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Evaluation of New Sesame Varieties for Growth and Yield Performance during the Deyr Season in Afgoye, Somalia

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Authors' contributions

This work was carried out in collaboration among all authors. Author SAS wrote the manuscript. Authors HNI and AOM analysed the data. Author MMI conducted the experiment. Authors MSI and AEM proofread the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The field experiment was conducted to evaluate new sesame varieties for growth and yield performance.
Study Design: A randomized completely block design (RCBD) with four replications was used for the experiment.
Place and Duration of Study: The study was conducted during the Deyr season (September-November) 2016 at the experimental farm of Somali Agriculture Technical Group (SATG), Afgoye, Somalia.
Methodology: Growth and yield characters of the varieties were measured during the trial. A

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complete of six sesame varieties was used for the trial. The new varieties were Setit, Yemeni, Nigerian, Humera and Indian while a local variety, Dunyar, was used as a control.

Results: Results from the experiment revealed that growth parameters such capsule length, number of branches per plant, number of capsules per plant and number of seeds per capsule were significantly different among the varieties. Yield performance of the sesame varieties was also significantly different. It was observed that Humera variety showed the highest seed yield of 2.82 ton per hectare while the Indian variety has given the lowest seed yield of 0.67 ton per hectare. The highest straw yield of 3.45 ton per hectare was recorded for Local variety while the lowest straw yield of 2.76 ton per hectare was observed in Setit variety. Likewise the highest biological yield of 6.18 ton per hectare was observed at Dunyar variety while the lowest biological yield of 3.61 ton per hectare was recorded for Indian variety.

Conclusion: The growth and yield of these particular varieties did not outperform the local variety, thus, future studies would be essential to look for other alternative methods and cultivars that would help increase the productivity.

Keywords: Sesame cultivars; sesame seed; growth and yield components.

1. INTRODUCTION

Sesame (*Sesamum indicum* L.), a member of the Pedaliaceae family, is an erect annual herb commonly known as sesamum, benniseed, or simsim and is one of the most ancient oilseed crops known to mankind [1]. It is widely grown in tropical regions around the world and it is primarily cultivated for its edible seeds [2]. Sesame has many species and mostly wild species were found in Sub-Saharan Africa [3]. The first cultivation of sesame was in Africa, but it was later taken to India at a very early date [4]. Sesame is adaptable to a range of soil types, although it performs well in well-drained, fertile soils of medium texture (typically sandy loam) at neutral pH [5]. Generally, sesame is a short-day plant that may grow in long-day areas; influenced by the light intensity and day period in various regions, sesame has produced genotypes with different photoperiod requirements with some varieties being day neutral [6]. Depending upon the variety, sesame crop attains its full maturity in 75–150 days after sowing [7]. Sesame seeds have both nutritional and medicinal value because they are rich in fat, protein, carbohydrates, fiber, and essential minerals [8]. It is used in sweets such as sesame bars and halva and in bakery products or milled to get high-grade edible oil [9]. Sesame seeds have also economic importance as it's exported to markets in Europe, Middle East and Asia [10]. In terms of world production, countries like India, China, Burma (Myanmar), Sudan, Ethiopia, Uganda, and Nigeria dominate sesame production with Asia and Africa being the leading continents that are growing fair percentages of the world's sesame crop [11].

Sesame is one of the important and leading Agriculture enterprises contributing to Somalia's gross domestic product (GDP) [12]. Somalia was ranked the 12th leading sesame exporting countries in 2012, that's before the production went low for the last 2 years [13]. Despite trade challenges, sesame partner companies have reported in exports of processed sesame worth $ 20 million in 2020 and this is an increase of 29 percent compared to 2018 [14]. In Somalia Sesame seeds are processed into oil, which is used in food and largely available in local markets. Most Sesame production in Somalia is carried out along the river Shabelle and River Juba and this is due to access to water for irrigation. Because of its ability to survive in adverse agro-ecological conditions, Sesame crop can be cultivated using traditional techniques. This has made sesame crop production easy for many small holder farmers in low rainfall areas of the country to draw value from the crop and to be able to produce it in large scale systems [15]. However, the production of sesame seeds in Somalia are below the expectations and therefore the potential might be significantly higher. The yield of sesame crop in the country is in the range of 0.15 tons to 0.9 tons per hectare and these lower yields are due to poor-quality seeds, lack of adequate training, lower use of inputs, poor management practices such as low or non-fertilization, no irrigation, lack of pest and disease control, poor harvesting and storage conditions [16]. There is also a lack of breeding programs for sesame in the country.

The sesame crop is grown under a variety of environments, which may probably affect its performance. The main weakness in sesame cultivation and production performance is susceptibility to biotic and abiotic stresses including soil fertility, pests and diseases [17]. Combined with seasonal droughts and antiquated farming methods, low yields of sesame crop are the result for small holder farmers in the country [18]. Thus, proper schemes are required that enhance the stability of sesame crop production by developing high yielding and tolerant sesame varieties that will be effective for small-scale sesame farming systems. Recently, several improved sesame varieties have been experimented within the country. The improved varieties were introduced to the country by international organizations. Yet, the cultivation of improved varieties by small scale farmers is limited in the country due to insufficient varietal information. The farmers still grow old local varieties with low yields. Therefore, adequate knowledge of production technology also nearly as good quality cultivars will help the farmers to enhance yield or increase sesame production in the study area. So the experiment was done with an objective of identifying and recommending adaptable high yielding sesame varieties for small scale farmers and farming communities for improving farmers' income and improving sesame production and productivity in Somalia.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

This experiment was conducted during the Deyr season (2016) at the experimental farm of Somali Agriculture Technical Group (SATG), Afgoye. The experimental site is situated about 30 kilometers west of Mogadishu, the nation's capital. River Shabelle of Somalia passes through the middle of Afgoye town. Somalia generally has an arid to semi-arid climate. The country's' climate is hot and dry. Rainfall is the most important characteristic of the climate in Somalia and has a great spatial and temporal variability [19]. The Deyr season starts in September, picks up in October and ends in November. The rains in the study area are small during the season and the average seasonal rainfall is 151-200 mm [20].

2.2 Soil of the Experimental Site

The soil of the experimental site was clay loam in texture. After soil testing, it was identified that the pH of soil was 8.32. The total Nitrogen was found to be 0.15%. The phosphorus level was 5.58 ppm while potassium was 625 ppm. The organic matter content of the soil was 2.56%.

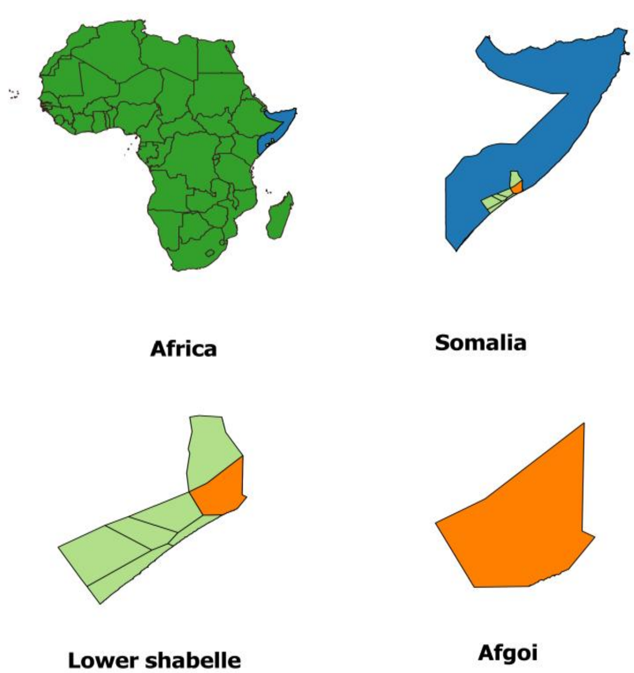

Fig. 1. Map of Africa, Somalia and the study area (Afgoye town)

2.3 Treatment and Experimental Design

The experiment was laid out in Randomized Completely Block Design (RCBD) with 4 replications. The size of unit plot was 37.1 m² with Spacing between Plots 1.3 m. The total number of treatments was 6 with total of 24 plots. The whole area was divided into 24 plots. The replications were separated by 2 m and plots were separated by 1.3 m distance. Seeds of six sesame varieties that are named Humera, Indian, Setit, Nigerian, Dunyar and Yemeni were sown for the trial. Seeds for the trial were sown in solid lines. Space between rows was 0.65 m while space between plants was 0.20 m. The row length with each plot was 9.5 m. Three to five seeds were sown per hill. Missing hills were refilled with the same seeds to maintain desired plant population.

2.4 Cultural Practice

The di-ammonium phosphate (DAP) fertilizer was applied at the sowing time at a rate of 50 kg per hectare. DAP fertilizer was incorporated into the soil before sowing of seeds. The desired population density was maintained by thinning plants after 8 days of emergence. Irrigation, mulching, weeding and plant protection measures were performed as needed to maintain uniform germination, better crop establishment and proper plant growth. To avoid losses of seeds, harvesting was done when 75% of the capsules turned yellow. Harvesting and threshing was carried with the use of human labor.

2.5 Data Collection Procedure

The data for growth and yield performance was collected from plant height, first capsule height, capsule length, number of branches per plant, number of capsules per plant, number of seeds per capsule**.** Also seed yield, straw yield, biological yield and harvest index were measured. The harvested plants were segmented into components such as straw (leaf, branch and stem together) and seed. The straw and capsule were then dried in the sun for 72 hours and weighed. The seeds were also dried in the sun and weighed. The seed weight was adjusted at 8% moisture content. Data was collected from average of six plants per plot. Plants were separated into their component parts (leaf, stem, branch, flower and capsule). Sample plants were collected from second and third rows. The first rows were avoided from sampling for border effect.

2.6 Data Analyses

The data were analyzed statistically by the F-test to examine whether the differences among treatments were significant. The mean comparisons of the treatments were evaluated by Duncan's Multiple Range Test (DMRT). The analysis of variance (ANOVA) for different parameters was done by a computer package programme 'R LANGUAGE' [21].

3. RESULTS AND DISCUSSION

Table 1 below displays the growth performance of the varieties under field condition. No significance difference was detected among the varieties in terms of plant height. However, the tallest plant height of was found in Yemeni variety while the lowest plant height was observed in Setit variety. Likewise there was no significant difference among the varieties when it comes to the first capsule height. Nevertheless the maximum first capsule height was found in Yemini variety while the lowest first capsule height was discovered in Indian variety. Capsule length was significantly different among varieties. The highest capsule length was found in Nigerian variety while the lowest capsule length was recorded for Setit variety. The number of branches per plant was significantly influenced by crop varieties. It had been observed that Yemeni variety had the most number of branches per plant while Setit variety had the lowest number of branches per plant. There was also a significant difference in varieties in terms of number of capsules per plant. It was observed that local variety has the highest number capsules per plant while Setit variety gave the lowest number of capsules per plant. Finally significant difference was observed in number of seeds per capsule. The highest number of seeds per capsule was observed at Nigerian variety while the lowest number of seeds per capsule was found at Setit variety. Study of the effect of planting method and plant population on growth and yield of sesame (*S. indicum*) have revealed variations in growth parameters of varieties under treatment [22]. It was also demonstrated that varieties were significantly different in growth characteristics [23]. Another study in 2012 also revealed that growth variables were also significantly influenced by sesame varieties [24].

Table 1. Growth performance of the varieties

Varieties	Plant Height (cm)	First Capsule Height (cm)	Capsule Length (cm)	No. of branches/plant	No. of Capsule/Plant	No Seeds/Capsule
Humera	91.25 b	45.03 ab	3.35 b	4.00 cd	62.00 a	72.25 b
Indian	94.00 b	28.60 b	3.95 a	4.50 c	45.75 a	67.75 b
Setit	90.25 b	47.08 ab	3.20 b	3.50 d	40.75 a	57.75 c
Nigerian	92.25 b	38.33 b	4.10 a	4.25 c	63.00 a	80.75 a
Dunyar	96.50 b	46.68 ab	3.93 a	5.75 b	86.50 a	74.25 b
Yemeni	109.00 a	65.00 a	3.43 b	6.00 a	79.75 b	75.25 b
Level of significance	NS	NS	*	**	**	*
CV (%)	14.32	16.82	7.539	9.383	10.98	11.78

** *= highly significant at p<0.01; *= significant at p<0.01; NS= not significance; CV= coefficient variation*

Table 2. Yield performance of the varieties

Varieties	Seed yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	HI (%)
Humera	2.82 a	3.25 a	6.07 a	46.46 a
Indian	0.67 c	2.94 b	3.61 b	18.56 c
Setit	1.21 b	2.76 b	3.97 b	30.48 b
Nigerian	1.25 b	3.09 ab	4.34 b	28.80 b
Dunyar	2.73 a	3.45 a	6.18 a	44.17 a
Yemeni	2.79 a	3.34 a	6.13 a	45.51 a
Level of significance	**	*	*	*
CV (%)	8.34	13.35	10.34	9.77

** *= highly significant at p<0.01; *= significant at p<0.01; NS= not significance; CV= coefficient variation*

Table 2 shows the yield performance of the sesame varieties. Seed yield (t/ha) was significantly different among sesame varieties. It was observed that Humera variety showed the highest yield while the Indian variety has given the lowest seed yield. Straw yield was also significantly different between varieties. The highest straw yield of was recorded for local variety while the lowest straw yield was observed in Setit variety. There is also significant variation among varieties in terms of biological yield. The highest biological yield was observed at Local variety while the lowest biological yield was recorded for Indian variety. Finally, there was significant variation among varieties in terms of harvest index. The highest harvest index was calculated for Humera variety while the lowest harvest index was detected at Indian variety. Many similar studies have indicated that sesame varieties were significantly different in yield components [25,26].

4. CONCLUSIONS

The results showed that there were significant differences among the varieties for most the characters measured. Parameters like number of branches per plant, number of capsules per plant, capsule length, seed yield and straw yield were significantly different among varieties. Nevertheless, the productivity of these particular varieties did not outperform the local variety, thus, future studies would be essential to look for other alternative methods and cultivars that would help to increase the productivity.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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