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Efficacy of Biostimulants on Quality and Economics of Chrysanthemum (*Dendranthema grandiflora* Tzvelev.) under Naturally Ventilated Polyhouse

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Abtract An experiment was conducted to know the influence of biostimulants on quality and economics of chrysanthemum under naturally ventilated polyhouse. 12 biostimulant formulations in 2 different concentrations were used for the study. Among different biostimulant treatments application of Biovita @ 0.5% resulted significantly maximum individual flower weight, flower diameter, stem length (46.89 cm, 5.06 g and 6.70 cm, respectively) vase life (22.5 days) and shelf life (11 days) with highest net returns and B : C ratio (Rs 3,12, 411.07 and 4.43, respectively). Whereas, the lowest for all the above parameters was recorded in control (RDF).

Keywords Biostimulant, Chrysanthemum, Biovita, Sea weed extract.

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Introduction

Flowers and flowering plants have been a fascinating part of our life. Among them, chrysanthemum (*Dendranthema grandiflora* Tzvelev.) is one of the most interesting and oldest flower crops which belong to the family, Asteraceae. In Dutch cut flower auction, ranks second after rose. Important both as cut flower, loose flower and potted plant, grown in an area of 16.63 '000 ha NHB [1]. It occupies prominent place in vase decorations, bouquets and garland making.

With the consequence of green revolution, the indiscriminate use of chemical fertilizers has lead to negative impact on environment. The biostimulants have been emerged as a supplement to mineral fertilizers and hold a promise to improve the yield as well as quality of the crop under protected condition Rawat and Vishal [2]. Keeping in view, the need and importance of biostimulants, the

present investigation was conducted with an objective to study the efficacy of biostimulants on quality and economics of chrysanthemum under protected cultivation.

Materials and Methods

The trial was taken up in chrysanthemum cultivar kolar Local between 2015-16 at Department of Floriculture and landscape Architecture, College of Horticulture, Mudigere. Healthy and uniform rooted terminal rooted cuttings of chrysanthemum were planted on the raised beds at a spacing of 30 cm ×30 cm under naturally ventilated polyhouse. The design adopted was randomized complete block design with 25 treatments and replicated two times. Treatments included T_1—Control (100 : 150 : 100 kg/ha), T_2–Humigrow (Humic acid) @ 0.3%, T_3–Humigrow@ 0.5%, T_4–Fulvic acid @ 0.3%, T_5–Fulvic acid @ 0.5%, T_6–Panchagavya @ 0.3%, T_7–Panchagavya @ 0.5%, T_8–Jeevamruta @ 0.3%, T_9–Jeevamruta @ 0.5%, T_{10}–Amruta Sanjeevini (lipoprotein + Humic acid) @ 0.3% T_{11} – Amruta Sanjeevini @ 05%, T_{12}– Zoom flower (Nitro benzene) @ 0.3%, T_{13} – Zoom flower @ 0.5%, T_{14}– Biovita (Sea Weed Extract) @ 0.3 %, T_{15} –Biovita @ 0.5%, T_{16} – Spicmex (Amino acid + Humic acid) @ 0.3%, T_{17}–Spicmex @ 0.5%, T_{18}–Neozyme @ 0.3%, T_{19}–Neozyme (Sea Weed Extract + Amino acid) @ 0.5%, T_{20}–Swara (Amino acid, Nicotinic acid, Vit Bl, B 6, B 7) @ 0.3%, T_{21} – Swara @ 0.5%, T_{22}–Humicel plus (Humic acid + Fulvic acid + Sea Weed Extract) @ 0.3%, T_{23}–Humicel plus @ 0.5%, T_{24} –Formula 15 (Humic acid + Fulvic acid + Amino acid) @ 0.3%, T_{25}–Formula 15 @ 0.5%. These biostimulants were sprayed on the foliage i.e. @ 60, 90 and 120 days after planting (DAP) and the observations like individual flower weight, flower diam-

Table 1. Efficacy of biostimulants on quality of chrysanthemum under naturally ventilated polyhouse.

Treatments	Concentration (%)	Flower diameter (cm)	Individual flower weight (g)	Stem length (cm)	Vase life (days)	Shelf life (days)
T_1 –Control (RDF)	–	4.19	3.50	34.21	15.00	5.50
T_2 –Humigrow	0.3	4.80	4.10	42.22	18.50	8.50
T_3 –Humigrow	0.5	5.26	4.60	44.91	21.00	9.50
T_4 –Fulvic acid	0.3	4.83	4.00	40.93	18.00	8.00
T_5 –Fulvic acid	0.5	5.19	4.45	43.67	19.50	9.00
T_6 –Panchagavya	0.3	4.70	3.65	36.52	16.00	6.50
T_7 –Panchagavya	0.5	4.99	3.87	38.76	17.50	7.00
T_8 –Jeevamruta	0.3	4.78	3.73	37.97	17.00	7.00
T_9 –Jeevamruta	0.5	5.20	3.96	40.06	18.00	7.50
T_{10} –Amruta sanjeevini	0.3	4.86	3.68	36.27	16.50	6.50
T_{11} –Amruta sanjeevini	0.5	5.01	3.94	38.04	17.50	7.00
T_{12} –Zoom flower	0.3	4.77	3.88	40.96	17.00	7.50
T_{13} –Zoom flower	0.5	5.05	4.20	41.98	18.50	8.00
T_{14} –Biovita	0.3	5.74	4.63	43.12	20.00	9.50
T_{15} –Biovita	0.5	6.70	5.06	46.89	22.50	11.00
T_{16} –Spicmex	0.3	4.62	3.71	36.65	19.50	6.50
T_{17} –Spicmex	0.5	4.98	3.90	37.85	21.50	7.50
T_{18} –Neozyme	0.3	5.02	3.88	41.09	17.50	7.00
T_{19} –Neozyme	0.5	5.30	4.25	43.15	18.50	8.00
T_{20} –Swara	0.3	5.05	4.04	42.11	18.00	7.50
T_{21} –Swara	0.5	5.39	4.39	44.21	19.50	8.50
T_{22} –Humicel plus	0.3	5.65	4.30	42.89	19.50	9.00
T_{23} –Humicel plus	0.5	6.60	4.89	46.35	21.50	10.50
T_{24} –Formula 15	0.3	5.48	4.23	42.57	19.00	8.50
T_{25} –Formula 15	0.5	6.58	4.83	45.91	21.00	9.50
SEm±		0.04	0.08	0.70	0.58	0.51
CD (5%)		0.13	0.23	2.05	1.53	1.49

eter, stem length, vase life and shelf life, economics were recorded and the data were statistically analyzed.

Results and Discussion

The data pertaining to quality and economics of chrysanthemum are presented in Tables 1 and 2. The quality parameters decide the significance of the particular biostimulant, which is suitable for commercial usage. Flower diameter, stem length and individual flower weight are the important parameters which decide the quality of the flower. Significant differences were observed among the different biostimulants for flower diameter, individual flower weight and stem length. The longest flower stem, individual flower weight and flower diameter was observed in foliar application of Biovita @ 0.5% (46.89 cm, 5.06 g and 6.70 cm, respectively) which was on par with Humicel plus @ 0.5% and Formula 15 @ 0.5 %. These results were in accordance with Shinde et al. [3] and Karthiraj et al. [4] who stated that the enlargement in size of the flower might be due to production of more food which was diverted to flowering area.The highest stem length was observed in sea weed extract sprayed plants as they are the precursors of auxin, cytokinin and micronutrients.

In terms of vase life, foliar application of Biovita @ 0.5% was found to be more effective and it had a maximum vase life of 22.5 days in normal tap water as compared to control (15.5 days). Similarly, the shelf life was found maximum in treatment comprising of Biovita @ 0.5% and minimum was found in control (5.5 days). The biostimulant induced photosynthesis that might have been led to recombination of nutrients in flower that is used for remaining long

Table 2. Effect of biostimulants on cost economics of chrysanthemum for 560 m^2 under naturally ventilated polyhouse. RDF as a constant for all the treatments.

Treatments		Concentration (%)	Total cost of production (Rs)	Flower yield/ 560m^2 (kg)	Sucker yield/ 560m^2 (No.)	Gross returns (Rs) (Flowers and sucker)	Net returns (Rs)	B : C ratio
T_1	–Control	–	70,226.93	1,047.2	27,468	1,85,836	1,15,609.07	1.64
T_2	–Humigrow	0.3	70,326.93	1,344.0	36,540	2,41,080	1,70,753.07	2.42
T_3	–Humigrow	0.5	70,326.93	1,652.0	42,084	2,90,668	2,20,341.07	3.13
T_4	–Fulvic acid	0.3	70,423.93	1,316.0	35,784	2,36,068	1,65,644.07	2.35
T_5	–Fulvic acid	0.5	70,423.93	1,556.8	40,320	2,75,240	2,04,816.07	2.90
T_6	–Panchagavya	0.3	70,266.93	1,075.2	30,240	1,94,880	1,24,613.07	1.77
T_7	–Panchagavya	0.5	70,266.93	1,215.0	33,516	2,18,907	1,48,640.07	2.11
T_8	–Jeevamruta	0.3	70,276.93	1,159.2	33,012	2,10,924	1,40,647.07	2.00
T_9	–Jeevamruta	0.5	70,276.93	1,265.6	35,784	2,29,776	1,59,499.07	2.26
T_{10}	–Amruta sanjeevini	0.3	70,301.93	1,103.2	32,256	2,02,412	1,32,110.07	1.87
T_{11}	–Amruta sanjeevini	0.5	70,301.93	1,220.8	35,028	2,22,656	1,52,354.07	2.16
T_{12}	–Zoom flower	0.3	70,376.93	1,176.0	35,935	2,18,870	1,48,493.07	2.10
T_{13}	–Zoom flower	0.5	70,376.93	1,299.2	38,203	2,38,806	1,68,429.07	2.39
T_{14}	–Biovita	0.3	70,376.93	1,825.6	43,344	3,14,888	2,44,511.07	3.47
T_{15}	–Biovita	0.5	70,376.93	2,268.0	49,644	3,82,788	3,12,411.07	4.43
T_{16}	–Spicmex	0.3	70,283.93	1,092.0	31,903	2,00,306	1,30,022.07	1.89
T_{17}	–Spicmex	0.5	70,283.93	1,181.6	34,120	2,15,940	1,45,656.07	2.07
T_{18}	–Neozyme	0.3	70,300.93	1,148.0	34,524	2,12,548	1,42,247.07	2.02
T_{19}	–Neozyme	0.5	70,300.93	1,260.0	36,892	2,31,284	1,60,983.07	2.28
T_{20}	–Swara	0.3	70,816.93	1,209.6	35,834.4	2,22,869	1,52,052.80	2.14
T_{21}	–Swara	0.5	70,816.93	1,344.0	39,009.6	2,46,019	1,75,202.07	2.47
T_{22}	–Humicel plus	0.3	70,351.93	1,780.8	41,076	3,04,752	2,34,400.07	3.33
T_{23}	–Humicel plus	0.5	70,351.93	2,184.0	48,3336	3,69,667	2,99,315.27	4.25
T_{24}	–Formula 15	0.3	70,326.93	1,730.4	40,521.6	2,97,343	2,27,016.07	3.22
T_{25}	–Formula 15	0.5	70,326.93	2,150.4	47,779.2	3,64,358	2,94,031.47	4.18

days in vase life. Entry of sea weed extract into the plant, which might have mediated the resporation by acting as a hydrogen acceptor and thus altering the carbohydrate metabolism of plants promoting the accumulation of sugar as inferred by Khan et al. [5]. Sea weed extract contain cytokinin and auxin that might have increased the antioxidant levels and resistance to senescence leading to enhanced longevity of stem.

The economic analysis reveals that, foliar application of Biovita @ 0.5% had resulted in the highest gross return of Rs 2,83,450 with a net return and BC ratio of Rs 2, 13, 07.07 and 3.02, respectively. This was followed by Humicel plus @ 0.5% which recorded a net return Rs 1, 99, 385.07/m^2 and B : C ratio of 2.83 with gross income of Rs 2,69,737 and formula 15 which had gross returns, net returns and benefit cost ratio of 2, 69, 312, 1, 98, 985.07 and 2.80, respectively. The lowest net return was observed in control at Rs 67,673.07 with a benefit cost ratio and gross income of and Rs 1.0 and 1, 37, 900, respectively. The results are supported by satapathy et al. [6].

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