Int.J.Curr.Microbiol.App.Sci (2018) *7*(1): 1889-1894

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 01 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.701.227

Effect of Foliar Application of Gibberellic Acid (GA_3) Concentrations and Spraying Frequencies on Vegetative and Floral Attributes of China aster [*Callistephus chinensis* (L.) Nees.]

Pragnya Paramita Mishra*, Geeta Pandey, Ashok Kumura, Rudramadhab Naik and Lucy Priyadarshini Pujahari

Department of Floriculture and Landscaping, College of Agriculture, OUAT, Bhubaneswar, India

**Corresponding author*

Keywords

China aster, GA_3, Spraying frequency, Growth, Yield

Article Info

Accepted:
14 December 2017
Available Online:
10 January 2018

A B S T R A C T

The present experiment was conducted on three varieties of china aster viz., Shashank, ArkaArchana and ArkaAadya grown in pots at the Department of Floriculture and Landscaping, College of Agriculture, OUAT, Bhubaneswar during 2016-17 in order to ascertain the influence of foliar application of gibberellic acid (GA_3) on growth, flowering and yield. The treatments of foliar spray of GA_3 (50, 100 and 150 ppm) was given with different spray frequencies (twice and thrice). Plants of variety ArkaAadya performed significantly better than varieties ArkaArchana and Shashank for number of leaves and number of flowers. However, days to bud initiation, bud showing colour and first flowering were earliest in variety ArkaArchana. Tallest plant with maximum number of primary branches was recorded in variety Shashank. Three times application of GA_3 at 100 ppm recorded maximum plant height, number of primary branches, number of leaves, number of flowers and duration of flowering. Days to bud initiation, bud showing colour and flowering were earliest when sprayed thrice with 100 ppm GA_3.

Introduction

China aster (*Callistephus chinensis* L. Nees.) is an important annual flower crop belonging to the family Asteraceae. In India, China aster ranks third among annual flowers, next only to chrysanthemum and marigold (Sheela, 2008). It is grown for its attractive flowers which cover a wide range of spectrum starting from white, rose, red, lavender, magenta and blue to their innumerable variations (Desai, 1967). In order to produce quality plants, flower growers use a variety of cultural practices and chemical products to influence the plant growth. These chemicals are called plant growth regulators (PGRs). It is well established that the growth and development of plants can be modified by exogenous application of growth substances through alteration in the levels of naturally occurring hormones. Gibberellins act at all stages in the plant life cycle, which display a remarkable diversity of physiological processes of plants (Choudhari, 2012). Gibberellic acid plays a major role in plant growth and development. It has been found to be the best for enhancing

vegetative attributes along with flower initiation. Although studies on effect of GA_3 on different ornamental plants has been done earlier, but information available about its effect on China aster is limited. Hence, the present investigation was conducted to evaluate the effect of GA_3 on growth, flowering and yield characteristics of China aster varieties.

Materials and Methods

The investigation was carried out in the form of a pot experiment at the Department of Floriculture and Landscaping, College of Agriculture, OUAT, Bhubaneswarduring 2016-2017.The treatments consisted of three china aster varieties *viz*., Shashank, ArkaArchana and ArkaAadya and two spray frequencies of GA_3i.e., twice (30 and 40 days after transplanting) and thrice (30, 40 and 50 days after transplanting). The treatments are T_1 - Control, T_2 - Two sprays of 50 ppm GA_3, T_3 - Three sprays of 50 ppm GA_3,T_4 - Two sprays of 100 ppm GA_3, T_5 - Three sprays of 100 ppm GA_3, T_6 -Two sprays of 150 ppm GA_3 and T_7 - Three sprays of 150 ppm GA_3. Four week old seedlings were planted in pots with media mixture of soil, FYM and sand in 2:1:$^{1}/_{2}$ratio.

They were provided with a common dose of fertilizer in equal quantities invariable of treatments. The experiment was laid out in Factorial Completely Randomized Design with three replications. All recommended package of practices were followed to raise a good crop.

Data on various growth and flowering parameters viz., plant height (cm), number of primary branches, number of leaves per plant, days to bud initiation, days to bud showing colour, days to first flowering, number of flowers per plant and flower duration (days) were recorded and statistically analysed.

Results and Discussion

Effect of GA_3 application on vegetative characters of China aster varieties

It is clear from the Table 1 that all the vegetative characters under present investigation were significantly influenced by different treatment combinations. It was observed that plants treated with T_5 (three sprays of 100 ppm GA_3) recorded maximum height (69.03 cm), maximum number of primary branches (15.63) and maximum number of leaves per plant (302.81).

However, the above characters were found to be minimum under T_1(control).Increase in plant height and number of primary branches may be due to the fact that GA_3 increased the growth of plant by increasing internodal length and due to cell division, cell enlargement and enhanced apical dominance indirectly by increasing the auxin content.

Similar type of results has also been reported by Kumar *et al.*, (2003), Nandre *et al.*, (2009) in China aster and Padmapriya and Chezhiyan (2002) in chrysanthemum. Increase in leaf number with GA_3 might be due to the enhanced induction of the leaf initial breaks i.e., differentiation of leaf primordial in the apical growing region. It may also be due to increase in height of plant and number of primary branches. Similar findings have been reported by Sajid *et al.*, (2016) in chrysanthemum and Kumar *et al.*, (2011) in African marigold.

Among all the varieties, Shashank (V_1) recorded maximum plant height (68.50 cm) and maximum number of primary branches (16.40) while maximum number of leaves per plant (356.75) was observed in variety ArkaAadya (V_3). The variation among the varieties might be due to the differences in the genetic makeup of the individual varieties.

Table.1 Effect of varying GA_3 levels and spraying frequencies on vegetative and floral characters of China aster

	Plant height (cm)	Number of primary branches	Number of leaves per plant	Days to bud initiation	Days to bud showing colour	Days to first flowering	Number of flowers per plant	Flowering duration (days)
Variety (V)								
V_1	68.50	16.40	188.25	70.40	87.26	90.51	70.49	28.62
V_2	60.00	13.52	321.24	69.29	86.02	89.65	61.33	32.18
V_3	63.30	15.06	356.75	72.17	89.05	92.35	79.95	32.58
SE (m) ±	0.31	0.12	0.61	0.33	0.40	0.40	0.27	0.13
CD at 5%	0.90	0.31	1.74	0.94	1.14	1.13	0.77	0.38
Treatment (T)								
T_1	55.60	14.00	272.44	81.28	98.94	102.49	61.81	27.11
T_2	59.92	14.78	279.00	71.94	90.67	94.20	66.30	29.05
T_3	65.38	14.81	283.59	69.72	86.22	89.60	69.78	30.64
T_4	64.50	15.33	287.15	70.50	86.78	90.46	71.52	31.21
T_5	69.03	15.63	302.41	65.07	79.72	82.83	77.04	35.65
T_6	65.82	15.30	297.85	68.83	87.17	90.70	74.00	30.88
T_7	67.41	15.11	298.78	66.89	82.61	85.58	73.70	33.36
SE (m) ±	0.48	0.16	0.93	0.50	0.61	0.61	0.41	0.21
CD at 5%	1.37	0.47	2.65	1.43	1.74	1.73	1.18	0.59
Variety × Treatment (V × T)								
V_1T_1	60.4	15.22	169.33	78.67	94.00	97.57	61.00	25.89
V_1T_2	65.8	16.44	176.00	72.00	90.33	93.83	67.22	26.40

V_1T_3	72.4	16.56	182.44	71.83	88.50	91.93	70.78	27.04
V_1T_4	70.5	17.11	184.33	69.00	86.17	89.87	74.11	28.59
V_1T_5	74.4	17.33	209.11	65.00	80.50	83.13	79.89	33.31
V_1T_6	67.8	16.11	200.22	68.67	87.00	90.30	71.00	28.39
V_1T_7	68.1	16.00	196.33	67.33	84.33	86.97	69.44	30.72
V_2T_1	50.7	12.56	308.00	77.00	95.00	98.80	53.33	28.12
V_2T_2	55.5	13.22	312.00	71.00	90.00	93.77	56.78	30.02
V_2T_3	61.1	13.11	316.33	69.17	84.00	87.60	59.56	32.77
V_2T_4	60.0	13.56	319.00	70.00	86.00	89.63	60.67	31.02
V_2T_5	66.9	14.33	338.11	63.00	76.00	79.40	64.22	37.04
V_2T_6	61.5	14.22	329.22	68.33	89.00	92.67	68.78	31.72
V_2T_7	64.6	13.67	326.00	66.50	82.17	85.67	66.00	34.59
V_3T_1	55.7	14.22	340.00	88.17	107.83	111.10	71.11	27.31
V_3T_2	58.5	14.67	349.00	72.83	91.67	95.00	74.89	30.72
V_3T_3	62.6	14.78	352.00	68.17	86.17	89.27	79.00	32.12
V_3T_4	63.0	15.33	358.11	72.50	88.17	91.87	79.78	34.01
V_3T_5	65.8	15.22	360.00	67.20	82.67	85.97	87.00	36.59
V_3T_6	68.1	15.56	364.11	69.50	85.50	89.13	82.22	32.52
V_3T_7	69.6	15.67	374.00	66.83	81.33	84.10	85.67	34.77
SE (m) ±	0.83	0.28	1.61	0.87	1.06	1.05	0.72	0.36
CD at 5%	2.38	0.81	4.60	2.83	3.02	2.99	2.05	1.02

N.B. V_1 - Shashank; V_2 - ArkaArchana; V_3 - ArkaAadya

T_1 - Control (water spray); T_2 - GA_3 @ 50 ppm (twice); T_3 - GA_3 @ 50 ppm (thrice); T_4 - GA_3 @ 100 ppm (twice); T_5 - GA_3 @ 100 ppm (thrice); T_6 - GA_3 @ 150 ppm (twice); T_7 - GA_3 @ 150 ppm (thrice)

The interaction effect of varieties and GA_3 application shows that maximum plant height (74.4 cm) and maximum number of primary branches (17.33) was obtained in variety Shashank when the plants were sprayed with T_5 - Three sprays of 100 ppm GA_3 (V_1T_5) whereas maximum number of leaves per plant (374.00) was recorded in variety ArkaAadya when treated with T_7 - Three sprays of 150 ppm GA_3 (V_3T_7).

Effect of GA_3 application on floral characters of China aster varieties

Datain the Table 1 clearly reveals that different treatment combinations have significant influence on the floral characters. It was observed that earliest bud initiation (65.07 days),earliest bud showing colour (79.72 days) and earliest flowering(82.83 days) was recorded under T_5 (three sprays of 100 ppm GA_3). However, the days to bud initiation, bud showing colour and first flowering was most delayed in T_1 (Control). The earliness in flowering might be due to the fact that GA_3 application enhanced the translocation of food for development of floral primordial, which led to early flowering. This may be due to increased photosynthesis and respiration along with enhanced fixation by GA_3 that led to flower bud initiation (Sen and Sen, 1968). It may also be due to synergistic effect of auxin with gibberellins observed in the shoot of plants. The results are in agreement with the findings by Sharma and Joshi (2015) and Nandre *et al.,* (2009) in China aster, Sen and Maharana (1971) in chrysanthemum and Bhattacharjee (1984) in dahlia. Maximum number of flowers per plant (77.04) and longest flowering duration (35.65 days) was recorded in T_5 (three sprays of 100 ppm GA_3) while minimum number of flowers and shortest duration of flowering was recorded under T_1 (Control). Increase in flower number due to GA_3 treatment may be attributed to the fact that GA_3 enhances induction of flower bud break i.e., differentiation of floral primordial in the apical growing region by GA_3 which leads to the increased production of flower per plant (Singh and Srivastava, 2008). The above results are in conformity with the findings of Kumar *et al.,* (2003) in China aster and Patra *et al.,* (2015) in gerbera. Enhancement of flowering duration under GA_3 treatment could be due to early flower induction as a result of replacement of a part of vernalisation by GA_3. The results are in accordance with the findings of Sharma and Joshi (2015) and Kumar *et al.,* (2003) in China aster.

Among the varieties, ArkaArchana (V_2) took least time (69.29 days, 86.02 days and 89.65 days, respectively) for bud initiation, bud showing colour and first flowering. Maximum number of flowers (79.78) and longest flowering duration (32.58 days) was observed under variety ArkaAadya (V_3). These differences may be due to the diversity in the genotype of the varieties.

Interaction between the varieties and GA_3 treatments showed that earliest days to bud initiation (63.00 days), minimum days to reach the stage when first flower bud showed colour (63.00 days),minimum days to flowering(79.40 days) and longest flowering duration (37.04 days) was recorded in variety ArkaArchana when the plants were treated with T_5 - Three sprays of 100 ppm GA_3(V_2T_5) while maximum number of flowers per plant (87.00) was recorded in variety ArkaAadya when treated with T_5 - Three sprays of 100 ppm GA_3(V_3T_5).

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How to cite this article:

Pragnya Paramita Mishra, Geeta Pandey, Ashok Kumura, Rudramadhab Naik and Lucy Priyadarshini Pujahari. 2018. Effect of Foliar Application of Gibberellic Acid (GA3) Concentrations and Spraying Frequencies on Vegetative and Floral Attributes of China aster [*Callistephus chinensis* (L.) Nees.]. *Int.J.Curr.Microbiol.App.Sci.* 7(01): 1889-1894.
doi: https://doi.org/10.20546/ijcmas.2018.701.227