The Bioscan 12(1): 273-276, 2017 (Supplement on Agronomy)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

EFFECT OF BIOSTIMULANTS ON MORPHOLOGY, FLOWERING AND YIELD OF CHRYSANTHEMUM (*DENDRANTHEMA GRANDIFLORA* TZVELEV.) CV. KOLAR LOCAL UNDER NATURALLY VENTILATED POLYHOUSE

PRUTHVI, P. HEGDE*, B. HEMLA NAIK, M. SHIVAPRASAD AND BEERALINGAPPA
Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere -577 132
University of Agricultural and Horticultural Sciences, Shivamogga - 577 216, Karnataka, INDIA
e-mail: pru.p.horti@gmail.com

KEYWORDS
Chrysanthemum
Biostimulants
Biovita
Sea weed extract

Received on :
10.11.2016

Accepted on :
11.02.2017

***Corresponding author**

ABSTRACT
An experiment was conducted to know the effect of biostimulants on morphology, flowering and yield of chrysanthemum Cv. Kolar Local under naturally ventilated polyhouse. 12 biostimulant formulations were tried at two different concentrations. The results revealed that application of Biovita at the rate of 0.5% showed maximum plant height (66.83cm), number of leaves (82.95), stem diameter (7.30 mm), number of primary branches per plant (8.70), number of secondary branches per plant (25.90), minimum days taken for first flowering (100.10), 50% flowering (115.80), maximum number of flowers per plant (92.15), flower yield per plant (424.09 g), flower yield per square meter (4.05 Kg) and flower yield per hectare (40.5 t/ ha). Treatment Formula 15 at the rate of 0.5 % resulted in maximum duration of flowering (61.50 days). The lowest values for all the above parameters were recorded with RDF alone.

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora* Tzvelev.) is one of the most interesting and oldest flower crops which belongs to the family Asteraceae with diploid chromosome number (2n = 36). It is a leading commercial crop grown for cut, loose flowers and pot plant. The plants are perennial in nature. It occupies prime position among commercial flower crops which has high demand in both domestic and international market. Chrysanthemum as a short-day plant, naturally flowers in the autumn and winter. The flowers are suitable for various purposes like bedding plant, vase decorations, garland making and for garden display (Mridubhashini *et al.,* 2014).

The decline in natural resources and the environmental damage inflicted by current agricultural practices have become major limitations in conventional agriculture. Therefore, in the recent decades, flower growing practices have been evolving towards organic, sustainable or eco-friendly approaches due to the impact of green revolution (Wezel *et al*., 2014). Increased flower production, quality of flowers and perfection in the form of plants are the important objectives to be reckoned in commercial flower production. It is impossible to meet the nutrient requirement of the crops, exclusively through the organic farming (Yathindra *et al*., 2016)Therefore, in modern floriculture new insights have been developed to achieve sufficient and sustainable yield and quality. One among these approaches is the use of Biostimulants.

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'. They promote the plant growth besides improving yield and quality (Suguna, 2005). 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 (Harshavardhan *et al*., 2016). The use of humic acid (HA) and sea weed extract is a promising natural resource to be utilized as an alternative for increasing crop production.

Keeping in view, the need and importance of biostimulants the present investigation was undertaken with an objective to study the effect of Biostimulants on morphology, flowering and yield of Chrysanthemum under naturally ventilated polyhouse.

MATERIALS AND METHODS

An experiment was conducted under polyhouse condition during 2015-16 at College of Horticulture, Mudigere, Chikkamagaluru, Karnataka. Rooted terminal cuttings of chrysanthemum *var*. Kolar Local were planted in raised beds of 3m x 1m with a spacing of 30 cm X 30 cm. The experiment was laid out in Randomized complete block design with 25 treatments and two replications. Treatments included T_1 – Recommended dose of fertilizers (RDF- 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 @ 0.5%, 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 $B_1 B_6 B_7$) @ 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% (Pruthvi, Hegde and B. Hemla Naik, 2016). These biostimulants were sprayed on the foliage at 3 intervals *i.e* @ 60, 90 and 120 days after planting (DAP) and the observations like plant height (cm), number of leaves, stem diameter (mm), number of primary branches, number of secondary branches, days taken for first flowering, days taken for 50 % flowering and duration of flowering were recorded for 5 random plants at peak growth period *i.e* @ 150 DAP and the data were subjected to statistical analysis as per Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The data presented in Table 1 to 3 revealed that all morphological, flowering and yield parameters were significantly differed by application of biostimulants. Among the different biostimulants studied Biovita @ 0.5 per cent (extract of *Ascophyllum nodosum*- a brown sea weed) recorded maximum plant height (66.83 cm), number of leaves (82.95) and stem diameter (7.30 mm) which was statistically on par with Humicel plus @ 0.5 per cent (64.68 cm, 80.55 and 7.13mm, respectively) and Formula 15 (63.88 cm, 78.90 and 7.07 mm, respectively). The results are supported by the findings of Poincelot (1994) in cosmos, Dhutraj *et al*. (2003) in gaillardia and Violeta *et al*. (2010) in chrysanthemum, where the humic acid @ 0.2% showed maximum number of leaves per plant, stem diameter and plant height.

The same treatment showed maximum number of primary branches (8. 70), secondary branches (25.90) which was found statistically on par with Humicel plus @ 0.5 per cent (8.10 and 24.80, respectively) and Formula 15 (8.05 and 23.15, respectively). However, minimum was recorded in untreated control *i.e* plants applied with only recommended dose of fertilizers (T_1). The enhanced plant morphology in Biovita (sea weed extract) applied plants was probably due to presence of cytokinin and auxin precursors, macro and micronutrients which increase the cell division and cell enlargement with better utilization of chemical fertilizers resulting in to rapid vegetative growth. Auxin and cytokinin also directly influence plant architecture by controlling formation, maintenance and growth of apical and axillary meristems of shoots. The other treatments were also found statistically significant over the control for all the parameter. These results are in agreement with earlier reports of Vivian *et al.* (2014) in marigold and Rajarajan *et al.* (2014) in crossandra.

Table 1: Effect of biostimulants on morphological parameters of chrysanthemum under naturally ventilated polyhouse

Treatment	Concentration (%)	Morphological parameters				
		Plant height	Number of leaves	Stem diameter	Number of primary branches	Number of secondary branches
T_1 - Control (RDF)	100: 150:100 Kg/ha	48.02	55.90	4.77	5.50	16.50
T_2 - Humigrow	0.3	56.58	68.10	6.27	6.55	20.70
T_3 - Humigrow	0.5	60.03	74.20	6.61	7.00	23.85
T_4 - Fulvic acid	0.3	55.33	66.30	6.20	6.40	19.80
T_5 - Fulvic acid	0.5	59.68	70.90	6.43	6.80	22.45
T_6 - Panchagavya	0.3	49.95	57.15	5.24	5.60	18.10
T_7 - Panchagavya	0.5	52.17	60.70	5.49	5.90	19.10
T_8 - Jeevamruta	0.3	52.39	58.15	5.30	5.80	18.90
T_9 - Jeevamruta	0.5	55.55	62.10	5.50	6.10	20.80
T_{10} - Amruta sanjeevini	0.3	50.94	58.05	5.35	5.90	18.70
T_{11} - Amruta sanjeevini	0.5	53.24	61.50	5.55	6.15	20.10
T_{12} - Zoom flower	0.3	52.89	59.25	5.50	6.00	19.40
T_{13} - Zoom flower	0.5	54.57	62.55	5.90	6.30	20.90
T_{14} - Biovita	0.3	61.51	75.85	6.78	7.10	23.20
T_{15} - Biovita	0.5	66.83	82.95	7.30	8.70	25.90
T_{16} - Spicmex	0.3	50.38	57.45	5.11	5.70	18.50
T_{17} - Spicmex	0.5	52.88	61.30	5.32	6.00	20.00
T_{18} - Neozyme	0.3	54.56	64.60	5.83	5.95	19.00
T_{19} - Neozyme	0.5	58.69	66.70	6.10	6.40	21.55
T_{20} - Swara	0.3	55.00	65.20	6.17	6.20	19.70
T_{21} - Swara	0.5	59.05	67.40	6.35	6.50	22.00
T_{22} - Humicel plus	0.3	60.94	73.31	6.74	6.90	22.20
T_{23} - Humicel plus	0.5	64.68	80.55	7.13	8.10	24.80
T_{24} - Formula15	0.3	60.75	73.02	6.65	6.60	21.05
T_{25} - Formula 15	0.5	63.88	78.90	7.07	8.05	23.15
S Em ±		1.55	1.70	0.13	0.23	0.69
C. D. (p=0.05)		4.52	4.95	0.39	0.68	2.07

Note*: RDF as common for all treatments

Table 2: Effect of biostimulants on flowering parameters under naturally ventilated polyhouse

Treatment	Concentration(%)	Days taken for first flowering	Days taken for 50 per cent flowering	Duration of flowering (days)
T_{1} - Control (RDF)	100: 150:100 Kg/ha	115.60	128.10	47.60
T_{2} - Humigrow	0.3	109.80	119.60	55.20
T_{3} - Humigrow	0.5	106.60	118.70	58.60
T_{4} - Fulvic acid	0.3	110.30	120.40	53.40
T_{5} - Fulvic acid	0.5	107.70	119.40	57.00
T_{6} - Panchagavya	0.3	113.00	123.10	49.10
T_{7} - Panchagavya	0.5	111.30	122.10	50.50
T_{8} - Jeevamruta	0.3	112.30	122.00	50.20
T_{9} - Jeevamruta	0.5	110.95	120.80	52.10
T_{10} - Amruta sanjeevini	0.3	112.50	122.90	49.30
T_{11} - Amruta sanjeevini	0.5	111.25	121.60	50.90
T_{12} - Zoom flower	0.3	111.05	121.70	50.80
T_{13} - Zoom flower	0.5	109.50	120.40	51.80
T_{14} - Biovita	0.3	104.20	118.40	57.10
T_{15} - Biovita	0.5	100.10	115.80	60.85
T_{16} - Spicmex	0.3	112.55	123.10	49.00
T_{17} - Spicmex	0.5	111.10	122.30	50.40
T_{18} - Neozyme	0.3	110.50	121.70	51.70
T_{19} - Neozyme	0.5	109.10	120.70	53.90
T_{20} - Swara	0.3	110.20	121.40	52.50
T_{21} - Swara	0.5	108.90	120.00	54.00
T_{22} - Humicel plus	0.3	105.10	118.50	56.10
T_{23} - Humicel plus	0.5	102.10	116.40	60.00
T_{24} - Formula15	0.3	105.70	118.70	56.00
T_{25} - Formula 15	0.5	102.75	116.70	61.50
S Em ±		0.96	0.70	1.05
C. D. (p=0.05)		2.79	2.06	3.06

Note*: RDF as common for all treatments

Table 3: Effect of biostimulants on yield parameters under naturally ventilated polyhouse

Treatment	Concentration(%)	Number of flowers/ plant	Flower yield per plant (g)	Flower yield per m^2 (Kg)	Flower yield per hectare (t)
T_{1} - Control (RDF)	100: 150:100 Kg/ha	60.00	201.3	1.87	18.7
T_{2} - Humigrow	0.3	67.30	251.11	2.40	24.0
T_{3} - Humigrow	0.5	75.30	305.80	2.95	29.5
T_{4} - Fulvic acid	0.3	67.10	248.38	2.35	23.5
T_{5} - Fulvic acid	0.5	73.45	290.57	2.78	27.8
T_{6} - Panchagavya	0.3	62.50	203.15	1.92	19.2
T_{7} - Panchagavya	0.5	65.75	230.31	2.17	21.7
T_{8} - Jeevamruta	0.3	64.56	214.76	2.07	20.0
T_{9} - Jeevamruta	0.5	67.50	236.25	2.26	22.6
T_{10} - Amruta sanjeevini	0.3	63.25	206.09	1.97	20.0
T_{11} - Amruta sanjeevini	0.5	66.25	228.82	2.18	21.8
T_{12} - Zoom flower	0.3	64.36	222.16	2.10	21.0
T_{13} - Zoom flower	0.5	69.40	248.24	2.32	2.32
T_{14} - Biovita	0.3	82.50	343.30	3.26	32.6
T_{15} - Biovita	0.5	92.15	424.09	4.05	40.5
T_{16} - Spicmex	0.3	63.00	204.07	1.95	19.5
T_{17} - Spicmex	0.5	66.15	231.53	2.11	21.1
T_{18} - Neozyme	0.3	63.40	220.30	2.05	20.1
T_{19} - Neozyme	0.5	68.65	251.24	2.25	22.5
T_{20} - Swara	0.3	64.70	229.61	2.16	21.6
T_{21} - Swara	0.5	72.70	268.56	2.40	24.0
T_{22} - Humicel plus	0.3	80.50	332.10	3.18	30.2
T_{23} - Humicel plus	0.5	91.15	405.68	3.90	39.0
T_{24} - Formula15	0.3	78.80	322.96	3.09	30.1
T_{25} - Formula 15	0.5	90.95	402.95	3.84	38.4
S Em ±	1.47	7.73	0.08	0.84	
C. D. (p=0.05)	4.28	22.56	0.24	2.26	

Note*: RDF as common for all treatments

With respect to the flowering parameters First flower emergence of the plant from the date of planting was significantly enhanced by biostimulant treatments. The enhancement was more pronounced in the treatment Biovita @ 0.5 per cent (100.10 days) which enhanced the flowering process by 15 days than control. The same treatment took least number of days required for 50 per cent flowering (115.80). It clearly indicated that biostimulants application helped in earliness for mum production. Whereas, the foliar application of Formula 15 showed increased total duration of flowering (61.50 days). This might be due to stimulated production of florigin and other flower inducing substances in the plants, which might have resulted in earliness of flowering while control recorded maximum number of days to first flowering, 50 per cent flowering and duration of flowering. The increased duration of the flowering might be attributed to the longer availability of humic and fulvic acids. These results are corroborated with the findings of Karthiraj *et al*. (2008) in China aster, Shinde and Naik (2010) in Marigold and Mamta Bohra and Ajit Kumar (2014) in Chrysanthemum.

The yield parameters *viz*., number of flowers per plant (92.15), yield per plant (424.09 g), yield per square meter (4.05 Kg) and yield per hectare (40.5 t/ ha) were found in Biovita @ 0.5 per cent which was statistically on par with Humicel plus @ 0.5 per cent and Formula 15 @ 0.5 per cent. While, the least were found in RDF alone. Improvement in yield over control may also be due to the greater availability of essential elements especially Nitrogen and phosphorous in sea weed extracts which is responsible for maximum shoot growth, more number of branches and hence ultimate size of the plant resulting in the production of higher photosynthesis, which subsequently led to desirable C: N ratio. These favourable situations led to production of more number of flowers and ultimately higher yield. The above results are supported by Russo *et al*. (1994) in Marigold, Shinde and Naik (2010) in Marigold and Karthiraj *et al*. (2008) in China aster.

REFERENCES

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

Du Jardin, P. 2012. The science of plant biostimulants - a bibliographic analysis.

Harshavardhan, M., Kumar, D. P., Rajesh, A. M., Yathindra, H. A. and Shivanand Hongal. 2016. Effect of integrated nutrient management on floral attributes of carnation [*Dianthus caryophyllus* L.]. *The Bioscan*. **11(2):** 1163-1166.

Karthiraj, K., Patil, R., Vasmate, S. and Manolikar, R. 2008. Effect of bioenzyme on growth, flower yield and vase life of china aster. *Asian J. Hort*. **3(1):** 178-179.

Mamta Bohra and Ajit Kumar. 2014. Studies on effect of organic manures and bioinoculants on vegetative and floral attributes of Chrysanthemum cv. Little darling. *The Bioscan*. **9(3):** 1007-1010.

Mridubhashini Patanwar., Gaurav Sharma., Chetna Banjare., Deepika Chandravanshi and Eshu Sahu. 2014. Growth and development of chrysanthemum (*Dendranthema grandiflora*) as influenced by integrated nutrient management. *The Ecoscan*. **6:** 459-462.

Panse, V.G. and sukhatame, P. V. 1985. Statistical methods for agricultural workers. ICAR, New Delhi.

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

Pruthvi, H. and Hemla Naik, B. 2016. MS.c.Thesis on Standardization of biostimulants on growth, yield and quality of chrysanthemum under protected condition.

Rajarajan, R., Selvaraju, S. and Vasanth, M. 2014. Effect of foliar spray with seaweed extract on growth and chemical constituents of *Crossandra infundibuliformis* (L.) Nees. *Int. J. Adv. Res. Biol. Sci*. **1(8):** 29-33.

Russo, R., Poincelot, R. and Berlyn, P. 1994. Use of commercial organic biostimulant for improved production of marigold cultivars. *J. Home and Consumer Hort.* **1(1):** 83-93.

Shinde, D., Naik, M. and Bhosale, A. 2010. Effect of bioenzymes on flowering, yield and vase life of marigold (*Tagetes erecta* L.). *Asian J. Hort*. **5(2):** 420-422.

Suguna, M. 2005. Effect of growth regulators and biostimulants on growth and yield of carnation (*Dianthus caryophyllus* L.) var. Mistral. M.Sc., Dissertation submitted to Tamil Nadu Agricultural University, Coimbator

Violeta, T., Lucia, D. and Irina, S. 2010. The influence of some fertilizers and biostimulants upon the stem anatomy of *Chrysanthemum indicum L. J. Plant Dev*. **17(1):** 3-12.

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

Wezel, A. 2014. Agroecological practices for sustainable agriculture. A review. *Agron. Sustain. Dev*. **34(1):** 1-20.

Yathindra, H. A., Krisha Manohar, R., Rajesh, A. M. and Harshavardhan, M, 2016, Effect if integrated nutrient management on growth parameters of bird of paradise [*Strelitzia reginae*(L.)]. *The Bioscan*. **11(1):** 565-568.