International Journal of Plant & Soil Science

Volume 36, Issue 10, Page 534-540, 2024; Article no.IJPSS.124862
ISSN: 2320-7035

Influence of Liquid Biofertilizers on Growth and Yield of Sesame (*Sesamum indicum* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ijpss/2024/v36i105104

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/124862

Original Research Article

Received: 14/08/2024
Accepted: 18/10/2024
Published: 31/10/2024

ABSTRACT

A field experiment was conducted at S.V. Agricultural College Farm, Tirupati during summer, 2024 to study the influence of liquid bio fertilizers and different levels of fertilizers on growth and yield of sesame. Results revealed that the application of 100% RDF + seed treatment + soil application of

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Cite as: *Tejaswini, Guda, Karanam Navya Jyothi, B. Sandhya Rani, P. Lavanya Kumari, and V. Chandrika. 2024. "Influence of Liquid Biofertilizers on Growth and Yield of Sesame (Sesamum Indicum L.)". International Journal of Plant & Soil Science 36 (10):534-40. https://doi.org/10.9734/ijpss/2024/v36i105104.*

liquid bio fertilizers (Azospirillum, PSB and KSB) reported higher plant height(99 cm), leaf area index(1.72), dry matter accumulation (3341 kg ha^{-1}), seed (945 kg ha^{-1}) and stalk (1890 kg ha^{-1}) yield as compared to other treatments. The grain yield of sesame with100% RDF + seed treatment + soil application of liquid bio fertilizers (Azospirillum, PSB and KSB) was enhanced by 26.5% and 24.3% when compared to the 100% RDF alone. The lowest seed yield (380 kg ha^{-1}) and stalk yield (830 kg ha^{-1}) was registered with absolute control.

Keywords: Liquid biofertilizers; seed treatment; soil application and sesame.

1. INTRODUCTION

Chemical fertilizers have been employed exponentially more often in recent years in an effort to boost crop productivity. This has led to land degradation and reduced crop productivity over the years. To overcome these problems biofertilizers are used as alternate source of nutrients. Sesame (*Sesamum indicum* L.) is one of the oldest and most important oilseed crop. Today, India has achieved self-sufficiency in cereal food production but still vegetable oil needs to reach at the stage of self-sufficiency. In India, sesame was cultivated in an area of 15.23 Lakh hectares with a production of 8.02 Lakh tonnes and productivity of 527 kg ha^{-1} (*www.indiastat.com*). The productivity of sesame is very low compared to the potential yield owing to lack of suitable crop management practices. The potential yield of any crop could be realized only when backed up with good agronomic management practices. Among the different agronomic management practices, nutrient management is crucial in sesame cultivation as it directly impacts the plants growth and yield. Being an exhaustive crop, sesame requires lot of chemical fertilizers or organic manures such as compost. While the use of organic manures is limited by the huge quantities needed to meet crop nutritional needs in view of its low nutrient content, the use of chemical fertilizers is limited by residual effects, cost and scarcity. Thus, supplementary application of biofertilizers either through seed treatment or soil application is frequently recommended for improving soil productivity, biological, physical and chemical properties of soil and to get agricultural products with good quality which are free of pollutants [1-3].

2. MATERIAL AND METHODS

A field experiment was conducted during January to April, 2024 at Tirupati (13.5°N and79.5°E) where the average rainfall is 16 mm, distributed mainly in January. The soil was sandy loam in texture, neutral in soil reaction, low in organic carbon (0.25) and available nitrogen (187), medium in available potassium (27.3) and available phosphorus.The present experiment was laid out in a randomized block design with eight treatments and replicated thrice. The treatments consisted of absolute control (T_1), 100% RDF (T_2), 100% RDF + seed treatment with liquid biofertilizers (T_3), 100% RDF + soil application of liquid biofertilizers (T_4), 100% RDF + seed treatment + soil application of liquid biofertilizers (T_5), 75% RDF + seed treatment with liquid biofertilizers(T_6), 75% RDF + soil application of liquid biofertilizers (T_7), 75% RDF + seed treatment + soil application of liquid biofertilizers (T_8). The variety YLM-66 (Sarada) was sown on 10-01-2024 and recommended dose of the fertilizer applied was 50-25-25 N-P_2O_5-K_2O kg ha^{-1}.

2.1 Application of LBFC (Liquid Biofertilizer Consortium)

Liquid biofertilizers can be applied to crop by seed treatment and soil application with FYM.

2.2 Seed Treatment

For 1 kg of the sesame seeds, 10 ml of liquid biofertilizer consortium (LBFC) was mixed with equivalent quantity 10 per cent jaggery solution and coated the mixture uniformly on the seed and exposed for drying in shade for 10 minutes before sowing [4].

2.3 Soil Application

Liquid biofertilizers consortium of 1250 ml ha^{-1} was used for soil application. The liquid consortium was diluted with 25 liters of water and then mixed with 500 kg of powdered farm yard manure then incubated overnight. This incubated FYM was applied to field directly at the rate of half kg of treated FYM per treatment [5].

2.4 Statistical Analysis

The data recorded for different characteristics were subjected to statistical analysis by adopting

the method of analysis of variance (ANOVA) as described by Gomez and Gomez [6]. The significance of comparison was tested. The significant difference values were computed for 5 per cent probability of error. Wherever the variance ratio (F value) was found significant, critical difference (CD) values were computed for the comparison among the treatment means.

3. RESULTS AND DISCUSSION

3.1 Effect of Liquid Biofertilizers on Growth Parameters at Different Intervals of Crop Growth in Sesame

Liquid biofertilizers application significantly influenced the plant height of sesame at different intervals of crop period and it is presented in Table 1. At 20,40,60 DAS and at harvest, application of 100% RDF + seed treatment + soil application of liquid biofertilizers recorded higher plant height of sesame as compared to the other treatments tried. This might be due to the synergistic relation between liquid biofertilizers (both seed and soil application) and inorganic fertilizers that triggered to produce elevated plant stature. Administration of liquid biofertilizers through seed treatment and soil application along with the inorganic fertilizers might have produced the growth promoting substances which speed up the cell division and cell elongation resulting in taller plants. The lowest plant height was recorded with absolute control (T_1) where no fertilizers were applied. Similar results were obtained by Lakhran et al. [7] and Ghosh et al. [8].

The highest values of leaf area index of sesame were recorded with application of 100% RDF + seed treatment + soil application of liquid biofertilizers(T_5) at 20,40, 60 DAS and at harvest. While the minimum leaf area index was associated with control (T_1) which might be due to the better availability of nutrients with the

Table 1. Plant height (cm) of sesame as influenced by different levels of fertilizers and liquid biofertilizers

Treatments	20 DAS	40 DAS	60 DAS	At harvest
T_1 : Absolute control	9.0	35.9	63	68
T_2 : 100% RDF	12.0	46.9	80	85
T_3 : 100% RDF + Seed treatment with liquid biofertilizers	12.2	47.8	82	89
T_4 : 100% RDF + Soil application of liquid biofertilizers	12.5	49.8	83	90
T_5 : 100% RDF + Seed treatment + Soilapplication of liquid biofertilizers	12.7	55.3	90	1890 kg ha^{-1}
T_6 : 75% RDF + Seed treatment with liquid biofertilizers	11.1	38.5	67	76
T_7 : 75% RDF + Soil application of liquid biofertilizers	11.3	39.4	69	73
T_8 : 75% RDF + Seed treatment + Soil application of liquid biofertilizers	11.5	44.3	76	81
SEm±	0.55	1.09	1.6	2.3
CD (P=0.05)	1.7	3.3	5	7

Table 2. Leaf area index of sesame as influenced by different levels of fertilizers and liquid biofertilizers

Treatments	20 DAS	40 DAS	60 DAS	At harvest
T_1 : Absolute control	0.10	0.53	1.58	0.78
T_2 : 100% RDF	0.25	1.35	2.41	1.42
T_3 : 100% RDF + Seed treatment with liquid biofertilizers	0.26	1.40	2.55	1.51
T_4 : 100% RDF + Soil application of liquid biofertilizers	0.27	1.46	2.60	1.56
T_5 : 100% RDF + Seed treatment + Soil application of liquid biofertilizers	0.28	1.61	2.83	1.72
T_6 : 75% RDF + Seed treatment with liquid biofertilizers	0.22	1.14	2.04	1.16
T_7 : 75% RDF + Soil application of liquid biofertilizers	0.23	1.18	2.09	1.19
T_8 : 75% RDF + Seed treatment + Soil application of liquid biofertilizers	0.24	1.31	2.32	1.35
SEm±	0.024	0.041	0.069	0.049
CD (P=0.05)	0.07	0.12	0.21	0.15

Table 3. Dry matter production (kg ha^{-1}) of sesame as influenced by different levels of fertilizers and liquid biofertilizers

Treatments	20 DAS	40 DAS	60 DAS	At harvest
T_1 : Absolute control	16.2	390	1154	1499
T_2 : 100% RDF	34.1	640	1861	2628
T_3 : 100% RDF + Seed treatment with liquid biofertilizers	35.0	660	1880	2730
T_4 : 100% RDF + Soil application of liquid biofertilizers	37.0	686	1911	2840
T_5 : 100% RDF + Seed treatment + Soil application of liquid biofertilizers	39.0	760	2077	3341
T_6 : 75% RDF + Seed treatment with liquid biofertilizers	33.0	480	1520	1970
T_7 : 75% RDF + Soil application of liquid biofertilizers	33.4	510	1560	1993
T_8 : 75% RDF + Seed treatment + Soil application of liquid biofertilizers	33.9	580	1720	2410
SEm±	2.33	20.7	47.8	75.7
CD (P=0.05)	7.1	63	145	230

Table 4. Seed and stalk yield (kg ha $^{-1}$) of sesame as influenced by different levels of fertilizers and liquid biofertilizers

Treatments	Seed yield	Stalk yield
T_1 : Absolute control	380	710
T_2 : 100% RDF	747	1520
T_3 : 100% RDF + Seed treatment with liquid biofertilizers	793	1583
T_4 : 100% RDF + Soil application of liquid biofertilizers	830	1660
T_5 : 100% RDF + Seed treatment + Soil application of liquid biofertilizers	945	1890
T_6 : 75% RDF + Seed treatment with liquid biofertilizers	550	1130
T_7 : 75% RDF + Soil application of liquid biofertilizers	610	1239
T_8 : 75% RDF + Seed treatment + Soil application of liquid biofertilizers	700	1418
SEm±	28.8	52.4
CD (P=0.05)	87	159

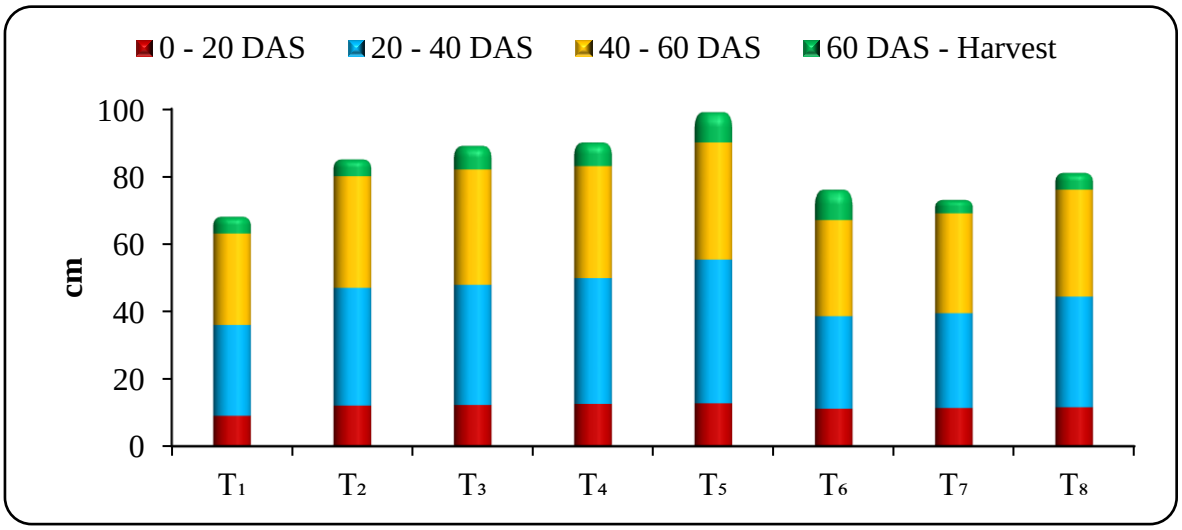

Fig. 1. Plant height (cm) of sesame at different growth stages as influenced by different levels of fertilizers and liquid biofertilizers

combined application of chemical and liquid biofertilizers *viz*., *Azospirillum,* PSB and KSB resulting in higher photosynthesis and more leaf formation, there by higher leaf surface area and higher LAI. These results are in conformity with the findings of Nayek et al. [9], Sahoo et al. [10].

Application of 100% RDF + seed treatment + soil application of liquid biofertilizers (T_5) registered higher dry matter production at all the intervals of sampling. The lowest dry matter was recorded with absolute control(T_1). This might be due to the enhanced nutrient availability which might have enriched the soil and provided the judicious amount of nutrients for various metabolic processes resulting in higher vegetative growth. The elevated stature of sesame might not only be attributed to the increased availability through liquid biofertilizers *viz*., *Azospirillum* which fixes atmospheric nitrogen, PSB and KSB which increases the solubility of native phosphorus and potassium, respectively in the rhizosphere but also to the production of growth hormones *viz*., IAA, GA and cytokinin by these liquid biofertilizers. Enhanced dry matter accrual with the application of biofertilizers, as evidenced in this investigation corroborates with the findings of Patel et al. [11], Samant [12] and Sattar and Gaur [13].

3.2 Effect of Liquid Biofertilizers on Yield of Sesame

Data on the seed yield of sesame (kg ha^{-1}) as influenced by the application of liquid biofertilizers revealed that the highest seed and stalk yield was registered with application of 100% RDF + Seed treatment + soil application of liquid biofertilizers (T_5) while the lowest yield was obtained in the absolute control.

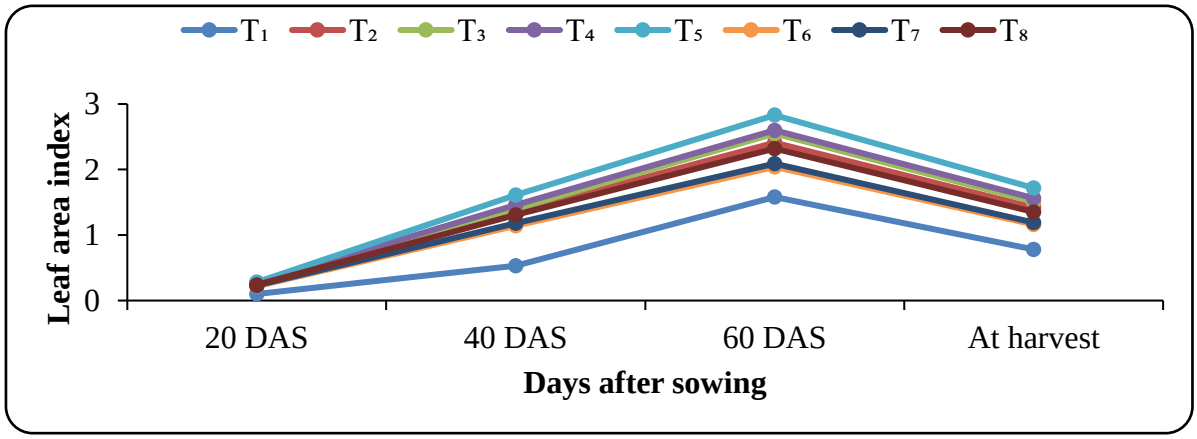

Fig. 2. Leaf area index of sesame at different growth stages as influenced by different levels of fertilizers and liquid biofertilizers

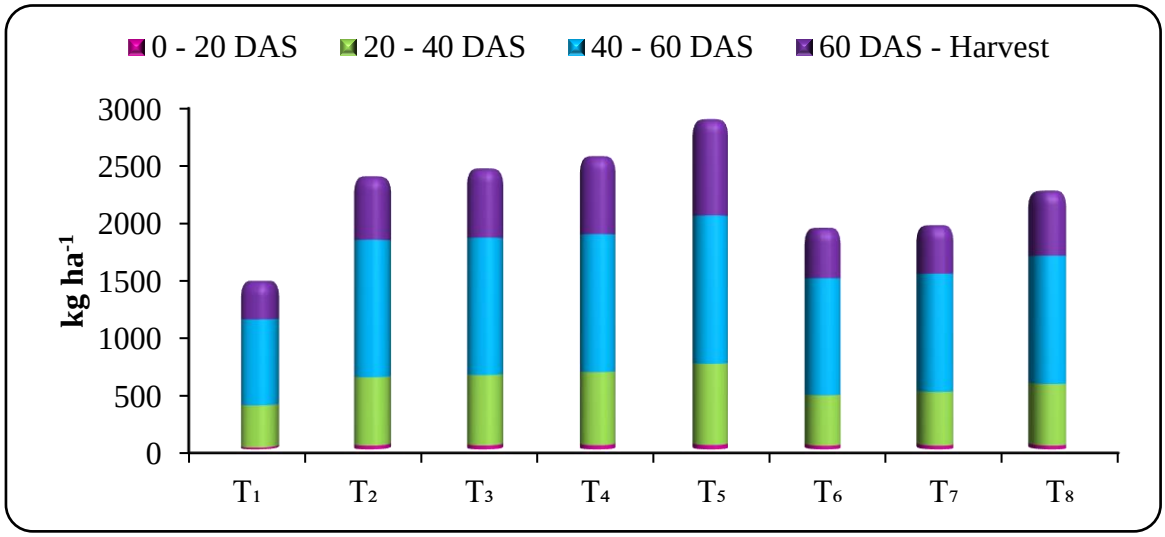

Fig. 3. Dry matter production (kg ha^{-1}) of sesame at different growth stages as influenced by different levels of fertilizers and liquid biofertilizers

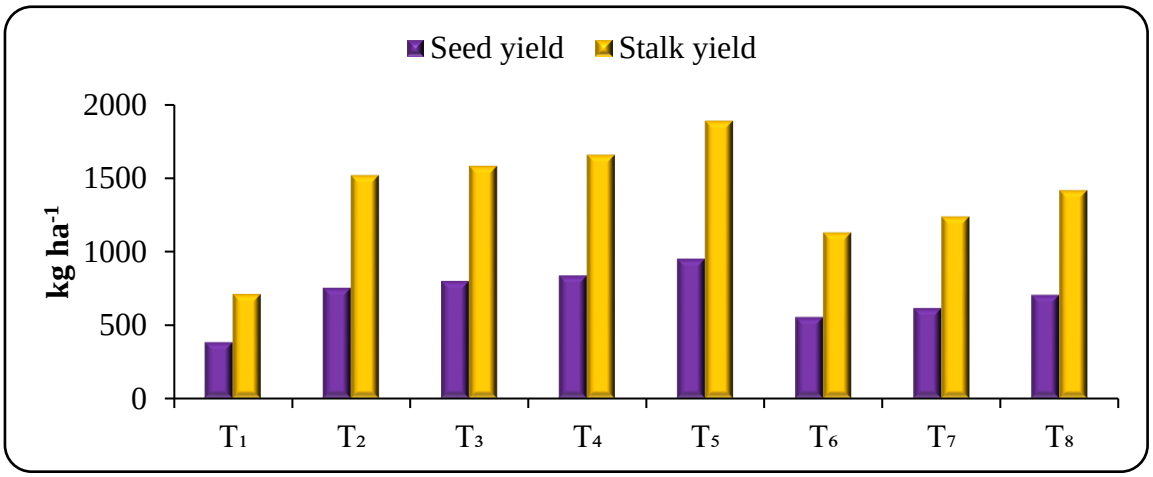

Fig. 4. Seed and stalk yield (kg ha^{-1}) of sesame as influenced by different levels of fertilizers and liquid biofertilizers

Application of 100 per cent RDF with combined application of liquid biofertilizer consortium in seed treatment and soil application resulted in better growth performance and yield. This might be due to combined application of inorganic fertilizers and liquid biofertilizers that increased availability of nitrogen, phosphorus and potassium in the root zone through atmospheric nitrogen fixation by *Azospirillum* and solubilization of unavailable phosphates and potassium by PSB and KSB respectively which in turn resulted in the better nutrient uptake and accelerated photosynthetic rate, adequate biomass production that further facilitated the efficient translocation of photosynthates from source to sink there by increasing the sink capacity resulting in the improved yield attributes and ultimately increased the yield of sesame. These results are supported by Sahoo et al. [10], Rathod et al. [14], Verma et al. [15], Parmar et al. [16] Kalita et al. [17], Lakhran et al. [7] and Aglawe et al. [18].

4. CONCLUSION

The present study indicated that among the nutrient management practices tried, application of 100% RDF + seed treatment + soil application of liquid biofertilizers (Azospirillum, PSB and KSB) recorded higher growth attributes and yield in sesame.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Gabhane AR, Gite PA, Khadse VA. Effect of compost, biofertilizer and organic sprays on yield, nutrient content and uptake of N, P, K and S by summer sesame. J Pharmacogn Phytochem. 2018;7(4):2843-7.
2. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: ICAR. 1985;187-202.
3. Shaikh AA, Desai MM, Shinde SB, Tambe AD. Yield of summer sesamum (*Sesamum indicum* L.) as influenced by integrated nutrient management. Int J Agric Sci. 2010;6(1):144-6.
4. Khandare RN, Ramesh C, Navneet P, Kiran PR. Carrier-based and liquid bio-inoculants of Azotobacter and PSB saved chemical fertilizers in wheat (*Triticum aestivum* L.) and enhanced soil biological properties in Mollisols. J Plant Nutr. 2020;43(1):36-50.
5. Trimurthulu N, Rao DLN. Liquid microbial inoculants and their efficacy on field crops. Amaravathi: ANGRAU, Agricultural Research Station. 2014;54.
6. Gomez KA, Gomez AA. Statistical procedures for agricultural research. New York: John Wiley & Sons; 1984. p. 20-30.

7. Lakhran H, Sadhu AC, Kumawat S. Quality and yield potential of summer sesame (*Sesamum indicum* L.) as influenced by sowing time and nutrient management in middle Gujarat. The Bioscan. 2015; 10(3):1409-11.
8. Ghosh AK, Duary B, Ghosh DC. Nutrient management in summer sesame (*Sesamum indicum* L.) and its residual effect on black gram (*Vigna mungo* L.). Int J Bio-resource Stress Manage. 2013; 4(4):541-6.
9. Nayek SS, Brahmachari K, Chowdhury MR. Integrated approach in nutrient management of sesame with special reference to its yield, quality and nutrient uptake. The Bioscan. 2014;9(1): 101-5.
10. Sahoo SK, Dwibedi SK, Sethi D, Kar PC. Effect of biofertilizers and levels of nitrogen on growth, yield attributes and yield of sesame (*Sesamum indicum* L.). Environ Ecol. 2010;28(1):132-5.
11. Patel HA, Raj AD, Khambhu CV, Vaja SJ. Effect on growth and yield characteristics of summer sesame (*Sesamum indicum* L.) as influenced by different levels of nitrogen, phosphorus and biofertilizers. The Pharma Innovation J. 2023;12(6): 5130-4.
12. Samant TK. Effect of biofertilizers and sulphur on growth, yield, economics and post-harvest soil chemical properties in sesame (*Sesamum indicum* L.). Chem Sci Rev Lett. 2020;9(34):475-80.
13. Sattar MA, Gaur AC. Production of auxins and gibberlins by phosphate dissolving microorganisms. Zentralblatt für Mikrobiologie. 1987;142:393-8.
14. Rathod AD, Thanki RB, Seta SN. Enhancing summer sesame (*Sesamum indicum* L.) productivity through integrated nutrient management: a comprehensive approach for sustainable agriculture. Int Res J Modernization Eng Technol Sci. 2024.
15. Verma S, Singh HV, Saxena R. Relative performance of sesame (*Sesamum indicum* L.) under organic, inorganic and integrated nutrient management. Indian J Agric Sci. 2013;83(3):143-9.
16. Parmar N, Jat JR, Malav JK, Kumar S, Pavaya RP, Patel JK. Growth, quality, yield and available nutrient status after harvest of summer sesamum (*Sesamum indicum* L.) in loamy sand as influenced by integrated nutrient management. J Pharmacogn Phytochem. 2020;9(3):388-92.
17. Kalita N, Bhuyan S, Maibangsa S, Saud RK. Effect of biofertilizer seed treatment on growth, yield and economics of Toria [*Brassica campestris* L.] under rainfed condition in Hill Zone of Assam. Curr Agric Res J. 2019;7(3):332-6.
18. Aglawe B, Waghmare Y, Ajinath B. Effect of biofertilizer on growth, yield and economics of sesame (*Sesamum indicum* L.). J Pharm Innov. 2021;10(10): 437-9.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/124862