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Effect of plant growth regulators on growth and flowering characters of China aster (*Callistephus chinensis* L. Nees) cv. ostrich feather

Sonu Kumar, AK Singh, Archana Singh and Amar Singh

Abstract
A field trial was conducted on China aster (*Callistephus chinensis* L. Nees) cv. Ostrich Feather at Main experiment Station, Horticulture, College of Horticulture & Forestry, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) during the year 2013-14. The Experiment was laid out in Randomized Block Design (R.B.D.) with 10 treatments as T_1 Control (water spray), T_2 (GA_3 100 ppm), T_3 (GA_3 200 ppm), T_4 (GA_3 300 ppm), T_5 (NAA 50 ppm), T_6 (NAA 100 ppm), T_7 (NAA 150 ppm), T_8 (Ethrel (100 ppm), T_9 (Ethrel 200 ppm) and T_{10} (Ethrel 300 ppm) replicated three times. Maximum plant height, plant spread, number of leaves per plant, number of branches per plant, minimum days taken for opening of first flower, maximum duration of flowering, maximum number of flowers per plant and flower weight was recorded with the application of GA_3 300 ppm followed by GA_3 200 ppm. The minimum values and shortest flower duration were recorded under control (Water spray), however number of days taken for opening of first flower was recorded maximum with the spray Ethrel 200 ppm.

Keywords: growth regulator, GA_3, NAA, ethrel, cut flower

Introduction
China aster (*Callistephus chinensis* L. Nees) is one of the most popular valuable seasonal flower belongs to family Asteraceae (Compositeae). The flowers are solitary and blue lavender rose and white are the prominent colours. China aster ranks next only to chrysanthemum and marigold in commercial cultivation. In recent years, China aster has gained more popularity due to its multifarious uses including cut flower, loose flower and landscaping purposes. It can be grown almost throughout the year, however under North Indian conditions can be grown only in winter season. It can easily be grown in the open fields and lath houses for the production of cut flower. The commercial importance of china aster increasing day by day in India specially in Karnataka, Tamil Nadu, West Bengal and Maharashtra. Its cultivation has been found to be a profitable enterprise for eastern Uttar Pradesh. In periurban surroundings of Bangalore (Karnataka) and Pune (Maharashtra) alone, it is being grown in an area of 500 and 400 ha, respectively.

Growth and development of plants are under the control of extremely minute quantity of hormone within the plant themselves. Production of improved quality flower depends greatly on the use of plant growth regulators at commercial level. The growth and flowering of China aster are greatly influenced by judicious application of PGRs therefore it is imperative to find out optimum doses PGRs, for quality flower production. Deficiency of PGRs results in poor growth and flowering. The present study is therefore, undertaken to investigate the possibilities of improving production and quality of China aster by application PGRs. Auxin is probably the investigated plant hormone and involve in virtually every aspect of plant growth and development. Auxin group of growth regulators such as NAA (Naphthalene acetic acid) increases the growth of plant both by cell division and cell elongation, apical dominance, regulation of flowering in a large number of plants. The apical dominance might be under control of auxin produced at the terminal bud. NAA is applied to regulate the flowering in desired season.

Gibberellins are deterpene that promote stem and leaf growth. In some species, GA_3 also induced seed germination and modulate flowering time and development of flowers, fruits and seed (Sum and Gubler, 2004) [12]. Gibberellins increases number of leaves per plant, number of stalk per plant, length of flower stalk and height of plant in tuberose (Narayan and Syamal, 2002) [8]. The application of ethrel retards plant height, number of nodes and internodal length in China aster. It increased branching, delayed flowering, more number of leaves formed below the terminal flower, increased number of flower per plant in China aster. Ethrel is

growth retardant check cell division in apical meristem only resulting in vascular synthesis beneath the apical meristem but the cambial and vascular cell continues to divide over a larger period and this results increase in thickness of stem (Sachs, 1961) [11]. Present investigation has been framed with the objective that to study the effect of plant growth regulators on vegetative growth and flowering of plant.

Materials and Method

Experimental Field Description

The present investigation was carried out at Main Experiment Station, Horticulture, Narendra Deva University of Agriculture & Technology, Narendra Nagar, (Kumarganj), Faizabad (U.P) during winter season of 2013-14, Kumarganj situated at 26.43˚ N latitude and 81.9˚ E longitudes and an altitude of 98 meter above mean sea level.

Climate and meteorological condition

The region enjoys sub humid and subtropical climate receiving a mean annual rainfall of about 1100 mm out of which about 85 per cent is concentrated from mid-June to end of September. The winter months are cold and dry and occasional frost occurs during this period. Westerly hot wind starts from the month of March and continues up to onset of monsoon. Meteorological observation recorded at the meteorological observatory of Narendra Deva University of Agriculture & Technology, Narendra Nagar, Kumarganj, Faizabad, is presented in Fig-3.1.

Experimental design

The experiment was laid out in Randomized Block Design (R.B.D.) replicated three times keeping 10 treatments. In the present study China aster cv. Ostrich Feather was taken as experimental material considering total number of plots 30 and 25 plants in each with spacing 30 cm x 30 cm. The treatments comprising of three levels of GA_3 (100,200 and 300 ppm), three levels of NAA (50, 100, 150 ppm), three levels of Ethrel (100, 200, and 300 ppm) and a Control (water spray). The different concentration of plant growth regulators were sprayed at one month after transplanting. The observations gathered with respect to plant height, plant spread, number of leaves per plant, number of primary branches per plant were recorded at the time of flower bud initiation in each tagged plant. Days taken for the opening of first flower was recorded from the date of transplanting of seedling to the days taken for opening of first flower and the duration of flowering (days) was noted by counting the date of first flowering to the last flowering. Total numbers of flowers per plant were recorded by adding all the harvest stage and flower weight (g) was recorded as twenty five fully matured flowers were plucked randomly from each plot and weighted and average was worked out. Statistical analysis of the data was done as suggested by Panse and Sukhatma (1967) [9].

Results and Discussion

Effect of PGR's on growth attributes

Plant Height

The data presented in the Table 1 showed that the maximum (52.27 cm) plant height was observed with the spray of GA_3 300 ppm under followed by with NAA 50 ppm and GA_3 200 ppm while (21.87 cm) minimum plant height was obtained under control. The promotive effect of gibbrellins on growth may be due to increasing auxin level of tissues or enhance the conversion of tryptophan to IAA which causes the cell division and cell elongation. Similar results were also reported by Kumar *et al*. (2006) [5] in tuberose using GA_3 200 ppm and Tyagi and Kumar (2006) [5] in African marigold with GA_3 200 ppm.

Effect on Plant Spread

The spread of plant was recorded significantly maximum (33.60 cm) with the foliar application of GA_3 300 ppm which was found at par with GA_3 200 ppm, while lowest (26.00 cm) plant spread was recorded in control treatment. GA_3 resulted hyper elongation of internodal length caused extension in plant height while increase in total count of main axis consequently increased number of dormant buds from where primary branches originated which resulting optimum spread of plant (Gautam *et al*. 2006) [3]. These findings are in close conformity with result of Dutta *et al*. (1998) [2] in chrysanthemum with GA_3 150 ppm.

Effect on Number of Leaves and Number of Branches

The number of leaves per plant was significantly maximum (90.00) with application of GA_3 300 ppm followed by GA_3 200 ppm and GA_3 100 ppm which was found at par with NAA 150 ppm, NAA 100 ppm however, minimum (64.07) number of leaves per plant was recorded under control. The maximum numbers of branches were recorded with GA_3 300 ppm which was found at par with GA_3 200 ppm and Ethrel 300 ppm. The minimum number of branches was reported with control treatment. Kadam *et al.* (2002) reported that GA_3 at 200 ppm resulted in tall plants, high number of leaves, high branch number and the maximum flower yield of China aster.

Duration of Flowering

The maximum duration of flowering (42.34 days) was recorded with GA_3 300 ppm which was found at par with GA_3 200 ppm (39.47 days) however, shortest flower duration was recorded in control (31.67days). GA_3 was most found effective in extending the flowering duration especially with GA_3 300 ppm followed by GA_3 200 ppm. It might be due to advanced stage of flowering in China aster. Gautam *et al.* (2006) [3] observed maximum flower duration in chrysanthemum with GA_3 200 ppm, Kumar *et al*. (2010) studied effect of growth regulators on flowering in African marigold with GA_3 (25, 50, 100 and 200 ppm) and longest duration of flowering was observed with GA_3 200 ppm.

Effect on days taken for opening of first flower

The minimum number of days taken for opening of first flower (58.27 days) was recorded with GA_3 300 ppm followed by GA_3 200 ppm (61.40days). Maximum number of days taken for opening of first flower (77.74 days) was recorded in Ethrel 200 ppm which was observed 8.60 days delayed from control treatment. Early flowering owing to GA_3 may be due to gibbrellins reduces juvenile period and termination of juvenile phase the shoot apical meristem instead of producing vegetative growth start producing flower. Dahiya and Rana (2001) [1] reported earlier flowering in chrysanthemum with GA_3 150 ppm and Mohariya *et al.* (2003) [7] observed earlier flowering in chrysanthemum with GA_3 150 ppm.

Number of flowers per plant

The maximum (12.74) numbers of flowers were recorded with the application of GA_3 200 ppm followed by GA_3 300 ppm and NAA 50 ppm which was found at par with Ethrel 300 ppm, NAA 100 ppm (Fig 1). However, minimum (8.00) number of flowers was recorded under control. The

enhancement in number of flower per plant might be due to the production of large number of laterals at early stage of growth which had sufficient time to accumulate carbohydrate for proper flower bud differentiation due to enhanced reproductive efficiency and photosynthesis restricted plant type. The result was in close conformity with Sunitha *et al.* (2007) [13] studied foliar application of GA_3 (100 and 200 ppm) in African marigold cv. Orange Double increase the number of flowers per plant. Patel *et al.* (2010) [10]; Tannirwar *et al.* (2011) [14] observed maximum number of flower per plant with GA_3 150 ppm in chrysanthemum.

Effect on Flower weight

The maximum (11.20 g.) flower weight was recorded with the application of GA_3 300 ppm followed by GA_3 200 ppm however; minimum weight of flower (8.80g.) was recorded in control (Fig 2). Sunitha *et al.* (2007) [13] in African marigold (*Tagetes erecta* L.) reported maximum flower weight.

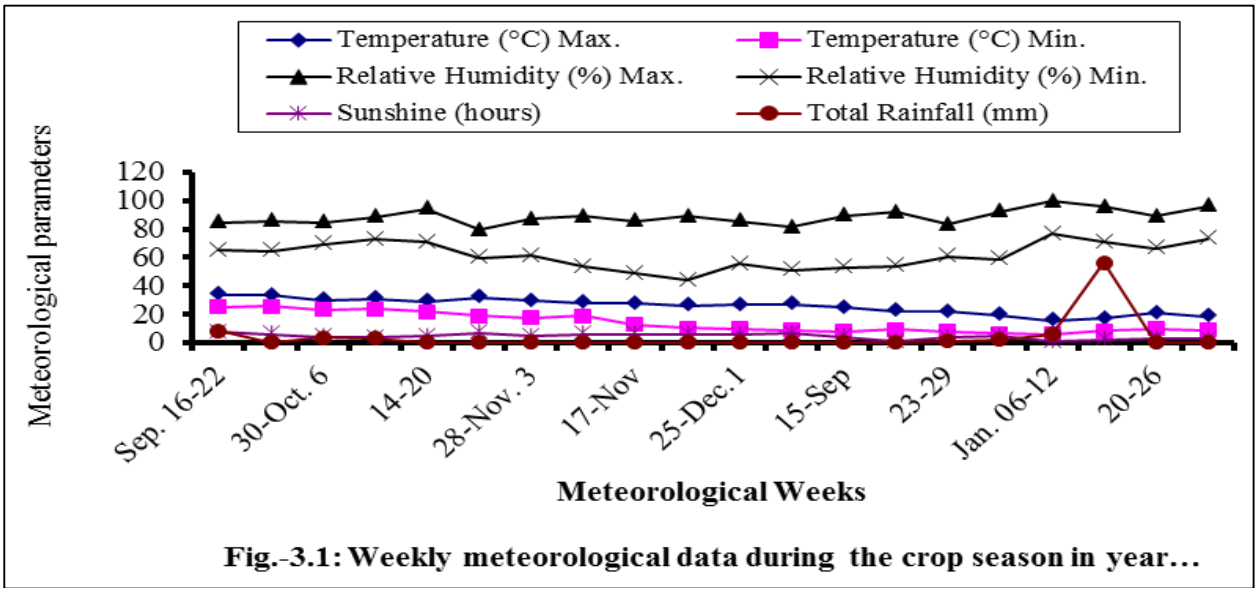

Fig.-3.1: Weekly meteorological data during the crop season in year...

Table 1: Effect of plant growth regulators on growth and flowering characters of China aster

Treatments	Height of plant (cm)	Spread of plant (cm)	Number of leaves	Number of branches
T_1: Control	21.87	26.00	64.07	4.80
T_2: GA_3 100 ppm	41.87	30.20	84.67	7.54
T_3: GA_3 200 ppm	42.20	32.34	87.40	8.47
T_4: GA_3 300 ppm	52.27	33.60	90.00	10.07
T_5: NAA 50 ppm	46.54	27.74	80.54	6.80
T_6: NAA 100 ppm	41.67	30.74	84.34	7.34
T_7: NAA 150 ppm	41.47	28.34	84.47	7.67
T_8: Ethrel 100 ppm	37.47	27.60	79.67	6.94
T_9: Ethrel 200 ppm	36.34	29.20	80.60	7.40
T_{10}: Ethrel 300 ppm	34.47	30.67	82.14	8.00
S.Em±	4.48	1.39	2.24	0.33
CD at 5%	13.31	4.14	6.65	0.99

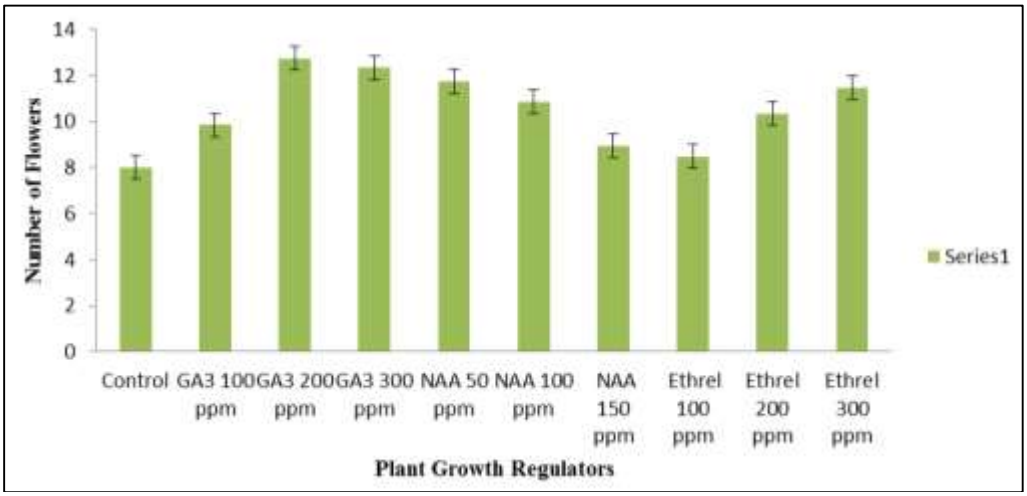

Fig 1: Effect of plant growth regulators on number of flowers per plant

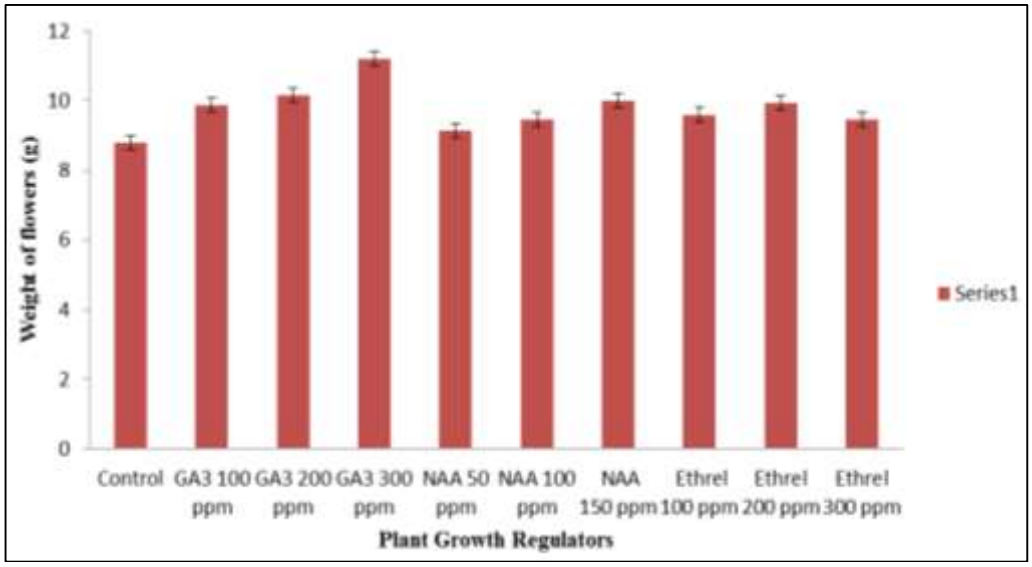

Fig 2: Effect of plant growth regulators on weight of flowers (g)

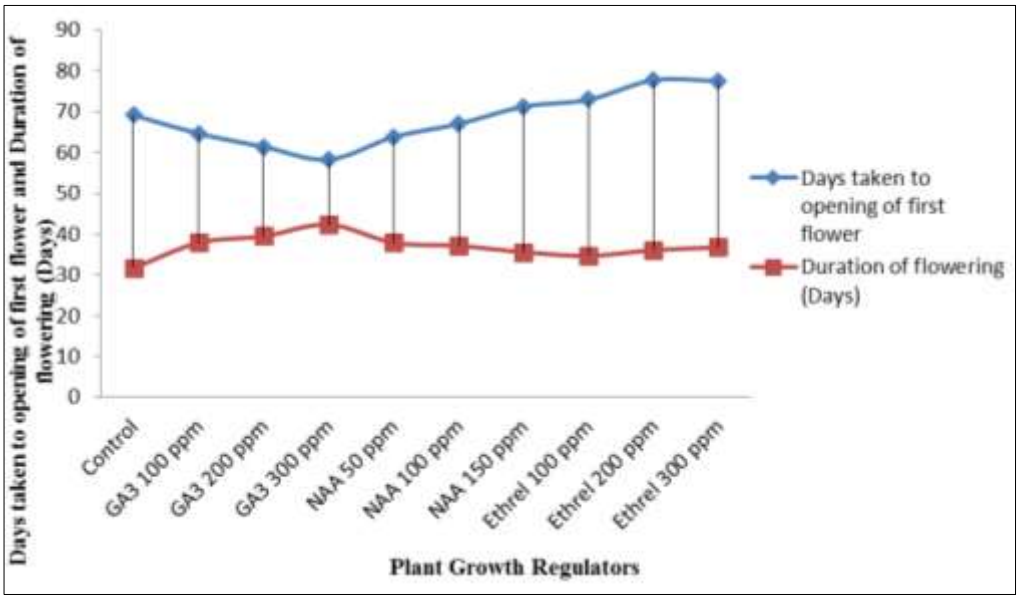

Fig 3: Effect of plant growth regulators on Duration of flowering (Days) and Days to opening of first flower

Conclusion

The above findings showed that foliar application of GA_3 300 ppm one month after transplanting was proved most effective in increasing the growth and flowering characters of China aster.

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References

1. Dahiya DS, Rana GS. Regulation of flowering in chrysanthemum as influenced by GA and shade house of different intensities. South Ind. Hort. 2001; 49:313-314.
2. Dutta JP, Seemanthini R, Ramdas S. Growth and flowering response of chrysanthemum to growth regulators treatments. Orissa J Hort. 1998; 26(1):70-75.
3. Gautam SK, Sen NL, Jain MC, Dahora LK. Effect of plant regulator on growth flowering and yield of chrysanthemum (*Chrysanthemum morifolium* Ram.) cv. Nilima. The Orissa J Hort. 2006; 34(1):36-40.
4. Kadam RE, Bankar GJ, Bhosale AM, Rathod NG, Dhengle RP. Effect of growth regulators on growth and flower yield of China aster (*Callistephus chinensis* (L.) Nees). Annals of Plant Physiology. 2002; 16(1):44-47.
5. Kumar J, Singh P, Pal K. Effect of growth substances on flowering and bulb production in tuberose (*Polianthes tuberosa* L.) cv. Pearl Double. J of Orn. Hort. 2006; 9(3):227-228.
6. Kumar R, Ram M, Gaur GS. Effect of GA_3 and ethrel on growth and flowering of African marigold *cv.* Pusa Narangi Gainda. Ind. J Hort. 2010; 67:362-366.
7. Mohariya AD, Patil BN, Wankhede SG, Band PE, Kartikeyan R. Effect of GA_3 and TIBA on growth, flowering and yield of different varieties of Chrysanthemum. Adv. Plant Sci. 2003; 16(1):143-146.
8. Narayan M, Syamal MM. Effect of gibbrellic acid on tuberose. (*Polianthes tuberosa* L.) cv. Single. Abs in: Floriculture research trend in India. Proc. of Symp. on Indian Floriculture in New Millennium 25-27 Feb, New Delhi, 2002, 70-72.

9. Panse VG, Sukhatme PV. Statistical method for agriculture workers, 5th Edn. Indian Council of Agriculture Research, New Delhi. Orissa J Hort. 1967; 25 (2):81-85.
10. Patel SR, Parekh NS, Parmar AB, Patel HC. Effect of growth regulators on growth, flowering and yield of chrysanthemum cv. "IIHR-6" under middle Gujarat conditions. Int. J of Agri. Sci. 2010; 6(1):243-245.
11. Sachs RM. Gibberellin and growth retardant affect cell division and shoot histogensis. Advanced chemistry. 1961; 28:49-58.
12. Sum T, Gubler F. Molecular mechanism of gibberellin signaling in plants regulator treatment. Annu. Rev. Plant Biol. 2004; 55:197-223.
13. Sunitha HM, Hanje R, Vyakaranahal BS, Bablad HB. Effect of pinching and growth regulators on plant growth, flowering and seed yield in African marigold (*Tageteserecta* L.) J of Orn. Hort. 2007; 10(2):91-95
14. Tannirwar AV, Dange NR, Brahmankar SB. Effect of growth regulators and nutrients on growth and flowering of chrysanthemum cv. ZIPRI. Asian J Hort. 2011; 6(1):269-270.
15. Tyagi AK, Kumar V. Effect of gibberellic acid and vermi compost on vegetative growth and flowering in African marigold (*Tagetes erecta* Linn.) J Orn. Hort. 2006; 9(2):150-151.