



ISSN Print: 2664-844X
 ISSN Online: 2664-8458
 IJAFA 2025; 7(2): 01-03
www.agriculturaljournals.com
 Received: 02-11-2024
 Accepted: 07-12-2024

Shailandra Vikram Singh
 Associate Professor Shri Durga
 Ji Post Graduate College,
 Chandeshwar, Azamgarh,
 Uttar Pradesh, India

Effect of bioenzyme and chitosan on the growth and quality of Strawberry (*Fragaria x Ananassa* Dutch)

Shailandra Vikram Singh

DOI: <https://doi.org/10.33545/2664844X.2025.v7.i2a.270>

Abstract

Bio enzyme and chitosan are two new bio stimulants intended to increase strawberry production. As customer demand for safer and healthier products grows, these materials are increasingly employed as agrochemical substitutes. The study aimed to find out the response of bio enzyme and chitosan on the growth and quality of strawberries. The present study was carried out in the year 2021-22 in Central Research farm, Department of Horticulture, Shri Durga Ji Post Graduate College, Chandeshwar, Azamgarh, Uttar Pradesh. The experiment was carried out in a randomized block design which was replicated thrice. The treatments were T₁ (Control), T₂ (25 ppm Chitosan), T₃ (50 ppm Chitosan), T₄ (25 ppm Bioenzyme), T₅ (25 ppm Bioenzyme + 25 ppm Chitosan), T₆ (25 ppm bioenzyme+ 50 ppm chitosan), T₇ (50 ppm bioenzyme), T₈ (50 ppm bioenzyme+25 ppm chitosan), T₉ (50 ppm bioenzyme+50 ppm chitosan). From the present investigation, it can be concluded that treatment T₉ (50 ppm bioenzyme+50 ppm chitosan) was found to be best in terms of plant height, plant spread, number of flowers, number of fruits, days to first flowering and fruiting, fruit length, fruit weight, total soluble solids (⁰B) and ascorbic acid (mg/100 g). According to the current study's findings, chitosan, a biostimulant made from the naturally occurring chitin present in the cell walls of fungi and crustaceans, and Biozyme, an extract from seaweed, can be utilized as ecologically beneficial agents at their lowest rates. Without requiring artificial inputs, these biostimulants support the sustainable production of premium strawberries.

Keywords: Strawberry, growth, quality, chitosan and bio enzyme

Introduction

Strawberry (*Fragaria × ananassa*) is one of the most widely cultivated and economically significant fruit crops worldwide. Its popularity can be attributed to its nutritional value, pleasant taste, and versatility in various food products Khan *et al.*, 2009) ^[7]. However, strawberry production faces several challenges, including susceptibility to pests, diseases, and environmental stressors, which often necessitate the use of agrochemicals. The growing consumer demand for healthier, pesticide-free produce has led to increased interest in sustainable agricultural practices, promoting the use of bio stimulants as viable alternatives to synthetic chemicals Kossak and Dyki, (2008) ^[8].

Bio stimulants, including natural substances such as bio enzymes and chitosan, are gaining recognition for their potential to enhance plant growth and improve the quality of crops. Bio enzyme, a seaweed extract, contains a rich array of bioactive compounds that stimulate plant growth, enhance nutrient uptake, and provide protection against environmental stressors Ghaouth *et al.*, 1991 ^[12]. Chitosan, a biopolymer derived from chitin found in the shells of crustaceans and fungal cell walls, has been shown to possess antimicrobial, growth-promoting, and stress-reducing properties in various crops Kumar *et al.*, (2023) ^[10]. These bio stimulants are considered environmentally friendly and have the potential to replace or reduce the reliance on chemical inputs in agriculture Sakif *et al.*, 2016 ^[13].

This study aims to explore the effect of bio enzyme and chitosan on the growth and quality of strawberries. By examining their influence on key parameters such as plant growth, fruit yield, and fruit quality, the research seeks to evaluate their effectiveness in enhancing strawberry production under sustainable agricultural practices. The findings could provide valuable insights into the use of these bio stimulants as alternative solutions for improving strawberry cultivation while minimizing the environmental impact associated with conventional farming practices Cardozo *et.al.* 2007 ^[3].

Corresponding Author:
Shailandra Vikram Singh
 Associate Professor Shri Durga
 Ji Post Graduate College,
 Chandeshwar, Azamgarh,
 Uttar Pradesh, India

Materials and Methods

The present study was conducted in Horticulture Research farm, Department of Horticulture, College of Agriculture, Azamgarh.

The study was carried out in the randomized block design which was replicated thrice. The treatments were T₁ (Control), T₂ (25 ppm Chitosan), T₃ (50 ppm Chitosan), T₄ (25 ppm Bio enzyme), T₅ (25 ppm Bio enzyme + 25 ppm Chitosan), T₆ (25 ppm bioenzyme+50 ppm chitosan), T₇ (50ppm bio enzyme), T₈ (50 ppm bioenzyme+25 ppm chitosan), T₉ (50ppm bioenzyme+50 ppm chitosan).

Results and Discussion

From Table 1 it can be inferred that the maximum plant height was recorded in the treatment T₉ (50 ppm bioenzyme+50 ppm chitosan) during experiments with the plant height of 8.52, 13.56, 19.59, and 23.65 cm at 30, 60, 90 and 120 days after transplanting which was followed by the treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with the plant height of 8.11, 13.41, 19.30 and 22.74 cm which was statistically superior over T₁ (Control) with 6.71, 11.90, 17.79 and 22.62 cm at 30, 60, 90 and 120 days after transplanting respectively. The maximum plant spread was recorded in the treatment T₉ (50 ppm bioenzyme+50 ppm chitosan) during experiments with the plant height of 8.98, 13.30, 18.06, and 21.27 cm at 30, 60, 90 and 120 days after transplanting which was followed by the treatment T₈ (50ppm bio enzyme + 25ppm chitosan) with the plant height of 7.56, 11.88, 16.64 and 19.85 cm which was statistically superior over T₁ (Control) with 5.89, 10.21, 14.97 and 18.18 cm at 30, 60, 90 and 120 days after transplanting respectively. The vegetative growth of the strawberry plants during the growing season was considerably ($p \leq 0.05$) impacted by the application of chitosan and biozyme. The plants that were treated according to the treatment that was allocated to them significantly varied from each other and showed a significant impact on the vegetative growth of the plant. The combination of both biostimulants has an additive effect which leads to rapid somatic cell division which furthers promotes mitotic cell division increasing vegetative growth.

The maximum number of flowers was recorded in T₉ (50 ppm bioenzyme +50 ppm chitosan) with 43.21 flowers which was followed by treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 41.26 flowers and the minimum number of flowers was recorded in the treatment T₁ (Control) with (26.32) flowers. The maximum number of fruits was recorded in T₉ (50 ppm bioenzyme+ 50 ppm chitosan) with 35.17 fruits which was followed by treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 31.16 fruits and the minimum number of flowers was recorded in the treatment T₁ (Control) with (19.26) fruits. The minimum number of days taken for 1st flowering was recorded in the treatment T₉ (50 ppm bioenzyme+50 ppm chitosan) with 37.26 days which was followed by the treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 38.48 days and the maximum number of days taken for 1st flowering was recorded in T₁ (Control) with 49.16 days. The minimum number of days taken for 1st fruiting was recorded in the treatment T₉ (50 ppm bioenzyme+ 50 ppm chitosan) with 67.18 days which was followed by the treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 69.26 days and the maximum number of days taken for 1st flowering was recorded in T₁ (Control) with 81.45 days. The application of

biozyme and chitosan rates had a substantial impact on the quantity of flowers and fruit produced by each plant. In comparison to the control, more blooms and fruits were seen on the treated plants. Decreased flower drops and increased fruit set may result from cytokinin and auxin-induced delays in abscission, which preserve the loss of pectin material in the middle lamella and improve resilience to nutrition and water stress (Kachave and Bhosale, 2007) [6]. Additionally, biozyme improved metabolite mobilisation to the flowers and photosynthesis (Bhatia and Kaur, 1997) [2]. The outcomes concur with those of Gore *et al.* (2007) and Kumar *et al.* (2000) [5, 9], who found that the use of biozyme considerably raised the yield of chilli.

The maximum length of fruits was recorded in T₉ (50 ppm bioenzyme+50 ppm chitosan) with 4.42 cm which was followed by treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 4.25 cm and the minimum number of flowers was recorded in the treatment T₁ (Control) with 3.01 cm.

The maximum weight of fruits was recorded in T₉ (50 ppm bioenzyme+ 50 ppm chitosan) at 25.72 g which was followed by treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 24.62 g and the minimum number of flowers was recorded in the treatment T₁ (Control) with 18.37 g. The application of biozyme and chitosan had a substantial impact on the length and diameter of strawberry fruits. The treated plots with the lowest rates of biozyme and chitosan produced the longest fruit length and diameter compared to the control. This increase in fruit size following the application of biozyme and chitosan might be attributed to the ability of auxins (NAA) to drive cell division and cell expansion in fruits. Biozyme promotes cell activation and differentiation, leading to increased floral buds and fruit production. Using biozyme during fruit growth promotes the creation of more epidermal cells, leading to larger and more commercially stable fruits. This study found that applying varied dosages of chitosan to the strawberry canopy improved vegetative growth, fruit output, and quality compared to the untreated control. Chitosan has been shown to reduce pre- and post-harvest diseases and boost production in ornamental and horticultural crops globally (Pichyangkura *et al.*, 2015) [11]. The maximum total soluble solids of fruits was recorded in T₉ (50ppm bioenzyme+50 ppm chitosan) at 8.78 °B which was followed by treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 8.21 °B and the minimum number of flowers was recorded in the treatment T₁ (Control) with 7.28 °B. The maximum ascorbic acid of fruits was recorded in T₉ (50 ppm bioenzyme+ 50 ppm chitosan) at 48.95 mg/100g which was followed by treatment T₈ (50 ppm bio enzyme + 25 ppm chitosan) with 47.56 mg/100 g and the minimum number of flowers was recorded in the treatment T₁ (Control) with 36.19 mg/100 g.

Conclusion

In the present study, the combined application of bioenzyme and chitosan was investigated to assess its impact on strawberry growth and quality. Among the treatments tested, T₉ (50 ppm bioenzyme + 50 ppm chitosan) consistently outperformed others in enhancing vegetative growth, yield, and fruit quality. This study aims to highlight the synergistic effect of these biostimulants in optimizing strawberry production while maintaining ecological balance. Both bioenzymes and chitosan are environmentally sustainable and exhibit the potential to improve crop performance, making them ideal for modern agricultural practices.

Table 1: Effect of chitosan and bio enzyme on plant height, plant spread and number of flowers of strawberry

Treatment	Plant height (cm)				Plant spread (cm)				Number of flowers
	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT	
T ₁ (Control)	6.71	11.9	17.79	22.62	5.89	10.21	14.97	18.18	26.32
T ₂ (25 ppm Chitosan)	6.99	12.43	18.32	22.53	6.21	10.53	15.29	18.5	31.56
T ₃ (50 ppm Chitosan)	7.52	11.96	17.85	22.06	6.45	10.77	15.53	18.74	35.45
T ₄ (25 ppm Bio enzyme)	7.05	12.68	18.57	22.78	6.76	11.08	15.84	19.05	37.28
T ₅ (25 ppm Bio enzyme + 25 ppm Chitosan)	7.77	12.88	18.77	22.98	6.98	11.3	16.06	19.27	39.62
T ₆ (25 ppm bioenzyme+50 ppm chitosan)	7.97	12.77	18.66	22.87	7.21	11.53	16.29	19.5	36.26
T ₇ (50 ppm bio enzyme)	7.86	13.02	18.91	23.12	7.34	11.66	16.42	19.63	39.26
T ₈ (50 ppm bio enzyme + 25 ppm chitosan)	8.11	13.41	19.3	22.74	7.56	11.88	16.64	19.85	41.62
T ₉ (50 ppm bio enzyme + 50 ppm chitosan)	8.52	13.56	19.59	23.65	8.98	13.3	18.06	21.27	43.21
F test	S	S	S	S	S	S	S	S	S
CD@5%	0.431	0.627	0.712	0.735	0.212	0.342	0.428	0.562	0.621
S.Ed. (±)	0.22	0.31	0.36	0.37	0.11	0.17	0.21	0.28	0.31

Table 2: Effect of chitosan and bio enzyme on plant height, plant spread and number of flowers of strawberry

Treatments	Number of fruits	Days to 1 st flowering	Days to 1 st fruiting	Fruit length (cm)	Fruit weight (g)	TSS (°B)	Ascorbic acid (mg/100 g)
T ₁ (Control)	19.26	49.16	81.45	3.01	18.37	7.28	36.19
T ₂ (25 ppm Chitosan)	20.15	47.34	79.62	2.48	19.35	7.64	39.46
T ₃ (50 ppm Chitosan)	23.36	45.25	77.06	2.65	19.48	7.29	41.28
T ₄ (25 ppm Bio enzyme)	24.56	43.19	75.72	3.45	20.35	7.51	42.65
T ₅ (25 ppm Bio enzyme + 25 ppm Chitosan)	29.21	42.64	74.26	3.28	21.25	7.65	36.08
T ₆ (25 ppm bioenzyme+50 ppm chitosan)	25.58	40.41	72.95	3.09	21.45	7.91	42.38
T ₇ (50ppm bio enzyme)	26.92	39.28	70.16	4.02	22.34	8.05	45.38
T ₈ (50 ppm bio enzyme + 25ppm chitosan)	31.16	38.48	69.26	4.25	24.62	8.21	48.56
T ₉ (50 ppm bio enzyme + 50 ppm chitosan)	35.17	37.26	67.18	4.42	25.72	8.78	40.95
F test	S	S	S	S	S	S	S
CD@5%	1.21	1.65	2.45	0.65	1.82	0.98	2.45
S.Ed. (±)	0.605	0.825	1.225	0.325	0.91	0.49	1.225

References

- Abou El-Yazied A, El-Gizawy AM, Ragab MI, Hamed ES. Effect of seaweed extract and compost treatments on growth, yield and quality of snap bean. *J Am Sci*. 2012;8(6):1-20.
- Bhatia DS, Kaur J. Effect of homobrassinolide and humicil on chlorophyll content, hill activity and yield components in mungbean (*Vigna radiata* L. Wilczek). *Phytomorphol*. 1997;47:421-426.
- Cardozo K, Guaratini T, Barros MP, Falcão VR, Tonon AP, Lopes NP, *et al*. Metabolites from algae with economical impact. *Comp Biochem Physiol C*. 2007;146:60-78.
- FAOSTAT. Food and Agriculture Organization of the United Nations Statistics Division. Available from: <http://www.fao.org/faostat>
- Gore AK, Jadhav SB, Gore AK, Ghuge TD. Effect of different bio-enzymes on growth, flowering and yield of green chilli (*Capsicum annuum* L.) variety "Pusa Jwala". *J Soils Crops*. 2007;17:105-109.
- Kachave DB, Bhosale AM. Effect of plant growth regulators and micronutrients on fruiting and yield parameters of Kagzi lime (*Citrus aurantifolia* Swingle) fruits. *Asian J Hort*. 2007;2:75-79.
- Khan W, Rayirath UP, Subramanian S, Jithesh MN, Rayorath P, Hodges DM, *et al*. Seaweed extracts as biostimulants of plant growth and development. *J Plant Growth Regul*. 2009;28:386-399.
- Kossak K, Dyki B. Effects of biostimulators on cultivation of Aboney F1 greenhouse tomato. In: Dąbrowski ZT, editor. *Biostimulators in Modern Agriculture. Solanaceous crops*. Warsaw: Editorial House Wieś Jutra; c2008. p. 13-20.
- Kumar R, Bakshi P, Srivastava JN. Fruit Cracking: A Challenging Problem of Fruit Industry. *Krishi Sandesh*. 2010..
- Kumar AS, Malik K. Standardization of fermentation process for mass production of fungal chitosan using agro-industrial waste. *Int J Adv Biochem Res*. 2023;7(2):5-11. DOI:10.33545/26174693.2023.v7.i2a.180
- Pichyangkura R, Chadchawan S. Biostimulant activity of chitosan in horticulture. *Scientia Hort*. 2015;196:49-65.
- El Ghaouth A, Arul J, Ponnampalam R, Boulet M. Chitosan coating effect on storability and quality of fresh strawberries. *Journal of food science*. 1991 Nov;56(6):1618-1620.
- Sakif TI, Dobriansky A, Russell K, Islam T. Does chitosan extend the shelf life of fruits?. *Advances in Bioscience and Biotechnology*. 2016;7(08):337.