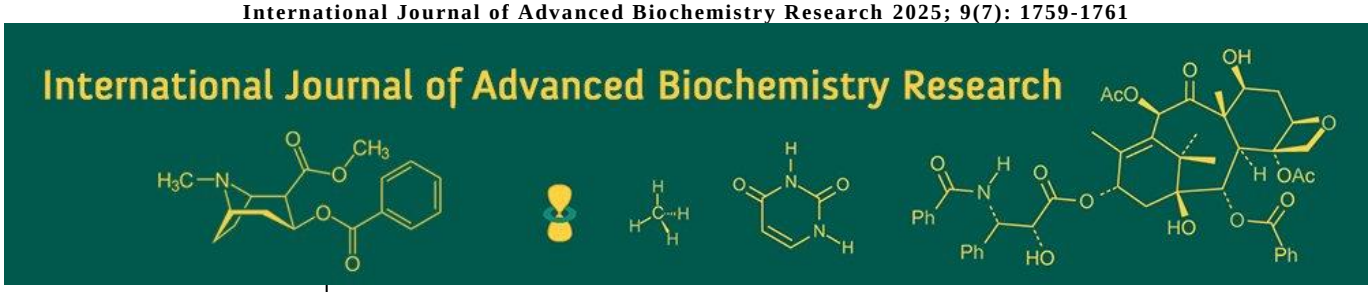

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Effect of direction of sowing and spacing on yield and economics of sesame (*Sesamum indicum* L)

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Abstract
The present investigation on experiment named "Effect of Direction of sowing and spacing on yield and economics of sesame (*Sesamum indicum* L.)" was carried out at during Kharif season of 2024 at the CRF (Crop Research Farm), Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. The experiment was laid out in randomized block design consisting of nine treatments replicated thrice. Findings of the investigation briefly summarized as below based on the objectives under taken: The significantly maximum number of capsules/plant (35.13), maximum seeds/capsules (51.53), higher seed yield (555.40 kg/ha), maximum stover yield (1193.50 kg/ha) were recorded in (treatment 6) 40 cm × 15 cm + North-South. Maximum gross return (INR 77,756.00/ha), net return (INR 49,056.00/ha) and B:C ratio (1.64) were also recorded in (treatment 6) 40 cm × 15 cm + North-South.

Keywords: Sesame, directions, spacing and economics

Introduction
Sesame (*Sesamum indicum* L.) is one of the most versatile and survivor crops that can be grown in semi-arid and arid regions. It has unique attributes that can fit almost any cropping system being a short duration crop with a potential to sustainable intensify crop production through crop diversification (Weiss, 2000) [6]. This evidently indicates the potentiality for improvement in yield. Worldwide sesame seed consumption was USD 6559.0 million in 2018, and it will reach USD 7244.9 million by 2024, with a CAGR (compound annual growth rate) of 1.7% Global sesame consumption is steadily increasing mainly due to changing consumer's consumption patterns and increasing health awareness. According to Directorate of Economics and Statistics (2019), India ranks first in world with 19.47 lakhs ha area and 8.66 lakhs tones production. The average yield of sesame (413 kg/ha) in India is low as compared with other countries in the world (535 kg/ha). The main reasons for low productivity of sesame are its rainfed cultivation in marginal and sub marginal lands under poor management and input starved conditions. However, improved varieties and agro production technologies capable of increasing the productivity levels of sesame are now developed for different agro ecological situations in the country. A well-managed crop of sesame can yield 1200-1500 kg/ha under irrigated and 800-1000 kg/ha under rainfed conditions (FAOSTAT, 2012) [2]. The crop is grown in almost all parts of the country. More than 85% production of sesame comes from West Bengal, Madhya Pradesh, Rajasthan, Uttar Pradesh, Gujarat, Andhra Pradesh (A.P) and Telangana.

Materials and Methods
The experiments on the Effect of Direction of sowing and spacing on yield and economics of sesame (*Sesamum indicum* L). The experiment was laid out in randomized block design consisting of nine treatments replicated thrice with 3 different spacing (20 cm × 15 cm, 30 cm × 10 cm, 40 cm × 15 cm) and 2 directions (East-West, North-South). Sesame variety Ronak-20 was selected for sowing. Seeds were sown in line manually on 2024. Seeds were covered with the soil immediately after sowing. The spacing adopted was plant to plant 10 cm and row to row 30 cm according to the treatment details and the seeds were drilled at 3-4 cm depth. All the treatments were applied by balancing to the initial soil test values and crop requirements to justify the crop response to the supplied nutrients in both years.

Results and Discussion

Number of capsules per plant

There was significant difference among the treatments, significantly higher number of capsules per plant (35.13) was recorded with the application of 40 cm × 15 cm + North-South. However, 30 cm × 10 cm + East-West (34.80) were statistically at par with Treatment (6) and minimum was reported in 20 cm × 15 cm + East-West (30.47).

Number of seeds per capsules

There was significant difference among the treatments, significantly higher number of seeds per capsules (51.53) was recorded with the application of 40 cm × 15 cm + North-South. However, 30 cm × 10 cm + East-West (51.20) were statistically at par with Treatment (6) and minimum was reported in 20 cm × 15 cm + North-South (46.80).

Seed yield (t/ha)

Higher seed yield (555.40 kg/ha) was recorded with the application of 40 cm × 15 cm + North-South. However, 30 cm × 10 cm + East-West (551.30 kg/ha) was statistically at par with Treatment (6) and minimum was reported in 20 cm × 15 cm + North-South (487.69 kg/ha).

Gross return (INR/ha)

Gross return (69,425.00 INR/ha) was found to be highest in the treatment 40 cm × 15 cm + North-South, and minimum Gross return (60,960.90 INR/ha) was found to be in 20 cm × 15 cm + North-South as compared to other treatments.

Net returns (INR/ha)

Net return (40,725.00 INR/ha) was found to be highest in the treatment 40 cm × 15 cm + North-South, and minimum Net return (32,260.90 INR/ha) was found to be in 20 cm × 15 cm + North-South as compared to other treatments.

Benefit cost ratio (B:C)

Benefit cost ratio (1.36) was found to be highest in the treatment 40 cm × 15 cm + North-South, and minimum Benefit cost ratio (1.07) was found to be in 20 cm × 15 cm + North-South as compared to other treatments.

Discussion

At low plant population there was minimal competition for space, light, moisture and nutrients which could have suggested enhanced dry matter production and seed yield hence higher output per hectare and this entails more returns. The decreased oil and protein contents of the seed at higher seed rates could be due to poor growth of plants. This must not be unconnected with the fact that rate beyond 5 kg ha-1 suffered high intra and inter plant competitions for growth resources. Thus, the superior yield at 5 kg ha-1 appeared to have been accounted by the high number of pods and seed yield/plant which is synonymous to increased output. Similar results were reported by (Malik *et al.*, 2003) [4] and (Duncan., 1955) [1] The interaction between sowing method and seed rate on number of pods and seed yield per hectare was an indication of differential response of sesame to seed rate irrespective to sowing methods. Highest yield/ha was obtained at 5 kg ha-1 seed rate for all the sowing methods. This could have resulted from higher inter and intra plant competitions for moisture, light and nutrients beyond optimum plant population. The work of Malik *et al.*, 2003 [4] Singh *et al.*, 2013 [5] and Kamble *et al.*, 2015 [3] gave a similar result.

Table 1: Effect of Direction of sowing and spacing on growth and yield attributes of sesame

S. No	Treatment combinations	No. of capsules/plant	No. of seeds/capsules	Seed yield (kg/ha)	Stover yield (kg/ha)
1.	20 cm × 15 cm + East-West	30.47	47.07	492.46	1104.93
2.	20 cm × 15 cm + North-South	31.13	46.80	487.69	1101.25
3.	30 cm × 10 cm + East-West	34.80	51.20	551.30	1180.32
4.	30 cm × 10 cm + North-South	32.20	47.60	490.54	1116.62
5.	40 cm × 15 cm + East-West	32.53	48.20	508.75	1112.76
6.	40 cm × 15 cm + North-South	35.13	51.53	555.40	1193.50
7.	50 cm × 10 cm + East-West	34.67	50.93	544.50	1162.10
8.	50 cm × 10 cm + North-South	33.07	49.93	529.80	1139.36
9.	Control RDF: NPK-40:60:40 kg/ha	33.93	50.00	511.40	1118.67
	S. Em (±)	0.52	0.55	7.70	15.31
	CD (p = 0.05)	1.55	1.66s	23.08	45.90

Table 2: Evaluation of Direction of sowing and spacing on Economics of sesame.

S. No	Treatment combination	Gross returns (INR/ha)	Net returns (INR/ha)	B:C ratio
1.	20 cm × 15 cm + East-West	68,944.12	40,244.12	1.34
2.	20 cm × 15 cm + North-South	68,276.21	39,576.21	1.31
3.	30 cm × 10 cm + East-West	77,182.00	48,482.00	1.61
4.	30 cm × 10 cm + North-South	68,675.60	39,975.60	1.33
5.	40 cm × 15 cm + East-West	71,225.50	42,525.50	1.42
6.	40 cm × 15 cm + North-South	77,756.00	49,056.00	1.64
7.	50 cm × 10 cm + East-West	76,230.00	47,530.00	1.60
8.	50 cm × 10 cm + North-South	74,172.00	45,472.00	1.53
9.	Control RDF: NPK-40:60:40 kg/ha	71,596.00	41,496.00	1.38

Conclusion

It is concluded that the application of 40 cm × 15 cm + North-South recorded higher yield and benefit cost ratio in Sesame.

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