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Influence of Sesame Varieties and Fertilizer Levels on the Yield of Sesame in Potiskum, Yobe State- Nigeria

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ABSTRACT

Field experiments were carried out in 2018 and 2019 cropping seasons to determine the influence of sesame varieties and fertilizer levels on the yield of sesame in the study area. Treatments consisted of three varieties of sesame (Jigida, NCRIBEN-01M and NCRIBEN-032) and four levels of NPK 15:15:15 fertilizer (0, 50,100 and 150 kg ha^{-1}). Treatments were laid out in a randomized complete block design (RCBD) and replicated three times. The fields were cleared and crop planted in both cropping seasons with all agronomic practices carried out as at when due. Prior to planting, surface (0-15 cm) soil samples were collected from eight points and bulked; post-harvest composite soil samples were also collected on the basis of treatments. All soil samples were analyzed using standard analytical procedures. Data on yield parameters collected included number of capsules per plant, number of seeds per capsule, length of capsule (cm), 1000 capsule weight (g), 1000 seeds weight (g) and seed yield per hectare (kg ha^{-1}). The crop data generated from the study were subjected to Analysis of Variance (ANOVA) using Genstat Release 10.3 DE after which significant means were separated using Least Significant Difference (LSD) at 5 % level of probability. Results indicated that the improved varieties performed better than the local variety in both cropping seasons. Sesame yield increased with increase in fertilizer rates up to 150 kg ha^{-1}. The highest yield obtained in 2018 and 2019 cropping seasons was 0.54 and 0.44 t ha^{-1} respectively. The effects of variety on soil properties did not differ significantly however, the improved varieties left lower essential nutrients in soil when compared with the local variety. Fertilizer application at 150 kg ha^{-1} of NPK 15:15:15 favoured the retention of organic matter in soil as well as other essential nutrient elements and is hereby recommended for sustainable sesame production in the study area.

1.0 Introduction

Sesame is one the tropical annual plants that is remarkably produced for its seeds and oil (Langham *et al.,* 2008). In Nigeria, sesame is becoming an important component of Nigeria's agricultural exports given its current rate of cultivation. Sesame is the third largest export commodity in Nigeria after petroleum and cocoa (USAID, 2002). The potentials of sesame production in Nigeria are high, with an estimated 3.5 million hectare of agricultural land devoted for its cultivation in the savanna zones (Eifediyi *et al.,* 2016). The possibility of cultivating under poor soil conditions makes sesame a crop that can be used for mitigating food security in the country. The sesame seeds serve as ingredients in soup and a source of oil (Biswas *et al.,* 2001). The oil is used for cooking, baking, candy making, soaps, lubricant, body massage, hair treatment, food manufacture, industrial uses and alternative medicine for blood pressure, aging, stress and tension (Ahmed *et al.,* 2009).

Today, both the white and brown types are commonly grown by smallholder farmers in Adamawa, FCT Abuja, Benue, Borno, Gombe, Jigawa, Kano, Katsina, Kebbi, Kogi, Nasarawa, Plateau, Taraba and Yobe State (USAID, 2002; Iorlamen *et al.,* 2014). The demand for sesame and its products is growing both at the National and International levels. Thus huge market potential exists for sesame. However, owing to its previous status as a minor crop, there has been little research efforts towards improved production of the crop (NCRI, 2002).

Soil fertilization is one of the main factors increasing the yield of plants (Ojeniyi *et al*., 2016). It affects the accumulation, mineralization and humification of organic matter added to the soil and determines plant production potentials (Ali *et al.,* 2015). The amount of mineral fertilizer introduced into the soil, affects the amount of mineral nitrogen available to the plants and the organic carbon content of the soil (Ojeniyi *et al.,* 2016). Fertilizer effects on plant growth and yield depends on the crop grown and the environmental conditions that crop encounters. Responses of various crops, including sesame, soybeans, maize, groundnut, wheat and rice to fertilizer application have been studied in Nigeria (Eifediyi *et al.,* 2016 and Ojeniyi *et al.,* 2016) and found to improve crop productivity.

Survey reports by various researchers in the savanna areas revealed that the yield of the sesame crop is low, probably due to lack of improved varieties and poor cultural practices carried out by farmers. According to Eifediyi *et al.,* (2018), cultivating the crop early in the season predisposes it to vegetative growth and pest invasion. In addition, traditional sesame growers in the study area rarely use fertilizers to increase the yield. Studies have shown that the crop performs well with the application of inorganic fertilizers (Ojeniyi *et al.,* 2016; Eifediyi *et al.,* 2018) and the use of improved varieties.

The recent increase in awareness, production and cultivation of sesame across the savanna zones has therefore, necessitated the need to determine its response to various fertilizer levels. Therefore, the objective of the study was to assess the yield of sesame varieties as influenced by fertilizer levels as well as identifying appropriate fertilizer level that will give optimal yield of sesame in the study area.

2.0 Materials and Methods

2.1 Study Site

Field experiments were carried out in 2018 and 2019 cropping seasons to determine the influence of sesame varieties and fertilizer levels on the yield of sesame at the Research Farm of Federal College of Education (Technical), Potiskum, Yobe State-Nigeria. Experimental treatments consisted of three varieties of sesame (Jigida, NCRIBEN-01M and NCRIBEN-032) and four levels of NPK 15:15:15 fertilizer (0, 50,100 and 150 kg ha^{-1}). The treatments were laid out in a RCBD with sesame varieties occupying the main plots and fertilizer levels at sub plots and were replicated three times. The study location falls within the Sudan Savanna Zone of Nigeria with mean rainfall of about 800 mm per annum and temperature of 39 – 42 ^{0}C. It is located between latitude 11^{0}42' N to 11^{0}43' N and longitude 11^{0}04' E to 11^{0}06' E (YSGN, 2008). The two vegetation zones in Yobe State are Sahel in the North and the Sudan Savanna in the Southern part of the state where Potiskum is located. The experimental area was cleared manually using cutlass and demarcated into experimental units. Thereafter flat bed and ridges were made using hoe. NCRIBEN-01M and NCRIBEN-032 (improved varieties) of sesame were sourced from National Cereals Research Institute, Badeggi-Niger State and Jigida (local variety) was sourced from the local farmers. The local variety served as a check.

Sesame seeds were sown at an inter and intra row spacing of 75 x 5 cm. Sesame seeds were drilled along the ridges (or straight lines on flat land) and thinned to have two plants per stand along the row two weeks after planting (WAP) to give a plant population of 133,333 plants ha^{-1} (Jakusko and Usman, 2013). This permits maintenance of appropriate plant density and also alleviates the attendant problems associated with high-density planting. Two hoe weedings at 3 and 9 weeks after planting (WAP) were done during the period of the experiments. Soil mounds were built around the plant stands at each weeding. The fertilizer application was done at 2 WAP by band placement in alternate rows.

Crop harvested from the net plots were used for grain yield determination. Sesame crop was harvested when about 50 % of the capsules turn yellow in colour from green. Harvesting was not delayed in order to prevent seed loss through shattering. Harvesting was done by cutting the stems with sickles. Harvesting by pulling the plants from the root was avoided in order to prevent contamination of seeds with sand. After harvesting, the plants were tied with a rope into bundles and positioned in an erected form on tarpaulin for the capsules to be fully dried.

2.2 Soil Data Collection and Analysis

Prior to planting, surface (0-15 cm) soil samples were collected from eight points and bulked; post-harvest composite soil samples were also collected on the basis of treatments. The soil samples taken from each plot according to treatment were air dried; crushed and sieved using 2 mm sieve and analyzed using standard soil analytical procedures at the Departments of Soil Science, University of Maiduguri, Borno State, Nigeria and Federal University of Agriculture, Makurdi, Nigeria. Particle size distribution was determined by the Hydrometer method (Bouyocous, 1951). Soil pH was measured with the glass electrode pH meter in soil solution ratio 1: 2 in 0.01 M $CaCl_2$. Soil organic carbon (OC) was determined by the Walkey and Black method. Total N by the macro-Kjeldahl digestion method (Bremner and Mulraney, 1982), Available P was determined by Bray and Kurtz (1945) extraction method. Exchangeable cations were extracted using NH_4OAC solution, K and Na were read using flame photometer, while Ca and Mg was determined using the Atomic Absorption Spectrophotometer (AAS). Effective cation exchange capacity (ECEC) was established as the summation of the exchangeable cations (K, Na, Ca, Mg) and exchange acidity.

2.3 Crop Data Collection and Analysis

Data were collected for the yield parameters of sesame for both cropping seasons as follows:-

The lengths of ten capsules from each net plot were measured from bottom of the sesame capsule to the capsule apex using a meter rule and the average value recorded. Five plants in the net plot were sampled, the number of capsules on each plant counted and average value determined and recorded. 1000 capsules were taken from ten sampled plants per plot and weighed also on a sensitive Mettler top-loading electronic balance (Model P. 1200) the mean weights were then recorded. Ten dry capsules were sampled randomly from each net plot. They were split open and the number of seeds in each capsule counted and average values were recorded. A total of 1000 sesame seeds from each plot were counted and weighed on an electronic top-loading Mettler balance to obtain the weight of 1000 seeds. From the seed yield per plot, seed yield per hectare for each plot was computed by converting it into kilogram per hectare by extrapolation.

Data collected for the yield parameters of sesame for both cropping seasons were subjected to the Analysis of Variance (ANOVA) using Genstat Release 10.3 DE after which significant means were separated using Least Significant Difference

(LSD) at 5 % level of probability.

Results and Discussion

3.1 Physical and Chemical Properties of the Experimental Site before Planting

The selected physical and chemical properties of the experimental site before planting are presented on Table 1. The results indicated that soils for both cropping seasons were sandy clay loam in texture. This texture is ideal for sesame production as sesame require soils that are well drained for optimum growth and yield. The high sand content of the soils in 2018 and 2019 respectively (67.10 – 65.00 %) was indicative of the low clay content (21.20 – 20.90 %) for both years which could be attributed to the soil separates sorting activities by organisms, clay eluviation, surface soil erosion, parent material or a combination of these factors (Malgwi *et al.,* 2008; Adamu *et al.,* 2010).

The slightly acidic pH of the soils (6.96 – 6.70) also indicate that the soils are suitable for sesame production as this pH range is the optimum pH for most crops and microbial activities in soil. Bennet (2011) reported that sesame is intolerant of very acidic or saline soils hence the pH obtained from this soil is ideal for optimum sesame production. Very low pH values have a drastic effect on growth, whereas some varieties can tolerate a pH value up to 8 (Naturland, 2002).

The results also (Table 1) indicate a poor soil fertility status that requires fertilizer application to replenish nutrients taken out from the soil through crop harvest and to supplement nutrients to boost yields (Olatunji and Ayuba, 2012). The values of SOM (1.95 and 0.98 %) for the two cropping seasons were below the average range of 2.5- 2.6 % considered for good crop growth (Aduayi *et al.,* 2002) in the study area. The results of the soil analysis thus indicated that soil amendment was required in line with earlier observation by Agboola (1975) who reported that farmers in Africa requires adequate soil amendment for good crop production as a result of low inherent soil fertility. In addition, the poor nutrient status of this soil is characteristic of many tropical soils where the slash and burn practice coupled with high insolation and rainfall prevents the build-up of organic matter which is the store house of most nutrients (Aduayi *et al.* (2002; Anjembe, 2004; Senjobi *et al.* (2013).

Other factors responsible for the low nutrient status may include intensive and continuous cropping without corresponding fertilizer application, weathering, and erosion/leaching

Table 1: Selected Physical and Chemical Properties of the Experimental Sites before Planting in Potiskum

Property	2018	2019
Chemical Property		
pH	6.96	6.70
Organic Carbon (%)	0.55	0.57
Organic Matter (%)	1.95	0.98
Total Nitrogen (%)	0.17	0.19
Available P (mgkg^{-1})	3.15	3.30
Exchangeable Cation (Cmol kg^{-1})		
Ca	3.10	2.83
Mg	2.80	2.60
K	0.24	0.22
Na	0.03	0.02
EB	6.17	5.67
EA	0.20	0.18
CEC	6.37	5.85
Base Saturation (%)	96.86	96.92
Particle Size Distribution		
Sand (%)	67.10	65.00
Silt (%)	11.70	14.10
Clay (%)	21.20	20.90
Textural Class	Sandy clay loam	

3.2 Influence of Sesame Variety and Fertilizer Levels on the Yield of Sesame

The influence of the sesame variety and fertilizer application on the yield of sesame in the 2018 and 2019 cropping season are presented on Table 2. Results indicated that the varieties had significant difference on all the parameters measured with the exception of capsule length in 2018 and 2019 cropping seasons. There were significant difference in the varieties with respect to some of the yield attributes such as number of capsules per plant, weight of 1000 capsules and 1000 seeds as well as grain yield in 2018 as a result of the differences in the varieties and apart from the local variety (jigida), the other varieties have been bred for higher yield and other desirable qualities. Number of capsules per plant ranged from 43.10 with jigida to 74.70 with NCRIBEN-032. Weight of 1000 capsules differed significantly in both years while Jigida, NCRIBEN-01M and NCRIBEN- 032 had 380.94, 401.47 and 421.72 g respectively. Significant differences were observed in the weight of 1000 seeds, NCRIBEN-032 had the highest weight of 222.92 g and 228.17 g in 2018 and 2019 respectively. Number of capsules and yield of the crop were higher in the improved varieties (NCRIBEN-01M and NCRIBEN-032) than the local variety. NCRIBEN-032 gave significantly higher yield than the other varieties in 2018 and 2019 cropping seasons.

However, Chude *et al.* (2012) reported that under farmers' conditions beniseed yield is between 200 and 450 kg ha^{-1} of dry seed. However, up to 500 – 800 kg ha^{-1} can be obtained by adopting improved practices with a plant population of 25 - 40,000 plants ha^{-1}. The yield obtained in the current study in 2018 was in the range of that reported by Chude *et al.* (2012) and yield of 700 kilograms per hectare reported by Nigeria's Harvest (2009) but in 2019, the yields were higher than those reported here. However, the yields obtained in this study in both years were lower than the 2000 kg ha^{-1} reported by Adebowale *et al.* (2010) and Hassen (2011).

The significant response of yield and yield attributes to fertilizer application is an indication of the role of fertilizers in plant nutrition. Nitrogen, Phosphorus and potassium are the three most limiting of the essential plant nutrient elements and are required in large quantities by crops especially in Nigerian soils with low inherent fertility (Ibrahim *et al.,* 2017). Yield and yield attributes increased with increasing levels of fertilizer application. The present findings are in conformity with the results obtained by Babeji *et al.* (2006) who reported significant increase in the yield attributes of sesame with increase in Nitrogen fertilizer.

The statuses of nutrients in soils of Nigeria especially those with history of intensive cultivation are generally low, hence the significant response of sesame yield and its other attributes to fertilizer application. In recent times, many farmers and researchers in Nigeria have used many fertilizer types to improve the yield of sesame, but the yield still remains very low, about 450 kg ha^{-1} (Eifediyi *et al*., 2016), compared to yield in Egypt (1,323 kg ha^{-1}) and Ethiopia (825 kg ha^{-1}) (FAO, 2009). When soils are continually cultivated, it results in low yields due to the mining of the soil nutrients. This calls for the use of external inputs in order to reverse the loss of nutrients and maintain productivity (Agbede, 2009). The replenishment of nutrient and enhanced quality of tropical soils could be achieved through the addition of fertilizers (Shangakkara *et al*., 2004). Fertilizer is a component of sustainable crop production systems. Sesame requires adequate supply of nutrients particularly nitrogen, phosphorus and potassium (NPK) for good growth and high yield hence the response of the sesame crop to fertilizer application in the current study.

Table 2: Influence of Sesame Variety and Fertilizer Levels on the Yield of Sesame in Potiskum

Varieties	Capsule Length (cm)		No. of capsules per plant		No. of seeds per capsule		Weight of 1000 capsules (g)		Weight of 1000 seeds (g)		Seed yield (t ha^{-1})	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
V1	3.21	3.24	43.10	76.3	52.69	58.89	380.94	424.50	221.31	226.83	0.70	1.10
V2	3.21	3.23	65.90	73.9	52.53	57.03	401.47	425.31	220.61	226.25	0.78	1.37
V3	3.20	3.24	74.70	80.2	54.92	60.53	421.72	425.78	222.92	228.17	0.87	1.38
LSD ($P \leq 0.05$)	NS	NS	22.01	NS	NS	2.50	15.24	NS	1.63	NS	0.05	0.15
Fertilizer Levels												
F1	3.07	3.03	59.60	63.6	43.85	48.41	408.41	409.67	209.81	213.04	0.70	1.20
F2	3.16	3.16	66.60	69.2	50.74	54.59	417.22	419.22	215.67	221.04	0.75	1.32
F3	3.39	3.27	73.40	76.7	56.11	60.78	424.26	428.04	224.07	230.30	0.78	1.40
F4	3.22	3.49	90.70	97.6	62.81	71.48	435.63	443.85	236.89	243.96	0.88	1.57
LSD ($P<0.05$)	0.063	0.06	6.08	6.75	2.78	2.88	3.44	3.79	4.03	3.56	0.03	0.06

NS = Not significant, F1 = 0 kg ha^{-1}, F2 = 50 kg ha^{-1}, F3 = 100 kg ha^{-1}, F4 = 150 kg ha^{-1}, V1 = Jigida, V2 = NCRIBEN-01M, V3 = NCRIBEN-032

Fertilizer application is one major farming operation needed to correct deficiencies in the soil in order to ensure proper growth and functioning of crops with the aim of increasing yield (Srivastava *et al*., 2006; Brady and Weil, 2014). Adekayode and Ogunkoya (2010) observed improved maize growth parameters with corresponding higher yield in plots treated with fertilizers at 300 and 250 kg per hectare in Nigeria. The report by Bonsu (2003) that an increase in the level of fertilizer application resulted in an increase in the growth and yield parameters of sesame confirms the current result. Similarly El-Nakhlawy and Shaheen (2009) stated that vegetative production in plants increases with increased level of fertilizer and this is in conformity with the results of the current study. Eifediyi *et al.* (2016) also observed an increase in number of leaves of sesame when inorganic fertilizer was used in southern Guinea savanna zone in Nigeria.

Crops require nutrients to perform optimally both in the vegetative and reproductive stages of their life cycle however; most Nigerian soils have been reported to be deficient in these essential nutrients (Ibrahim *et al.,* 2017). Hence the need for application of external source for these plant nutrients. For the study under consideration, increase in yield and yield attributes with increasing levels of fertilizer application from the control plots where fertilizer was not applied to plots that received 150 kg ha^{-1} of the NPK 15:15:15 was observed.

Responses of various crops, including sesame, soybeans, maize, ground nut, wheat and rice to fertilizer application have been studied in Nigeria (Eifediyi *et al.,* 2016; Ojeniyi *et al.,* 2016). Eifediyi *et al.* (2016) reported that NPK fertilizer significantly ($p<0.05$) influenced the yield of sesame. The results of their study also revealed that NPK fertilizer at the rate of 400 kg ha^{-1} and 300kg ha^{-1} produced the highest grain yield of sesame for 2013 and 2014 respectively; these dosage of fertilizer used in obtaining optimum yield were higher than the 150 kg ha^{-1} in the present study. Jakusko and Usman (2013) obtained maximum yield of sesame with NPK fertilizer at the rate of 300kg ha^{-1} and 200kg ha^{-1} in 2009 and 2010 respectively.

3.3 Influence of Varieties and Fertilizer Levels on Soil Properties

The influence of variety and fertilizer on selected soil properties are presented on Table 3a-c. The varieties did not have significant difference in their effect on most of the soil properties after harvest in 2018 and 2019 cropping seasons. The effects of fertilizer levels show that no significant differences were observed in most parameters studied though, most soil parameters increased with increasing levels of fertilizer application.

The effects of fertilizer applications on soil physical and chemical properties are importance to agricultural sustainability and to increase crop yield (Ayoola, 2006; Oloworeke, 2014). The physical and chemical properties of a soil are one of the fundamental factors affecting crop growth, development and yield. This is because these properties have very high degree of correlation with crop production and have high influence on soil fertility and crop performance (Adeniyan, 2008 and Onwudiwe *et al.,* 2014). For the study under consideration more focus was on the chemical properties and results revealed that the soil properties were improved with increasing levels of fertilizer application though no significant difference was observed in the interaction effects of most of the soil parameters in both seasons.

Many African soils show nutrient deficiency problems after only a short period of cultivation because of their nature as well as prevailing environmental conditions. Farmers have sought to furnish additional nutrient by the application of chemical fertilizer so that the yields of crops will no longer be limited by the amount of plant nutrients that the natural system can supply (Agber *et al.,* 2012 and Agbede *et al.,* 2013). Fertilizers are usually applied to soil for increasing or maintaining crop yields to meet the increasing demand of food (Olatunji and Ibrahim, 2014; Babbu *et al.,* 2015). Application of inorganic fertilizers results in higher soil organic matter accumulation and biological activity due to increased plant biomass production and organic matter returns to soil in the form of decaying roots, litter and crop residues (Adekiya and Agbede, 2009; Babbu *et al.,* 2015). Addition of soil organic matter enhances soil organic carbon content, which is an important indicator of soil quality and crop productivity (Babbu *et al.,* 2015). Fertilizer additions also affect the chemical composition of soil solution which can be responsible for dispersion/flocculation of clay particles and thus, affects the soil aggregation stability (Haynes and Naidu, 1998).

3.4 Effects of Year of Planting on the Yield of Sesame Varieties

The effects of year of planting were significant on all the parameters with the exception of capsule length which did not differ significantly (Table 4). All the parameters were significantly higher in 2018 than 2019. Number of capsules and number of seeds per capsule in 2018 were 76.79 and 58.81 respectively while for 2019 these values were 72.59 and 53.38 respectively. Weight of 1000 capsules and weight of 1000 seeds were 425.19 g and 227.08 g in 2018 while in 2019 they were 421.38 g and 221.61 g respectively. Yield in 2018 was significantly higher than that of 2019. In 2018 yield of 1.37 t ha^{-1} was obtained while in 2019 it was 0.78 t ha^{-1}. NCRIBEN-032 gave higher yield than the other varieties most especially above the control which is the local variety.

All the varieties performed better in 2018 than 2019, this can be attributed to differences in agronomic practices and yearly rainfall variation that may affect the growth of the crop. Good drainage is crucial, as sesame is very susceptible to short periods of water logging (Bennet, 2011). The soils in 2019 were waterlogged towards ending of September and this may be responsible for the low yield obtained in 2019. During each of its development stages, sesame is highly susceptible to water-logging, and can therefore only thrive during moderate rainfall, or when irrigation is carefully controlled in drier regions (Naturland, 2002).

4.0 Conclusion and Recommendations

Based on the findings of this study, the improved varieties performed better than the local variety in terms of yield. NCRIBEN-032 variety gave higher yield than the other varieties most especially above the control which is the local variety. All the varieties performed better in 2018 than 2019. The effects of variety on soil properties did not differ significantly however, the improved varieties left lower essential nutrients in soil and the local variety gave higher values in soil properties after harvest. The effect of year of planting did not influence yield significantly in both cropping seasons. The yield of 1.37 t ha^{-1} in 2018 was significantly higher than the yield of 0.78 t ha^{-1} in 2019. Fertilizer application at 150 kg ha^{-1} of NPK 15:15:15 favoured the retention of organic matter as well as other essential nutrient elements in soil and is hereby recommended for increase in yield of sesame in the study area.

Table 3a: Influence of Varieties and Fertilizer Levels on Soil Properties in Potiskum

Varieties	BS (%)		CEC (cmol kg^{-1})		Ca (cmol kg^{-1})		EA (cmol kg^{-1})		EB (cmol kg^{-1})		K (cmol kg^{-1})	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
V1	89.12	92.20	6.31	6.35	3.46	3.48	0.45	0.45	5.85	5.87	0.26	0.34
V2	88.12	91.39	6.48	6.58	3.59	3.61	0.48	0.56	6.00	6.02	0.28	0.28
V3	88.57	90.62	6.24	6.34	3.40	3.44	0.48	0.58	5.74	5.71	0.26	0.26
LSD (P≤0.05)	NS	NS	NS	0.19	NS	0.17	NS	0.05	NS	NS	NS	NS
Fertilizer Levels												
F1	88.22	90.47	6.45	6.54	3.47	3.52	0.53	0.60	5.88	5.87	0.26	0.27
F2	88.51	91.45	6.38	6.50	3.57	3.60	0.43	0.50	5.95	5.97	0.28	0.27
F3	88.63	92.86	6.30	6.31	3.48	3.50	0.43	0.43	5.87	5.88	0.27	0.37
F4	89.06	90.85	6.24	6.33	3.41	3.44	0.49	0.57	5.74	5.76	0.26	0.25
LSD (P≤0.05)	NS	1.56	NS	NS	NS	NS	NS	0.06	NS	NS	NS	NS

NS= Not significant, F1 = 0 kg ha^{-1}, F2 = 50 kg ha^{-1}, F3 = 100 kg ha^{-1}, F4 = 150 kg ha^{-1}, V1 = jigida, V2 = NCRIBEN-01M, V3 = NCRIBEN-032

Table 3b: Influence of Varieties and Fertilizer Levels on Selected Soil Properties in Potiskum

Varieties	Mg (cmol kg^{-1})		N (%)		Na (cmol kg^{-1})		OC (%)		OM (%)		P (mg kg^{-1})	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
V1	1.50	1.50	0.080	0.082	0.63	0.63	0.90	0.90	1.56	1.56	3.48	3.49
V2	1.80	1.52	0.084	0.085	0.62	0.61	0.86	0.86	1.49	1.48	3.47	3.48
V3	1.49	1.49	0.080	0.079	0.59	0.58	0.87	0.87	1.50	1.50	3.55	3.56
LSD (P≤0.05)	NS	NS	0.003	0.004	NS	NS	0.03	NS	0.05	NS	NS	NS
Fertilizer Levels												
F1	1.53	1.53	0.083	0.083	0.62	0.62	0.88	0.87	1.52	1.51	3.42	3.44
F2	1.50	1.50	0.082	0.081	0.61	0.60	0.87	0.87	1.51	1.49	3.43	3.43
F3	1.88	1.50	0.081	0.082	0.62	0.61	0.88	0.88	1.52	1.52	3.68	3.69
F4	1.48	1.48	0.080	0.081	0.60	0.59	0.88	0.88	1.52	1.52	3.48	3.49
LSD (P≤0.05)	0.20	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS= Not significant, F1 = 0 kg ha^{-1}, F2 = 50 kg ha^{-1}, F3 = 100 kg ha^{-1}, F4 = 150 kg ha^{-1}, V1 = jigida, V2 = NCRIBEN-01M, V3 = NCRIBEN-032

Table 3c: Influence of Varieties and Fertilizer Levels on Selected Soil Properties in Potiskum

Varieties	pH		Sand (%)		Clay (%)		Silt (%)	
	2018	2019	2018	2019	2018	2019	2018	2019
V1	6.61	6.61	71.72	71.50	15.37	15.37	12.92	13.13
V2	6.57	6.57	71.10	71.10	15.42	15.51	13.48	13.39
V3	6.57	6.57	72.00	71.84	14.95	14.95	13.05	13.21
LSD (P≤0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Fertilizer Levels								
F1	6.55	6.55	72.02	71.52	15.06	15.17	12.92	13.31
F2	6.60	6.60	71.26	71.26	15.49	15.49	13.26	13.26
F3	6.59	6.59	71.63	71.52	15.26	15.26	13.11	13.22
F4	6.59	6.59	71.51	71.62	15.19	15.19	13.30	13.19
LSD (P≤0.05)	NS	NS	NS	NS	NS	NS	NS	NS

NS= Not significant, F1 = 0 kg ha^{-1}, F2 = 50 kg ha^{-1}, F3 = 100 kg ha^{-1}, F4 = 150 kg ha^{-1}, V1 = jigida,

V2 = NCRIBEN-01M, V3 = NCRIBEN-032

Table 4: Effect of Year on Yield and Yield Attributes of Sesame in Potiskum

Year	Capsule Length (cm)	No. of capsules per plant	No. of seeds per capsule	Weight of 1000 capsules (g)	Weight of 1000 seeds (g)	Seed yield (t ha^{-1})
2018	3.23	76.79	58.81	425.19	227.08	1.37
2019	3.21	72.59	53.38	421.38	221.61	0.78
LSD (P<0.05)	NS	3.19	1.36	1.77	1.855	0.025

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