Response of Sesame (*Sesame Indicum L.*) Varieties to Different Sowing Dates in Lowland Irrigated Areas of Somali Region, Ethiopia

.

ABSTRACT

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| A field experiment was conducted to investigate the yield performance of four sesame varieties at different sowing dates, with the aim of determining the optimum sowing date for improved sesame varieties in the lowland irrigated areas of the Somali Region. The experiment was laid out in a randomized complete block design (RCBD) with three replications. At each location—Idan, Barsan, Kelafo, and Serkamo—four sesame varieties and four sowing dates (mid-April, late April, mid-May, and late May) were used as treatments. The findings revealed that sesame varieties and sowing dates differed significantly in yield-related traits. The variety Idan (ACCOO44) recorded the highest number of capsules per plant (37.75) and biomass yield (2,489 kg/ha), while the Kelafo variety recorded the highest number of seeds per capsule (53.0), thousand seed weight (2.23 g), and grain yield (2,216 kg/ha). Plots sown in mid-April produced the highest values for number of capsules per plant, number of seeds per capsule, thousand seed weight (g), biomass yield (kg/ha), and grain yield (kg/ha) compared to the other sowing dates. In conclusion, both varietal differences and sowing dates had significant effects on the agronomic performance and yield of sesame, with mid-April sowing proving most favorable across all traits evaluated. Therefore, this research recommends that the two varieties, Kelafo and Idan (ACCOO44), be sown in mid-April to achieve higher grain and biomass yields in the study areas. |

***Keywords****:* Biomass yield, Grain yield, Sesame, Sowing dates

1. INTRODUCTION

Sesame (*Sesamum indicum L.*), otherwise known as sesamum, a member of the family Pedaliaceae, is one of the ancient oilseeds domesticated and cultivated in tropical and subtropical parts of the world by humans for edible oil and medicinal purposes for more than 5,000 years (Umar *et al.,* 2010). Though there is controversy regarding the origin of sesame, it is believed to have originated in Ethiopia due to the existence of both cultivated and wild types in the country (Wijnands *et al.,* 2009). Sesame, locally called “Selit” or “Sisin,” is one of the major economically important oil crops in Ethiopia. It is used as one of the main cash crops and is the second export commodity next to coffee in Ethiopia, playing a significant role as a source of rural employment and in ensuring food security for millions of people (Abebe, 2016).

The sesame sector is a multi-million-dollar industry that supports the livelihoods of thousands of smallholder farmers and hundreds of medium-to-large-scale private farms, along with thousands of other actors involved in the production-to-consumption/export chain. Ethiopia is one of the well-known and major producers of sesame in sub-Saharan Africa, and Ethiopian sesame is among the highest quality in the world (Taghouti *et al.,* 2017). From a nutritional point of view, sesame is also rich in phosphorus, iron, magnesium, manganese, zinc, and vitamin B1 (Anilakumar *et al.,* 2010).

The crop is grown under different environmental conditions, which may affect its growth performance. Environmental and biotic factors (weeds, diseases, and insect pests) as well as management practices are the main sesame production constraints. The environmental factors include temperature, rainfall, and soil types. Areas with annual rainfall of 625–1100 mm, deep, well-drained, fertile sandy loams, and temperatures above 27°C are most conducive for sesame production (Terefe *et al.,* 2012). Management practices, on the other hand, include plant population, time of sowing, and type and rate of fertilizers. Sowing dates play a vital role in determining the final seed yield of crops (Malik *et al.,* 2003), and the types of sesame varieties that adapt to a particular area may also be critical to boosting sesame production.

The productivity of sesame in the Somali Region is lower than the national average yield of 686 kg/ha (CSA, 2019). However, sesame productivity can reach 1000–1200 kg/ha under optimum agronomic cultivation (Ali *et al.,* 2017). The low productivity of sesame in the study area might be due to the cultivation of low-yielding varieties and poor management practices, such as inappropriate sowing dates. Sowing date is one of the agronomic management practices, and its manipulation could increase the yield performance of sesame varieties. The effect of sowing dates on yield and yield components of sesame has been reported by several researchers. Therefore, this study was conducted to investigate the yield performance of four sesame varieties under different sowing dates to determine the optimum sowing date for the performance of improved sesame varieties in the lowland irrigated areas of the Somali Region.

2. material and methods

The research was conducted at the Gode Agricultural Research Sub-Center, located in the Somali Regional State of Ethiopia. Gode is situated in a semi-arid lowland area characterized by hot and dry climatic conditions. The area receives low and erratic annual rainfall, typically ranging between 200–300 mm, with average temperatures often exceeding 30°C. The soils are generally sandy to sandy loam, with moderate fertility and good drainage, making the area suitable for irrigated agriculture. The site was selected for its representativeness of lowland irrigated environments suitable for sesame cultivation in the Somali Region.

The experiment was carried out at the Gode Experimental Field under irrigated conditions during the 2019 cropping season. A randomized complete block design (RCBD) with three replications was used. The treatments consisted of four sesame varieties (Iidan, Barsan, Kelafo-74, and Serkamo) and four sowing dates (mid-April, late April, mid-May, and late May). Each gross plot measured 5 m × 3.2 m (16 m²), while the net plot size was 5 m × 2.4 m (12 m²). Row and plant spacing were maintained at 40 cm and 10 cm, respectively. A distance of 1 m was maintained between blocks, and 0.5 m between plots within a block. Data on phenological, growth, yield, and yield-related parameters were collected and analyzed using GenStat software, version 15.

3. results and discussion

**3.1 Phenological Parameters**

The dates of 50% crop emergence, 50% flowering, and 75% crop maturity were not significantly affected by sowing date, sesame variety, or their interaction (Table 1). This observation aligns with the findings of Adhikary *et al.* (2020), who reported that phenological stages such as seedling emergence, first branching, flowering initiation, capsule formation, and physiological maturity were not significantly influenced by different sowing dates or sesame varieties under pre-kharif conditions in India.

**Table 1. Date of 50% crop emergence, 50% flowering and 75% crop maturity as affected by sowing dates and sesame varieties**

|  |  |
| --- | --- |
| **Treatments** | **Parameters** |
| **Planting dates** | **DE 50%** | **DF 50%** | **DM 75%** |
| Mid April | 4.25a | 39.5a | 79.42a |
| Late April | 4.00a | 39.0a | 76.67a |
| Mid May | 4.00a | 40.0a | 84.50a |
| Late May | 3.88a | 39.58a | 80.25a |
| LSD (P<0.05) | NS | NS | NS |
| Sesame varieties |  |  |  |
| ACC0016 (barsan) | 3.92a | 39.5a | 84.3a |
| ACCOO44 (Idan) | 4.0a | 39.8a | 81.25a |
| Serkamo | 4.08a | 40.0a | 78.33a |
| Kelafo | 4.1a | 40.5a | 75.92a |
| LSD(P<0.05) | NS | NS | NS |
| CV (%) | 10.1 | 6.1 | 12 |

*\*NS = non-significant, CV (%) = coefficient of variation in %, LSD = least significant difference at 5% level of significance, means in column and followed by the same letters are not significantly different at 5% level of significance according to LSD test.DE50: 50%Date of Emergence, DF50%: Date of 50% flowering and DM75%: Date of 75% maturity.*

**3.2 Plant Height**

Plant height was highly significantly affected (P<0.01) by sowing date (Table 2). Sowing in mid-April produced significantly taller plants compared to mid-May and late May sowings. However, late April and mid-May sowings were statistically at par. The taller plant height observed in the mid-April sowing may be attributed to the longer vegetative growth period allowed by the earlier planting. Similar results were reported by Rakesh *et al.* (2022) regarding the effect of planting date on sesame plant height. On the other hand, plant height was not significantly affected by sesame variety or the interaction between variety and sowing date.

**3.3 Number of branches per plant**

Mid-April, late April, and mid-May sowings produced a statistically similar number of branches per plant. However, mid-April sowing resulted in significantly more branches compared to late May sowing (Table 2). The number of branches per plant showed a decreasing trend from mid-April to late May. Delayed planting reduced the number of branches per plant, which is consistent with the findings of Sarkar *et al.* (2007), who attributed the reduction in branch number under delayed planting to unfavorable environmental conditions, particularly rainfall. Regarding varieties, although the differences were not statistically significant, the Kelafo variety produced the highest number of branches (3.50), while the Serkamo variety had the lowest (2.66) branches per plant. The interaction between sowing date and sesame variety was also not significant.

**3.4 Number of capsules per plant**

The number of capsules per plant was not significantly affected by sowing dates, but it was significantly influenced by variety (P<0.05). The highest number of capsules per plant (37.75) was recorded for the Idan (ACCOO44) variety, which was statistically at par with Kelafo and Barsan (ACC0016) varieties. The lowest number of capsules (25.25) per plant was observed in the Serkamo variety (Table 2). The higher number of capsules per plant in certain varieties may be attributed to genetic differences. This finding is consistent with Valiki et al. (2015), who reported significant variation among sesame varieties in capsule number due to their genetic makeup. The interaction between sowing date and sesame variety was not significant.

**3.5 Number of seeds per capsule**

Data on the number of seeds per capsule indicated that crops sown in mid-April produced a significantly higher number of seeds per capsule (51.83) (Table 2). The lowest number of seeds per capsule (44.6) was recorded in the late May sowing, although this value was not significantly different from those of the late April and mid-May sowings. The higher seed count in early planting could be attributed to a longer photoperiod, which likely enhanced assimilate accumulation in the capsules, resulting in a greater number of seeds per capsule. Similar findings were reported by Sarkar et al. (2007), who observed a higher number of seeds (57) per capsule in early sowing compared to late sowing.

Among the varieties, the highest number of seeds per capsule (53) was recorded for the Kelafo variety, while the lowest (44.75) was observed for the Barsan (ACC0016) variety (Table 2). This variation may be due to inherent genetic differences among the varieties. A study by Tana et al. (2017) on groundnut also found that the number of seeds per pod varied among varieties, and the authors concluded that seed number is primarily influenced by genetic factors rather than agronomic practices. The interaction between sowing date and sesame variety was not significant.

**3.6 Thousand Seed weight (g)**

Mean values for sowing dates indicated that crops sown in mid-April produced the heaviest seeds, with a thousand seed weight of 2.37 g, while the lightest seeds (1.72 g) were obtained from crops sown in late May (Table 2). The earlier sown crops experienced a longer growth period under more favorable conditions, which likely contributed to the development of heavier seeds compared to the late-sown crops. Similar observations were reported by Rahman *et al.* (2017) and Sarkar *et al.* (2007), who found that early sowing significantly improved seed weight compared to late sowing. Thousand seed weight was not significantly affected by sesame varieties or by the interaction between variety and sowing date.

**3.7 Biomass Yield**

Biomass yield was significantly affected by both sowing dates and sesame varieties, but not by their interaction. The highest biomass yield (2705 kg/ha) was obtained from plots sown in mid-April, while the lowest yield (2022 kg/ha) was recorded from plots sown in late May, although the latter was statistically at par with the other sowing dates (Table 2). The higher biomass yield from early sowing may be attributed to increased vegetative growth compared to late sowing. These results align with those reported by Sarkar *et al.* (2007), who found that early June sowing significantly improved biomass yield compared to later sowings.

Among the sesame varieties, the highest biomass yield (2489 kg/ha) was recorded for the ACC0044 (Idan) variety, which was statistically similar to the Kelafo variety. The lowest biomass yield (2029 kg/ha) was obtained from the Serkamo variety, which was statistically similar to the Barsan (ACC0016) variety. These differences may be attributed to genetic variation among the varieties.

**Table 2. Growth and Yield and yield components parameters as affected by sowing dates and sesame varieties**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Treatments | PH (cm) | NBP | NCPP | NSPC | TSW(g) | BM(kg/ha) | GY(kg/ha) | HI% |
| Planting dates |  |  |  |  |  |  |  |  |
| Mid April | 111.08C | 3.75b | 32.58a | 51.83b | 2.367b | 2705b | 2181b | 13a |
| Late April | 99.75bc | 3.08ab | 30.50a | 48.58ab | 2.183ab | 2198a | 1999ab | 11a |
| Mid May | 92.17ab | 3.08ab | 33.33a | 47.08ab | 2.117ab | 2206 a | 1933ab | 12.5a |
| Late May | 81.75a | 2.750a | 31.25a | 44.67a | 1.717a | 2022a | 1536a | 12a |
| LSD(P<0.05) | 10.72 | 0.6 | NS | 1.63 | 0.38 | 334.5 | 432.2 | NS |
| Sesame varieties |  |  |  |  |  |  |  |  |
| ACC0016(Barsan) | 93.42a | 3.33a | 32.08ab | 44.75a | 2.175a | 2197ab | 1824a | 12a |
| ACCOO44(Idan) | 93.67a | 3.17a | 37.75b | 46.83ab | 1.900a | 2489b | 1885bc | 11.5a |
| Serkamo | 103.67a | 2.66a | 25.25a | 47.58ab | 2.075a | 2029a | 1725a | 12a |
| Kelafo | 94.00a | 3.50a | 32.58ab | 53.00b | 2.233a | 2416b | 2216c | 13a |
| LSD(P<0.05) | NS | NS | 8.18 | 1.63 | NS | 334.5 | 432.2 | NS |
| CV(%) | 13.4 | 16.8 | 9.0 | 11.8 | 17 | 17.6 | 16 | 12 |

*NS = non-significant, CV (%) = coefficient of variation in %, LSD = least significant difference at 5% level of significance, means in column and followed by the same letters are not significantly different at 5% level of significance according to LSD test.*

**3.8 Grain Yield**

Grain yield was significantly (P<0.05) affected by both sowing date and sesame variety, but not by their interaction (Table 2). The highest grain yield (2181 kg/ha) was recorded from plots sown in mid-April, which was statistically similar to yields obtained from late April and mid-May sowings. The lowest yield (1536 kg/ha) was observed in plots sown in late May, though it was statistically comparable to those from late April and mid-May. This trend indicates a general decline in grain yield with delayed planting from mid-April to late May. Sarkar *et al.* (2007) similarly reported that early sowing of sesame resulted in higher seed yields, attributing this to an increased number of branches and seeds per capsule. Likewise, studies by Ahmed *et al.* (2009) and Shekh *et al.* (2012) found that early sowing significantly enhanced sesame seed yield, while delayed sowing reduced yield due to shortened vegetative and reproductive phases. Bhardwaj *et al.* (2014) also concluded that earlier planting dates significantly improved seed yield, underscoring the importance of optimal sowing time for maximizing sesame production.

In terms of varietal performance, the highest grain yield (2216 kg/ha) was recorded for the Kelafo variety, which was statistically similar to the Idan variety. The lowest grain yield (1725 kg/ha) was obtained from the Serkamo variety, which was statistically comparable to the Barsan variety. These yield differences may be attributed to the varying adaptability and genetic potential of the varieties under the soil and climatic conditions of the study area. Similar findings were reported by Mahdi *et al.* (2007), who observed significant yield differences among sesame genotypes across different environments, highlighting the need to select varieties suited to specific agro-ecological zones.

4. Conclusion

The introduction of improved and high-yielding sesame varieties, along with the adoption of appropriate sowing dates, could significantly contribute to increased agricultural production and productivity in the lowland irrigated areas of the Somali region. The present research findings demonstrated that sesame varieties and sowing dates had significant effects on yield-related traits. The Idan (ACCOO44) variety recorded the highest number of capsules per plant (37.75) and biomass yield (2489 kg/ha), while the Kelafo variety produced the highest number of seeds per capsule (53.0), thousand seed weight (2.23 g), and grain yield (2216 kg/ha). On the other hand, the plots sown in mid-April achieved the highest number of capsules per plant, seeds per capsule, thousand seed weight (g), biomass yield (kg/ha), and grain yield (kg/ha) compared to the other sowing dates. Based on these results, the study recommends that the Kelafo and Idan (ACCOO44) varieties should be sown in mid-April for optimal yield performance in the study areas.

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