



Economic Analysis of Organic Strawberry Production Influenced by Biofertilizers and Biostimulants Application

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/ijpss/2025/v37i35360>

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://pr.sdiarticle5.com/review-history/132744>

Original Research Article

Received: 14/01/2025
Accepted: 17/03/2025
Published: 22/03/2025

ABSTRACT

The present study was conducted to evaluate the impact of biofertilizers and biostimulants on the economic of organic strawberry (*Fragaria x ananassa*) cultivation, specifically the Chandler variety, in Central Uttar Pradesh. Experiment was conducted over two growing seasons (2022–2024) using a randomized block design, the experiment included ten treatments combining biofertilizers such as *Azotobacter* and Phosphate-Solubilizing Bacteria (PSB) with biostimulants like Panchagavya, Jiva Amrit and Amritpani. The study assessed fruit yield, cost of cultivation, net returns and the benefit-

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Cite as: Sonkar, Satyarath, and V. K. Tripathi. 2025. "Economic Analysis of Organic Strawberry Production Influenced by Biofertilizers and Biostimulants Application". *International Journal of Plant & Soil Science* 37 (3):207-14. <https://doi.org/10.9734/ijpss/2025/v37i35360>.

cost (B:C) ratio. Results indicate that treatment T₉ (Panchagavya + PSB + *Azotobacter*) yielded the highest productivity (167.12 Q/Ha), followed closely by T₁₀ (Jiva Amrit + PSB + *Azotobacter*) with 160.38 Q/Ha. The highest net return (Rs. 1,947,610/Ha) and B:C ratio (3.48) were observed in T₉, making it the most profitable option. In contrast, the control (T₁) with only farmyard manure (FYM) recorded the lowest yield (68.78 Q/Ha) and profitability (B:C ratio: 0.87). The findings highlight the economic viability of integrating biofertilizers and biostimulants in organic strawberry production. Treatments with Panchagavya and Jiva Amrit significantly enhanced soil fertility, nutrient uptake and plant resistance, contributing to improved yield and marketable quality. Given the rising demand for chemical-free produce, organic strawberry farming offers a sustainable and profitable alternative for farmers. Adoption of T₉ or T₁₀ is recommended for maximizing returns while ensuring long-term soil health and environmental sustainability.

Keywords: *Organic strawberry cultivation; biofertilizers and biostimulants; economic analysis; Benefit-cost ratio (B:C); sustainable agriculture.*

1. INTRODUCTION

Strawberry (*Fragaria × ananassa*) is one of the most widely cultivated fruit crops globally, valued for its unique flavor, vibrant color and high nutritional content (Bhat et al., 2025). It is rich in vitamins, antioxidants and dietary fiber, making it a popular choice among consumers. Among the various strawberry cultivars, Chandler stands out due to its large fruit size, excellent taste, high yield potential and adaptability to diverse agro-climatic conditions. For farmers, strawberry cultivation is an economically rewarding venture due to its high market demand, relatively short growing cycle and potential for high returns per unit area. However, the intensive use of chemical fertilizers and pesticides in conventional strawberry farming has raised concerns about environmental sustainability, soil health and long-term economic viability.

The importance of strawberry cultivation for farmers lies in its ability to generate higher income compared to traditional crops. Strawberries are often grown as a cash crop and their cultivation can significantly improve the livelihoods of small and marginal farmers. Besides, strawberries have a short harvest period (typically 3-4 months) (Claire et al., 2018), allowing farmers to cultivate other crops in the same field during the remaining months, thereby maximizing land use efficiency. However, the high input costs associated with chemical fertilizers, pesticides and irrigation pose challenges for farmers, particularly in resource-constrained regions. This has led to a growing interest in sustainable farming practices that reduce dependency on chemical inputs while maintaining or enhancing productivity (Morris et al., 2017). Strawberry cultivation in the plains of Uttar Pradesh encounters several agronomic and

environmental challenges, primarily related to climatic and edaphic factors. The high temperatures prevalent during the growing season induce heat stress in strawberry plants, adversely affecting fruit development and leading to reduced yields. Beyond, the humid climate of the region promotes the proliferation of phytopathogens and insect pests, including powdery mildew (*Podosphaera aphanis*) and aphids (*Aphidoidea*), which necessitate extensive pesticide applications, thereby escalating production costs. Moreover, the highly perishable nature of strawberries limits their marketability, restricting access to distant markets and consequently reducing the profitability of cultivation in the region (Rattanpal et al., 2011; Prakash & Sarkar, 2017).

The application of bio-fertilizers and bioenhancers has gained attention as a sustainable alternative to chemical fertilizers in strawberry cultivation. Bio-fertilizers are formulations containing beneficial microorganisms such as nitrogen-fixing bacteria (e.g., *Azospirillum*), phosphate-solubilizing bacteria (e.g., *Phosphobacteria*) (Tripathi et al., 2016). These microorganisms enhance soil fertility by fixing atmospheric nitrogen, solubilizing insoluble phosphates and producing growth-promoting substances, thereby improving nutrient availability and plant growth. Bioenhancers, on the other hand, are organic formulations derived from natural sources such as cow dung, cow urine and plant extracts. Examples include Panchagavya and Jeevamrit, which are known to enhance soil microbial activity, improve plant immunity and promote overall plant health.

The use of bio-fertilizers and bioenhancers is particularly important in strawberry cultivation for

several reasons such as strawberries are a high-value crop with specific nutrient requirements and the excessive use of chemical fertilizers can lead to nutrient imbalances, soil degradation and environmental pollution. Bio-fertilizers and bioenhancers provide a balanced supply of nutrients while improving soil structure and microbial diversity. The organic inputs are cost-effective and environmentally friendly, reducing the dependency on expensive chemical fertilizers and minimizing the ecological footprint of farming practices Rashmi et al., (2022), Chauhan et al., (2024), Biradar et al. (2022) and Simpson (2018). Application of bio-fertilizers and bioenhancers has been shown to enhance the quality of strawberries, including their size, taste and nutritional content, which can fetch higher prices in the market.

Despite the potential benefits, the adoption of bio-fertilizers and bioenhancers in strawberry cultivation remains limited due to a lack of awareness, technical knowledge and access to quality products among farmers. Therefore, there is a need for research to demonstrate the efficacy of these organic inputs on economic returns of strawberry cultivation. This study aims to address this gap by evaluating the impact of bio-fertilizers and bio-enhancers on the cultivation of strawberry Cv. Chandler and will provide a comprehensive understanding of their effects on profitability and sustainability in strawberry production in Central Uttar Pradesh.

2. MATERIALS AND METHODS

The present field experiment was conducted during the 2022–2023 and 2023–2024 growing seasons at the Horticulture Garden, Department of Fruit Science, College of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh. Geographically, Kanpur district is situated in the subtropical zone, between 25.260° and 26.580° North latitude and 79.310° and 80.340° East longitude, at an elevation of 135 meters above sea level. The experiment was designed using a randomized block design (RBD) with nine treatment combinations, along with one control. The ten treatment consisting of T1 control (FYM - 5 kg/bed), T2 (Amritpani (20%) + *Azotobacter* (50g/bed), T3 (Panchagavya (3%) + *Azotobacter* (50g/bed), T4 (Jiva amrit (20%) + *Azotobacter* (50g/bed), T5 (Amritpani (20%) + *PSB* (50g/bed), T6 (Panchagavya (3%) + *PSB* (50g/bed), T7 (Jiva amrit (20%) + *PSB* (50g/bed), T8 (Amritpani (20%) + *PSB* (50g/bed) + *Azotobacter* (50g/bed),

T9 (Panchagavya(3%) + *PSB* (50g/bed) + *Azotobacter* (50g/bed) and T10 (Jiva amrit (20%) + *PSB* (50g/bed) + *Azotobacter* (50g/bed). The data collected on various parameters during both experimental years were analyzed and presented separately. The allocation of treatments to experimental units was carried out using a randomized approach based on the Fisher and Yates random table method (Panse and Sukhatme, 1985). To ensure statistical robustness, the experiment was replicated three times.

3. OBSERVATIONS RECORDED

3.1 Fruit Yield (kg/plant)

The number of fruits set per strawberry plant was determined by counting the total number of fruits formed on each plant and multiplying it by the average fruit weight. The final yield per plant was obtained by averaging the values across multiple plants for each treatment.

3.2 Estimated Fruit Yield (tons/ha)

The fruit yield per hectare was estimated by multiplying the average yield per plant by the total number of plants accommodated within one hectare, with the final yield expressed in tons per hectare (tons/ha).

3.3 Cost of Cultivation (Rs. /ha)

The cost of strawberry cultivation was calculated separately for each treatment by summing the costs of various inputs, including labor charges, planting material, organic inputs and bio-fertilizers, over the experimental period. The total cost was expressed in Rupees per hectare (Rs. /ha).

The overall cost estimation included expenditures for field plowing, layout preparation, seedling procurement, transplanting, weeding, irrigation, harvesting, packaging and total labor costs. The treatment-wise cost was then determined based on these input values.

List 1. Cost of bio-fertilizers and Bioenhancers

Particulars	Rate
<i>Azotobacter</i>	Rs. 100/kg
<i>PSB</i>	Rs. 100/kg
Amritpani	Rs. 5.50 /kg
Panchagavya	Rs. 46.00 /kg
Jivamrit	Rs. 7.50/kg

3.4 Gross Return (Rs./ha)

The yield of strawberry (treatment-wise) was converted into gross income based on the prevailing market price.

$$\text{Gross return (Rs./ha)} = \text{Selling price} \times \text{Total yield}$$

3.5 Net Return (Rs./ha)

The net income per hectare was calculated for each treatment by deducting the cost of production from the gross income obtained in each treatment.

$$\text{Net return (Rs./ha)} = \text{Gross return} - \text{Total fixed cost}$$

3.6 Benefit-Cost Ratio

The Benefit-cost ratio of different treatments was calculated by dividing the gross income by the respective cost of cultivation of different treatments using the following formula.

$$\text{B: C ratio} = \frac{\text{Net return}}{\text{Total fixed cost}}$$

4. RESULTS AND DISCUSSION

Organic farming plays a vital role in enhancing soil health, increasing yield and ensuring long-term sustainability. The experiment conducted on strawberry cultivation using various organic inputs, including FYM, Amritpani, Panchagavya, Jiva Amrit, PSB (Phosphate-Solubilizing Bacteria) and *Azotobacter*, highlights their impact on yield, cost-effectiveness and profitability. Below is an analysis of different treatments based on yield, cost, returns and reasons why farmers should adopt organic strawberry cultivation.

4.1 Fruit Yield (Q/Ha) and Productivity

The highest yield was recorded in T₁₀ (Jiva Amrit (20%) + PSB (50g/bed) + *Azotobacter* (50g/bed) with 160.38 Q/Ha, followed closely by T₉ (Panchagavya (3%) + PSB (50g/bed) + *Azotobacter* (50g/bed) with 167.12 Q/Ha) (Table 4). The integration of biofertilizers, beneficial microbes and natural growth promoters significantly enhanced plant growth, nutrient uptake and fruit production. In contrast, the lowest yield was observed in T₁ (Control: FYM -5

kg/bed, 68.78 Q/Ha), suggesting that sole application of farmyard manure (FYM) is insufficient to maximize productivity. Organic biofertilizers like Panchagavya, Jiva Amrit and *Azotobacter* enrich the soil with beneficial microbes, enhancing nutrient absorption and improving plant resistance to diseases. Collectively, biofertilizers and bioenhancers enhance nutrient availability, stimulate root development, strengthen plant immunity and promote overall plant vigor, ultimately leading to increased fruit yield. This integrated approach also contributes to soil health, ensuring sustainable and improved productivity in strawberry cultivation (Kumar et al., 2020). Similar findings have been reported by Nayyer et al. (2014) and Bhaduria and Tripathi (2023) in strawberry production.

4.2 Cost of Cultivation

The highest cost of cultivation was recorded in T₁₀ (559,664.00), followed by T₉ (559,214.00) and T₈ (559,580.00) due to the combined application of multiple organic fertilizers. However, this investment was justified by the significant increase in yield and returns.

The lowest cost was recorded in T₁ (552,500.00), as it involved only FYM application, making it the least expensive but also the least productive (Table 4). Organic treatments may have slightly higher initial costs, but they reduce dependency on expensive synthetic fertilizers over time. Sustainable soil health minimizes the need for costly soil amendments in the long run (Rani et al., 2023).

4.3 Gross Return (Revenue from Selling Yield)

The highest gross return was obtained in T₁₀ (2,405,703.00) and T₉ (2,506,824.00), followed by T₈ (2,316,348.00), proving that integrated organic nutrient management results in higher economic returns. These bio-inoculants enhance nutrient availability, improve plant health and reduce disease incidence, resulting in higher marketable yields and increased gross returns for farmers (Tripathi et al., 2017; Siddiqui et al., 2021). The lowest gross return was in T₁ (1,031,634.00) due to its limited productivity (Table 4). Organic strawberries fetch premium prices in the market, as consumers prefer chemical-free, eco-friendly products (Tripathi and Shukla, 2024.).

Table 1. Effect of bio-fertilizers and bio stimulant on fixed cost of cultivation (Rs./ha)

Particulars	Unit	Cost per Unit (₹)	Fixed Cost (₹)
A. Land Preparation			
Ploughing & Bed Preparation (2 times)	Per hectare		30000.00
Organic Manure Application (FYM)	20 tons per hectare	3000 per ton	60000.00
Mulching Material (Straw/Plastic)	Per hectare	200000	20000.00
B. Seedlings & Planting			
Strawberry Seedlings (74,000 plants)	Per plant	5	370000.00
Planting Labor	40 laborers @ ₹300	300 per laborer	12000.00
C. Irrigation & Water Management			
Drip Irrigation System	Per hectare	20000	20000.00
Irrigation Cost (Water + Electricity)	Per hectare	5000	5000.00
D. Pest & Disease Management			
Organic Pest Control (Neem Oil, Traps)	Per hectare	5000	5000.00
Labor for Spraying	10 laborers @ ₹300	300 per laborer	3000.00
E. Labor & Miscellaneous Costs			
Weeding (twice)	15 laborers @ ₹300	300 per laborer	4500.00
Harvesting & Packing	20 laborers @ ₹400	400 per laborer	8000.00
Transport to Market	Per hectare	5000	5000.00
Miscellaneous Expenses	Per hectare	3000	10000.00
F. Total Cost of Cultivation			552500.00

Table 2. Effect of bio-fertilizers and organic mulch on the cost of treatments (Rs. /ha)

Treatments	Fixed cost	Variable cost					Total cost (Rs.)
		Azotobacter	PSB	Amritpani	Panchagavya	Jivamrit	
T ₁	552500	0	0	0	0	0	552500
T ₂	552500	2100	0	330	0	0	554930
T ₃	552500	2100	0	0	414	0	555014
T ₄	552500	2100	0	0	0	450	555050
T ₅	552500	0	4200	330	0	0	557030
T ₆	552500	0	4200	0	414	0	557114
T ₇	552500	0	4200	0	0	450	557150
T ₈	552500	2100	4200	330	0	450	559580
T ₉	552500	2100	4200	0	414	0	559214
T ₁₀	552500	2100	4200	0	414	450	559664

Table 3. Treatment cost

Biostimulant/Biofertilizer	Price
Azotobacter	2100.00 R.s./ha
PSB	4200.00 R.s./ha
Amritpani	330.00 R.s./ha
Panchagavya	414.00 R.s./ha
Jivamrit	450.00 R.s./ha

4.4 Net Return (Profit After Cost Deduction)

Net return was highest in T₉ (1,947,610.00), followed by T₁₀ (1,846,039.00) and T₈ (1,756,768.00). This confirms that multi-component organic treatments maximize profitability. The lowest net return was recorded in T₁ (479,134.00), indicating that using only FYM is not financially viable for farmers (Table 4). Higher profit margins are achieved due

to reduced input costs and higher market demand for organic produce. Increased productivity and enhanced fruit quality contribute to higher revenue, ultimately improving overall profitability, even when accounting for the increased costs of cultivation (Tripathi et al., 2010; Pawlak et al., 2022; Pratap et al., 2024; Chouhan & Tripathi 2025). Farmers can avoid price fluctuations in chemical fertilizers, making their expenses more predictable.

Table 4. Effect of bio-fertilizers and organic mulch on B: C ratio

Treatments	Total cost	Yield Q/Ha	Price/Kg	Gross income	Net income	B:C ratio
T ₁	552500.00	68.78	150.00	1031634.00	479134.00	0.87
T ₂	554930.00	82.15	150.00	1232322.00	677392.00	1.22
T ₃	555014.00	87.44	150.00	1311576.00	756562.00	1.36
T ₄	555050.00	89.20	150.00	1337994.00	782944.00	1.41
T ₅	557030.00	101.46	150.00	1521921.00	964891.00	1.73
T ₆	557114.00	128.88	150.00	1933176.00	1376062.00	2.47
T ₇	557150.00	117.99	150.00	1769784.00	1212634.00	2.18
T ₈	559580.00	154.42	150.00	2316348.00	1756768.00	3.14
T ₉	559214.00	167.12	150.00	2506824.00	1947610.00	3.48
T ₁₀	559664.00	160.38	150.00	2405703.00	1846039.00	3.30

4.5 Cost: Benefit Ratio (B:C Ratio – Profitability Indicator)

The highest B:C ratio was observed in T₉ (3.48), followed by T₈ (3.14) and T₁₀ (3.30), indicating that these treatments provided the best return on investment. The lowest B:C ratio was in T₁ (0.87), meaning it was not profitable, as the income generated was lower than the investment (Table 4). High B:C ratio ensures sustainable farming with consistent economic gains. Less dependency on synthetic inputs lowers production risks, making organic farming a reliable, long-term investment. Similarly, Anushi and Tripathi (2024) recorded with maximum benefit cost ratio (3.94) in strawberry under organic production.

5. CONCLUSION

The comparative study on organic treatments in strawberry cultivation highlights the significant advantages of adopting integrated organic nutrient management. Treatments incorporating Panchagavya, Jiva Amrit, PSB (Phosphate Solubilizing Bacteria) and *Azotobacter* proved to be the most effective in enhancing fruit yield, profitability and long-term soil sustainability. The highest yield was recorded in T₁₀ (Jiva Amrit + PSB + *Azotobacter*) with 160.38 Q/Ha, while the most profitable treatment was T₉ (Panchagavya + PSB + *Azotobacter*), which provided the highest net return and the best cost-benefit ratio. This confirms that a combination of natural biofertilizers, beneficial microbes and organic stimulants significantly improves plant growth, nutrient uptake and fruit quality.

Organic farming promotes better soil health and long-term sustainability. Unlike chemical fertilizers, organic inputs enhance soil fertility, microbial activity and water retention, reducing the risks of nutrient depletion and soil

degradation. As well, treatments using Panchagavya and Jiva Amrit showed natural antimicrobial properties, reducing pest and disease incidence without the need for chemical pesticides. This makes organic farming cost-effective in the long run, as it lowers input costs while maintaining high productivity.

Economically, organic strawberry farming offers higher profit margins due to the increasing demand for chemical-free produce. Organic strawberries command premium prices in both local and export markets, ensuring better financial security for farmers. While organic cultivation may have a slightly higher initial investment, the long-term benefits in terms of profitability, reduced dependency on synthetic fertilizers and improved soil health outweigh the costs. Besides, organic farming contributes to environmental conservation, reducing chemical runoff, soil erosion and pollution, making it a more sustainable approach to agriculture. Based on these findings, farmers should consider adopting T₉ (Panchagavya + PSB + *Azotobacter*) or T₁₀ (Jiva Amrit + PSB + *Azotobacter*) as the most effective treatments for achieving higher yields, maximum profitability and sustainable agricultural practices. Organic farming is not just a profitable alternative but a necessity for future agricultural success, ensuring healthier produce, better soil management and an eco-friendly farming system. By transitioning to organic strawberry cultivation, farmers can secure long-term economic stability while contributing to a healthier environment and meeting the rising consumer demand for organic products.

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 the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Anushi, & Tripathi, V. K. (2024). Impact of bio-fertilizer and organic mulch on the economics of cultivation of strawberry cv. *Katrain Sweet*. *Plant Archives*, 24(2), 1867-1872.
- Anushi, Tripathi, V. K., & Shukla, P. (2024). Influence of biostimulants and organic mulch on soil microbial population in strawberry (*F. x ananassa* Dutch.). *Biochemical and Cellular Archives*, 24(2), 2551-2555.
- Bhadauria, A. S., & Tripathi, V. K. (2023). Fruit characteristics and yield of mango cv. *Amrapali* as influenced by bio-enhancers and bio-fertilizers. *International Journal of Environment and Climate Change*, 13(10), 1973-1981.
- Bhat, M., Jasrotia, A., Bakshi, P., Jamwal, M., Sharma, N., Sharma, A., ... & Sinha, B. K. (2025). Improvement in growth, yield and fruit quality of strawberry (*Fragaria x ananassa* Duch.) with plant growth promoting rhizobacteria. *Applied Fruit Science*, 67(1), 22.
- Biradarar, P., Saravanan, S., Yadravi, R. N., & Kullur, L. R. (2022). Studies on the effect of different biofertilizers and organic manures on yield and quality of strawberry (*Fragaria ananasa* Duch.) cv. *Chandler* under Allahabad agro-climatic condition. *International Journal of Environment and Climate Change*, 12(11), 2863-2867.
- Chauhan, P., Kumar, A., Tripathi, S. K., Katiyar, H., Kumar, A., Verma, A. K., & Singh, S. (2024). Effect of organic manures and bio-fertilizers on growth, yield and quality of dragon fruit (*Hylocereus undatus* L.) under western Uttar Pradesh conditions. *Journal of Scientific Research and Reports*, 30(11), 1106-1117.
- Chouhan, N. K., & Tripathi, V. K. (2025). Impact of bio-enhancers and bio-fertilizers on the production economics of winter season guava. *Plant Archives*, 25(Suppl. 1), 1437-1442.
- Claire, D., Watters, N., Gendron, L., Boily, C., Pépin, S., & Caron, J. (2018). High productivity of soilless strawberry cultivation under rain shelters. *Scientia Horticulturae*, 232, 127-138.
- Kumar, A., & Tripathi, V. K. (2020). Effect of *Azotobacter*, PSB and vermicompost on growth, flowering, yield and quality of strawberry (*Fragaria x ananassa* Duch.) cv. *Chandler*. *Progressive Horticulture*, 52(2), 157-161.
- Morris, J., Else, M. A., El-Chami, D., Daccache, A., Rey, D., & Knox, J. W. (2017). Essential irrigation and the economics of strawberries in a temperate climate. *Agricultural Water Management*, 194, 90-99.
- Nayyer, M. A., Tripathi, V. K., Kumar, S., Lal, D., & Tiwari, B. (2014). Influence of integrated nutrient management on growth, yield and quality of tissue cultured banana (*Musa paradisiaca*) cv. *Grand Naine*. *Indian Journal of Agricultural Sciences*, 84(6), 680-683.
- Pawlak, J., Wroblewska, W., & Paszko, D. (2022). Production and economic efficiency in the cultivation of strawberry (*Fragaria x ananassa* Duch.) depending on the method of production-case study. *Agronomy Science*, 77(1), 15-26.
- Prakash, S., & Sarkar, D. (2017). Production economics of strawberry in Haryana, India. *Economic Affairs*, 62(4), 697-704.
- Pratap R., Tripathi, V. K., & Trivedi, A. K. (2024). Influence of vermicompost and biofertilizers on yield and economic feasibility of dragon fruit. *International Journal of Environmental Protection*, 11(4), 545-550.
- Rani, M., Kaushik, P., Bhayana, S., & Kapoor, S. (2023). Impact of organic farming on soil health and nutritional quality of crops. *Journal of the Saudi Society of Agricultural Sciences*, 22(8), 560-569.
- Rashmi, I., Kumawat, A., Munawery, A., Karthika, K. S., Sharma, G. K., Kala, S., & Pal, R. (2022). Soil amendments: an ecofriendly approach for soil health improvement and sustainable oilseed production. In *Oilseed Crops-Uses, Biology and Production*. IntechOpen.
- Rattanpal, H. S., Gill, M. I. S., & Sangwan, A. K. (2011). Micropropagation of strawberry through meristem culture. *Acta Horticulturae*, 890, 149-153.

- Siddiqui, A., Mukunda, G. K., & Srinivasappa, K. N. (2021). Effect of organic manures and bio-fertilizers on plant growth and yield of dragon fruit (*Hylocereus undatus* (Haworth) Britton and Rose.) and (*Hylocereus polyrhizus* (F.A.C. Weber)) under eastern dry zone of Karnataka. *The Mysore Journal of Agricultural Sciences*, 55(3), 223-229.
- Simpson, D. (2018). The economic importance of strawberry crops. In *The genomes of rosaceous berries and their wild relatives* (pp. 1-7).
- Tripathi, V. K., Kumar, N., Shukla, H. S., & Mishra, A. N. (2010). Influence of *Azotobacter*, *Azospirillum* and PSB on growth, yield and quality of strawberry cv. *Chandler*. In *National Symposium on Conservation Horticulture* (pp. 198-199), Dehradun.
- Tripathi, V. K., Kumar, S., Kumar, K., Kumar, S., & Dubey, V. (2016). Influence of *Azotobacter*, *Azospirillum* and PSB on vegetative growth, flowering, yield and quality of strawberry cv. *Chandler*. *Progressive Horticulture*, 48(1), 49- 53.

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