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The names and affiliations of all authors are provided below, following the references.

Economic assessment of Goldenrod (*Solidago canadensis* L.) in response to different bio-stimulants

Y. R. Rakshitha¹, S. Y. Chandrashekar², Y. Annappa Hugar³, R. N. Kencharaddi⁴, B. Archana⁵

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ABSTRACT

Abstract: An experiment entitled Economic assessment of Goldenrod (*Solidago canadensis* L.) in response to different bio-stimulants was conducted at the experimental block of Department of Floriculture and Landscaping, School of Post Graduation Studies, Iruvakk, under Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, during 2025-26. The experiment was laid out in Randomized Complete Block Design (RCBD) consisting of nine treatments viz., T₁ (Humicel @ 0.3%), T₂ (Humicel @ 0.5%), T₃ (Spic Cytozyme @ 0.3%), T₄ (Spic Cytozyme @ 0.5%), T₅ (Kelpak @ 0.3%), T₆ (Kelpak @ 0.5%), T₇ (Samras @ 0.3%), T₈ (Samras @ 0.5%) and T₉ (Control), replicated thrice. The plants were sprayed with bio-stimulants at 30, 60 and 90 days after transplanting. The results revealed that treatment T₇ (Samras @ 0.3%) recorded the maximum spike yield (5.06 lakh spikes/ha), gross returns (₹20,22,720.00/ha), net returns (₹14,21,141.00/ha) and benefit:cost ratio (3.36). The treatment control recorded the minimum spike yield (2.92 lakh spikes/ha), gross returns (₹11,69,280.00/ha), net returns (₹6,02,801.00/ha) and B:C ratio (2.06). Thus, the foliar application of Samras @ 0.3 per cent proved to be the most economically efficient treatment for enhancing spike yield and profitability of Goldenrod and can be recommended for commercial cultivation.

Keywords: Bio-stimulants, Goldenrod, Spike yield, Gross returns, Net returns, B:C ratio

Introduction

Indian floriculture sector is witnessing steady growth, driven by the expanding area under flower cultivation and increasing demand for loose and cut flowers. According to the Ministry of Agriculture and Farmers Welfare (2024-25), flower crops occupied approximately 397 thousand hectares, with production of 3226 thousand metric tonnes of loose flowers and 1039 thousand metric tonnes of cut flowers (Anon., 2025) [1].

Goldenrod (*Solidago canadensis* L.) is gaining importance as a promising ornamental crop for cut foliage and filler purposes due to its attractive foliage, golden yellow inflorescences, good vase life and suitability for floral arrangements. The economic potential of the crop largely depends on higher marketable spike yield, quality produce, production cost and returns obtained per unit area (Semple, 2025) [2]. Bio-stimulants have emerged as promising sustainable inputs for improving plant growth, nutrient uptake, physiological efficiency, flowering and yield of horticultural crops, thereby enhancing marketable yield and profitability Traon *et al.* (2014) [3]. However, limited information is available on the economic performance of Goldenrod under different bio-stimulant treatments. Hence, the present investigation was undertaken to evaluate the economic efficiency of different bio-stimulant treatments in Goldenrod.

2. Materials and Methods

The present investigation was carried out at the Experimental Block, Department of Floriculture and Landscaping, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences (KSNUAHS), Shivamogga, Karnataka, during 2025-26. The experimental field was thoroughly prepared through repeated tillage operations, followed by levelling and formation of flat beds measuring 2.1 m × 1.2 m. Well-decomposed farmyard manure (FYM) at 25 t/ha was incorporated during land preparation. The recommended dose of fertilizers (RDF) of 100:50:50 kg N:P₂O₅:K₂O/ha, as recommended by Rakesh (2022) [4], was applied, with the entire dose of phosphorus and potassium and half of the nitrogen applied as basal, while the remaining half of nitrogen was top-dressed in two equal splits at 30 and 60 days after transplanting (DAT). Healthy and uniform rooted suckers of Goldenrod were planted at a spacing of 30 × 30 cm. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and nine treatments, namely T₁-Humicel @ 0.3%, T₂-Humicel @ 0.5%, T₃-Spic Cytozyme @ 0.3%, T₄-Spic Cytozyme @ 0.5%, T₅-Kelpak @ 0.3%, T₆-Kelpak @ 0.5%, T₇-Samras @ 0.3%, T₈-Samras @ 0.5% and T₉-Control. The respective bio-stimulants were applied as foliar sprays at 30, 60 and 90 DAT. Economic analysis was carried out by

Corresponding Author:

Y. R. Rakshitha

PG Scholar, Department of Floriculture and Landscaping, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, (KSNUAHS), Shivamogga (Karnataka), India.

estimating the total cost of cultivation, spike yield, gross returns, net returns and benefit:cost ratio for each treatment. Gross returns were calculated based on the prevailing market price of Goldenrod spikes, while net returns were obtained by deducting the total cost of cultivation from the gross returns. The benefit:cost ratio was calculated as the ratio of gross returns to the total cost of cultivation. The data ob-

tained were subjected to statistical analysis to assess the economic performance of different bio-stimulant treatments.

Results and Discussion

The findings of the present investigation were interpreted and are presented in Table 1 based on the observations recorded during the experimental study.

Table 1. Effect of foliar application of bio-stimulants on economics of spike yield per hectare of Goldenrod (*Solidago canadensis* L.)

Treatment No.	Treatments	Spike yield per hectare (lakhs)	Total cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	B:C ratio
T ₁	Humicel @ 0.3%	3.70	5,93,479.00	14,78,400.00	8,84,921.00	2.49
T ₂	Humicel @ 0.5%	3.63	6,10,979.00	14,51,520.00	8,40,541.00	2.38
T ₃	Spic Cytozyme @ 0.3%	4.03	5,90,779.00	16,12,800.00	10,22,021.00	2.73
T ₄	Spic Cytozyme @ 0.5%	4.20	6,06,529.00	16,80,000.00	10,73,471.00	2.77
T ₅	Kelpak @ 0.3%	4.27	6,20,479.00	17,06,880.00	10,86,401.00	2.75
T ₆	Kelpak @ 0.5%	4.37	6,55,479.00	17,47,200.00	10,91,721.00	2.67
T ₇	Samras @ 0.3%	5.06	6,01,579.00	20,22,720.00	14,21,141.00	3.36
T ₈	Samras @ 0.5%	4.70	6,24,329.00	18,81,600.00	12,57,271.00	3.01
T ₉	Control	2.92	5,66,479.00	11,69,280.00	6,02,801.00	2.06

Note: Selling price of Spike (Rs. 4/spike)

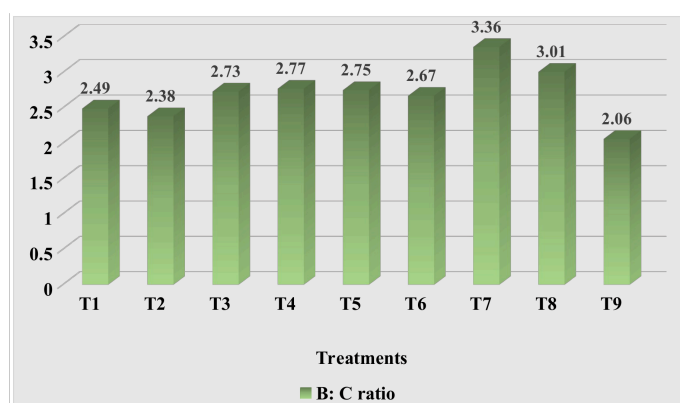


Figure 1. Effect of foliar application of bio-stimulants on Benefit:Cost ratio (B:C) of Goldenrod (*Solidago canadensis* L.)

Economic parameters

The economic performance of Goldenrod was markedly influenced by the application of different bio-stimulant treatments. Treatment T₇ (Samras @ 0.3%) recorded the maximum spike yield (5.06 lakh

spikes/ha), gross returns (₹20,22,720.00/ha), net returns (₹14,21,141.00/ha) and B:C ratio (3.36), indicating its superior economic efficiency. The higher economic returns under Samras @ 0.3 per cent may be attributed to its favourable influence on vegetative growth, flowering and spike production, which resulted in higher marketable yield and consequently greater returns. The enhanced availability of amino acids and protein hydrolysates in Samras may have promoted nutrient assimilation, photosynthetic activity and efficient translocation of assimilates towards developing reproductive structures, thereby increasing spike production and profitability. In contrast, the treatment control (T₉) recorded the minimum spike yield (2.92 lakh spikes/ha), gross returns (₹11,69,280.00/ha), net returns (₹6,02,801.00/ha) and B:C ratio (2.06). The results indicate that Samras @ 0.3 per cent was the most economically viable treatment for Goldenrod cultivation under the present experimental conditions. Similar findings were reported by Rakesh (2022) [4] in Goldenrod, Bolagam et al. (2019) [5] in Gladiolus and Hegde et al. (2016a) and Hegde et al. (2018b) [6] in Chrysanthemum and Ahmad et al. (2014) and Hegde et al. (2022) [7] in *Dendrobium* orchid.

Table 2. Cost and quantity of bio-stimulants formulations required for 1 ha

Bio-stimulant formulation	Bio-stimulants unit cost (₹)	Quantity required (litre/ha)	Cost involved (₹/ha)
Humicel @ 0.3 %	500 /l	54	27,000
Humicel @ 0.5 %	500 /l	89	44,500
Spic Cytozyme @ 0.3 %	450 /l	54	24,300
Spic Cytozyme @ 0.5 %	450 /l	89	40,050
Kelpak @ 0.3 %	1000 /l	54	54,000
Kelpak @ 0.5 %	1000 /l	89	89,000
Samras @ 0.3 %	650 /l	54	35,100
Samras @ 0.5 %	650 /l	89	57,850
Total cost			3,71,800.00

Conclusion

Improving profitability, spike yield and economic efficiency are important objectives in commercial Goldenrod cultivation. The overall results of the present investigation revealed that foliar application of bio-stimulants improved spike yield and economic returns. Among the different treatments, Samras @ 0.3 per cent (T₇) proved to be the most effective, recording the highest spike yield, gross returns, net returns and B:C ratio. Hence, Samras @ 0.3 per cent can be recommended for commercial cultivation of Goldenrod to achieve higher yield, profitability and economic efficiency under the prevailing agro-climatic conditions.

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Authors

Y. R. Rakshitha

PG Scholar, Department of Floriculture and Landscaping, College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, (KSNUAHS), Shivamogga (Karnataka), India.

S. Y. Chandrashekar

Professor and Head, Department of Floriculture and Landscaping, College of Horticulture, Hiriyyur, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, (KSNUAHS), Shivamogga (Karnataka), India.

Y. Annappa Hugar

Professor, Department of Agronomy, College of Agriculture, Shivamogga, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, (KSNUAHS), Shivamogga (Karnataka), India.

R. N. Kencharaddi

Professor and Head, Department of FBTI, College of Forestry, Ponnampet, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, (KSNUAHS), Shivamogga (Karnataka), India.

B. Archana

Assistant Professor, Department of Horticulture, College of Agricultural Sciences, Iruvakkal Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, (KSNUAHS), Shivamogga (Karnataka), India.