Studies on the effect of biostimulants on quality of cut flower of Chrysanthemum (*Dendranthema grandiflora*) cv. Denjigar White.

Abstract:

The experiment entitled- "Effect of biostimulants on quality of cut flower of Chrysanthemum (*Dendranthema grandiflora*) cv. Denjigar White" was conducted during the *Rabi* season of the year 2020-2021 at Ammapuram (V), Thorrur (M), Mahabubabad district. Among the treatments, the treatment T_2 (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum flower diameter (7.48 cm), individual flower weight (6.55 g), stem length (72.10 cm), vase life (21.60 days) and shelf life (5.84 days), gross returns (₹ 76,93,200), net returns (₹ 59,82,204) and best benefit cost ratio (3.50). However, control recorded minimum in all the parameters.

Key words: Bio stimulants, chrysanthemum, Denjigar White, *Ascophyllum nodosum.*

Introduction:

Flowers and flowering plants have been a fascinating part of our life. Chrysanthemum (*Dendranthema grandiflora*) is a most beautiful and oldest flowering plant, commercially grown in different parts of the world.Chrysanthemum occupies a prominent place in ornamental horticulture and is one of the commercially exploited flower crop, belongs to the family 'Asteraceae' and referred as "Queen of the East", "Autumn Queen", and "Guldaudi" having diploid chromosome number 2n=18.

The word "Chrysanthemum" comes from two Greek words, *Chrysos* -golden and *anthos* - flower which means golden flower. It is native to the Northern hemisphere and is widely distributed in Europe and Asia. However, the origin of chrysanthemum is China (Carter, 1990).

After green revolution, the indiscriminate use of chemical fertilizers has lead to negative impact on environment. To mitigate this, biostimulants have been emerged as a supplement to the mineral fertilizers and hold a promise to improve the yield as well as quality of the crop underprotected conditions (Rawat and Vishal, 2002).

Biostimulants are the materials other than the fertilizers that promote the plant growth when applied in minute quantities and are also referred as 'metabolic enhancers' (Zhang and Schmidt, 1997). Keeping in view, the need and importance of biostimulants, the present investigation was conducted with an objective to study the effect of biostimulants on growth, yield and quality of cut flower of Chrysanthemum (*Dendranthema grandiflora*) cv. Denjigar White.

Materials and methods:

The present investigation entitled "Effect of biostimulants on quality of cut flower of chrysanthemum (*Dendranthema grandiflora*), cv. Denjigar White" was carried out during the *Rabi* season of the year 2020-2021 at the season of the year 2020-2021 at Ammapuram (V), Thorrur (M), Mahabubabad district. Healthy and rooted terminal cuttings were planted on the raised beds at a spacing of 15 cm x 15 cm under polyhouse. The design adopted was Randomized Block Design with nine treatments and replicated thrice. Treatments included T_1 - *Ascophyllum nodosum* @ 2.5 ml L^{-1}, T_2- *Ascophyllum nodosum* @ 5 ml L^{-1}, T_3- Rhodophyte extract @ 0.2 g L^{-1}, T_4- Rhodophyte extract @ 0.4 g L^{-1}, T_5- Potassium humate @ 1.5 g L^{-1}, T_6- Potassium humate @ 3 g L^{-1}, T_7- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 2 g L^{-1}, T_8- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 4 g L^{-1}, T_9- Control (Water spray). These biostimulants were sprayed on the foliage at 3 intervals *i.e.* @ 30, 45 and 60 days after transplanting (DAT) and the observations recorded were flower diameter, individual flower weight, stem length, vase life, shelf life and economics were recorded and the data were statistically analysed.

Schedule of spray : 30,45 and 60 days after transplanting (DAT).

Results and Discussion:

The effect of biostimulants on quality of cut flower of chrysanthemum (*Dendranthema grandiflora*), cv. Denjigar White and the results of the experiment were presented in Table 1 to 3.

Flower diameter (cm)

With respect to the quality parameters in chrysanthemum, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum flower diameter (7.48 cm). Whereas the minimum flower diameter was recorded in T_9 - Control (Water spray) (4.48 cm). The enlargement in size of the flower might be due to production of more food which was diverted to flowering area. There by due to presence of more food reserves in the flowering parts results in maximum diameter of flowers. Similar findings were reported by Hegde *et al*. (2016) in chrysanthemum, Tartil *et al*. (2016) in pot marigold, Kahkashan *et al*. (2017) in tuberose, Hegde *et al*. (2020) in orchids and Lingwal *et al*. (2017) in strawberry.

Individual flower weight (g)

Among all the treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded highest individual flower weight (6.55 g). While T_9 - Control (Water spray) recorded lowest individual flower weight (5.09 g). The increase in the individual flower weight was might be due to translocation of food reserves from vegetative parts to reproductive parts. Due to the increase of food and carbohydrate reserves in flower portion, the size of the flower increases there by, the weight of the flower increases. Similar findings were reported by Hegde *et al*. (2016) in chrysanthemum, Kahkashan *et al*. (2017) in tuberose, Selvakumari and Venkatesan (2017) in tomato, Hegde *et al*. (2020) in orchids and Lingwal *et al*. (2017) in strawberry.

Stem length (cm)

Irrespective of the treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum stem length (72.10 cm). Whereas the minimum stem length was recorded in T_9 - Control (Water spray) (62.87 cm). The highest stem length was observed in sea weed extract sprayed plants as they are the precursors of auxin, cytokinin and micronutrients. The increase in the stem length might be due to the fact that, gibberellins promoted the efficacy of plants in terms of photosynthetic activity, uptake of nutrients and their translocation, better partitioning of assimilates into reproductive parts. Similar findings were reported by Aziz *et al*. (2012) in Amaranthus tricolor plants, Hegde *et al*. (2016) in chrysanthemum, Tartil *et al*. (2016) in pot marigold, Kahkashan *et al*. (2017) in tuberose, Majeed Khadim Al-Hamzawi (2019) in Chinese carnation and Gazania splender and Hegde *et al*. (2020) in orchids.

Vase life (days)

The data recorded on the vase life depicts that treatment T_2 (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded highest vase life (21.60 days). Whereas T_9 - Control (Water spray) recorded lowest vase life (14.82 days). The increase in the vase life of chrysanthemum may be due to the entry of sea weed extract into the plant, might have mediated the respiration by acting as a hydrogen acceptor, thus altering the carbohydrate metabolism of plants promoting the accumulation of sugar (Cacco and Dell Agnola, 1984) and also sea weed extract contain cytokinin and auxin that might have increased the antioxidant levels and resistance to senescence leading to enhanced longevity of stem. Similar findings were reported by Hegde *et al*. (2016) in chrysanthemum, Tartil *et al*. (2016) in pot marigold, Kahkashan *et al*. (2017) in tuberose and Hegde *et al* . (2020) in orchids.

Shelf life (days)

Among all the treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded maximum shelf life (5.84 days). While the minimum shelf life was recorded in T_9 - Control (Water spray) (3.52 days). The increase of shelf life in *Ascophyllum nodosum* treated plants over control may be due to that sea weed extract biostimulant induced photosynthesis that might have led to recombination of nutrients in flower that is used for remaining long days. Similar results were reported by Hegde *et al*. (2016) in chrysanthemum, Povolny (1976) in tomato.

Economic analysis

Among the biostimulant treatments, T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) recorded highest gross returns (₹ 76,93,200), net returns (₹ 59,82,204) and benefit cost ratio (3.50). Whereas T_9 - Control (Water spray) recorded lowest gross returns (₹ 50,13,200), net returns (₹ 33,92,200) and benefit cost ratio (2.09). It is evident from the data that, maximum gross return was recorded in T_2 treatment (*Ascophyllum nodosum* @ 5 ml L^{-1}) which might be due to higher number of flower stalks hectare $^{-1}$ as compared to others.

Table 1. Effect of biostimulants on flower diameter and individual flower weight of chrysanthemum cv.Denjigar White.

Treatments / Biostiumlants (T)	**Flower diameter (cm)**	**Individual flower weight (g)**
T_1 - *Ascophyllum nodosum* @ 2.5 ml L^{-1}	6.46[a]	6.08[a]
T_2- *Ascophyllum nodosum* @ 5 ml L^{-1}	7.48[a]	6.55[a]
T_3- Rhodophyte extract @ 0.2 g L^{-1}	4.83[b]	5.14[c]
T_4- Rhodophyte extract @ 0.4 g L^{-1}	5.02[b]	5.19[c]
T_5- Potassium humate @ 1.5 g L^{-1}	5.12[b]	5.23[c]
T_6- Potassium humate @ 3 g L^{-1}	5.64[b]	5.74[b]
T_7- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 2 g L^{-1}	5.82[b]	5.87[b]
T_8- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 4 g L^{-1}	6.63[a]	6.39[a]
T_9- Control (Water spray)	4.48[b]	5.09[c]

S.E. m±	**0.53**	**0.20**
CD@ 5%	**1.62**	**0.59**

Table 2. Effect of biostimulants on stem length, vase life and shelf life of chrysanthemum cv. Denjigar White.

Treatments / Biostiumlants (T)	**Stem length (cm)**	**Vase life (days)**	**Shelf life (days)**
T_1 - *Ascophyllum nodosum* @ 2.5 ml L^{-1}	69.23^{a}	19.59^{b}	4.89^{b}
T_2- *Ascophyllum nodosum* @ 5 ml L^{-1}	72.10^{a}	21.60^{a}	5.84^{a}
T_3- Rhodophyte extract @ 0.2 g L^{-1}	64.66^{c}	15.56^{f}	3.88^{c}
T_4- Rhodophyte extract @ 0.4 g L^{-1}	65.49^{c}	16.48^{e}	4.16^{c}
T_5- Potassium humate @ 1.5 g L^{-1}	66.82^{b}	17.56^{d}	4.40^{b}
T_6- Potassium humate @ 3 g L^{-1}	67.90^{b}	18.53^{c}	4.56^{b}
T_7- Fulvic acid 10% + Seaweed 8% + Spirulina 6% @ 2 g L^{-1}	68.51^{b}	19.27^{b}	4.75^{b}
T_8- Fulvic acid 10% + Seaweed 8% Spirulina 6% @ 4 g L^{-1}	70.39^{a}	20.84^{a}	5.31^{a}
T_9- Control (Water spray)	62.87^{c}	14.82^{f}	3.52^{c}
S.E. m±	**1.06**	**0.39**	**0.26**
CD@ 5%	**3.19**	**1.17**	**0.78**

Table 3. Effect of biostimulants on economics of chrysanthemum cv.Denjigar White.

Treatments / Biostiumlants (T)	**Concent ration**	**Number of flower stalks ha $^{-1}$ (Yield)**	**Total cost of cultivation ha $^{-1}$ (₹)**	**Gross returns (₹)**	**Net returns (₹)**	**B:C ratio**
T_1 - *Ascophyllum nodosum*	2.5 ml L^{-1}	17,98,500	16,65,993	71,94,160	55,28,167	3.32
T_2- *Ascophyllum nodosum*	5 ml L^{-1}	19,23,300	17,10,996	76,93,200	59,82,204	3.50
T_3 - Rhodophyte extract	0.2 g L^{-1}	13,75,950	16,52,635	55,03,800	38,51,165	2.33

T_4 - Rhodophyte extract	0.4 g L^{-1}	14,84,750	16,84,270	59,39,000	42,54,730	2.53
T_5 -Potassium humate	1.5 g L^{-1}	15,52,600	16,59,500	62,10,400	45,50,900	2.74
T_6 -Potassium humate	3 g L^{-1}	16,37,200	16,98,000	65,48,800	48,50,800	2.86
T_7 -Fulvic acid 10% + Seaweed 8% + Spirulina 6%	2 g L^{-1}	17,35,000	16,66,329	69,40,000	52,73,671	3.16
T_8 -Fulvic acid 10% + Seaweed 8% + Spirulina 6%	4 g L^{-1}	18,73,350	17,11,658	74,93,400	57,81,742	3.38
T_9 -Control (Water spray)	-	12,53,300	16,21,000	50,13,200	33,92,200	2.09

Conclusion

On the basis of the results obtained in the present investigation it is concluded that *Ascophyllum nodosum* @ 5 ml L^{-1} proved for improving the quality of cut chrysanthemum, the present study also confirmed that the use of bio-stimulant is an eco-friendly technique to enhance crop production. Thus, it may be recommended that the chrysanthemum plants can be sprayed to get maximum *Ascophyllum nodosum* @ 5 ml L^{-1} vase life and flower yield which may ensure us to get a maximum net returns.

References:

Cacco, G. and Dell Agnola. 1984. Plant growth regulator activity of sea weed extracts. Can. *Journal of Soil Science*. 64: 225–228.

Carter, G. D. 1990. In: Introduction to Floriculture (ed. R. A. Larson), Academic Press Inc.

Hegde, P. P., Hemla Naik, B. and Beeraligappa. 2016. Growth, yield, quality and economics of chrysanthemum as influenced by foliar application of biostimulants under naturally ventilated polyhouse. *International Journal of Current Research.* 8(11): 41552-41555.

Hegde, P. P., Patil, B. C., Hegde, N. K., Kulkarni, M. S., Laxman, K., Shiragur, M. and Harshavardhan, M. 2020. Influence of biostimulants on yieldand quality of Dendrobium orchid (*Dendrobium nobile* Lindl.) var. Sonia-17 under protected cultivation. *International Journal of Plant & SoilScience*. 32(10): 11-15.

Kahkashan, B. K., Nellipalli, V. K., Raghupati, B. and Pal, A. K. 2017. Effect of biostimulants on growth and floral attributes of tuberose (*Polianthes tuberosa* L.) cv. Prajwal. *Journal of Current Microbiology and Applied Sciences.* 6(6): 2557-2564.

Lingwal, K., Vishal, S. R., Pramod Kumar and Neerja, R. 2019. Influence of growth, yield and quality of strawberry (Fragaria x ananassa Duch.) under polyhouse conditions. M. Sc. Thesis (Fruit Science) submitted to Dr. Yashwant Singh Parmar University of Horticulture and Forestry Solan (Nauni) HP.

Povolny, M. 1976. Effect of seaweed extract on yield, ripening and storage of tomatoes. *Sborniku VTIZ-Zahradnictivi*. 3(6): 133-144.

Rawat and Vishal. 2002. Organic all the way. *Agriculture Today*. 6: 55-56.

Selvakumari, P. and Venkatesan, K. 2017. Seasonal influence of seaweed gel on growth and yield of tomato (*Solanum lycopersicum* Mill.) Hybrid COTH2. *International Journal of Current Microbiology and Applied Sciences*. 6(9): 55-66.

Tartil, E., Hosni, M., Ibrahim, K. and Hewidy, M. 2016. Response of pot marigold (*Calendula - officinalis* L.) to different application methods and concentrations of seaweed extract. *Arab Universities Journal of Agricultural Sciences*. 24(2): 581-591.

Zhang, X. and Schmidt, R. E. 1997. The impact of growth regulators on the a - tocopherol status in water stressed *Poa pratensis* L. *Int Turf grass Res. J.,* 8: 1364-1373.