Eco. Env. & Cons. 30 (July Suppl. Issue) : 2024; pp. (S207-S211)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2024.v30i04s.037

Efficacy of growth regulators and biostimulants on growth, yield and quality of *Celosia cristata* var. Chief Fire

Pothuraju Mallikarjuna Hari Prasad[1], B. C. Patil[2], Mukund Shiragur[3], Naveen M. Puttaswamy[4], Sumangala Koulagi[5] and Pallavi G.[6]

[1,2]Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India
[3]Department of Floriculture and Landscape Architecture, O/o. ADRE, University of Horticultural Sciences, Bagalkot, India
[4]Department of Floriculture and Landscape Architecture, Horticulture Research and Extension Centre, Kanbargi, Karnataka, India
[5]Department of Plant Pathology, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India
[6]Department of Agricultural Extension, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka, India

(Received 24 November, 2023; Accepted 3 January, 2024)

ABSTRACT

Studies on the effect of growth regulators and bio stimulants on growth, yield, and quality of *Celosia cristata* var. Chief Fire were carried out at the experimental field of the Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot, Karnataka during the year 2022-2023. Nine treatments of growth regulators, bio stimulants and their combinations were taken for the study *viz* T_1- Water spray (control), T_2- NAA @ 100 ppm, T_3- GA_3 @ 100 ppm, T_4- Kinetin @ 50 ppm, T_5- Humic acid 1%, T_6- Biovita 1%, T_7- NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm T_8- Biovita 1% + Humic acid 1% and T_9- NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm + Biovita 1% + Humic acid 1 %. Growth regulators, bio stimulants and their combinations were sprayed twice (sprayed at 30 and 45 days after transplanting). The results revealed that among the growth regulators, biostimulant and their combination treatments, the treatment receiving the combination of bio stimulants Biovita 1% + Humic acid 1 % showed maximum plant height (30.66 and 60.00 cm), number of branches (6.62 and 13.33), number of leaves (50.67 and 100.33), leaf area (48.17 and 87.74 cm^2) leaf area index (0.035 and 0.065). While minimum number of days for first flowering and 50% flowering (28.83 and 33.84 days), number of spikes per plant (14.66), weight of single spike (83.00 g) and vase life (8.81 days). However, the minimum values for all the parameters were recorded in the control. Thereby, Biovita 1% + Humic acid 1% showed potential for improving the growth, yield and quality parameters of *Celosia cristata* var. Chief Fire.

Key words : *Growth regulators, Yield and quality, Celosia cristata*

([1]M.Sc Scholar, [2]Prof. and Head, [3]Associate Prof., [4]Assistant Prof. and Head, [5]Asstt. Prof. and Head, [6]Assistant Prof.)

Introduction

Celosia cristata is an attractive ornamental plant with beautiful vibrant coloured inflorescence. It belongs to the family Amaranthaceae and class Magnoliopsida of order Caryophyllales. It is also known as Red Cock's comb, Crested celosia and Fire-flame bush and is called as Chi Kuan in China. The showy flowers look like the head of a rooster (cock) for which the common name is Cock's comb. The tight, velvety texture of the cock's comb flowers look like brain tissues to some people. Due to its beautiful flower colours *C. cristata* has great economic values as a cut flower throughout the world. Its demand as a cut flower has been increasing due to its attractive shape and better vase life. Celosias are versatile plants and have been used potent landscape bedding plants for its beautiful mass colour effect as potted plants and dry flowers. It was initially grown in India for religious purposes as well as in Burma and China. It can be found on the stony, arid slopes of America as well as India and Africa. Since 18th century, flowers have been grown throughout North America (Pandy, 2021).

The fertilizer recommendation have some adverse effect on physical, chemical and biological properties of soil and also reflects directly on increased cost of production, which is an incoming calamity faced by the agriculturists. Thus, any step leading to reduction of fertilizer doses is a boon to the farmers. Further, the continuous use of chemical fertilizers tends to degrade the soil structure. In this context, growth regulators and biostimulants are the materials other than the fertilizers that promote the plant growth, yield and quality when applied in minute quantities and are also referred as 'metabolic enhancers'. So, it is the major area to be concern in order to improve the yield and quality of the flowers without any impact on environment (Vinutha, 2017).

Use of plant growth substances has been found to be of great significance in the commercial cultivation of many ornamental crops. In our country, their use is very limited but in many of the Western countries they are creating excitements in the field of agriculture in general horticulture in particular. Growth regulators had been found beneficial in enhancement of vegetative growth and flower production in Marigold (Anuradha, 2016). Growth regulating chemicals were reported to be very effective in manipulating growth and flowering in gladiolus. Growth and development are to be regulated either by single or by interaction of several hormones. Growth regulators are known to stimulate physiological responses in plants and alter the source-sink metabolism through their effect on photosynthesis and sink formation.

Plant bio-stimulant is "any substance or microorganism in the form in which it is supplied to the user, applied to plants, seeds or the root environment with the intention to stimulate natural processes of plants benefiting nutrient use efficiency, tolerance to abiotic stress, regardless of its nutrients content, or any combination of such substances and or microorganisms intended for this use" (Traon *et al*., 2014). Therefore, the present investigation was carried out to know the effect of growth regulators and biostimulants on growth, yield and quality of *Celosia cristata* var. Chief Fire.

Materials and Methods

In the academic year 2022–2023, research was conducted in the Department of Floriculture and Landscape Architecture, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot. *Celosia cristata* var. Chief Fire seedlings that were thirty days old were transplanted at a distance of 45 cm × 30 cm. With 9 treatments and three replications, the experiment was set up using a randomized complete block design (RCBD). T_1- Water spray (control), T_2- NAA @ 100 ppm, T_3- GA_3 @ 100 ppm, T_4- Kinetin @ 50 ppm, T_5- Humic acid 1%, T_6- Biovita 1%, T_7- NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm T_8- Biovita 1% + Humic acid 1% and T_9- NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm + Biovita 1% + Humic acid 1 % were the treatments. The growth regulators, biostimulants and their combinations were sprayed sprayed at 30 and 45 days after transplanting (DAT). The observations were recorded after 45 and 60 DAT. The data on growth, yield and quality parameters recorded during the period of these studies was subjected to statistical analysis as per the procedure given by Panse and Sukhatme (1997).

Results and Discussion

Based on the observations made over the course of the research, the results were evaluated in great detail and summarized in Tables 1 and 2.

Growth regulators and biostimulants impact on growth parameters

Among all the growth regulators and biostimulant treatments foliar application of treatment combination of biostimulants Biovita 1% + Humic acid 1% found to be superior at 45 and 60 DAT in growth parameters throughout the growth period with respect to plant height (30.66 and 60.00 cm), number of branches (6.62 and 13.33), number of leaves (50.67 and 100.33), leaf area (48.17 and 87.74 cm^2) and leaf area index (0.035 and 0.065), respectively. Whereas, it was minimum in control. The increased growth in biovita (sea weed extract) and humic acid applied treatment was probably due to presence of cytokinin and auxin precursors, macro and micronutrients present in biovita which increase the cell division, cell enlargement with better utilization of chemical fertilizers resulting in rapid vegetative growth. Auxin and cytokinin also directly influence plant architecture by controlling formation, maintainance and growth of apical and axillary meristems of shoots. The results are supported by the findings of Poincelot (1994) in cosmos, Dhutraj (2003) in gaillardia, Karuppaiah and Sendhilnathan (2011) in orchid, Vivian *et al*. (2014) in marigold, Violeta *et al*. (2010) and Pruthvi *et al*. (2017) in chrysanthemum. Humic acid enhances organic carbon content uptake by the plant and sea weed extract mainly contains amino acids like betaines and sterols which enhance the photosynthetic activity, nitrogen metabolism and protein synthesis and also growth regulators especially auxin and cytokinin which are responsible for faster cell division and cell enlargement and thereby promotes the plant growth. These results are supported by Karuppaiah and Sendhilnathan (2011).

Growth regulators and biostimulants impact on flowering, flower yield and quality parameters.

Yield and quality parameters include number of days for first flowering, number of days for 50% flowering, number of spikes per plant, weight of single spike and vase life. Ultimate aim of any flower grower is to get higher yield with better quality which generates more revenue. These flower parameters directly or indirectly influence the yield and quality of the cockscomb.

The minimum number of days for first flowering and 50% flowering (28.83 and 33.84 days) was recorded with the Biovita 1% + Humic acid 1%. It might be due to the early production of florigen and other flower inducing substances in biostimulants treated plants which might have resulted in early flowering while control recorded the maximum number of days to first flowering and 50 per cent flowering. These results are corroborated with the findings of Shinde *et al.* (2010) in marigold.

Regarding number of spikes per plant maximum spike yield (14.66) was recorded with the treatment combination of biostimulants Biovita 1% + Humic acid 1% which increases vegetative growth, more photosynthates by changing or altering source /

Table 1. Effect of growth regulators and biostimulants on plant height, number of branches, number of leaves per plant, Leaf area and leaf area index of *Celosia cristata* var. Chief Fire

Treatment details	Plant height(cm)		Number of branches		Number of leaves per plant		Leaf area (cm^2)		Leaf area index	
	45 DAT	60 DAT	45 DAT	60 DAT	45 DAT	60 DAT	45 DAT	60 DAT	45 DAT	60 DAT
T_1: Water spray (Control)	23.00	36.40	3.26	4.40	42.00	60.67	13.13	36.90	0.009	0.027
T_2: NAA @ 100 ppm	23.70	51.33	4.41	6.41	45.00	91.59	23.23	47.36	0.017	0.035
T_3: GA_3 @ 100 ppm	25.34	43.00	5.00	8.33	47.00	92.66	31.37	64.23	0.023	0.047
T_4: Kinetin @ 50 ppm	23.33	42.40	4.10	5.42	43.00	91.33	13.63	45.95	0.010	0.034
T_5: Humic acid 1 %	25.33	45.66	4.34	10.33	44.33	95.34	26.97	50.09	0.020	0.039
T_6: Biovita 1%	24.00	46.34	4.70	7.30	45.10	94.41	24.01	52.92	0.017	0.038
T_7: NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm	27.00	51.33	5.66	11.34	45.54	96.66	34.18	81.12	0.025	0.060
T_8: Biovita 1% + Humic acid 1 %	30.66	60.00	6.62	13.33	50.67	100.33	48.17	87.74	0.035	0.065
T_9: NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm + Biovita 1% + Humic acid 1 %	25.00	49.70	5.33	9.67	44.00	94.67	32.73	74.30	0.024	0.055
S. Em ±	1.44	3.44	0.76	0.90	1.49	6.67	6.03	10.88	0.004	0.007
C.D. (5 %)	4.32	10.33	2.28	2.71	4.49	20.03	18.10	32.65	0.013	0.021

Note: DAT – Days after transplanting

Table 2. Effect of growth regulators and biostimulants on weight of single spike, number of spikes per plant, vase life, minimum number of days for first flowering and 50% flowering of *Celosia cristata* var. Chief Fire

Treatment details	Minimum number of days for first flowering	minimum number of days for 50% flowering	number of spikes per plant	Weight of single spike	Vase life
T_1: Water spray (Control)	35.70	40.66	7.40	38.00	4.96
T_2: NAA @ 100 ppm	33.00	38.00	9.34	58.33	7.25
T_3: GA_3 @ 100 ppm	31.83	36.83	13.32	63.16	7.38
T_4: Kinetin @ 50 ppm	35.34	40.34	8.33	44.66	7.21
T_5: Humic acid 1 %	30.40	34.83	11.67	64.83	7.35
T_6: Biovita 1%	30.00	35.40	10.33	62.66	7.43
T_7: NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm	29.79	34.67	14.41	81.43	8.45
T_8: Biovita 1% + Humic acid 1 %	28.83	33.84	14.66	83.00	8.81
T_9: NAA @ 100 ppm + GA_3 @ 100 ppm + Kinetin @ 50 ppm +Biovita 1% + Humic acid 1 %	29.00	34.00	13.00	80.83	7.79
S. Em ±	1.58	1.52	1.17	9.03	0.66
C.D. (5 %)	**4.76**	**4.57**	**3.53**	**27.10**	**1.99**

sink rates which had the direct bearing on synthesis of flowering hormone (Florigen) and thus might be responsible for change of plant from vegetative to reproductive phase results in producing more number of flowers per lateral and plant. Greater dry matter accumulation shows better photosynthetic activity, other metabolic activities and uptake of nutrients from soil which were probably diverted towards more flower production compared to T_1 (control). Similar findings were also reported by Doddagoudar (2004) in China aster, Anil (2004) in French marigold.

In terms of the weight of the single spike maximum weight (83.00 g) was observed in treatment combination of biostimulants T_8 (Biovita 1% + Humic acid 1%) is might due to the fact that the combined effect of seaweed extract and humic acid helpful in producing more vigorous growth there by producing more food which was diverted to flowering area compared to control. These results were in accordance with Shinde *et al.* (2010).

Among all the treatments maximum vase life (8.81 days) was obtained with the treatment combination of biostimulants Biovita 1% + Humic acid 1%. This may be due to biostimulant induced photosynthesis that might have been led to recombination of nutrients in flower that is used for remaining long days. 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 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 compared to control. A similar trend also obtained by Pruthvi *et al.* (2017) in chrysanthemum.

Conclusion

On the basis of the result obtained in the present investigation it is concluded that Biovita 1% + Humic acid 1 % proved significant for improving the flower yield and quality of cockscomb in both *Celosia cristata* var. Chief Fire and *Celosia plumosa* var. Century Pink apart from improved growth parameter, the present study also confirmed that the use of growth regulators and biostimulant is an eco-friendly technique to enhance crop production and can help in reducing the environmental impact of chemical fertilizers by increasing nutrient uptake, improving soil health and fertilizer management practices. Thus, it may be recommended that the Cockscomb can be treated with Biovita 1% + Humic acid 1 % to get maximum flower and yield which may ensure us to get a maximum net return.

Conflict of Interest: None

Acknowledgement

The Corresponding Author is highly thankful to major advisor, members of advisory committee, all

the teaching and non-teaching staff, batch mates and juniors of KRCCH, Arabhavi for their constant and consistent support during his research work.

References

Anil, K.S. 2004. Influence of plant bioregulators on growth and seed yield in french marigold (*Tagetes patula* Linn.). *Journal of Ornamental Horticulture.* 7(2):193-195.

Anuradha, R.W. 2016. *Effects of pinching and plant growth regulators on growth and yield of African Marigold (tagetes erecta l.) cv. Calcutta orange in Krishna command area*. M. Sc. (Hort.) Thesis, University of Horticultural Sciences, Bagalkot (India).

Dhutraj, S.V. 2003. *Effect of various bioenzymes on growth, flower yield and vase life of gaillardia*. M. Sc. (Agri) Thesis, MAU, Parbhani (India).

Doddagoudar, S. R., Vyakarnahal, B. S. and Shekar Gouda, M. 2004. Effect of mother plant nutrition and chemical spray on seed germination and seedling vigour of China aster cv. Kamini. *Karnataka Journal of Agricultural Sciences.* 17(4): 701-704.

Karuppaiah and Sendhilnathan, 2011. Effect of Vermiwash on Dendrobium orchid cv. Sakura pink. *Asian Journal of Horticulture.* 45(7): 21-23.

Pandy, P.R. 2021. *Genetic variability and character association in Cock's comb (Celosia cristata L.).* M. Sc. (Agri.) Thesis, *Odisha University of Agriculture & Technology*, Bhubaneswar (India).

Panse, V.G. and Sukhatmes, P.V. 1967. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi, pp. 152-174.

Poincelot, R. 1994. Use of a commercial organic biostimulant for field grown bedding plants. *Journal of Home and Consumer Horticulture*. 1(1): 95-110.

Pruthvi, P.H., Hemla, N.B., Shivaprasad, M. and Beeralingappa, 2017. Effect of biostimulants on morphology, flowering and yield of Chrysanthemum (*Dendranthema grandiflora*) cv. Kolar Local under naturally ventilated polyhouse. *The Bioscan.* 12(1): 273-276.

Shinde, D.H., Naik, D.M., Barkule, S.R., Bhosale, A.M. and Shinde, S.B. 2010. Effect of bioenzymes on flowering, yield and vase life of marigold (*Tagetes erecta* Linn.). *Asian Journal of Horticulture.* 5(2): 420-422.

Traon, D., Amat, L., Zotz, F. and Jardin, D.P. 2014. A legal framework for plant biostimulants and agronomic fertiliser additives in the EU.

Vinutha, D.B. 2017. *Effect of Biostimulants on flowering and seed yield of China aster cv. Kamini.* M. Sc. (Hort.) Thesis, University of Agriculture and Horticultural Sciences, Shivamogga, Karnataka (India).

Vivian, P.D., Ana, C.P. and Marcia, E.A. 2014. Effect of biostimulant application on production and flavonoid content of marigold. *Revista Ceres*. 61(6): 983-988.