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Effect of different priming methods on growth, flowering, yield and postharvest attributes in China aster cv. Kamini

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Abstract
An experiment was performed to evaluate the effect of seed priming on growth, flowering, yield and postharvest quality of China aster [*Callistephus chinensis* L. Nees.] in Horticulture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, and Varanasi (U.P.). The experiment was laid out in Randomized Block Design (RBD) with three replications. The treatments comprised of different concentrations of GA_3, $CaCl_2$, distilled water of various levels including control. Among all the priming treatments, seeds primed with GA_3 200 ppm showed maximum effect in all the growth characters, flowering, yield and postharvest quality in China aster cv. Kamini. Treatment GA_3 200 ppm reported maximum plant height at 90 DAT (58.25 cm), maximum number of secondary branches (22.66), early flowering (107.11 days), maximum flower diameter (4.74 cm), maximum flower yield, seed yield along with postharvest quality of cut flowers in China aster cv. Kamini.

Keywords: Seed priming, China aster, postharvest quality, GA_3 and $CaCl_2$

Introduction

China aster (*Callistephus chinensis* L. Nees) is an important annual flower crop grown in many parts of the world for loose flowers and cut flowers. Its position is next to chrysanthemum and marigold among all annuals (Singh and Sisodia, 2017) [17]. It belongs to Asteraceae family and its evolution has remarkable variations. The present day aster has been developed from single form of wild species, *C. chinensis*, a plant native to China (Singh and Sisodia, 2017) [17]. China aster is being popularizing rapidly in India due to easy cultural practices, a huge range of colours and various uses. Commercial production of China aster flowers is often affected by unavailability of good quality of seeds which is generally caused by adverse environmental conditions during seed development and seed maturation period (Yu-jie *et al*., 2009) [21]. Development of some techniques and methods for achieving improved seed quality in China aster is the present thrust area. Poor seed germination and subsequently, poor yield establishment are some general phenomenon at adverse conditions of the prevailing environment. To overcome this hurdle seed priming which is a water based technique that consents metabolic processes necessary for enhancing germination rate can be used as best source (Sisodia *et al.*, 2018) [19]. Hence, there is a critical need to develop some strategies and techniques to improve the inherent qualities in China aster seeds especially for enhancing seed germination rate and production of quite healthy and stocky seedlings. The present investigation was undertaken to find out the effect of various seed priming treatments in China aster cv. Kamini on growth, flowering, seed yield and postharvest quality.

Materials and methods

The present field study was carried out in the Horticulture Research Farm and postharvest study was undertaken in Postharvest Laboratory, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P.) to determine the effect of seed priming treatments on vegetative growth, flowering, yield and postharvest quality of China aster cv. Kamini. The seeds were primed for 24 hrs with different concentrations of GA_3 and $CaCl_2$ in laboratory conditions provided with no direct sunlight in Postharvest Laboratory of Department of Horticulture. Total treatments were 8 *viz.*, control, distilled water, GA_3 100,150 and 200 ppm and $CaCl_2$ 0.1%, 0.2% and 0.3%. After seed priming, seeds were dried back to reduce the excess amount of moisture which facilitates seed sowing. The seeds were sown in line on 15 cm raised nursery beds. Immediately after sowing, beds were covered with paddy straw mulch providing light irrigation. Seedlings were transplanted in the main field when they reached 4-5 leaf stage at spacing of 30 cm × 30 cm. The experiment was laid out in

Randomized Block Design (RBD) with three replications. The plants were observed on the regular basis to note the growth stage and to see any disease incidence. For postharvest study, flowers were harvested during morning hours and were brought immediately to laboratory without any damage. The observations were taken for different characters of growth, flowering and seed yield and were statistically analyzed using critical difference (CD) at 0.05% probability level.

Results and Discussion

The results of statistical analysis indicated that seed priming influenced significantly growth, flowering, yield and postharvest quality in China aster cv. Kamini (Table 1). The recorded data for plant height at seedling stage and 90 DAT, number of secondary branches, days to 50 % flowering, flower yield, seed weight and seed yield were found statistically significant due to various concentrations of GA_3 and $CaCl_2$ including control (Table 1).

Table 1: Effect of seed priming treatments on growth, flowering and seed yield in China aster cv. Kamini

Treatment	Plant height at seedling stage	Plant height at 90 DAT	No. of secondary branches	Days to first flowering	Flower diameter (cm)	Days to 50% flowering	Flower yield/ha (q)	Seed weight (g)	Seed yield/ha (kg)
Control	3.40	46.75	16.05	118.22	4.49	124.66	21.15	0.05	50.38
Distilled water	3.70	46.19	17.89	115.28	4.55	119.00	22.35	0.15	192.40
GA_3 100 ppm	5.37	48.79	19.33	110.27	4.57	115.00	27.03	0.21	172.66
GA_3 150 ppm	6.03	58.09	21.89	111.66	4.67	115.00	30.82	0.24	201.95
GA_3 200 ppm	6.36	58.26	22.66	107.11	4.74	107.66	31.06	0.27	280.92
$CaCl_2$ 0.1%	3.77	50.67	18.66	108.22	4.54	109.87	27.23	0.18	257.66
$CaCl_2$ 0.2%	4.47	53.97	19.11	109.44	4.56	110.67	27.70	0.19	149.25
$CaCl_2$ 0.3%	5.70	57.83	19.33	111.28	4.59	117.66	29.25	0.23	138.14
CD at 5%	1.03	7.58	2.60	NS	NS	9.24	5.77	0.07	76.04

Maximum plant height (6.36 cm) during seedling stage was recorded with treatment GA_3 200 ppm which was at par with treatment GA_3 150 ppm (6.03 cm), $CaCl_2$ 0.3% (5.70 cm) and GA_3 100 ppm (5.37 cm), whereas, minimum plant height was recorded with control (3.40 cm). These results were also reported by Pangtu *et al.* (2018) [9] in China aster and Anandhi and Rajmani (2012) [1] in glory lily. Similar trend was observed in later growth stage, where at 90 DAT, maximum plant height (58.26 cm) was recorded with GA_3 200 ppm which was found at par with GA_3 150 ppm (58.09 cm), $CaCl_2$ 0.3% (57.83 cm) and $CaCl_2$ 0.2% (53.97 cm), whereas, minimum plant height was recorded with distilled water (46.19 cm) and control (46.75 cm) (Table 1). Presowing treatment of seeds with GA_3 might greatly modify the growth pathway, plant physiological and metabolism related cycles resulting in constitution of biological production of vital cellular metabolites (Mazid, 2014) [6]. These results are also in agreement with Sisodia *et al.* (2012) [18] in onion, Rani and Singh (2013) [12] in tuberose and Ramzan *et al.* (2014) [11] in tulip, Pangtu *et al.* (2018) [9] in China aster and Shah *et al.* (2018) [13] in lisianthus.

Data appended in Table 1 indicates that maximum number of secondary branches (22.66) were observed with treatment GA_3 200 ppm which was at par with treatment GA_3 150 ppm (21.89), whereas, minimum number of secondary branches (16.05) were recorded with control. Maximum number of secondary branches per plant with application of GA_3 might be due to the fact that GA_3 is well known for its influential translocation and transcription mechanism of protein biosynthesis, also stimulation of cell division, cell enlargement. While increasing plasticity of cell wall and formation of phosphates full of energy that result in an increased number of productive branches. The present study was in line with the findings of Shyamal *et al.* (1990) [14] in marigold and China aster, Singh *et al.* (2017) [17] in African marigold, Pangtu *et al.* (2018) [9] and Palekar *et al.* (2018) [8] in China aster.

All treatments of GA_3 and $CaCl_2$ failed to report significant effect on early flowering and flower diameter in China aster cv. Kamini. However, among all the treatments applied, early flowering (107.11 days) and maximum flower diameter (4.74 cm) was recorded with GA_3 200 ppm, whereas, maximum days to first flowering (118.22 days) and minimum flower diameter (4.49 cm) was recorded with control. (Table 1)

Higher dose of GA_3 (200 ppm) also reported to produce 50% flowering in short duration (107.66 days) which was at par with treatment $CaCl_2$ 0.1% (109.87 days), $CaCl_2$ 0.2% (110.67 days), GA_3 150 ppm (115.00 days), and GA_3 100 ppm (115.00 days). Though, longest duration for producing 50% flowering (124.66 days) was seen in treatment control. The earliness in flowering with minimum days requirement for 50% flowering might be due to GA_3 that have stimulated and enhanced the vegetative growth by increasing photosynthesis and respiration with improved CO_2 fixation in primed seedlings which would have associated with an early flowering and induction of 50% flowering in least number of days. Moreover, GA_3 is quite influencing in reduction of juvenile period of plant. The obtained result in present study is in close conformity with the findings of Ramzan *et al.* (2014) [11] in tulip, Vijaya kumar *et al.* (2017) [20], Pangtu *et al.* (2018) [9] and Palekar *et al.* (2018) [8] in China aster and Shah *et al.* (2018) [13] in lisianthus.

Maximum flower yield per hectare (31.06 q) was recorded with treatment GA_3 200 ppm which was found at par with GA_3 150 ppm (30.82 q), $CaCl_2$ 0.3% (29.25 q), $CaCl_2$ 0.2% (27.70 q), $CaCl_2$ 0.1% (27.23 q) and GA_3 100 ppm (27.03 q), whereas, minimum flower yield per hectare (21.15 q) was recorded with control, as indicated in Table 1. This might be due to the reason that GA_3 treated plants were more vigorous and produced more number of flowers with increased flower size. These results were found similar to Pangtu *et al.* (2018) [9] and Kumar (2005) 5[5] in China aster.

Weight of seeds (obtained from 3 flowers) recorded maximum (0.27 g) with treatment GA_3 200 ppm which was found at par with GA_3 150 ppm (0.24 g), $CaCl_2$ 0.3% (0.23 g) and GA_3 100 ppm (0.21 g), whereas, minimum (0.051 g) was recorded with control, as indicated in Table 1. Similarly, maximum seed yield per hectare (280.92 kg) was recorded with treatment GA_3 200 ppm which was at par with $CaCl_2$ 0.1% (257.66 kg), whereas, minimum seed yield (50.38 kg) was recorded with control. The increase in seed yield per hectare might be due to increase in the yield attributes *viz.*, number of flowers and thousand seed weight and increase in growth parameters like number of branches per plant. Similar results were reported by Pavan kumar *et al.* (2015) [10] in China aster.

Table 2: Effect of seed priming on postharvest life in China aster cv. Kamini

Treatment	Weight of flower stalk at 1st day (g)	Weight of flower stalk at 3rd day (g)	Weight of flower stalk at 5th day (g)	Days to neck bending	Withering of 1st flower	Days to withering of 50% flowers	Stem length at 1st day (cm)	Stem length at 5th day (cm)	Water uptake at 1st day (ml)	Water uptake at 5th day (ml)
Control	5.66	2.51	1.95	2.55	3.89	3.44	27.07	26.35	4.66	9.66
Distilled water	5.79	2.64	1.73	2.44	3.89	3.66	27.11	26.72	4.89	11.55
GA_3 100 ppm	6.74	3.17	2.43	2.77	4.22	3.89	29.97	29.40	5.66	14.44
GA_3 150 ppm	7.06	4.03	2.68	2.78	4.66	4.11	30.57	30.32	6.22	15.00
GA_3 200 ppm	7.83	4.40	2.90	2.99	4.66	4.22	31.16	30.80	9.11	15.11
$CaCl_2$ 0.1%	5.97	2.82	2.20	2.55	3.99	3.77	27.37	26.80	5.33	12.33
$CaCl_2$ 0.2%	6.70	2.86	2.04	2.66	4.11	3.78	29.22	28.96	5.44	12.55
$CaCl_2$ 0.3%	6.79	3.55	2.43	2.78	4.55	3.99	30.28	29.88	5.88	14.77
CD at 5%	1.10	0.89	0.53	NS	0.57	NS	2.23	2.61	0.58	0.82

Data pertaining to Table 2 revealed that all the postharvest parameters in China aster exerted a significant effect except parameters like days to neck bending and days to withering of 50% flowers due to various treatments of GA_3 and $CaCl_2$. Maximum weight of flower stalk at 1st day (7.83 g), 3rd day (4.40 g) and 5th day (2.90 g), withering of 1st flower (4.66 days), stem length at 1st day (31.16 cm) and 5th day (30.80 cm) and water uptake at 1st day (9.11 ml) and at 5th day (15.11 cm) were registered with GA_3 200 ppm treatment which was statistically at par with GA_3 150 ppm and $CaCl_2$ 0.3% treatments and found significant to other treatments. While minimum weight of flower stalk at 1st day (5.66 g) and 3rd day (2.51 g), withering of 1st flower (3.89 days), stem length at 1st day (27.07 cm) and 5th day (26.35 cm) and water uptake at 1st day (4.66 ml) and at 5th day (9.66 cm) were obtained with control treatment.

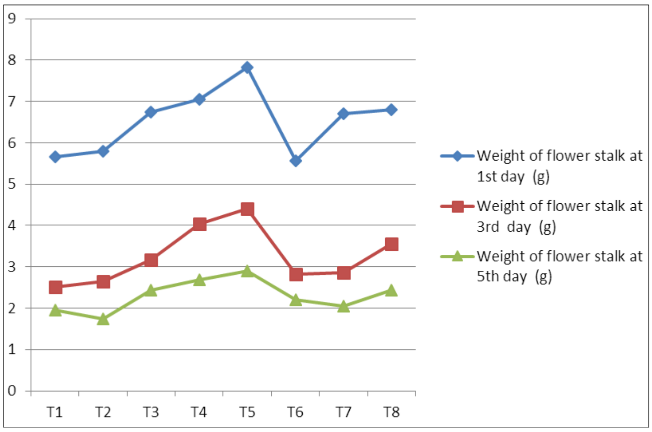

Fig 1: Effect of seed priming on weight of flower stalk of China aster during postharvest life

Gibberelic acid promotes hydrolysis of starch and sucrose (contents of dry matter) into glucose and fructose. Hence, there is decrease in dry matter constituents in flower head and stalk. The higher contents of reducing sugar in flower head and stalk may increase the osmotic potential, thus, enhancing the water absorption and maintain their turgidity which leads to prolonged postharvest life of cut flowers. These findings were supported by Emongor (2004) [3] in gerbera, Devadanam *et al.* (2007) [2] in tuberose, Mishra *et al.* (2018) [7] and Vijayakumar *et al.* (2017) [20] in China aster, Hassani and Alimirzaii (2017) [4] in cut roses and Singh *et al.* (2018) [15] in gerbera.

Conclusion

Seed priming with GA_3 200 ppm was found superior among all the priming treatments in promoting vegetative growth, flowering, yield and postharvest life of China aster. Thus, among all the priming treatments, seed priming with GA_3 200 ppm for 24 hrs can be the best priming treatment for inducing better growth, flowering and postharvest life of cut flowers in China aster.

References

1. Anandhi S, Rajamani K. Studies on seed germination and growth in *Glorios superba* (L.). Global Journal of Research on Medicinal Plants & Indigenous Medicines. 2012; 1(10):524-528.
2. Devadanam A, Shinde BN, Sable PB, Vedpathak SG. Effect of foliar spray of plant growth regulators on flowering and vase life of tuberose (*Polianthes tuberosa* L.). Journal of Soils and Crops. 2007; 17(1):86-88.
3. Emongor VE. Effects of gibberellic acid on postharvest quality and vaselife life of gerbera cut flowers (*Gerbera jamesonii*). Journal of Agronomy. 2004; 3(3):191-195.
4. Hassani RN, Alimirzaii F. Postharvest foliar application of gibberellic acid and calcium chloride improved vase life and water balance of cut rose flower cv. Velvet. Biological Forum – An International Journal. 2017; 9(1):56-61.
5. Kumar S. Evaluation of cultivars, planting dates and GA_3 on flowering and seed yield of China aster (*Callistephus chinensis* L. Nees.) varieties. M.Sc. Thesis. Department of Floriculture and Landscape Architecture. Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, 2005, 85p.
6. Mazid M. Seed priming application of gibberellic acid on growth, biochemical, yield attributes and protein status of chickpea (*Cicer arietinum* L. cv. DCP 92-3). International Journal of Genetic Engineering and Biotechnology. 2014; 5(1):17-22.
7. Mishra PP, Pandey G, Moharana DP. Influence of various concentrations of gibberellic acid (GA_3) and spraying frequencies on growth, yield and post-harvest parameters of China aster [*Callistephus chinensis* L. Nees.]. International Journal of Chemical Studies. 2018; 6(3):89-92.
8. Palekar AR, Raut VU, Watane AA, Thakre SA. Growth, flowering and quality of China aster flowers influenced by various plant growth regulators. International Journal of Chemical Studies. 2018; 6(5):1182-1184.

9. Pangtu S, Sharma BP, Dilta BS, Chaudhary SVS. Effect of seed priming on growth and flowering of China aster [*Callistephus chinensis* L. Nees.]. Agric International. 2018; 5(1):38-42.
10. Pavan Kumar K, Padmalatha T, Pratap M, Narender Reddy S. Effect of plant bio-regulators on growth, flowering and seed yield in China aster [*Callistephus chinensis* L. Nees.] cv. Kamini. Indian Journal of Agricultural Research. 2015; 49(4):348-352.
11. Ramzan F, Younis A, Riaz A, Ali S, Siddique MI, Lim KB. Pre-planting exogenous application of gibberellic acid influences sprouting, vegetative growth, flowering, and subsequent bulb characteristics of 'Ad-Rem' tulip. Horticulture, Environment and Biotechnology. 2014; 55(6):479-488.
12. Rani P, Singh N. Impact of gibberellic acid pretreatment on growth and flowering of tuberose (*Polianthes tuberosa* L.) cv. Prajwal. Journal of Tropical Plant Physiology. 2013; 5:33-41.
13. Shah MAS, Qureshi US, Chughtai S, Mehmood K. Comparison of impact induced by different priming techniques on germination and plant development in lisianthus (*Eustoma grandiflorum*). Pakistan Journal of Botany. 2018; 50(6):2159-2165.
14. Shyamal MM, Rajput CBS, Upadyay RK, Singh JN. Effect of GA_3 and MH on growth, flowering and seed yield of marigold and China aster. Indian Journal of Horticulture. 1990; 47(4):439-441.
15. Singh AK, Barman K, Sisodia A, Pal AK, Padhi M, Saurabh V. Effect of salicylic acid and nitric oxide on postharvest quality and senescence of cut gerbera flowers. Journal of Pharmacognosy and Phytochemistry. 2018; 7(5):715-719.
16. Singh AK, Kumar P, Sisodia A, Pal AK, Singh HV, Padhi M. Effect of pinching, urea and GA_3 on growth, flowering and seed attributes in African marigold (*Tagetes erecta* L.). Journal of Ornamental Horticulture. 2017; 20(1):34-39.
17. Singh AK, Sisodia A. Textbook of Floriculture and Landscaping. New India Publishing Agency, New Delhi, 2017, 304.
18. Sisodia A, Nagaich KN, Singh AK. Effect of nitrogen and GA_3 on growth, yield and yield attributes in onion (*Allium cepa*) cv. Nasik Red. Annals of Horticulture. 2012; 5(2):293-297.
19. Sisodia A, Padhi M, Pal AK, Barman K, Singh AK. Seed Priming on Germination, Growth and Flowering in Flowers and Ornamental Trees. In: Rakshit A. and Singh H. (eds). Advances in Seed Priming, Springer, Singapore, 2018, pp263-288.
20. Vijaya Kumar S, Rajadurai KR, Pandiyaraj P. Effect of plant growth regulators on flower quality, yield and postharvest shelf life of China aster [*Callistephus chinensis* L. Nees.] cv. Local. International Journal of Agricultural Science and Research. 2017; 7(2):297-304.
21. Yu-jie LJ, Dorna H, Guo SJ, Zhai MP. Effects of osmopriming and hydropriming on vigour and germination of China aster [*Callistephus chinensis* L. Nees.] seeds. Forestry Studies in China. 2009; 11(2):111-117.