at the 2nd week of July was significantly (P<0.05) higher other sowing dates (Table 4). Influence of intra-row spacing was significant (P<0.05) on seed yield per hectare at both sampling stages and locations (Table 4). At both locations, sowing of sesame at intra row spacing of 25cm gave significantly (P<0.05) higher seed yield per hectare than other levels of intra row spacings.

Interaction between Variety and intra-row Spacing on seed yield per hectare at Katsina in 2023 growing season is presented on Table 5. According to the result EX -SUDAN variety sown at 25 and 20cm were at par and produced highest amount of Seed Yield per hectare (673.11kg and 628.89 kg respectively) and the lowest quantity was realized from KENANA-4 sown at 10 cm (470.56 kg).

Seed oil analysis (%)

Influence of variety, sowing date and Intra-row spacing on seed oil yield of sesame in 2023 growing seasons at Dutsin-Ma and Katsina is presented Table 6. The varietal effect was significant (P<0.05) and

EXSUDAN was significantly (P<0.05) higher than other varieties. Sowing date was significant (P<0.05) on seed oil yield at both sampling stages and locations at Dutsin-Ma, sowing sesame at the 1st week of July was significantly (P<0.05) higher than other sowing dates (Table 6). Influence of intra-row spacing was significant (P<0.05) on oil yield at both locations (Table 6). At Dutsin-Ma. 25 and 20 cm were at par but at katsina, 25 cm was significantly higher than other levels of intra row spacings.

Crude protein analysis (%)

Influence of variety, sowing date and Intra-row spacing on crude protein of sesame in 2023 growing seasons at Dutsin-Ma and Katsina is Presented in Table 6. The varietal effect wes significant (P<0.05), EX-SUDAN was significantly (P<0.05) higher than other varieties. Sowing date was significant (P<0.05) at both locations; 1st week of July was significantly (P<0.05) higher than than other sowing dates (Table 6). Influence of intra-row spacing was significant (P<0.05) on crude protein at both locations (Table 6). At Dutsin-Ma, 25 and 20 cm were at par likewise 15 and 10 cm unlike Katsina where sowing of sesame at intra row spacing of 25cm was significantly higher than other levels of intra row spacings.

Table 2: Influence of Variety, Sowing date and Intra-row spacing on number of capsules, Capsule length and seed per capsule of sesame in 2023 and 2024 growing seasons at Dutsin-Ma and Katsina

Treatment	Dutsin-Ma			Katsina		
	NCP	CL	NSC	NCP	CL	NSC
Varieties (V)						
E8	101.00 b	3.34 b	67.67	96.00 b	3.50 b	62.28c
EX-SUDAN	105.47 a	3.42a	93.64	103.31a	3.64 a	73.19a
KENANA – 4	102.03 b	3.40 a	110.72	61.00 c	3.29 c	69.89b
SE(+)	0.89	0.02	14.44	0.66	0.02	1.55
Sowing date (T)						
First week of July	116.19 b	3.21 b	92.81c	80.67 c	3.43 b	67.44
Second week of July	122.56 a	3.48 a	108.22a	93.83 a	3.56 a	72.89
Third week of July	66.75 c	3.45 a	71.00c	85.81 b	3.44 b	65.03
SE(+)	0.89	0.02	14.44	0.66	0.02	1.55
Intra-row Spacing						
10 cm	82.41 c	3.31 b	60.52	76.74 d	3.31 d	52.11c
15 cm	100.89 b	3.33 b	96.52	82.81 c	3.43 c	56.93c
20 cm	106.67 a	3.46 a	98.41	90.44 b	3.54 b	70.89b
25 cm	107.37 a	3.44 a	107.26	97.07 a	3.62 a	93.89a
SE(+)	1.03	0.02	16.68	0.76	0.02	1.79
Interaction						
V x T	NS	NS	NS	*	NS	NS
V x S	NS	NS	NS	NS	NS	NS
T x S	NS	NS	NS	NS	NS	NS
V x T x S	NS	NS	NS	NS	NS	NS

Means followed by the same latter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT. NS: Not-significant

*: Significant at 5% level of probability, NCP: Number of capsules per plant, CL: Capsule length, NSC: Number of Seed per capsule

Table 3: Interaction between variety and sowing date on Number of Capsules per plant at Katsina in 2023 growing season

	Number of capsules per plant		
	First week of July	**Second week of July**	**Third week of July**
Varieties			
E8	57.92g	60.42f	64.67e
EX-SUDAN	88.83d	93.50 c	111.17a
KENANA – 4	88.83d	103.50b	105.67b
SE (+)		1.14	

Means followed by the same latter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT

Table 4: Influence of Variety, Sowing date and Intra-row spacing on 1000 SW, Seed yield plant^{-1} and Seed yield per hectare of sesame in 2023 growing seasons at Dutsin-Ma and Katsina

Treatment	**Dutsin-Ma**			**Katsina**		
	1000 SW	**SYP**	**SYH**	**1000 SW**	**SYP**	**SYH**
Varieties (V)						
E8	5.39^{b}	2.43^{b}	634.97^{c}	5.14^{b}	2.17^{b}	572.08^{c}
EX-SUDAN	5.49^{a}	2.48^{a}	659.19^{a}	5.59^{a}	2.26^{a}	596.44^{a}
KENANA – 4	5.39^{b}	2.39^{c}	647.22^{b}	3.75^{c}	2.16^{c}	576.02^{b}
SE (+)	0.04	0.03	3.19	0.07	0.02	3.73
Sowing date (T)						
First week of July	3.37^{c}	2.27^{b}	602.86^{c}	4.44^{c}	2.21^{b}	560.42^{c}
Second week of July	6.51^{a}	2.63^{a}	696.31^{a}	5.22^{a}	2.29^{a}	608.31^{a}
Third week of July	6.03^{b}	2.42^{b}	642.22^{b}	4.82^{b}	2.12^{c}	575.83^{b}
SE (+)	0.04	0.03	3.19	0.07	0.02	3.73
Intra-row Spacing						
10 cm	4.88^{d}	2.30^{c}	612.19^{c}	4.24^{d}	1.90^{d}	507.17^{d}
15 cm	5.06^{c}	2.47^{b}	655.56^{b}	4.68^{c}	2.09^{c}	557.07^{c}
20 cm	5.55^{b}	2.44^{b}	649.44^{b}	4.99^{b}	2.30^{b}	603.74^{b}
25 cm	6.21^{a}	2.54^{a}	671.33^{a}	5.40^{a}	2.49^{a}	658.09^{a}
SE (+)	0.08	0.05	6.38	0.08	0.03	4.31
Interaction						
V x T	NS	NS	NS	NS	NS	NS
V x S	NS	NS	NS	NS	NS	*
T x S	NS	NS	NS	NS	NS	NS
V x T x S	NS	NS	NS	NS	NS	NS

Means followed by the same latter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT. NS: Not-significant.

*: Significant at 5% level of probability. SYP: Seed yield per plant, SYH: Seed yield per hectare WAS: Weeks after sowing

Table 5: Interaction between Variety and intra-row Spacing on Seed Yield per hectare at Katsina in 2023 growing season

	Seed yield per hectare			
	10 cm	**15 cm**	**20 cm**	**25 cm**
Varieties				
E8	518.56f	541.89	597.33c	640.44b
EX-SUDAN	525.22e	571.56 d	628.89b	673.11a
NANA – 4	470.56g	551.89 d	607.67c	677.11a
SE (+)		10.84		

Means followed by the same latter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRT.

Table 6: Influence of Variety, Sowing date and Intra-row spacing on Seed Oil Content and Crude Protein of sesame in 2023 growing season at Dutsin-Ma and Katsina

Treatment	Dutsin-Ma		Katsina	
	Oil content	CP	Oil content	CP
Varieties (V)				
E8	43.32b	21.17b	41.79b	19.53c
EX-SUDAN	44.59a	21.80a	43.43a	21.02a
KENANA – 4	44.21a	21.41b	41.74b	20.59b
SE(+)	0.37	0.15	0.28	0.18
Sowing date (T)				
1st week of July	47.19a	23.18a	45.07a	22.12a
2nd week of July	42.66b	20.34b	41.87b	19.09c
3rd week of July	42.28b	20.86b	40.02c	19.92b
SE(+)	0.37	0.15	0.28	0.18
Intra-row Spacing				
10 cm	43.41b	21.28b	38.64d	18.33d
15 cm	42.99c	20.77b	41.12c	19.64c
20 cm	44.71a	21.74a	43.06b	20.99b
25 cm	45.07a	22.05a	46.46a	22.55a
SE (+)	0.43	0.18	0.33	0.21
Interaction				
V x T	NS	NS	NS	NS
V x S	NS	NS	NS	NS
T x S	NS	NS	NS	NS
V x T x S	NS	NS	NS	NS

Means followed by the same latter(s) within the same column and treatment are not significantly different at 5% level of probability using DMRTNS: Not-significant. CP: Crude protein

DISCUSSION

Good soil and adequate moisture are important for the growth and development of sesame in the Sudan savannah. Soils of the experimental sites were sandy clay and sandy loam, which are suitable for the growth of sesame. However, the soils of the experimental sites were found to be low in organic carbon, total nitrogen, available phosphorus and CEC. This indicates the characteristic nature of soils in savanna. Soils of savanna are known to be low in total nitrogen, available phosphorus, organic carbon, effective CEC and exchangeable cations with clay and silt content (Singh, 1987). Hence, it made it absolutely necessary the NPK fertilizer that was applied at 3 and 6 WAS in the experimental soils. Adesoji *et al*. (2018) reported that soils of Nigerian savanna do hardly support worthwhile crop production in the absence of any approach to enhance their fertility status through the addition of fertilizer, either organic or inorganic.

The result of the study revealed that varietal effect was significant in the measured yield parameters, which could be attributed to variations in genetic constitution of these varieties. Sesame growth and development can be attributed to the improved genetic composition of the variety (Audu *et al.,* 2021). EX-SUDAN variety performed significantly higher than KENANA-4 and E8 varieties on number of capsules, capsule length, 1000 SW, seed yield per plant, seed output per hectare, oil and crude protein. The outstanding Characteristics of EX-SUDAN variety comprised high seeds yield, early maturity and higher yield of (1.3 t ha^{-1}) against KENANA-4 and E8 (with 1.2 and 1.0 t ha^{-1}) respectively (Anon, 2024). The result, confirmed the findings of Mohammed et al., (2019), who reported that, EX-SUDAN variety showed superiority on local varieties, TUMKUR (Local black) and GULBARGA (Local white) among the treatments in all the yield parameters investigated. It is also in line with the findings of Ibrahim *et al.,* (2016) who

reported, EX-SUDAN variety recorded higher number of capsules per plant, seeds per capsule, thousand seed weight and grain yield (kg ha^{-1}), compared with KENANA-4 and GWOZA varieties. It is also in line with findings of Rufai *et al.,* (2024), who reported significant increase in number of capsules per plant of EX-SUDAN (which produced forty-one number of capsules per plant) higher than and E8 varieties (which produced thirty number of capsules per plant). Sowing date determines the duration of the growth and development, exposure to moisture, and the crop's ability to escape or tolerate drought stress. The experiment further revealed that yield of sesame was greatly influenced by the time of sowing. Sesame sown at 2nd week of July demonstrated better performance than the one sown at 1st and 3rd week of July on most of the characters such as number of capsules, capsule length, 1000 SW, seed yield per plant number of seeds per capsule and seed output per hectare. But oil content and crude protein were greater at 1st week of July. This is also in conformity with the findings of Yisa *et al*. (2023) who reported: sesame planted in middle of July did better than sesame planted in middle of August. But the highest oil output and crude protein content were obtained from sesame seeds sown during the first week of July. This may be linked to the fact that longer growing season led to early germination and better establishment which may lead to accesses to nitrogen and sulfur (which are critical for protein and oil synthesis) more efficiently before leaching or volatilization losses occur later, all that enables sesame to take advantage of the best growing season rainfall and temperature conditions.

The intra-row spacing was significant where sowing of sesame at an intra-row spacing of 25 cm outperformed other intra-row spacings, as exemplified by significant increases observed on numbers of capsules, numbers of seed per capsule, seed yield per plant yield output per hectare oil and crude protein contents. This showed that at low plant population densities, proper use of light, moisture, and nutrients was higher, allowing sesame cops to fully utilize light and nutrients in the two sites under study. This corroborates the findings of Fetene and Alemayehu (2016) whom reported that, with the increase in intra row spacing from 5 to 25 cm, plant height (cm), primary branches/plant, capsules/plant, seed yield/plant (g), 1000-seed weight (g) and seed yield (kg/ha) increased from 101.31 to 117.8729 to 43, 73 to 138, 2.51 to 3.63, 2.01 to 3.27 and 648 to 1114 respectively. Similarly, the result coincides with findings of Galadima *et al*. (2019), that reported: the lower yield, in kilogram per hectare, observed for low Intra-row spacing was due to the relatively higher population of plant on the plots where the spacing was low.

CONCLUSION

Based on the result of the study, it can be concluded that, variety EX-SUDAN is recommended due to its superior performance on seed and oil yields. For greater output of seed yield, sowing date of second week of July is recommended because it recorded higher values while first week of July is the best for oil and crude protein contents. Intra-row spacing of 25 cm proved to be more productive it is therefore recommended in the Sudan savanna ecological zone

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