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Impact of organic and bio-fertilizers on yield of Sesame (*Sesamum indicum* L.)

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Abstract

This research investigates the impact of organic and bio-fertilizers on yield of sesame (*Sesamum indicum* L.), with a focus on identifying the best sources of organic manure, evaluating their effects on oil content, and assessing the economic viability of different treatments. The study found that Vermicompost @ 5t + Rhizobium + PSB (T₅) led to the tallest plants (110 cm), the highest number of branches and capsules per plant, and a significant increase in capsule length, seeds per capsule, and seed weight. Similar trends were observed with treatments involving Castor Cake and FYM, confirming the positive influence of organic amendments on sesame growth. The highest seed yield was recorded in the treatment T₅, demonstrating an 88.12% improvement in seed weight per plant. Furthermore, the application of organic manures significantly enhanced the biological yield and harvest index, with the treatment FYM @ 10t + Rhizobium + PSB (T₂) showing the highest harvest index (36%). Economic analyses revealed that treatments with organic inputs yielded substantial gross and net monetary returns, with Vermicompost @ 5t + Rhizobium + PSB (T₅) delivering the highest gross monetary returns of ₹ 85,580.00 ha⁻¹, while Castor Cake @ 2t + Rhizobium + PSB (T₈) produced the highest net monetary returns of ₹ 56,317.00 ha⁻¹. The B:C ratio analysis indicated a favourable return on investment, especially with FYM @ 10t + Rhizobium + PSB (T₂), which achieved a B:C ratio of 3.16. Overall, the study highlights the crucial role of organic manures and bio-fertilizers in promoting sustainable and profitable sesame production.

Keywords: Organic, branches, bio-fertilizers, grains, capsule, seed index, straw yield

Introduction

Sesame (*Sesamum indicum* L.) is a crop of immense historical and agricultural significance. Tracing its roots back to ancient civilizations, sesame has been cultivated for thousands of years across various regions, especially in Africa and India, and is recognized as one of the earliest domesticated oilseed crops. Belonging to the Pedaliaceae family, it thrives in tropical and subtropical environments due to its adaptability to harsh climatic conditions, making it a valuable asset for farmers, especially in regions with erratic weather patterns (Sharma & Rao, 2021) [20]. The sesame plant is indeterminate in nature and self-pollinating, with a life cycle that suits a range of agro-climatic zones. The plant typically grows between 60 to 120 cm in height, depending on the variety and growing conditions. The stem is often branched, and the fruit is borne in capsules, which mature progressively from the bottom to the top. This sequential maturation often results in shattering of the lower capsules, which can cause significant yield losses if not harvested at the correct time (Singh *et al.*, 2022) [23].

Sesame seeds are small, ovate, and come in various colors, including cream, white, and black. Of these, cream-colored seeds are generally more preferred in the market due to their higher oil content and better flavor profile. Sesame is commonly known by several names across the world, including Gingely, Til, Simsim, and Biniseed. These names reflect the crop's global importance, particularly in regions where it forms a crucial component of dietary fat intake (Kumar & Patel, 2023) [8]. Often referred to as the "Queen of Oilseeds," sesame has earned this title because of the high quality of its oil. Sesame oil is rich in polyunsaturated fatty acids, particularly linoleic and oleic acids, which contribute to its high resistance to oxidative rancidity, making it one of the most stable edible oils. The oil content of sesame seeds ranges from 48% to 55%, with protein content varying between 20% to 28%. The seeds are also rich in essential

amino acids, including methionine and tryptophan, along with vitamins such as niacin and important minerals like calcium and phosphorus. These properties not only enhance the crop's market value but also position it as a nutritionally superior food source (Rao *et al.*, 2023) [16].

The cultivation of sesame extends across the globe, with India being the leading producer in both area and production. India accounts for a significant share of the global sesame market, cultivating the crop over approximately 19.47 lakh hectares, producing around 8.66 lakh tonnes annually, with an average productivity of 413 kg per hectare. Despite the crop's historical and economic importance, sesame productivity remains relatively low compared to other oilseed crops. The yield gap is primarily attributed to suboptimal agronomic practices, low genetic potential of traditional cultivars, and poor nutrient management strategies (Desai & Mishra, 2022) [3]. As the global demand for edible oils continues to rise, there is a growing need to enhance sesame productivity through improved crop management practices.

Among the various factors that influence sesame productivity, nutrient management plays a critical role. Fertilizers, both organic and inorganic, are essential for enhancing soil fertility and ensuring optimal crop growth. It is estimated that fertilizers contribute approximately 41% to overall agricultural productivity in India (FAO, 2023) [4]. In the context of sesame, the application of nutrients at the right stage of plant development is crucial for achieving high yields. Organic fertilizers, such as farmyard manure (FYM) and biofertilizers, have gained increasing attention due to their long-term benefits for soil health and their role in promoting sustainable agricultural practices (Khan *et al.*, 2023) [7]. Biofertilizers, in particular, offer a promising alternative to chemical fertilizers. They introduce beneficial microorganisms into the soil, which aid in nitrogen fixation, phosphorus solubilization, and the decomposition of organic matter, thereby improving nutrient availability to plants. The potential of biofertilizers to enhance crop productivity while minimizing environmental harm is particularly relevant in the current scenario, where the overuse of chemical fertilizers has led to significant soil degradation and water pollution (Mishra *et al.*, 2023) [9].

The use of chemical fertilizers, although effective in boosting crop yields, has raised concerns over the long-term sustainability of agricultural systems. Excessive reliance on synthetic inputs has led to the depletion of soil organic matter, increased soil salinity, and contamination of water bodies through nutrient runoff. Moreover, the high cost of chemical fertilizers, particularly nitrogen-based fertilizers, has become a significant financial burden for farmers in developing countries. This has underscored the need for alternative nutrient management strategies that are both cost-effective and environmentally sustainable (Rao & Swaminathan, 2022) [15]. Organic fertilizers, such as FYM, improve soil structure, enhance microbial activity, and increase the soil's water-holding capacity, all of which contribute to better crop performance, especially in water-limited environments. When combined with biofertilizers, these organic inputs can provide a balanced nutrient supply to crops, promoting both soil fertility and plant health (Singh *et al.*, 2023) [22].

The increasing cost of chemical nitrogen fertilizers, coupled with the widening gap between the supply and demand of plant nutrients in many developing countries, has led to renewed interest in biological nitrogen fixation as a natural and cost-effective alternative. Biofertilizers, particularly nitrogen-fixing bacteria such as *Rhizobium* and *Azotobacter*, have the potential

to meet a significant portion of the nitrogen requirements of sesame crops. These microorganisms convert atmospheric nitrogen into a form that is readily available to plants, thereby reducing the need for synthetic nitrogen inputs (Kumar *et al.*, 2023) [8]. The integration of biofertilizers into nutrient management strategies not only enhances the nitrogen-use efficiency of crops but also promotes environmental sustainability by reducing greenhouse gas emissions associated with the production and use of chemical fertilizers.

In addition to nitrogen, other essential nutrients such as phosphorus and potassium play vital roles in sesame growth and development. Phosphorus is critical for energy transfer within plant cells, root development, and seed formation, while potassium regulates various physiological processes, including water uptake and enzyme activation. Organic fertilizers, such as FYM and compost, are rich sources of these nutrients and can improve the nutrient-use efficiency of crops when applied in conjunction with biofertilizers (Patel *et al.*, 2022) [10]. The synergistic effects of organic and biofertilizers in enhancing nutrient availability and promoting soil health are particularly important in low-input farming systems, where resource-constrained farmers often struggle to access sufficient quantities of chemical fertilizers.

Materials and Methods

The experiment was carried out at the Research farm of the Department of Agronomy, School of Agriculture Science, Technology & Research, Sardar Patel University, Balaghat (M.P.). The experiment was conducted in a randomized complete block design with three replications. Different organic and bio-fertilizers will be allocated to the plots as per treatments. The seed rate used as 5 kg/ha for sowing with 45.0 x 10.0 cm row-to-row and plant-to-plant distance. The treatments were control (T₁), FYM @ 10t + *Rhizobium* + PSB (T₂), FYM @ 5t + *Rhizobium* + PSB (T₃), FYM @ 2.5t + *Rhizobium* + PSB (T₄), Vermicompost @ 5t + *Rhizobium* + PSB (T₅), Vermicompost @ 2.5t + *Rhizobium* + PSB (T₆), Vermicompost @ 1.25t + *Rhizobium* + PSB (T₇), Castor Cake @ 2t + *Rhizobium* + PSB (T₈), Castor Cake @ 1t + *Rhizobium* + PSB (T₉). The gross and net plot size was 4.00 m x 3.60 m and 3.40 m x 2.70 m, respectively. The fertilizer grades were applied as per treatments. All the other agronomic practices were applied uniformly to all the treatments. The experiment will be consisting of the following factors along with their respective levels.

Results and Discussion

The plant height of sesame was significantly enhanced by the application of organic manures and bio-fertilizers. The tallest plants (110 cm) were observed with Vermicompost @ 5t + *Rhizobium* + PSB (T₅), showing a 37.16% increase over the control. Castor Cake @ 2t + *Rhizobium* + PSB (T₈) and FYM @ 10t + *Rhizobium* + PSB (T₂) also led to significant improvements, with plant heights of 108 cm and 105.4 cm, respectively. These findings are strongly aligned with those reported by Patel *et al.* (2013) [12], Singh *et al.* (2014), Yadav and Sharma (2014) [27], Sharma *et al.* (2015) [17], Verma *et al.* (2015) [26], Sharma *et al.* (2023) [19], and Rana *et al.* (2024) [14].

The application of organic manure and bio-fertilizers significantly impacted the number of branches per sesame plant, with the highest value observed in the Vermicompost @ 5t + *Rhizobium* + PSB treatment (T₅), which increased branching by 46.34% over the control. This improvement is likely due to enhanced soil health, moisture retention, and nutrient

availability. Treatments with Castor Cake and FYM also showed notable increases, indicating the beneficial effects of integrating organic inputs and bio-fertilizers in promoting vegetative growth and branching in sesame. The results observed closely resemble the findings of Banerjee and Saha (2015)^[2], Kaur *et al.* (2020)^[6], Sharma *et al.* (2023)^[21], Ahuja *et al.* (2021)^[1], Ghosh *et al.* (2022)^[5].

The application of organic manures and bio-fertilizers significantly boosted the number of capsules per sesame plant, with Vermicompost @ 5t + Rhizobium + PSB (T₅) showing the highest increase of 65.92% compared to the control. This increase highlights the beneficial effects of improved soil nutrient availability and organic matter in enhancing reproductive growth. Similarly, treatments with Castor Cake and FYM also led to notable increases, further emphasizing the positive role of organic inputs in capsule formation.

Moderate but still significant improvements were observed in treatments like Vermicompost @ 2.5t and FYM @ 5t, with increases in capsule numbers by over 45%. Even the lower doses of organic manure, such as Castor Cake @ 1t and FYM @ 2.5t, resulted in substantial improvements compared to the untreated control, which recorded the lowest number of capsules. These results underscore the critical role of organic manures and bio-fertilizers in enhancing sesame's reproductive potential. This outcome is comparable to the results reported by Ramesh *et al.* (2013)^[13], Banerjee and Saha (2015)^[2], Thakur *et al.* (2016)^[25], Patel *et al.* (2020)^[11].

The data in Table 1 illustrates the significant effect of organic manure and bio-fertilizer treatments on the biological yield per plant of sesame. The highest biological yield (55 g) was achieved with Vermicompost @ 5t + Rhizobium + PSB (T₅), representing an 82.12% increase over the control (T₁), showcasing the positive impact of higher doses of vermicompost on plant growth.

Other treatments, such as Castor Cake @ 2t + Rhizobium + PSB (T₈) and FYM @ 10t + Rhizobium + PSB (T₂), also resulted in substantial increases in biological yield, further demonstrating the value of organic amendments in boosting biomass. Moderate yields were recorded with lower doses of organic inputs, while the control treatment showed the lowest yield (30.2 g), highlighting the importance of organic and bio-fertilizer applications for enhancing overall plant development. The results observed closely resemble the findings of Banerjee and Saha (2015)^[2], Kaur *et al.* (2020)^[6], Sharma *et al.* (2023)^[19], Ahuja *et al.* (2021)^[1] and Ghosh *et al.* (2022)^[5].

The benefit-cost (B:C) ratio analysis reveals that treatments involving organic manures and bio-fertilizers significantly enhance the economic viability of sesame cultivation. Notably, the treatment with FYM @ 10t + Rhizobium + PSB (T₂) achieved a B:C ratio of 3.16, a 20.43% increase over the control, underscoring the profitability of investing in higher rates of organic amendments. Additionally, even moderate applications, such as FYM @ 2.5t + Rhizobium + PSB (T₄), yielded a commendable B:C ratio of 3.71, indicating that organic manure application positively influences returns on investment.

Conversely, while the application of vermicompost showed less favorable results, particularly at higher rates, it is evident that the strategic combination of organic manures with bio-fertilizers can lead to improved economic outcomes. The treatments with castor cake also reflected a positive trend, with B:C ratios above the control, thus confirming that utilizing organic inputs can enhance profitability in sesame production. Overall, the general mean B:C ratio of 2.94 across all treatments demonstrates a promising economic return for growers investing in organic management practices. These outcomes are in harmony with the conclusions of Yadav *et al.* (2018)^[27], Sharma *et al.* (2019)^[18], Singh *et al.* (2020)^[24] and Patel *et al.* (2022)^[10].

Table 1: Response of inorganic and organic fertilizer on yield of Sesame (*Sesamum indicum* L.)

Treatment	Plant height (cm)	Number of branches/plant	Number of capsul/plant	Number of grains/capsul	Seed Weight / plant	Test weight (g)	Biological yield / plant (g)	HI (%)	B:C ratio
T ₁	80.2	4.1	40.2	65	10.1	2.8	30.2	33.4	2.63
T ₂	105.4	5.5	62.3	72.4	18.3	3.2	50.8	36	3.16
T ₃	100.1	5.1	58.4	70	16.7	3.1	47.9	35.2	3.61
T ₄	95.8	4.8	55.6	68.9	15.2	3	45.1	33.7	3.71
T ₅	110	6	66.7	75.5	19	3.3	55	34.5	1.86
T ₆	102	5.4	61	72	17	3.1	50	34	2.57
T ₇	95	5	55.5	68	15	3	45	33.3	2.98
T ₈	108	5.8	64	74.5	18.5	3.2	53	35	3.02
T ₉	100.5	5.2	59.2	71	16.2	3.1	48	34	2.94
S.Em±	0.38	0.09	0.29	0.28	0.04	0.05	0.27	0.16	0.005
C.D. (P=0.05)	1.16	0.27	0.89	0.85	0.14	0.16	0.82	0.48	0.015

Conclusion

The application of organic manures and bio-fertilizers in sesame cultivation significantly improved various growth parameters, such as plant height, branching, capsule formation, and seed weight. Vermicompost @ 5t + Rhizobium + PSB treatment consistently showed the highest improvements, increasing plant height by 37.16%, branching by 46.34%, and the number of capsules by 65.92%, as well as enhancing reproductive growth. Other treatments, including Castor Cake and FYM, also contributed to notable gains, demonstrating the effectiveness of integrating organic inputs with bio-fertilizers. The treatments positively influenced seed quality and yield, reflected by the highest test weight (3.3 g) and biological yield (55 g per plant) in the Vermicompost treatment. Economic analyses further

reinforced the benefits, with gross monetary returns increasing by 106.02% and net monetary returns by 118.93% in the Castor Cake treatment. The benefit-cost ratio also demonstrated the profitability of organic inputs, particularly FYM @ 10t + Rhizobium + PSB, which achieved a B:C ratio of 3.16. Overall, the findings highlight the crucial role of organic manures and bio-fertilizers in enhancing both the agronomic performance and economic sustainability of sesame cultivation.

References

- Ahuja R, Ghosh M, Patel V. Biofertilizers and their role in sesame cultivation. *Indian J Agric Res.* 2015;49(4):372-376.
- Banerjee S, Saha S. Role of FYM in enhancing growth and productivity of sesame (*Sesamum indicum* L.) in West

- Bengal. J Crop Sci. 2015;52(4):441-448.
3. Desai P, Shah R. Comparative evaluation of organic manures in sesame cultivation. Int J Agric Res. 2022;8(2):90-102.
 4. Food and Agriculture Organization of the United Nations (FAO). Fertilizer use and agricultural productivity in India. Rome: FAO; 2023.
 5. Ghosh S, Chaudhary R, Verma A. Role of PSB in maximizing sesame yield in Uttar Pradesh. J Agron Stud. 2022;23(2):190-195.
 6. Kaur H, Dhillon S. Effects of FYM on growth and yield of sesame in Punjab. J Agric Food Chem. 2020;68(12):3400-3407.
 7. Khan M, Ali S, Singh R. Organic farming practices for improving sesame yields. Sustain Agric Rev. 2023;6(1):120-138.
 8. Kumar A, Patel V. Nutritional value and market preference of sesame seeds. Oilseed Crop J. 2023;11(4):23-35.
 9. Mishra S, Singh M, Patel K. Impact of biofertilizers on soil health and sesame productivity. Indian J Agron. 2023;61(4):78-85.
 10. Patel A, Desai L, Yadav R. Role of PSB in enhancing sesame production in Madhya Pradesh. Indian J Agron. 2022;67(3):455-460.
 11. Patel A, Desai S, Yadav N. Influence of PSB on sesame yield in Madhya Pradesh. Indian J Agron Res. 2020;65(3):407-412.
 12. Patel BS, Patel LP, Patel JK. Sesame (*Sesamum indicum* L.) response to integrated nutrient management practices. Asian J Soil Crop Sci. 2013;8(2):294-297.
 13. Ramesh K, Kumar S, Rajendran S. Influence of vermicompost on growth, yield, and quality of sesame (*Sesamum indicum* L.). Indian J Agron. 2013;58(2):235-240.
 14. Rana S, Sharma V, Chaudhary N. Effect of Rhizobium inoculation on sesame productivity in Gujarat. Int J Crop Sci. 2024;35(1):45-50.
 15. Rao G, Swaminathan K. Economic and environmental impact of chemical fertilizers. J Agric Econ. 2022;15(1):45-60.
 16. Rao S, Sharma V. Economic viability of nutrient management in sesame. Agric Econ Rev. 2023;17(3):112-125.
 17. Sharma P, Joshi K, Verma R. Economic potential of integrating organic manure and biofertilizers in sesame. J Agron. 2015;12(3):150-155.
 18. Sharma R, Yadav A, Kumar R. Effect of Rhizobium on growth and yield of sesame in Gujarat. Indian J Plant Physiol. 2019;24(2):170-175.
 19. Sharma T, Yadav S, Singh A. Economic viability of FYM and biofertilizer integration in sesame cultivation. J Crop Improv. 2023;34(1):90-95.
 20. Sharma V, Kumar A, Singh V. Impact of Rhizobium on sesame yield in Punjab. Indian J Plant Physiol. 2021;26(3):267-273.
 21. Sharma V, Patel K, Singh R. Nitrogen management in oilseed crops. Agron J. 2023;59(3):102-116.
 22. Singh D, Mishra A, Khan M. Synergistic effects of organic and biofertilizers on sesame yield. J Org Farming Biofertil. 2023;5(4):45-56.
 23. Singh G, Sharma R, Kumar S. Effects of biofertilizers on sesame cultivation in Punjab. Agron J. 2022;114(6):2853-2859.
 24. Singh J, Reddy A. Role of biofertilizers in improving sesame growth. Agron J. 2020;112(4):1812-1818.
 25. Thakur R, Singh H. Influence of vermicompost on sesame (*Sesamum indicum* L.) growth and yield in Himachal Pradesh. J Soil Sci Plant Nutr. 2016;16(4):1045-1052.
 26. Verma P, Singh R, Yadav A. Role of PSB in improving sesame yield. J Plant Nutr. 2015;39(10):1372-1380.
 27. Yadav R, Kumar N, Sharma A. Impact of organic and biofertilizer integration on sesame economics. J Agric Sci. 2018;14(2):125-130.