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Effect of planting geometry on the performance of sesame varieties

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Abstract
A field experiment was conducted during *kharif* 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.6), low in organic carbon (0.597%), available N (278.93 kg/ha), available P (37.8 kg/ha) and available K (247.1 kg/ha). The experiment was laid out in Randomized Block Design with ten treatments each replicated thrice. The treatments consist of three Varieties and three levels of spacing. The results showed that crop sown at Spacing 45 cm × 10 cm + variety DSS-9 recorded significantly higher plant height (90.37 cm), Plant dry weight (17.81 g/plant), capsules/plant (51.50), Seeds/capsule (55.74), Seed yield (1196.67 kg/ha), Stover yield (2966.67 kg/ha), gross returns (INR 107700.3/ha), net return (INR 75868.5/ha) and benefit cost ratio (2.4) as compared to other treatments.

Keywords: Economics, geometry, growth parameters, sesame, seed yield and varieties

Introduction
Oil seed crop plays an important role in Indian agriculture economy next to food grains. It is superior to other oil seed crop due to adaptability to varied agro-climatic condition and higher degree of drought tolerance it is widely grown in many countries and also in drier parts of African and Mediterranean countries. The oilseeds are very important because of its capability of synthesis of sulphur containing amino acids, vitamins, and constituent in human dietary system next to carbohydrates, protein and fats. Sesame seeds are rich source of food, nutrition, edible oil and bio- medicine. Sesame oil has excellent nutritional, medicinal, cosmetic and cooking qualities for which it is known as 'the queen of oils'(Ashri, 1994) [3].

The spacing of the crop sown has influence on the amount of sunlight received by the plants and also the competition for light, nutrient, moisture and space between the plants. Wider crop geometry improved most of the yield attributes over lesser crop geometry owing to favorable geometric arrangement which helped better absorption of moisture and nutrients, and efficient photosynthesis, thereby resulting in better manifestation of yield attributes (Ghosh 1994) [4]. Row spacing is one of the vital components, manipulation of that can lead for optimizing yield. Population density has profound have an impact on on grain yield. The plant density may be adjusted through the usage of either distinctive seed rates or distinctive row spacing. Optimum planting density permits the sesame plant to develop well each in its aerial and underground elements through making use of most radiant energy, area and water which in the long run leads to reinforce crop production (Shinde *et al.* 2011) [13]. As a C_3 plant, sesame will be affected by photorespiration. Better plant geometry influences by minimizing the photorespiration which ultimately escalates the crop yield. As per modern technology, spacing has a connotation in relation to plant population, which usually depends upon the soil fertility eminence and moisture level of the field. Plant geometry improves the light interception and carbon assimilation by revising the canopy structure and also increasing productivity. Proper nutrient management improves the growth and yield of crops. (Subrahmaniyan *et al.* 1999) [14].

Materials and Methods

The experiment was conducted during *Kharif* season of 2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental field was sandy loam in texture, nearly neutral in soil reaction (pH 7.6), organic carbon (0.597%), available N (278.93 kg/ha), available P (37.8 kg/ha) and available K (247.1 kg/ha). The treatment consists of T1: Variety DS-1 at 30 cm × 10 cm spacing, T2: Variety E8 at 30 cm × 10 cm spacing, T3: Variety DSS-9 at 30 cm × 10 cm spacing, T4: Variety DS-1 at 30 cm × 20 cm spacing, T5: Variety E8 at 30 cm × 20 cm spacing, T6: Variety DSS-9 at 30 cm × 20 cm spacing, T7: Variety DS-1 at 45 cm × 10 cm spacing, T8: Variety E8 at 45 cm × 10 cm spacing, T9: Variety DSS-9 at 45 cm × 10 cm spacing, T10: Control. The experiment was laid out in Randomized Block Design, with 10 treatments replicated thrice. The collected data was subjected to statistical analysis by analysis of variance method. Sesame, Variety DS-1, Variety- E8, Variety-DSS-9 were selected for sowing. Seeds are adopted of spacing (30 x 10 cm), (30 x 20 cm), (45 x 10 cm) and sown at depth of 2-3 cm. The recommended dose of fertilisers 40:25:25 NPK was applied according to the treatment details as through Urea, SSP, MOP. Whole of nitrogen, phosphorus, potash was applied as basal at the time of sowing. Application of 40 kg Sulphur 20 kg as basal dose and 20 kg at 20 days after sowing (DAS). Thinning & Gap filling was done at 15 DAS to maintain the plant population according to treatment in order to attain recommended plant population for proper growth and yield of crop. To control the infestation of Phyllody disease which are spread by mycoplasma-like organism transmitted through leaf hoppers. So for the control by foliar application of Metasystox at the rate of 1 millilitre per litre of water was sprayed at 30 DAS, 36 DAS and 40 DAS. Weeding was done to remove all weeds from the field in order to check any form of initial crop-weed competition and also checks the spread of yellow vein mosaic virus disease thus helpful for crop nourishment. Hand weeding was done 25 DAS & 45 DAS. Five representative healthy plants were selected and tagged randomly to take observations. The growth contributing characteristics such as plant height (cm), plant dry weight (g). Yield contributing characters such as Capsules per plant (No), Seeds per capsule (No.), Seed yield (kg/ha) and Stover yield (kg/ha) were noted at the time of harvest.

Results and Discussion

Growth parameters

The data revealed that significantly higher plant height (58.79 cm) was recorded with (treatment 9) spacing 45 cm × 10 cm + variety DSS-9. However, treatment (T6) spacing 30 cm × 20 cm + variety DSS-9 was found to be statistically at par with highest. Increase in plant height is due to nitrogen which is essential element of bio-molecules such as amino acids, proteins, nucleic acids and enzymes. It stimulates growth, expansion of the crop canopy and interception of solar radiation. Phosphorus is an essential nutrient both as a part of several key plant structure compounds and stimulates root development, increase stem strength, improve flower formation and seed production, more uniform and earlier crop maturity. The results were found accordance with Kashani *et al.* (2015) [5].

The data revealed that Significantly highest plant dry weight (16.60) was recorded treatment 9 with spacing 45 cm × 10 cm + variety DSS-9. However, treatment T6 spacing 30 cm × 20 cm + variety DSS-9 was found to be statistically at par with highest. The dry matter production is an indication of utilization of light, nutrients and water by the plants. It is also an indicator of growth over the entire period. The results are in accordance with Angel *et al.* (2022) [2].

Yield parameters

Treatment-9 Spacing 45cm × 10cm + variety DSS-9 was recorded significantly higher number of capsule per plant (51.50). However, treatment 6 spacing 30 cm × 20 cm + variety DSS-9 was found to be statistically at par with the highest. Significant increase in number of capsules/plant is due to increase in the availability of Nitrogen and Phosphorous (Ahmad *et al.* 2018) [1] found that Sulphur levels had an effect on number of branches and suggested that sulphur enhanced the metabolic and meristematic activities of crop resulting with increase in branches per plant.

Treatment-9 Spacing 45cm × 10cm + variety DSS-9 was recorded significantly maximum number of seeds per capsule (55.74). However, treatment 6 spacing 30 cm × 20 cm + variety DSS-9 was found to be statistically at par with highest. These results agree with those of (Kathiresan *et al.* 2002) [7] who reported that decrease in row spacing increased intraspecific competition which eventually caused reduction in the number of seeds /capsule as compared to wider row spacing. The yield attributing characters such as number of seeds/capsule were significantly higher with wider spacing. It may be due to less competition exerted for light, moisture and nutrients. Sufficient interception of sunlight promotes efficient photosynthesis activities and ultimately greater accumulation of photosynthates under wider spacing.

Treatment-9 Spacing 45cm × 10cm + variety DSS-9 was recorded significantly maximum Seed yield (1196.67 kg/ha) which was superior over all other treatments. However, treatments 6 spacing 30 cm × 20 cm + variety DSS-9 was found to be statistically at par with Treatment-9 Spacing 45cm × 10cm + variety DSS-9. These results are in agreement with Olowe and Busari (2003) [8] who reported that wider row spacing showed more potential to realise high seed yield than the closest spacing. Increase in seed yield at wider row spacing may be due to larger space and growth resources available per individual plant, which enhanced growth and development.

Treatment-9 Spacing 45cm × 10cm + variety DSS-9 was recorded significantly maximum Stover yield (2966.67 kg/ha) which was superior over all other treatments. However, treatments 6 spacing 30 cm × 20 cm + variety DSS-9 was found to be statistically at par with Treatment-9 Spacing 45cm × 10cm + variety DSS-9. Higher yield and stover yield is due to increasing wider spacing might be due to availability of larger feeding area for better utilisation of natural resources like space, sunlight, water, nutrients, minerals etc. and the optimum plant population is due to higher yield of the crop. The results are in agreement with the findings of (Sinde *et al.* 2011) [13].

Table 1: Effect of planting geometry on growth attributes of Sesame

			60 DAS
S. No	**Treatments**	**Plant height (cm)**	**Dry weight (g/plant)**
1	Variety DS-1 at 30 cm × 10 cm spacing	52.37	15.99
2	Variety E8 at 30 cm × 10 cm spacing	55.27	16.72
3	Variety DSS-9 at 30 cm × 10 cm spacing	56.05	17.16
4	Variety DS-1 at 30 cm × 20 cm spacing	51.06	16.22
5	Variety E8 at 30 cm × 20 cm spacing	54.37	22.92
6	Variety DSS-9 at 30 cm × 20 cm spacing	57.08	17.58
7	Variety DS-1 at 45 cm × 10 cm spacing	50.05	15.04
8	Variety E8 at 45 cm × 10 cm spacing	53.31	16.30
9	Variety DSS-9 at 45 cm × 10 cm spacing	58.79	17.81
10	Control	48.07	14.71
	SE m (±)	1.56	2.14
	CD (p=0.05)	4.64	6.38

Table 2: Effect of planting geometry on yield attributes on Sesame

S. No	Treatments	Capsules/plant (No.)	Seeds/capsule (No.)	Seed yield (kg/ha)	Stover yield (kg/ha)
1	Variety DS-1 at 30 cm × 10 cm spacing	42.35	47.83	1036.73	2460.00
2	Variety E8 at 30 cm × 10 cm spacing	46.57	51.26	1066.73	2590.00
3	Variety DSS-9 at 30 cm × 10 cm spacing	48.43	53.72	1036.67	2733.33
4	Variety DS-1 at 30 cm × 20 cm spacing	41.02	47.53	910.18	2400.00
5	Variety E8 at 30 cm × 20 cm spacing	44.78	51.13	980.05	2560.00
6	Variety DSS-9 at 30 cm × 20 cm spacing	50.76	54.40	1076.73	2830.00
7	Variety DS-1 at 45 cm × 10 cm spacing	39.04	46.50	956.74	2360.00
8	Variety E8 at 45 cm × 10 cm spacing	43.70	49.57	993.49	2520.00
9	Variety DSS-9 at 45 cm × 10 cm spacing	51.50	55.74	1196.67	2966.67
10	Control	37.28	45.02	993.56	2320.00
	SE m (±)	1.29	1.54	50.25	131.83
	CD (p=0.05)	3.84	4.60	149.31	391.65

Conclusion

It can be concluded that Treatment-9 with Spacing 45cm row to row and 10cm plant to plant along with variety DSS-9 recorded better in growth parameters and yield attributes

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