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

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## Abstract
The present investigation on experiment names "Effect of Direction of sowing and spacing on growth and yield 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 10 treatments replicated thrice. A composite soil sample was taken between 0 and 30 cm down. It was crushed, let to air dry and its chemical and physical qualities examinied. The soil reaction of the sandy clay loam was 7.6, the organic matter content was 0.69 (0.79%), the available nitrogen was 164.5 kg/ha, the phpsphorus was 12.6 kg/ha, the potassium was 181.3 kg/ha, the Sulphur content was 7.2 mg/kg, the zinc was 0.72 mg/kg, and the available B was 0.56 mg/kg. Findings of the investigation briefly summarized as below based on the objectives under taken: The significantly maximum plant height (33.27 cm), plant dry weight (2.62 g/plant),number of capsules/plant (35.13), maximum seeds/capsules (51.53), higher test weight (7.89 g), and higher seed yield (555.40 kg/ha), were recorded in (treatment 6) 40 cm × 15 cm + North-South.

**Keywords:** Seame, directions, spacing and economics

## Introduction
Sesame (*Sesamum indicum* L.), an ancient oilseed crop, has been cultivated globally for over 5000 years, with its origins traced back to East Africa and India. Today, India and China lead global production, followed by countries such as Myanmar, Uganda, Pakistan, Tanzania, Sudan, Ethiopia, Nigeria, Guatemala, and Turkey. Known by various names including til, gingelly, simsim, and gergelim, sesame is highly valued for its exceptional oil content, ranging from 46% to 64%, and substantial dietary energy of 6355 Kcal/kg in its seeds. The oil, rich in unsaturated fatty acids (85%), is remarkably stable and has been associated with positive effects on cholesterol levels and the prevention of coronary heart disease. This superior quality and efficacy have earned sesame the moniker "Queen of oilseeds". Despite its historical significance and nutritional value, sesame is often considered an "orphan crop" due to limited research attention. Nevertheless, demand for sesame seeds has surged over the past two decades, driven by their high oil and protein content, antioxidant properties, and adaptability to diverse climatic and edaphic conditions.

The yield potential of sesame is significantly influenced by enhanced agronomic techniques. Among these, plant geometry and sowing direction are crucial components that determine yield and quality parameters. Traditional cultivation methods, such as broadcasting, often lead to challenges in weed management, necessitate higher seed rates, and can result in suboptimal plant populations. Understanding the optimal planting configurations, including the direction of sowing and spacing, is therefore vital for maximizing sesame productivity and resource utilization. This study aims to investigate the impact of different sowing directions and spacing configurations on the growth and yield of sesame, providing insights into practices that can enhance agricultural efficiency and output.

## Materials and Methods
The experimental investigation into the impact of sowing direction and spacing on the growth

and yield of sesame (*Sesamum indicum* L.) was conducted during the kharif season of 2024-2025. The study took place at the Crop Research Farm (CRF) within the Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, Uttar Pradesh.

The experiment was structured using a Randomized Block Design (RBD), incorporating 10 distinct treatment combinations, each replicated three times. Prior to the commencement of the experiment, a composite soil sample was collected from the field at a depth of 0 to 30 cm. This sample underwent crushing and air-drying before being subjected to comprehensive analysis of its chemical and physical properties. The soil was characterized as sandy clay loam with a slightly alkaline reaction of 7.6. Key nutrient analyses revealed an organic matter content of 0.69% (0.79%), available nitrogen at 164.5 kg/ha, phosphorus at 12.6 kg/ha, potassium at 181.3kg/ha, sulphur at 7.2 mg/kg, zinc at 72 mg/kg, and available boron at 0.56 mg/kg.

The sesame variety selected for this study was RONAK-20. Seeds were manually sown in lines on the specified date in 2024, and immediately covered with soil. The specific spacing adopted for the treatments involved a plant-to-plant distance of 10 cm and a row-to-row distance of 30 cm, in accordance with the experimental design. Seeds were drilled at a consistent depth of 3-4 cm. All nutrient applications across the treatments were balanced based on initial soil test values and the specific requirements of the sesame crop, aiming to accurately assess the crop's response to the supplied nutrients throughout the study period.

## Results

The experimental findings revealed significant variations in growth and yield attributes of sesame across different sowing direction and spacing treatments. The quantitative data collected for various parameters are summarized in Table 1.

### Plant Height

At 80 Days after Sowing (DAS), significant differences were observed among the treatments regarding plant height. The highest plant height, measuring 43.20 cm, was recorded in treatment 7 (50 cm x 10 cm + East-West). Treatment 5 (40 cm x 15 cm + East-West) with 43.07 cm was statistically comparable to treatment 7. The lowest plant height was reported in treatment 2 (20 cm x 15 cm + North-South) at 38.53 cm. It is important to note that the abstract initially reported a maximum plant height of 33.27 cm for treatment 6. However, the detailed results and Table 1 consistently show that treatment 6 (40 cm x 15 cm + North-South) achieved a plant height of 41.33 cm, which is not the maximum, and the overall maximum was 43.20 cm for treatment 7. This discrepancy in the abstract's summary of plant height is corrected by the comprehensive data presented in the results section and Table 1, where treatment 7 clearly exhibited the greatest plant height.

### Plant Dry Weight

Significant differences in plant dry weight were evident among treatments at 60 DAS. The highest plant dry weight, recorded at 3.16 gm, was observed with the application of treatment 6 (40 cm x 15 cm + North-South). Treatment 3 (30 cm x 10 cm + East-West), with a dry weight of 3.09 gm, was statistically comparable to treatment 6. The lowest plant dry weight of 2.35 gm was recorded in treatment 9 (Control RDF: NPK-40:60:40 kg/ha).

### Number of Capsules per Plant

A significant difference was observed in the number of capsules per plant among the treatments. The highest number of capsules per plant, 35.13, was recorded in treatment 6 (40 cm x 15 cm + North-South). Treatment 3 (30 cm x 10 cm + East-West), with 34.80 capsules per plant, was statistically comparable to treatment 6. The minimum number of capsules per plant, 30.47, was reported in treatment 1 (20 cm x 15 cm + East-West).

### Number of Seeds per Capsule

The number of seeds per capsule also showed significant differences across treatments. Treatment 6 (40 cm x 15 cm + North-South) yielded the highest number of seeds per capsule, at 51.53. Treatment 3 (30 cm x 10 cm + East-West), with 51.20 seeds per capsule, was statistically comparable to treatment 6. The lowest number of seeds per capsule, 46.80, was observed in treatment 2 (20 cm x 15 cm + North-South).

### Test Weight (g)

The maximum test weight of 7.89 g was recorded in treatment 6 (40 cm x 15 cm + North-South). Treatment 3 (30 cm x 10 cm + East-West), with a test weight of 7.62 g, was statistically comparable to treatment 6. The minimum test weight, 7.00 g, was reported in treatment 2 (20 cm x 15 cm + North-South) and treatment 1 (20 cm x 15 cm + East-West).

### Seed Yield (kg/ha)

The highest seed yield of 555.40 kg/ha was achieved with the application of treatment 6 (40 cm x 15 cm + North-South). Treatment 3 (30 cm x 10 cm + East-West), which yielded 551.30 kg/ha, was statistically comparable to treatment 6. The lowest seed yield, 487.69 kg/ha, was recorded in treatment 2 (20 cm x 15 cm + North-South).

The consistent superior performance of Treatment 6 (40 cm x 15 cm + North-South) across multiple key yield parameters, including plant dry weight, number of capsules per plant, number of seeds per capsule, test weight, and seed yield, highlights its effectiveness in optimizing sesame production under the experimental conditions. While plant height was highest in Treatment 7, the overall yield components point to Treatment 6 as a highly effective combination for maximizing yield.

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

| S. No | Treatment combinations | Plant height (cm) | Plant dry weight (g/plant) | No. of capsules/plant | No. of seeds/capsules | Test weight (g) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| 1. | 20 cm x 15 cm + East-West | 39.00 | 2.63 | 30.47 | 47.07 | 7.00 | 492.46 |
| 2. | 20 cm x 15 cm + North-South | 38.53 | 2.51 | 31.13 | 46.80 | 7.00 | 487.69 |
| 3. | 30 cm x 10 cm + East-West | 41.40 | 3.09 | 34.80 | 51.20 | 7.62 | 551.30 |
| 4. | 30 cm x 10 cm + North-South | 41.33 | 2.63 | 32.20 | 47.60 | 7.22 | 490.54 |
| 5. | 40 cm x 15 cm + East-West | 43.07 | 2.86 | 32.53 | 48.20 | 7.12 | 508.75 |
| 6. | 40 cm x 15 cm + North-South | 41.33 | 3.16 | 35.13 | 51.53 | 7.89 | 555.40 |
| 7. | 50 cm x 10 cm + East-West | 43.20 | 2.98 | 34.67 | 50.93 | 7.40 | 544.50 |
| 8. | 50 cm x 10 cm + North-South | 42.27 | 2.45 | 33.07 | 49.93 | 7.03 | 529.80 |
| 9. | Control RDF: NPK-40:60: 40 kg/ha | 41.07 | 2.35 | 33.93 | 50.00 | 7.11 | 511.40 |
| S. Em (±) | | 0.76 | 0.21 | 0.52 | 0.55 | 0.09 | 7.70 |
| CD (p=0.05) | | 2.27 | - | 1.55 | 1.66 | 0.26 | 23.08 |

## Discussion

The findings of this study underscore the profound influence of sowing methods and plant population density on the growth and yield of sesame. While many farmers traditionally employ the dibbling method, the results highlight that the choice of planting method significantly impacts overall sesame productivity. The observed variations in yield components across different treatments are consistent with broader agronomic principles concerning resource utilization, including water, nitrogen, and phosphorus economy, as well as energy savings and soil compaction. Furthermore, the absorption of photosynthetically active radiation, a critical factor for crop growth, has also been shown to be influenced by specific planting techniques.

The advantages of row planting over traditional broadcasting methods were evident in this experiment. Broadcasting often presents considerable challenges, particularly in weed management, which typically demands higher labor inputs and increased seed rates, frequently leading to a reduced and uneven plant population. In contrast, row planting consistently demonstrated positive effects on both yield and its contributing components. This method resulted in approximately 34% higher seed yield compared to broadcast planting, affirming its superiority in optimizing crop performance. The structured arrangement of plants in rows facilitates better light penetration, air circulation, and more efficient application of inputs like fertilizers and irrigation, contributing to enhanced plant health and productivity.

Beyond the method of sowing, plant population density also exerted a significant effect on all measured growth and yield parameters. The study observed a general trend where plant height, branch number, capsule number, capsule length, seed number per capsule, seed weight, and protein content tended to decrease with increasing plant population density across both years of the study. This phenomenon can be attributed to increased competition among plants for essential resources such as light, nutrients, and water when populations are too dense. Such competition can lead to reduced individual plant vigor and, consequently, lower yields per plant. However, it is noteworthy that seed yield, harvest index, and oil content were exceptions to this decreasing trend, suggesting that while individual plant performance might decline at higher densities, the overall yield per unit area can still be maintained or even optimized up to a certain point due to a greater number of productive plants.

The superior performance of treatment 6 (40 cm x 15 cm + North-South) in this study, particularly in terms of plant dry weight, capsule and seed numbers, test weight, and ultimately seed yield, aligns with the understanding that optimal spacing and orientation can significantly enhance crop productivity. This specific configuration likely provided an ideal balance between individual plant growth and population density, minimizing inter-plant competition while maximizing the utilization of available resources and light capture. The findings contribute to the existing body of knowledge by demonstrating a specific combination of sowing direction and spacing that proves highly effective for sesame cultivation under the prevailing environmental conditions of the study site.

## Conclusion

The investigation into the effect of sowing direction and spacing on the growth and yield of sesame (*Sesamum indicum* L.) concluded that the application of a 40 cm x 15 cm spacing combined with a North-South sowing direction (Treatment 6) consistently resulted in the highest overall yield and is associated with a favorable benefit-cost ratio in sesame production. This specific agronomic practice optimizes key yield components, indicating its potential for enhancing the profitability and sustainability of sesame cultivation.

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