*Original Research Article*

# Effect of Spacing and Nitrogen Management on Yield and Economics of Summer Sesame (*Sesamum indicum* L.)


## ABSTRACT

A field experiment was carried out in *Zaid* 2022 at the Department of Agronomy's Agricultural Research Farm in Prayagraj (U.P).The three planting geometries used in the experiment are 30 cm x 10 cm, 40 cm x 10 cm, and 50 cm x 10 cm. There are three nitrogen management treatments used in the experiment: 50% of the Recommended Dose of Nitrogen (RDN) through inorganic fertiliser, 50% of the RDN through inorganic fertiliser in combination with 50% of Nitrogen provided through FYM with *Azotobacter* seed inoculation, and 50% of the RDN through inorganic fertiliser. Ten treatments were duplicated three times in the randomised block design of the experiment. Findings showed that 30x10cm spacing ,Maximum plant height (124.48 cm), dry weight (29.85 g), number of capsules/plant (78.69), number of seeds/capsule (36.39), and seed yield (552.38 kg/ha) were obtained with 50% RDN + 50% N via FYM + Biofertilizer (*Azotobacter*).



**Key words**:
Spacing, Farm Yard Manure (FYM), Recommended Dose of Nitrogen (RDN), *Azotobacter,* and *Zaid.*


## INTRODUCTION

Sesame (*Sesamum indicum* L.), a key oilseed crop, is produced extensively in India. As well as sesame, this seed is also known as til, simsim, benised, gingelly, and gergelim. Sesame has a key role in the agricultural and industrial industries of our country. The only crop that produces more edible oil than sesame is groundnut. Because to the exceptional oil quality, flavour, and softness of sesame, it is referred to as " the queen of the oilseed crops". It typically has an oil content of 46% to 52%. By enabling optimal light contact and satisfactory absorption of nutrients and water from the soil, proper spacing in the case of ses ame led to a better crop output. Sesame (*Sesamum indicum*) is a seasonal shortday plant (*Sesamum indic um* L.).The oldest indigenous oilseed crop in India with the longest history of cultivation is sesame (Sesamum indicum L.). The names til (Hindi, Punjabi, Assamese, Bengali, Marathi), tal (Gujarati), nuvvulu, manchi nuvvulu (Telugu), and ellu are all used to refer to sesame or gingelly (Tamil, Malayalam, Kannada) With 19.47 lakh acres of land and 8.66 lakh tonnes of production, tila/pitratarpana (Sanskrit) and rasi (Odia) in various parts of India rank first in the globe. In comparison to other nations (535 kg/ha), India has a low average output of sesame (413 kg/ha). Sesame's low productivity is primarily due to its rainfed cultivation on marginal and submarginal fields with poor management and material shortages. For various agro-ecological settings in the nation, better varieties and agro-production techniques are now being created. Sesame crops may produce 1200–1500 kg/ha when irrigated and 800–1000 kg/ha when rainfed with proper management. Sesame (*Sesamum indicum* L.) is one of the oldest and most significant oilseed crops, is grown around the world (Abou Gharbia et al., 1997). The plant family Pedaliaceae includes sesame. It has been cultivated in the Middle East, Asia, and Africa since 1500 BC (Ali et al., 2007). With an average productivity of 455 kg/ha, India ranks first in both area (1.78 M ha) and production (0.81 Mt) as the world's largest producer of sesame (*Sesamum indicum* L.)It has earned the title of "the queen of oilseeds" due to its improved nutritional, medicinal, and culinary quality. Sesame productivity is declining as a result of its cultivation on marginal and sub-marginal soils and ineffective crop management techniques.

**MATERIALS AND METHODS**

The experiment was conducted in the *Zaid* of 2022 at the Crop Research Farm,Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agricultural, Technology and Sciences (SHUATS), Prayagraj

(U.P.) The property is situated at 25° 57'12" N latitude and 87° 50'12" E longitude, 98 metres above mea n sea level (MSL). This region is situated on the *Yamuna River's* right bank along the Prayagraj Rewa road, some 12 kilometres from the city. Ten treatments, each replicated three times and categorised as ha ving three levels, were used in an experiment to see how spacing and nitrogen management affected th e development and output of summer sesame (*Sesamum indicum* L.). The farm is situated at 25 degrees, 98 metres above mean sea level. 87° 50'12" East, 25° 57'12" North latitude; sea level (MSL).

This region is situated on the *Yamuna River's* right bank along the Prayagraj,rewa path, about 12 kilom etres from the city.

The experiment was set up using a randomised block design with 10 treatments that are duplicated three times in order to examine the effects of spacing and nitrogen management on summer sesame (*Sesamum indicum* L.) growth and yield.

When employed in combinations, the treatments are separated into 3 levels of plant geometry and 3 for ms of nitrogen as follows:$T_1$: Spacing 30cm × 10cm + 50% RDN + 50% N through FYM,$T_2$: Spacing 30cm × 10cm + 50% RDN + Biofertilizer (*Azotobacter*) ,$T_3$: Spacing 30cm × 10cm + 50% RDN + 50% N through FYM + Biofertilizer(*Azotobacter*),$T_4$: Spacing 40cm × 10cm + 50% RDN + 50% N through FYM,$T_5$: Spacing 40cm × 10cm + 50% RDN + Biofertilizer (*Azotobacter*),$T_6$: Spacing 40cm × 10cm + 50% RDN + 50% N through FYM + Biofertiizer (*Azotobacter*),$T_7$: Spacing 50cm × 10cm + 50% RDN + 50% N through FYM, $T_8$: Spacing 50cm × 10cm + 50% RDN + Biofertilizer (*Azotobacter*),$T_9$: Spacing 50cm × 10cm + 50% RDN 50% N through FYM + Biofertilizer(*Azotobacter*), $T_{10}$ : 10.Spacing 30cm × 10 cm + 50 : 40 : 30 NPK Kg/ha (Control)

. When the oil harvest was ready, it was carefully handled. After harvesting, seeds were extracted from each net plot and dried for three days in the sun. Five randomly selected sample plants from each plot of each replication were manually measured for growth characteristics such plant height (cm), dry matter a ccumulation (g/plant), and more.

After cleaning and winnowing, grain yield per hectare was estimated and expressed in kilogrammes per hectare. Each net plot's leftover yield was measured and expressed,after full drying in the sun for 10 day s, in tones per acre.

The statistical method developed by Gomez and Gomez was used to calculate and analyse the data (1984). The benefit:cost ratio was established after figuring out how much the seed with stover was wort h, and the full cost of crop production was taken into consideration.



## RESULTS AND DISSCUSION

### Effect of Spacing and nitrogen management on growth parameters:

**Plant height (cm)**

Table 1 makes it quite evident that plant height measurements increased as the crop grew.
The treatment T3 (Spacing 30cm 10cm + 50% RDN + 50% N through FYM + Biofertilizer (*Azotobacter* )) resulted in a maximum plant height of 124.48 cm, whereas the treatments T2 and T6 had statistically c omparable results for spacing 30cm 10cm + 50% RDN + 50% N through FYM and Biofertilizer (*Azotob acter*).Due to nitrogen and spacing, sesame plants grew substantially higher. The spacing reveals the ses ame's larger plant height, greater quantity of seeds and capsules, greater number of plants and capsules, and greatest test weight.
Solar radiation is absorbed by plants for a variety of reasons, including improved mineral, nutrient, wate r, and solar radiation use, as well as plants' predisposition to extend towards light when incoming solar r adiation is inadequate notably the lower canopies of plants.
The findings are consistent with those made public by Yadav et al., (2007). Because it is a crucial comp onent of many different types of metabolically active substances, including amino acids, proteins, nuclei c acids, purines and pyrimidines, nucleotides, enzymes, coenzymes, and alkaloids, nitrogen plays a signi ficant role in plant metabolism. Increased meristematic activity of plant tissues and an increase in cell si ze and quantity may have contributed to higher levels of organic manure's continuous availability of nitr ogen, which ultimately led to the development of taller plants. Rao et al., as well as Ghosh and Sen (198 0), also produced results that were comparable (1990). (2000) Ghosh reported that Sesame plant height was boosted by azotobacter seed inoculation.

**Dry matter accumulation (g/plant)**

The most plant dry weight was found in treatment T3 (Spacing 30cm 10cm + 50% RDN + 50% N throu gh FYM + Biofertilizer (*Azotobacter*).Yet it was found that therapy T3 (spacing 30cm 10cm + 50% RD N + 50% N through FYM + biofertilizer) was statistically equal to treatment (*Azotobacter*) spacing 30 cm 10cm + 50% RDN + 50% N through FYM (*Azotobacter*). The dry weight of sesame increased significantly as a result of nitrogen and spacing. Spacing suggests that better mineral, food, water, solar radiation, etc. intake may be the cause of the increased dry weight. Nitrogen is involved in a variety of physiological processes, such as protein synthesis and enzyme activation. Reduced plant density at a 45 cm by 10 cm spacing might result in an increase in plant dryness. Plants might create weight. If they had access to enough food, water, and room. These results support Patra and Mishra's conclusions

(2000). Since it improves plant photosynthesis when handled appropriately, nitrogen is an essential part of chlorophyll. Higher nitrogen levels have been found to increase the dry matter in plants because increased photosynthetic activity leads to the production of more photosynthate. Moreover, Ogundare et al.,(2015) found that raising nitrogen doses to the necessary level led to improved dry matter accumulation in sesame plants.

**Effect of Spacing and nitrogen management on Yield and Yield Attributes:**

**Number of capsules/plants**

Treatment's statistical analysis of the amount of capsules produced by each plant identified a substantial impact. At a spacing of 30 cm 10 cm + (50% RDN + 50% N via FYM + Biofertilizer (*Azotobacter*)), the plant produced the largest number of capsules per unit of time (78.69). Nonetheless, it was shown that the spacings of 30cm 10cm + (50% RDN + 50% N through FYM + Biofertilizer) and 40cm 10cm + (50% RDN + 50% N through FYM + Biofertilizer) were statistically equal to one another (*Azotobacte*r). A sufficient quantity of sunlight absorption promotes efficient photosynthesis, which causes more photosynthates to accumulate across a larger region. With restricted spacing and a dense plant population, lower yield attribute values were attained.

**Number of seeds/ capsules**

**Seed yield (kg/ha)**

Notably, treatment T3 (spacing 30 cm 10 cm + 50% RDN + 50% N via FYM + biofertilizer (*Azotobacter*)) outperformed the other treatments and had the maximum number of capsules per plant (36.39). Both the T2 treatment (spacing 30 cm 10 cm + 50% RDN + biofertilizer (*Azotobacter*) and the T8 treatment (spacing 50 cm 10 cm + 50% RDN + biofer (*Azotobacter).* These results are in line with those of Yadav and colleagues (2007). Since it improves plant photosynthesis when handled appropriately, nitrogen is an essential part of chlorophyll. Higher nitrogen concentrations have been shown to increase dry matter because increased photosynthetic activity leads to the production of more photosynthate. In sesame, Shinde et al. (2011) discovered that increasing the allowed quantity of nitrogen led to the plant accumulating dry matter.The grain yield showed that treatment T3 (spacing 30 cm 10 cm + 50% RDN + 50%

N via FYM + Biofertilizer (*Azotobacter*)) outperformed the other treatments and provided the maximum quantity of seed yield (552.38 kg/ha). While it was less successful than the highest treatment T3 (Spacing 30cm 10cm + 50% RDN + 50% N via FYM + Biofertilizer), treatment T2 (Spacing 30cm 10cm + 50% RDN + Biofertilizer (*Azotobacter*)). Perhaps less competition exists for nutrients, moisture, and light. Adequate sunlight absorption promotes efficient photosynthesis, which causes more photosynthates to accumulate across a larger region. With restricted spacing and a dense plant population, lower yield attribute values were attained. Ogundare (2015), Patra, and Mishra found findings that were comparable to these (2000).

**Stover yield (kg/ha)**

The yield of sesame stover was also influenced by the usage of spacing and nitrogen management. The treatment T10 (Control with specified spacing and RDN) produced the greatest recorded stover yield (2052.3 kg/ha), whereas the treatment T1 (Spacing 30 cm 10 cm + 50% RDN + 50% N via FYM) produced the lowest reported yield (1920.6 kg/ha). Perhaps less competition exists for nutrients, moisture, and light. A sufficient quantity of sunlight absorption promotes efficient photosynthesis, which causes more photosynthesis to accumulate across a larger region. With restricted spacing and a dense plant population, lower yield attribute values were attained. Potassium is involved in a variety of physiological processes, such as protein synthesis and enzyme activation. Similar findings were reported by Nayek et al. (2014) and Preeti (2010).



## CONCLUSION

It can be concluded that sesame should be sown at a spacing of 30cm (row to row) × 10cm (plant to plant) and 50% Recommended doseof nitrogen through inorganic should be met out through 50% Nitrogen through FYM along with *azotobacter* seed inoculation was found more productive (552.38 kg/ha) as well as economically viable (30,221.00 INR/ha).

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**Table 1. Effect of spacing and nitrogen management on yield attributes of summer sesame.**

| Yield and Yield Attributes | | | | | | |
|---|---|---|---|---|---|---|
| **Treatment combinations** | **No.of capsules/Plant** | **No. of seeds/ capsule** | **Test Weight (g)** | **Seed Yield (kg/ha)** | **Stover Yield (kg/ha)** | **Harvest Index (%)** |
| 1. Spacing 30cm × 10cm + 50% RDN + 50% N through FYM | 70.89 | 32.72 | 3.34 | 409.65 | 1920.6 | 15.03 |
| 2. Spacing 30cm × 10cm + 50% RDN + Biofertilizer (*Azotobacter*) | 75.61 | 35.28 | 3.38 | 451.64 | 1980 | 14.86 |
| 3. Spacing 30cm × 10cm + (50% RDN + 50% N through FYM + Biofertilizer (*Azotobacter*) | 78.69 | 36.39 | 3.38 | 552.38 | 2052.3 | 17.51 |
| 4. Spacing 40cm × 10cm + 50% RDN + 50% N through FYM | 68.93 | 29.68 | 3.31 | 401.82 | 2250.6 | 15.15 |
| 5. Spacing 40cm × 10cm + 50% RDN + Biofertilizer (*Azotobacter*) | 72.54 | 34.12 | 3.34 | 438.69 | 2271 | 14.92 |
| 6. Spacing 40cm × 10cm + 50% RDN + 50% N through FYM + Biofertilizer (*Azotobacter*) | 74.69 | 34.54 | 3.35 | 443.26 | 2501.9 | 14.76 |
| 7. Spacing 50cm × 10cm + 50% RDN + 50% N through FYM | 66.73 | 27.86 | 3.30 | 396.89 | 2560.8 | 16.70 |
| 8. Spacing 50cm × 10cm + 50% RDN + Biofertilizer (*Azotobacter*) | 68.61 | 28.73 | 3.30 | 399.51 | 2315.6 | 16.29 |
| 9. Spacing 50cm × 10cm + 50% RDN + 50% N through FYM + Biofertilizer (*Azotobacter)* | 69.76 | 31.33 | 3.32 | 419.36 | 2587.9 | 15.59 |
| 10.Spacing 30cm ×10 cm + 50: 40: 30 NPK Kg/ha (Control) | 65.35 | 25.56 | 3.29 | 387.69 | 2602.6 | 16.80 |
| F test | S | S | NS | S | S | NS |
| SEm(+) | 0.81 | 0.48 | 0.04 | 8.10 | 2.60 | 0.28 |
| CD (P=0.05) | 2.40 | 1.43 | - | 24.06 | 7.72 | - |

**Table 2. Effect of spacing and nitrogen management on economics of summer sesame.**

| S.no | Treatments | Cost of cultivation (INR/ha) | Gross returns (INR/ha) | Net returns (INR/ha) | B:C ratio |
|---|---|---|---|---|---|
| 1. | Spacing30cm×10cm+50%RDN+50%NthroughFYM | 30878.00 | 53255.00 | 22376.00 | 1.72 |
| 2. | Spacing 30×10cm+50%RDN+Biofertilizer(*Azotobacter)* | 36273.00 | 58713.00 | 22440.00 | 1.62 |
| 3. | Spacing30cm×10cm+50%RDN+50%NthroughFYM+Biofertilizer (*Azotobacter)* | 41588.00 | **71809.00** | **30221.00** | **1.73** |
| 4. | Spacing 40×10cm+50%RDN+50%NthroughFYM | 30788.00 | 52237.00 | 21458.00 | 1.70 |
| 5. | Spacing 40×10cm+50%RDN+Biofertilizer(*Azotobacter)* | 36173.00 | 57030.00 | 20857.00 | 1.58 |
| 6. | Spacing40cm×10cm+50%RDN+50%NthroughFYM+Biofertilizer (*Azotobacter)* | 41488.00 | 57624.00 | 16136.00 | 1.39 |
| 7. | Spacing 50×10cm+50%RDN+50%NthroughFYM | 30678.00 | 51596.00 | 20917.00 | 1.68 |
| 8. | Spacing 50×10cm+50%RDN+Biofertilizer(*Azotobacter)* | 36073.00 | 51936.00 | 15863.00 | 1.44 |
| 9. | Spacing50×10cm+50%RDN+50%NthroughFYM+Biofertilizer (*Azotobacter)* | 41388.00 | 54517.00 | 13129.00 | 1.32 |
| 10. | Spacing 30cm × 10cm + 50 : 40 : 30 NPK kg/ha | 30227.00 | 50400.00 | 20713.00 | 1.67 |