International Journal of Pharmaceutical Research and Applications
Volume 6, Issue 6 Nov-Dec 2021, pp: 278-283 www.ijprajournal.com ISSN: 2249-7781

Effect of various stimulants on flower quality and yield of chrysanthemum

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Submitted: 10-11-2021 Revised: 24-11-2021 Accepted: 27-11-2021

ABSTRACT
The present investigation entitled 'Effect of various stimulants on growth, flower quality and yield of chrysanthemum' was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari during 2019-20. Foliar application of 0.5% FeSO4 + 0.5% ZnSO4 + 20 ppm NAA to chrysanthemum plants significantly early flower bud initiation (40.80 days), flower bud opening (62.80 days), days taken to 50 % flowering (80.67 days), diameter (11.03 cm), flower stem length (32.89 cm), vase life (7.87 days), higher flower yield 5.73 per plant, 150.27 per plot and 340654 per ha) were observed with foliar application of 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA (T_4).
Keywords: Chrysanthemum, stimulants, foliar application and flower yield

I. INTRODUCTION

Flowers being idol creation of God. Besides beauty and aesthetic values of flowers, they are used commercially as loose as well as cut blooms, for making value added products like gulkand, extraction of essential oils and pigments etc. Thus, floriculture is an intensive type of agriculture and the income per unit area from floriculture is much higher than any other branch of agriculture. Owing to the thoroughbred bond between flowers and humans, floriculture has emerged as a lucrative trade across the globe with more than 200 countries in trade.

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 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. Therefore, in modern floriculture new approaches have been developed to achieve sufficient and sustainable yield with quality blooms.

The use of stimulants which has the capacity to modify plant growth has widely used over the last decade. Iron is an essential component of several dehydrogenase, proteinase, peptidase which acts as a catalyst in the formation of chlorophyll and promotes activity of growth hormones (Kumar et al., 2009). In addition, it is a structural part of some enzymes (Bagheri et al., 2013.Zinc is an important for the formation of chlorophyll, in the functioning of several enzymes (catalyase, tryptophan synthate) and the growth hormone auxin (IAA) as well as various physiological activities. 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.The application of Zn has been found beneficial in increasing growth, flowering and yield in flowers crops.

Naphthaleneacetic acid (NAA) being a member of auxin group promotes vegetative growth by active cell division, cell enlargement and cell elongation due to increase amylase activity, permeability of cell wall and formation of energy rich phosphate (ATP) which is utilized by plants for more vegetative growth of plant (Pandey and Sinha, 1984). The main function of urea fertilizer is to provide the plants with nitrogen to promote green leafy growth and make the plants look lush. It has the lowest osmolality among all N sources (Weast, 1978) and its uptake before hydrolysis is much slower than nitrate or ammonium (Kirkby and Mengel, 1967). Novel organic liquid fertilizer

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Volume 6, Issue 6 Nov-Dec 2021, pp: 278-283 www.ijprajournal.com ISSN: 2249-7781

(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 are used as organic biostimulants because of their biological origin (Schnitzer, 2000). Panchgavya contains macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA and beneficial microorganisms (Natarajan, 2007; Sreenivasa et al., 2010). Humic acid can be used as an alternative to synthetic fertilizers to increase crop production (Maggioni et al., 1992), or an indirect effect, mainly by changing the soil structure (Biondi et al., 1994). Humic acid is also proven to be effective in enhancing the mineral nutrient uptake (Pan and Dong, 1995).

II. MATERIALS AND METHODS

The present investigation to study the "Effect of various stimulants on growth, flower quality and yield of chrysanthemum" was carried out 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 = FeSO4 (0.5%), T_2 = ZnSO4 (0.5%), T_3 = 20 ppm NAA + 1% Urea, T_4 = 0.5% FeSO4 + 0.5% ZnSO4 + 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. All five plants were tagged for recording the observations and average value for each net plot was computed and recorded.

III. RESULTS AND DISCUSSION

Flowering parameters

Data regarding the flowering characters of chrysanthemum showed significant effect and have been presented in Table no. 1 & 2. early flower bud initiation (40.80 days), flower bud opening (62.80 days), days taken to 50 % flowering (80.67 days), diameter (11.03 cm), flower stem length (32.89 cm) and vase life (7.87 days) were observed with foliar application of 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA (T_4) were observed in treatment T_4 (0.5% FeSO4+ 0.5% ZnSO4 + 20 ppm NAA). An early flowering might be due to enhanced growth and development of plant resulted by zinc sulphate, ferrous sulphate and NAA. Zinc favours the storage of more carbohydrates through photosynthesis and iron involves in synthesis of plant hormones and also plays an important role in chlorophyll synthesis, photosynthesis and respiration. This may be the attributing factor for the positive effectiveness of optimum dose of zinc and iron on reducing juvenile phase of the plant. Similar results are also obtained by Balakrishnan et al. (2007) in African marigold and Chopde, Neha et al. (2016). Various quality parameters viz. flower bud diameter, length of flower bud and weight of hundred buds were significantly influenced by 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA in chrysanthemum. The increase in flowering attributes might be due to the beneficial role of zinc and iron in enhancing the translocation of carbohydrates, minerals, water and amino acid from the site of synthesis to the storage tissue especially on flowers which in turn increase number, size and weight of flowers. According to Chopde, Neha et al. (2016) due to application of 0.5% $FeSO_4$ and 0.5% $ZnSO_4$ enhanced vegetative growth is resulted into production of more food material which in turn might have been utilized for better development of flowers of annual chrysanthemum. The results are in close conformity with the findings of Lahijie (2012) in gladiolus. According to Narayan S. (2015), the increase in fresh weight of floral heads with the spray of NAA might be due to mobilization or movement of nutrients in to flowers in which NAA helps to maintain sink-source ratio. The results are in accordance with the findings of Naveenkumar et al. (2009) and Karuppaiah (2014) and Chopde, Neha et al. (2016) in chrysanthemum, Balakrishnan et al. (2007) in marigold and Kakade, et al. (2009) in china aster. Better quality of chrysanthemum flower might be due to higher carbohydrate, other essential nutrients, plant growth regulators and enzymes deposition in flower cells by the zinc and iron physiological role which resulted in production of good quality flowers. This good quality flowers suppress ethylene and abscisic acid and prolong shelf life and appearance of flowers. Similar

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Volume 6, Issue 6 Nov-Dec 2021, pp: 278-283 www.ijprajournal.com ISSN: 2249-7781

findings were given by Tisdale et al. (1985) in orchid and Vijaykumar (2009) in asparagus.

Yield parameters

With regards to flower yield, plants sprayed with 0.5% $FeSO_4$ + 0.5% $ZnSO_4$ + 20 ppm NAA recorded significantly higher flower yield 5.73 per plant, 150.27 per plot and 340654 per ha which was statistically at par with T_8 i.e application of Panchgavya (1 %) showed in Table no. 3. Application of zinc and iron not only relieved the chlorosis and produced healthy green plants but also increased the synthesis of chlorophyll, growth promoting substances and mobility of minerals, water, photosynthates and amino acids from the source to sink which may in turn increase the flower production and ultimately flower yield. The results are in agreement with the findings of Nag and Biswas (2002) in tuberose, Balakrishnan et al., (2007) in African marigold, Naveenkumar et al. (2009), Karuppaiah (2014) and Chopde, Neha et al. (2016) in chrysanthemum.

IV. CONCLUSION

Based on the results of present investigation, it can be concluded that foliar application of 0.5% FeSO4 + 0.5% ZnSO4 + 20 ppm NAA at 30, 45 and 60 DATP gave maximum flowering and yield.

Table 1: Effect of various stimulants on flowering parameters in chrysanthemum cv. Thai Chen Queen

Treatments		**Days taken to flower bud initiation**	**Days taken to flower bud opening**	**Days taken to 50 % flowering**
T_1	$FeSO_4$ (0.5 %)	44.73	66.20	85.60
T_2	$ZnSO_4$ (0.5 %)	47.33	69.87	86.00
T_3	NAA (20 ppm) + Urea (2 %)	46.93	70.73	86.13
T_4	$FeSO_4$ (0.5 %) + $ZnSO_4$ (0.5 %) + NAA (20 ppm)	40.80	62.80	80.67
T_5	Nauroji Novel Organic liquid nutrient 1%	44.27	69.20	86.60
T_6	Nauroji Novel Organic liquid nutrient 2%	43.47	64.80	86.27
T_7	Panchgavya (0.5 %)	47.47	65.73	88.60
T_8	Panchgavya (1.0%)	42.53	64.07	86.87
T_9	Humic acid (0.25 %)	47.00	69.27	86.67
T_{10}	Humic acid (0.5 %)	43.20	69.60	82.93
T_{11}	Water spray	48.00	72.20	86.33
T_{12}	No spray (Control)	52.80	77.07	87.87
S. Em. ±		2.031	2.163	3.006

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C. D. at 5 %	5.96	6.35	NS
C. V. %	7.70	5.47	6.06

Table 2: Effect of various stimulants on flower quality parameters in chrysanthemum cv. Thai Chen Queen

Treatments		**Flower diameter (cm)**	**Flower stem length (cm)**	**Vase life (days)**
T_1	$FeSO_4$ (0.5 %)	9.86	29.00	6.13
T_2	$ZnSO_4$ (0.5 %)	9.81	29.63	6.00
T_3	NAA (20 ppm) + Urea (2 %)	10.28	30.29	6.53
T_4	$FeSO_4$ (0.5 %) + $ZnSO_4$ (0.5 %) + NAA (20 ppm)	11.03	33.56	7.87
T_5	Nauroji Novel Organic liquid nutrient 1%	9.83	28.53	6.20
T_6	Nauroji Novel Organic liquid nutrient 2%	9.89	31.37	6.40
T_7	Panchgavya (0.5 %)	9.88	31.23	6.33
T_8	Panchgavya (1.0%)	10.67	31.71	7.00
T_9	Humic acid (0.25 %)	9.80	27.20	5.60
T_{10}	Humic acid (0.5 %)	9.81	27.05	5.87
T_{11}	Water spray	8.90	26.39	5.40
T_{12}	No spray (Control)	7.93	23.89	5.27
S. Em. ±		0.462	1.549	0.425
C. D. at 5 %		1.36	4.54	1.25
C. V. %		8.18	9.20	11.87

Table 3: Effect of various stimulants on yield parameters in chrysanthemum cv. Thai Chen Queen

Treatments		**No. of flower stems per plant**	**No. of flower stems per plot**	**No. of flower stems per ha**
T_1	$FeSO_4$ (0.5 %)	4.87	125.33	284131

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T_2	$ZnSO_4$ (0.5 %)	4.67	120.27	272645
T_3	NAA (20 ppm) + Urea (2 %)	4.73	120.33	272796
T_4	$FeSO_4$ (0.5 %) + $ZnSO_4$ (0.5 %) + NAA (20 ppm)	5.73	150.27	340655
T_5	Nauroji Novel Organic liquid nutrient 1%	4.80	121.93	276423
T_6	Nauroji Novel Organic liquid nutrient 2%	5.20	135.27	306650
T_7	Panchgavya (0.5 %)	5.00	129.67	293954
T_8	Panchgavya (1.0%)	5.60	146.53	332191
T_9	Humic acid (0.25 %)	4.53	115.87	262670
T_{10}	Humic acid (0.5 %)	4.87	126.27	286247
T_{11}	Water spray	4.53	115.73	262367
T_{12}	No spray (Control)	4.47	112.73	255566
S. Em. ±		0.259	5.973	13541.74
C. D. at 5 %		0.76	17.52	39718.98
C. V. %		9.13	8.17	8.17

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International Journal of Pharmaceutical Research and Applications
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