

Response of Sesamum (*Sesamum indicum* L.) to Integrated Nutrient Management on Yield

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Abstract - Sesamum (*Sesamum indicum* L.), popularly known as the “queen of oilseeds,” is an important oilseed crop valued for its high-quality edible oil and nutritional significance. However, its productivity in India remains low due to poor soil fertility and imbalanced nutrient management. Therefore, a field experiment entitled “Response of Sesamum (*Sesamum indicum* L.) to Integrated Nutrient Management” was conducted during the Rabi season of 2025–26 at the Research Farm of Vivekananda Global University, Jaipur, Rajasthan. The experiment was laid out in a Randomized Block Design with three replications and eleven nutrient management treatments comprising different combinations of inorganic fertilizers, vermicompost, biogas slurry, and poultry manure. The sesamum variety RT-346 was used for the study. Observations on growth, yield attributes, seed yield, stalk yield, harvest index, nutrient uptake, oil content, and economics were recorded and analyzed statistically.

The results revealed that integrated application of nutrient sources significantly influenced crop productivity. The treatment receiving 75% recommended dose of nitrogen (RDN) through chemical fertilizers + 25% RDN through vermicompost recorded the highest seed yield (1283 kg ha⁻¹) and stalk yield (3345 kg ha⁻¹), which remained at par with treatments involving integrated use of chemical fertilizers and organic manures. The lowest seed yield (543 kg ha⁻¹) and stalk yield (746 kg ha⁻¹) were recorded under 100% RDN supplied through biogas slurry alone. Harvest index was not significantly affected by different nutrient management treatments. The superior performance of integrated nutrient management treatments was attributed to improved nutrient availability, enhanced soil physical and chemical properties, and greater nutrient-use efficiency. The study demonstrated that combining inorganic fertilizers with vermicompost can effectively enhance sesame productivity and sustain soil health under semi-arid conditions. Therefore, application of 75% RDN through chemical fertilizers along with 25% RDN through vermicompost may be recommended for achieving higher yield and sustainable sesame production.

Keywords: Sesamum, integrated nutrient management, vermicompost, biogas slurry, poultry manure, seed yield, soil fertility.

INTRODUCTION

Sesamum (*Sesamum indicum* L.) is one of the oldest cultivated oilseed crops in the world and is popularly known as the “queen of oilseeds” because of its superior oil quality, excellent stability, and high nutritional value. India is among the leading producers and exporters of sesame, cultivating the crop on about 1.7–1.9 million hectares with an annual production of approximately 0.8–0.9 million tonnes. However, the average productivity remains relatively low, ranging from 450–500 kg ha⁻¹, primarily due to cultivation under rainfed conditions, poor soil fertility, inadequate nutrient management, and limited adoption of improved production technologies (Anonymous, 2023–24).

Sesame seeds contain 45–52% high-quality edible oil rich in unsaturated fatty acids, particularly oleic and linoleic acids, along with natural antioxidants such as sesamin and sesamol, which contribute to its nutritional and medicinal value. In addition to oil production, sesame cake serves as a valuable source of protein-rich livestock feed and organic manure. With the growing demand for edible oils in India and increasing dependence on imports, enhancing the productivity of sesame has become an important national priority.

Nutrient management plays a vital role in improving sesame productivity and quality. Continuous cultivation coupled with imbalanced use of chemical fertilizers has led to nutrient depletion and deterioration of soil health, resulting in reduced crop response to fertilizers. Integrated Nutrient Management (INM), which combines organic and inorganic nutrient sources, offers a sustainable approach for maintaining soil fertility and enhancing crop productivity. Organic manures such as farmyard manure, vermicompost, and poultry manure improve soil physical, chemical, and biological properties while supplying essential plant nutrients. Their combined use with chemical fertilizers improves nutrient-use efficiency, soil microbial activity, and long-term soil health.

Among essential nutrients, nitrogen is a key element influencing vegetative growth, yield formation, nutrient uptake, and quality of sesame. The use of different nitrogen sources under an integrated nutrient management system can improve nutrient availability and crop performance while ensuring sustainability. Therefore, the present investigation entitled “Response of Sesamum

(*Sesamum indicum* L.) to Integrated Nutrient Management” was undertaken to evaluate the effect of different nitrogen sources on growth, yield, nutrient uptake, quality parameters, and economics of sesame cultivation.

MATERIAL AND METHODS

A field experiment was conducted during the Rabi season of 2025–26 at the Research Farm of Vivekananda Global University, Jaipur, Rajasthan, India. The experimental site is located at 26°51' N latitude and 75°47' E longitude with an altitude of 390 m above mean sea level and falls under Agro-climatic Zone III-A (Semi-Arid Eastern Plain Zone) of Rajasthan. The region experiences a semi-arid climate with annual rainfall ranging from 500–700 mm, most of which is received during the monsoon season. During the crop season, a total rainfall of 25.6 mm was recorded.

Prior to sowing, composite soil samples were collected from 0–30 cm depth and analyzed for physico-chemical properties. The soil was loamy sand in texture, alkaline in reaction (pH 8.1), low in organic carbon (0.24%) and available nitrogen (139.2 kg ha⁻¹), and medium in available phosphorus (58.5 kg ha⁻¹) and potassium (216 kg ha⁻¹). The electrical conductivity of the soil was 0.18 dS m⁻¹.

The experiment was laid out in a Randomized Block Design (RBD) with three replications and eleven nutrient management treatments. The treatments included 100% recommended dose of nitrogen (RDN, 80 kg N ha⁻¹) through chemical fertilizers, vermicompost, biogas slurry, and poultry manure, as well as different combinations of inorganic and organic nitrogen sources. The sesame variety RT-346 was used for the study. Each plot measured 3.0 m × 6.0 m with a net plot area of 14.4 m². The crop was sown on 15 October 2025 by the pora method using a seed rate of 4 kg ha⁻¹ and row spacing of 30 cm.

The field was prepared by one deep ploughing followed by harrowing and leveling. Calculated quantities of fertilizers and organic nutrient sources were applied according to treatment specifications before sowing. Seeds were treated with Apron 35 SD @ 6 g kg⁻¹ seed to protect against seed-borne diseases. Standard agronomic practices, including thinning, hand weeding, and irrigation through a sprinkler system, were followed uniformly for all treatments.

Observations on plant height, dry matter accumulation, number of branches plant⁻¹, capsules plant⁻¹, seeds capsule⁻¹, test weight, seed yield, stalk yield, and harvest index were recorded using standard procedures. Nitrogen, phosphorus, and potassium contents in seed and stalk were determined by Kjeldahl, vanado-molybdate yellow colour, and flame photometric methods, respectively. Nutrient uptake was calculated based on nutrient concentration and yield. Oil content was estimated using the Soxhlet extraction method, and oil yield was computed accordingly. Economic parameters, including net returns and benefit-cost ratio, were also calculated.

The experimental data were statistically analyzed using analysis of variance (ANOVA) following Fisher’s method. Treatment means were compared using the critical difference (CD) test at the 5% level of significance. Standard error of mean [SEm (±)] and coefficient of variation (CV) were calculated to assess experimental precision.

RESULTS

Treatments	Yield (kg ha ⁻¹)	Stalk yield (kg ha ⁻¹)	Harvest index
100%RDN (80 kgN) through chemical fertilizers	1174	2740	30.11
100% RDN through Vermicompost	797	1709	31.77
100% RDN through Biogasslurry	543	746	41.81
100% RDN through Poultry Manure	876	2126	29.01
75%RDN through chemical fertilizers+25% through Vermicompost	1283	3345	27.72
75%RDN through chemical fertilizers+25% through Biogasslurry	1211	2844	29.87

50%RD N through chemical fertilizers +25% through Poultrymanure+25%	1124	2601	30.28
50% RD N through chemical fertilizers+25% through Biogass slurry+25%	1079	2540	29.89
50% RD N through chemical fertilizers +25% through Poultry manure+25%	1006	2463	29.20
1/3 RDN through Each Vermicompost, Biogas Slurry and Poultry Manure	931	2294	29.07
SEm □	66	160	0.95
C.D(P=0.05)		472	NS

SEED YIELD

The seed yield differed significantly due to addition of different combinations of nitrogen source treatments. It was observed that there was remarkable seed yield obtained against the application of chemical fertilizers. Seed yield of sesamum was ranged between 543 to 1283 kg ha⁻¹ with different treatments and the highest yield 1283 kg ha⁻¹ was obtained in 75% RDN through chemical fertilizers+25% through Vermicompost which found at par with the treatment T₆, T₇, T₈ and T₁. The increase in seed yield under all treatment combination was significantly higher as compared to absolute application of organic sources of nitrogen presented in table 4.5.

Stalk yield

Similar trend was also observed in Stalk yield data depicted in table 4.5. It was observed that maximum Stalk yield (3345 kg ha⁻¹) obtained with the application of 75% RDN through chemical fertilizers+25% through Vermicompost closely followed by 75% RDN through chemical fertilizers+25% through poultry manure. Integration of chemical fertilizers with organic manures like vermicompost and poultry manure increased the Stalk yield over the application of absolute organic manures.

Harvest index

The results showed non-significant effect on harvest index among different sources of nitrogen application at 5% level of significance given in the table 4.5. The use of 75% RDN through chemical fertilizers + 25 % through poultry manure gave higher harvest index (23.76%). The minimum harvest index (29.01%) was found in T₄.

DISCUSSION

The seed and Stalk yield differed significantly due to addition of different combinations of nitrogen sources. Seed and Stalk yield of sesamum was ranged between 543 to 1283 and 746 to 3345 kg ha⁻¹ with different treatments and the highest yield was obtained in T₅ (75%RDN through chemical fertilizers + 25 % through Vermicompost). The increase in yield under all treatment combination was significantly higher as compared to chemical fertilizers use presented in table 4.5. Amongst the treatments, T₅ seems more effective than other treatments in respect to yield. This improvement in yield is might be due to improvement of soil pH, physicochemical properties of soil due to application of vermicompost and poultry manures and instant availability of nutrients from inorganic fertilizers. The balanced nutrient management practices contributed to a great extent influencing the seed yield of sesamum. The yield enhancement obtained in present study were also in agreement with the finding of Piri *et al.* (2012) who stated that may be due to the effect of availability of micronutrients in increasing growth attributes. The beneficial effect of combined application of FYM and liming improving the physicochemical condition of the acid soil for achieving higher seed yield of sesamum has been reported by Saha *et al.* (2010) and Pooniyan *et al.* (2022).

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