Biological Forum – An International Journal **14(1): 646-650(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of various Stimulants on Growth, Leaf analysis and Economics of Chrysanthemum

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(Received 21 October 2021, Accepted 28 December, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The experiment was laid out at Floriculture Research Farm, ACH&F, Navsari Agricultural University, Navsari during 2019-20. The experiment was carried out in Randomized Blocked Design with three replication and twelve treatments *viz*.T_1 = $FeSO_4$ 0.5 %, T_2 = $ZnSO_4$ 0.5 %, T_3 = NAA 20 ppm + Urea 2%, T_4 = $FeSO_4$ (0.5 %) + $ZnSO_4$ (0.5 %) + NAA (20 ppm), T_5 = *Nauroji* Novel Organic liquid nutrient 1 %, T_6 = *Nauroji* Novel Organic liquid nutrient 2 %, T_7 = Panchgavya 0.5 %, T_8 = Panchgavya 1.0 %, T_9 = Humic acid 0.25 %, T_{10} = Humic acid 0.5 %, T_{11} = Water spray, T_{12} = No spray (control). Among these treatments foliar application of 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA to chrysanthemum plants significantly increased maximum plant height 28.83 cm and 34.26 cm, plant spread at N-S direction (27.18 and 30.29 cm) and E-W direction (27.46 cm and 29.48 cm) and highest number of branches per plant (6.93 and 8.53) at 60 and 75 days, respectively. Looking to the economics of present investigation, higher cost benefit ratio (3.00) and net returns (Rs. 365982 per ha) were obtained in treatment T_8 (1.0 % *Panchgavya*) at 30, 45 and 60 days after transplanting.

Keywords: Foliar application, stimulants and *panchgavya.*

INTRODUCTION

The flowers are the most effective option to express the feelings rather than words as flowers are the symbol of purity, beauty, peace, love and passion. In India, cultivation of flower occupies an area of 3,39,386 ha with the production of 19,91,381 MT of loose flowers and 8,67,081 MT (Anonymous, 2018) of cut flowers. Chrysanthemum (*Dendranthema grandiflora*) belongs to family Asteraceae, a native of northern hemisphere chiefly Europe and Asia with a few in other areas, comprising of about 200 species and is a popular commercial flower grown for cut flowers, loose flowers as well as a pot plant in all over the world. It is popularly known as 'Queen of East', 'Glory of East', 'Autumn Queen', 'Mums', 'Crown Daisy' and 'Garland Chrysanthemum'. It is commonly called as '*Guldaudi*' in hindi and '*Sevanti*' in Gujarati.

Chrysanthemum is the second largest flower crop grown all over the world. Chrysanthemum as a short-day plant, naturally flowers in the autumn and winter. There is a substantial scope to enhance the productivity of chrysanthemum by adopting proper crop management techniques. The use of stimulants which has the capacity to modify plant growth has widely used over the last decade. Micronutrients play important role in plant's physiological and chemical activity. Iron is one of the important element that is closely associated with growth, all these factors contributed to cell multiplication, cell division and cell differentiation resulting in increased photosynthesis and translocation of food material which enhanced the plant spread. Foliar application of Zn is effective when problems of nutrient fixation in the soil are exists (Jat *et al*., 2007). Zinc favours the storage of more carbohydrates through photosynthesis. Plant growth is increased by the osmotic uptake of water and nutrient under the influence of NAA. Urea also aids the photosynthesis process of plants. Novel organic liquid fertilizer (*Nauroji*) contains biochemicals such as gibberellic acid, NAA, cytokinin, major nutrients (N, P, K, Ca, Mg, S), micronutrients (Mn, Cu and Zn), beneficial microbes (PSB, *Rhizobium*, *Azotobacter* and Fungus), amino acid and phenol content which enhance plant growth. *Panchgavya* and humic acid were used as organic biostimulants because of their biological origin (Schnitzer, 2000) and they contain beneficial micro-organisms, growth hormones and vital nutrients for plant growth and yield.

MATERIALS AND METHODS

The present experiment was bring off during September-2019 to April-2020 at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. The experiment was laid out in Randomized Blocked Design with three replication and twelve treatments *viz*. T_1 = $FeSO_4$ (0.5%), T_2 = $ZnSO_4$ (0.5%), T_3 = 20 ppm

NAA + 1% Urea, T_4 = 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA, T_5 = *Nauroji* Novel Organic liquid nutrient 1 %, T_6 = *Nauroji* Novel Organic liquid nutrient 2 %, T_7 = 0.5% *Panchgavy*, T_8 = 1.0% *Panchgavya*, T_9 = 0.25 % Humic Acid, T_{10} = 0.5 % Humic Acid, T_{11} = Water spray, T_{12} = Control. The gross plot size of the experiment 210 cm × 270 cm and net plot size was 210 cm × 210 cm. The spacing was 30 × 30 cm. The preparation of solution was done as per the said concentration. First spray was done at 30 DATP and then two sprays were done at 45 days and 60 DATP. Fresh stimulants solution was prepared at time of each spray and used immediately. Among net plot five random plants were tagged and the observations was recorded after that average value for each net plot was computed and recorded carefully.

RESULTS AND DISCUSSION

A.Vegetative parameters

The data recorded on various aspects were tabulated and subjected to statistical analysis in comparison with treatments. Data regarding the effect of different stimulants of vegetative characters of chrysanthemum showed significant effect and have been presented in Table 1. Significantly maximum plant height (28.83 cm and 34.26 cm), and highest number of branches per plant (6.93 and 8.53), (Table 1), plant spread at N-S (27.18 and 30.29 cm) and E-W direction (27.46 cm and 29.48 cm) (Table 2) at 60 and 75 days respectively were reported in treatment T_4 (0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA). Increase in growth may be attributed to the fact that zinc and iron act as the activator of several enzymes, alcoholic dehydrogenase, pyridine nucleotide dehydrogenase and carbonic anhydrase. The iron applied with proper concentration acts as an important catalyst in the enzymatic reaction of metabolism. This ultimately would have helped in larger biosynthesis of photoassymilates, thereby enhanced vegetative growth of plant. Similarly, zinc closely involved in metabolism of RNA and ribosomal content in plant cell, which leads to stimulation of carbohydrates, proteins and DNA formation. It also helps in synthesis of tryptophan which acts as a growth promoting substance. Zinc and iron also favour the storage of more carbohydrates through photosynthesis, which may in turn be the attributing factor for the positive effect on growth attributes (Senthamizhselvi, 2000). The results are in conformity with the findings of Karuppaiah (2014) and Chopde *et al*. (2016) in chrysanthemum. Moreover, Metabolites partition and chanalization helped in apical dominance which ultimately improved the length of the longest shoot as application of NAA might be increased the plant vigour which ultimately increase in biomass may be attributed to the fact that NAA increases CO_2 fixation, photosynthate assimilation and chlorophyll content of leaves. The results are in agreement with the findings of Narayan (2015) in marigold. Other scientists have also reported significant influenced of $FeSO_4$ and $ZnSO_4$ in chrysanthemum by Ganga *et al*. (2008), in orchid (Ganga *et al*. 2009), in gerbera (Khosa *et al*., 2011).

B. Leaf analysis

Plants sprayed with 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA recorded significantly maximum Fe and Zn content in leaves. Micronutrient sprays increased the concentration of respective micronutrient in the leaves. Khoshgoftarmanesh *et al*. (2008) also showed that genotypic difference and enough application of micronutrients in proper quantity and micronutrient absorption of leaf as compared to water spray.

This may be due to that major raised in carbohydrates, nitrogen, phosphorus, potassium, zinc and copper percentages found in leaves compare with the control treatments in carnation plants (El-Naggar, 2009).

Table 1: Effect of various stimulants on plant height (cm) and number of branches in chrysanthemum cv. Thai Chen Queen.

Treatments		Plant height (cm)		No. of branches	
		60 DATP	75 DATP	60 DATP	75 DATP
T_1	$FeSO_4$ (0.5 %)	25.29	28.87	5.53	7.33
T_2	$ZnSO_4$ (0.5 %)	25.17	28.35	5.47	7.20
T_3	NAA (20 ppm) + Urea (2 %)	27.50	32.15	6.00	7.33
T_4	$FeSO_4$ (0.5 %) + $ZnSO_4$ (0.5 %) + NAA (20 ppm)	28.83	34.26	6.93	8.53
T_5	*Nauroji* Novel Organic liquid nutrient 1%	26.78	30.63	6.07	7.47
T_6	*Nauroji* Novel Organic liquid nutrient 2%	27.13	31.68	6.53	8.27
T_7	*Panchgavya* (0.5 %)	26.45	29.48	6.13	7.47
T_8	*Panchgavya* (1.0%)	27.12	30.75	6.87	8.40
T_9	Humic acid (0.25 %)	23.09	26.70	5.87	7.40
T_{10}	Humic acid (0.5 %)	24.55	28.95	6.00	7.07
T_{11}	Water spray	22.68	26.75	4.87	6.47
T_{12}	No spray (Control)	22.21	26.21	4.67	6.40
S. Em. ±		1.201	1.548	0.276	0.348
C. D. at 5 %		3.52	4.54	0.81	1.02
C. V. %		8.14	9.07	8.11	8.11

Present finding collaborated with the results obtained by Soni *et al*. (2009) in gerbera, Ahmad *et al*. (2010) in rose and Bhattacharjee, (1996) in rose. Foliar application of 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA (T_4) to chrysanthemum plants significantly increased chlorophyll content. It might be due to its direct effect on plant growth which has been attributed to the increase in chlorophyll content, the acceleration of the respiration process, hormonal growth responses, increasing penetration in plant membranes or a combination of these processes (Jariene *et al*. 2008). Iron is critical for chlorophyll formation and photosynthesis and it is important in the enzyme systems and respiration of plants (Havlin *et al*., 1999).

C. Economics

The data pertaining to the economics on various treatments have been presented in Table 3. It is evident from the data that, highest BCR (3.00) was obtained from T_8 (1.0 % *Panchgavya*) and least (2.09) was recorded from control (T_{12}).

Table 2: Effect of various stimulants on plant spread (N-S) & (E-W) in chrysanthemum cv. Thai Chen Queen.

Treatments		Plant spread (cm) (N-S)		Plant spread (cm) (E-W)	
		60 DATP	75 DATP	60 DATP	75 DATP
T_1	$FeSO_4$ (0.5 %)	23.75	26.20	23.55	25.70
T_2	$ZnSO_4$ (0.5 %)	23.34	25.45	23.53	25.63
T_3	NAA (20 ppm) + Urea (2 %)	27.16	28.85	26.56	29.11
T_4	$FeSO_4$ (0.5 %) + $ZnSO_4$ (0.5 %) + NAA (20 ppm)	27.18	30.29	27.46	29.48
T_5	*Nauroji* Novel Organic liquid nutrient 1%	24.64	26.66	24.33	26.55
T_6	*Nauroji* Novel Organic liquid nutrient 2%	25.05	27.24	24.51	26.91
T_7	*Panchgavya* (0.5 %)	24.44	26.60	23.71	25.88
T_8	*Panchgavya* (1.0%)	24.66	26.94	24.48	26.59
T_9	Humic acid (0.25 %)	22.95	25.33	22.97	25.12
T_{10}	Humic acid (0.5 %)	23.76	26.25	23.62	25.75
T_{11}	Water spray	22.13	24.97	21.51	23.65
T_{12}	No spray (Control)	20.78	23.76	21.01	22.96
S. Em. ±		1.224	1.131	1.197	1.125
C. D. at 5 %		3.59	3.32	3.51	3.30
C. V. %		8.78	7.38	8.66	7.47

Table 3: Effect of various stimulants on economics of chrysanthemum cv. Thai Chen Queen.

Treatments		BCR
T_1	$FeSO_4$ (0.5 %)	2.37
T_2	$ZnSO_4$ (0.5 %)	2.26
T_3	NAA (20 ppm) + Urea (2 %)	2.39
T_4	$FeSO_4$ (0.5 %) + $ZnSO_4$ (0.5 %) + NAA (20 ppm)	2.72
T_5	*Nauroji* Novel Organic liquid nutrient 1%	2.40
T_6	*Nauroji* Novel Organic liquid nutrient 2%	2.67
T_7	*Panchgavya* (0.5 %)	2.62
T_8	*Panchgavya* (1.0%)	3.00
T_9	Humic acid (0.25 %)	2.27
T_{10}	Humic acid (0.5 %)	2.48
T_{11}	Water spray	2.30
T_{12}	No spray (Control)	2.22

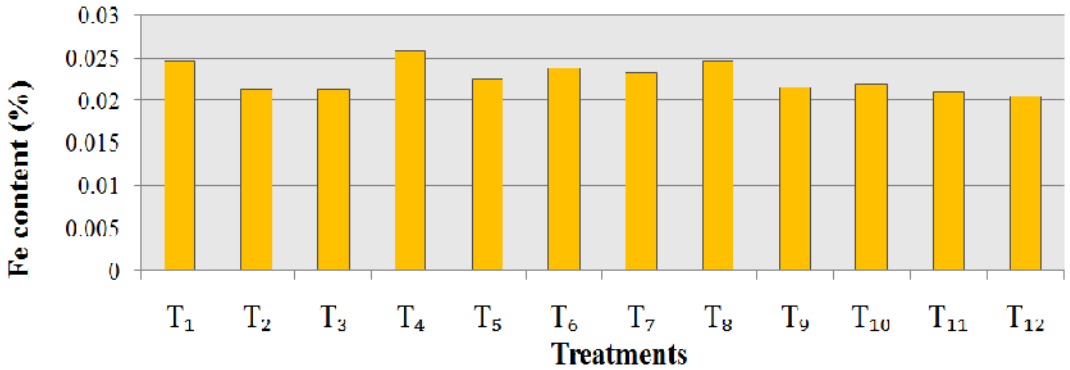

Fig. 1. Effect of various stimulants on Fe content from leaf of chrysanthemum cv. Thai Chen Queen.

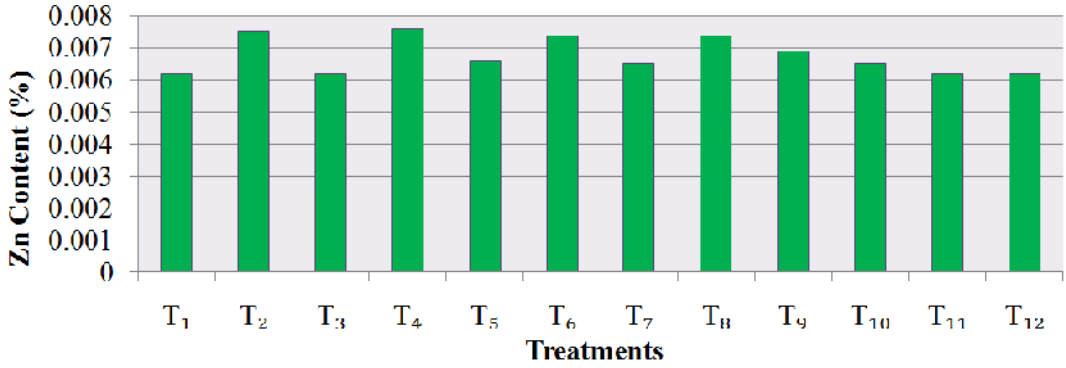

Fig. 2. Effect of various stimulants on Zn content from leaf of chrysanthemum cv. Thai Chen Queen.

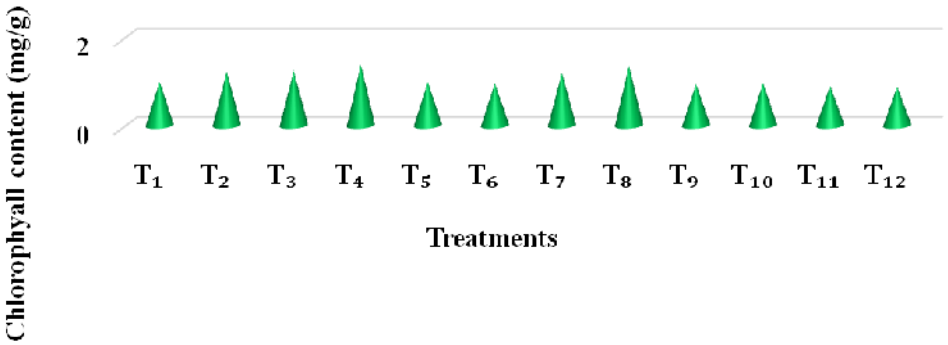

Fig. 3. Effect of various stimulants on chlorophyll content from leaf of chrysanthemum cv. Thai Chen Queen

CONCLUSION

Related on the findings of present investigation, it can be obtained that foliar application of 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA at 30, 45 and 60 DATP gave maximum vegetative growth and maximum iron, zinc and chlorophyll content in leaves. While on the basis of economics foliar application of 1.0 % *Panchgavya* as per above gave better response to highest BCR (3.00) along with fetching better price and get higher net returns (Rs. 365982).

Acknowledgement. Authors are thankful to the guide and other committee members of floriculture department for constant encouragement and support. Authors are also thankful to the Navsari Agricultural University, Navsari, Gujarat to finding and providing all kind of necessary support during the research period.

Conflict of Interest. None.

REFERENCES

Ahmad, I., Khan, M. A., Qasim, M., Ahmad, R. & Randhawa, M. A. (2010). Growth, yield and quality of *Rosa hybrida* L. as influenced by various micronutrients. *Pak. J. Agric. Sci*, *47*(1), 5-12.

Anonymous (2018). Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Government of India, New Delhi.

Bhattacharjee, S. K. (1996). Influence of boron on growth, flowering, post - harvest life and nutrient remobilization in 'Raktagandha' roses. *Indian Journal of Horticulture*, *53*(2), 155-159.

Chopde, Neha ., Borse, G. H., Ommala, K. & Ghodke, A. T. (2016). Effect of zinc sulphate and ferrous sulphate on growth and flowering of annual chrysanthemum. *Plant Archives*. *16*(2): 594-596.

El-Naggar, A. H., & EI-Sayed, S. G. (2009). Response of *Dianthus caryophyllus* L. plants to foliar nutrition. *World Journal of Agricultural Sciences*, *5*(5), 622-630.

Ganga, M., Jegadeeswari, V., Padmadevi, K., & Jawaharlal, M. (2008). Response of chrysanthemum cv. Co.1 to the application of micronutrients. *Journal of Ornamental Hort*iculture, *11*(3), 220-223.

Ganga, M., Padmadevi, K., Jegadeeswari, V., & Jawaharlal, M. (2009). Performance of *Dendrobium* cv. Sonia 17 influenced by micronutrient. *Journal of Ornamental Hort*iculture, *12*(1), 39-43.

Havlin, J. L., Beaton, J. D., Tisdale, S. L., & Nelson, W. L. (1999). Soil Fertility and Fertilizers, an introduction to nutrient management 7th ed. Prentice Hall, Upper Saddle River.

Jariene, E., Danilcenko, H., Kulaitiene, J. & Gajewski, M. (2007). Effect of fertilizers on oil pumpkin seeds crude fat, fibre and protein quantity. *Agron Res*, *5*(1), 43-49.

Jat, R. N., Khanelwal, S. K. and Gupta, K. N. (2007). Effect of foliar application of urea and zinc sulphate on growth and flowering parameters in African marigold (*Tagetes erecta* Linn.). *J. Ornam. Hort.*, *10*(4), 271-273.

Karuppaiah, P. (2014). Effect of zinc and iron on growth, yield and quality of chrysanthemum (*Dendrathemum grandiflorum* Tzeuleu). *Asian J. Hort.*, *9*(1), 232-236.

Khosa, S. S., Younis, A., Yameen, S. and Rayit, A., (2011). Effect of foliar application of micro nutrients on growth and flowering of gerbera (*Gerbera jamesonii*). *American-Eurasian J. Agri. And Environ. Sci*., *11*(5), 736-757.

Khoshgoftarmanesh, A. H., Khademi, H., Hosseini, F. & Aghajani, R. (2008). Influence of additional micronutrient supply on growth, nutritional status and

flower quality of three rose cultivars in a soilless culture. *Journal of Plant Nutrition*, *31*(9), 1543-1554.

Narayan, S. (2015). Effect of foliar application of NAA and microelements on vigour and flowering of marigold (*Tagetes erecta* L.) cv. Pusa Basanti. Hortflora Res. Spectrum, *4*(3), 264-267.

Schnitzer, M. (2000). A life time perspective on the chemistry of soil organic matter. *Adv. Agron.*, *68*: 3-54.

Senthamizhselvi, B. (2000). Studies on the flowering and productivity of Gundumalli (*Jasminum sambac* Ait) as influenced by nutrient management technique. *M.Sc. (Hort.) Thesis*, Tamil Nadu Agricultural University, Coimbatore (T.N.) INDIA.

Soni, S. S., Godara, A. K., Goyal, R. K. & Sehrawat, S. K. (2009). Effect of foliar application of micronutrients on nutrients and chlorophyll content of gerbera var. Winter Queen. *Haryana J. Hortic. Sci.*, *38*(3&4): 274-275.

How to cite this article: Alka, Dipal S. Bhatt, Monu Kumari, Suchitra and Bambhaniya Kinjal (2022). Effect of various Stimulants on Growth, Leaf analysis and Economics of Chrysanthemum. *Biological Forum – An International Journal*, *14*(1): 646-650.