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Influence of Ghana jeevamrutha and foliar application of panchagavya for growth, yield and quality of China aster (*Callistephus chinensis* [L.] Nees.)

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Abstract
The experiment on “In influence of ghana jeevamrutha and foliar application of panchagavya for growth, yield and quality of China aster (*Callistephus chinensis* [L.] Nees.)” Was carried at Department of Floriculture and Landscape Architecture, K. R. C. College of Horticulture, Arabhavi. Among all the treatments, ghana jeevamrutha applied @ 2000 kg/ha and foliar application of panchagavya @ 1 per cent (G_4P_3) was recorded significantly higher plant height (46.88 and 57.37 cm at 60 and 90 DAT, respectively), plant spread N-S (23.30 and 27.35 cm at 60 and 90 DAT, respectively), E-W (25.33 and 28.00 cm at 60 and 90 DAT, respectively) directions and number of primary branches per plant (7.72 and 10.84 at 60 and 90 DAT, respectively), number flowers (34.29/plant), flower yield (106.64 g/plant, 4.91 kg/plot and 7.27 t/ha, respectively) flower diameter (5.49 cm), individual flower weight (3.00 g), shelf life (3.39 days) and vase life (8.22 days) in pooled data.

Keywords: Ghana jeevamrutha, panchagavya, flower yield and quality

Introduction

China aster (*Callistephus chinensis* [L.] Nees.) is semi hardy crop, native of Northern China (Navalinskien *et al*., 2005) [1], a diploid plant (2n=18) and belongs to the family Asteraceae. The plants are erect with branches bearing hispid hair, leaves are of broadly ovate or triangular ovate shaped, deeply and irregularly toothed and arranged alternately on branches. The flowers are solitary; the flower head composed of two types of florets such as ray (pistillate) and disc (hermaphrodite) florets. The ray florets are long whereas, the disc florets are usually short (Rao *et al*., 2012) [11]. It is mainly used as loose flower, cut flower and as a bedding plant in landscape. For getting optimum yield and profitable cultivation of China aster, suitable production technologies are essential prerequisites besides right type of cultivar and climate. Commercial cultivation of China aster demands excessive usage of synthetic inputs leading to soil and environmental degradation and also agro-ecological imbalances. The widespread use of fertilizers and pesticides in modern farming practices resulted in pollution of soil and water bodies besides reduced input efficiency. So organic and natural farming is needed now a days for maintaining soil and environmental health.

Jeevamrutha, ghana jeevamrutha and panchagavya prepared out of desi cow dung and urine contain macronutrients, essential micro nutrients, vitamins, essential amino acids, growth promoting substances including IAA, GA and beneficial microorganisms (Ali *et al*., 2011) [1]. Jeevamrutha is prepared from available farm wastes like cow dung and cow urine of desi cow along with other ingredients like jaggery, pulse flour, hand ful of native soil and water. Panchagavya is prepared from desi cow dung, cow ghee, cow urine, cow milk, cow curd, jaggery, tender coconut water and ripened banana. It is an important organic liquid formulation that provides a congenial environment to microorganisms upon its application to the soil which helps in making essential nutrients available for plant growth and development of the crop *viz*., nitrogen, phosphorus and potassium to the plants (Palekar, 2006) [9]. Jeevamrutha is a low cost improvised preparation that enriches the soil with indigenous microorganisms that are necessary for soil mineralization. It is a fermented microbial culture. It offers nutrients but more significantly, it works as a catalytic agent, promoting the activity of soil microbes and increasing earthworm activity. Keeping these points in view, the present investigation was undertaken with objective to study the influence of ghanajeevamrutha and foliar application of panchagavya for growth, yield and quality of China aster (*Callistephus* *chinensis* [L.] Nees.).

Material and Methods

The present investigation was carried out at Kittur Rani Channamma College of Horticulture Arabhavi, Karnataka, under the University of Horticultural Sciences, Bagalkot during *Rabi* 2020-21 and *Kharif* 2021-22. The experiment was laid out in two Factorial Randomized Block Design with fourteen treatments (4×3+2) and three replications. Factor-A includes dosage of ghana jeevamrutha (D) at four levels *i.e*., G_1: 500 Kg/ha, G_2: 1000 Kg/ha G_3: 1500 Kg/ha and G_4: 2000 Kg/ha Factor-B includes foliar application of panchagavya (P) at three concentration *i.e*., P_1: 0.3%, P_2: 0.5% and P_3: 1% and these treatment combinations were compared with control treatment *i.e*., INM: Integrated nutrient management (50% RDN through FYM (9 t/ha) + 50% RDN through inorganic fertilizer (45 kg N/ha) + 120 kg P/ha + K @ 60 Kg/ha + 20 t FYM/ha + *Azospirillum* @ 2.5 kg/ha + PSB @ 2.5 kg/ha and RPP: Recommended package of practice (NPK @ 90:120:60 kg/ha + 20 t FYM/ha). The treatment details were given in table 1. Vegetative parameter like plant height, plant spread (N-S and E-W) and number of primary branches were taken at 30, 60 and 90 days after planting.

Table 1: Treatment combinations (G x P)

T_1	G_1P_1	Application of ghana jeevamrutha @ 500 kg/ha + foliar application of panchagavya @ 0.3%.
T_2	G_1P_2	Application of ghana jeevamrutha @ 500 kg/ha + foliar application of panchagavya @ 0.5%.
T_3	G_1P_3	Application of ghana jeevamrutha @ 500 kg/ha + foliar application of panchagavya @ 1%.
T_4	G_2P_1	Application of ghana jeevamrutha @ 1000 kg/ha + foliar application of panchagavya @ 0.3%.
T_5	G_2P_2	Application of ghana jeevamrutha @ 1000 kg/ha + foliar application of panchagavya @ 0.5%.
T_6	G_2P_3	Application of ghana jeevamrutha @ 1000 kg/ha + foliar application of panchagavya @ 1%.
T_7	G_3P_1	Application of ghana jeevamrutha @ 1500 kg/ha + foliar application of panchagavya @ 0.3%.
T_8	G_3P_2	Application of ghana jeevamrutha @ 1500 kg/ha + foliar application of panchagavya @ 0.5%.
T_9	G_3P_3	Application of ghana jeevamrutha @ 1500 kg/ha + foliar application of panchagavya @ 1%.
T_{10}	G_4P_1	Application of ghana jeevamrutha @ 2000 kg/ha + foliar application of panchagavya @ 0.3%.
T_{11}	G_4P_2	Application of ghana jeevamrutha @ 2000 kg/ha + foliar application of panchagavya @ 0.5%.
T_{12}	G_4P_3	Application of ghana jeevamrutha @ 2000 kg/ha + foliar application of panchagavya @ 1%.
T_{13}	INM	Integrated nutrient management (INM) (50% RDN through FYM (9 t/ha) + 50% RDN through inorganic fertilizer (45kg N/ha) + P @ 120 kg/ha + K @ 60 kg/ha + 20 t FYM/ha + *Azospirillum* @ 2.5 kg/ha + PSB @ 2.5 kg/ha).
T_{14}	RPP	Recommended package of practice (RPP). (NPK @ 90:120:60 kg/ha + 20t FYM/ha).

Note: Beejamrutha treatment, ghana jeevamrutha @ 1000 kg per hectare at the time of planting and application of mulch was common to all the treatments except T_{13} and T_{14}, treatments were imposed after 15 DAT

Results and Discussion

Dosage of Ghana jeevamrutha and panchagavya affected the vegetative parameters significantly. It was revealed that, the dosage of Ghana jeevamrutha @ 2000 kg per hectare (G_4) and foliar application of panchagavya @ 1 per cent (P_3) was found better in influencing the growth parameters significantly than other levels. Based on the pooled analysis of the two years data, it was recorded that significantly highest plant height (42.53 and 52.84 cm at 60 and 90 DAT, respectively), plant spread N-S (23.34 and 26.22 cm at 60 and 90 DAT, respectively), E-W (21.65 and 25.90 cm at 60 and 90 DAT, respectively) and number of primary branches per plant (6.49 and 10.34 at 60 and 90 DAT, respectively) were recorded in G_4 (ghana jeevamrutha applied @ 2000 kg/ha). Similarly, foliar application of panchagavya @ 1 per cent (P_3) also recorded higher plant height (44.15 cm and 54.93 cm at 60 and 90 DAT, respectively), plant spread N-S (23.21 and 25.08 cm at 60 and 90 DAT, respectively) and E-W (19.51 and 27.04 cm at 60 and 90 DAT, respectively) directions and number of primary branches per plant (6.35 and 7.92 at 60 and 90 DAT, respectively). It was found that interaction treatments between ghana jeevamrutha applied @ 2000 kg per hectare and foliar application of panchagavya @ 1 per cent (G_4P_3) also resulted significantly highest plant height (46.88 and 57.37 cm at 60 and 90 DAT, respectively), plant spread N-S (23.30 and 27.35 cm at 60 and 90 DAT, respectively), E-W (25.33 and 28.00 cm at 60 and 90 DAT, respectively) directions and number of primary branches per plant (7.72 and 10.84 at 60 and 90 DAT, respectively) in pooled data (Table 2).

Among different interaction treatments, the plants treated with Ghana jeevamrutha @ 2000 kg/ha and foliar application of panchagavya @ 1 per cent (G_4P_3) was record the maximum values for all the vegetative parameters. Higher growth parameters with Ghana jeevamrutha application were due to the presence of growth promoting substances and beneficial microorganisms apart from having both macro and micro nutrients. Similarly, increase in growth parameters were also observed with increased levels of Ghana jeevamrutha application in one of the study involving field bean (Devakumar *et al*., 2008) [3]. Panchagavya stimulated growth by raising plant height and spread by increasing the synthesis of phytohormones like auxins and gibberellins. The presence of growth enzymes like GA_3 oxidase and GA_2 oxidase in panchagavya could be the explanation for the enhanced growth characteristics, which favoured rapid cell division and multiplication while also assisting in the improvement in plant biological efficiency. As a result, the required growth and development of plants was boosted, resulting in increased output. Similar findings were observed in the study by Naik *et al*. (2013) [7] in cymbidium orchids and Pruthvi *et al*. (2018) [10] in Chrysanthemum.

The RPP and INM were compared with other interaction treatments it was revealed that, significantly higher in INM plant height (30.28, 65.80 and 75.63 cm at 30, 60 and 90 DAT, respectively), plant spread N-S (23.73, 33.09 and 36.61 cm at 30, 60 and 90 DAT, respectively), plant spread E-W (22.62, 32.61 and 36.70 cm 30, 60 and 90 DAT, respectively) and number of primary branches per plant (5.21, 9.82 and 13.35 at 30, 60 and 90 DAT, respectively) and also in RPP plant height (27.06, 60.84 and 71.10 cm at 30, 60 and 90 DAT, respectively), plant spread N-S (22.72, 30.01 and 34.72 cm at 30, 60 and 90 DAT, respectively), plant spread E-W (20.72, 30.92 and 34.18 cm at 30, 60 and 90 DAT, respectively) and number of primary branches per plant (5.09, 9.60 and 12.67 at 30, 60 and 90 DAT, respectively) than other interaction treatments. Application of fertilizers might have helped in more uptake of nitrogen and other nutrients from the soil which in turn increased the growth parameters and the same could be attributed to better proliferation of root and increased growth habit due to better availability of nutrients. These findings are in accordance with those reported by Laxmi *et al.* (2015) [6] in tomato and also this might be due to readily available nitrogen from fertilizers and its supply from organic source (FYM) throughout the crop growth period along with improvement in soil physical and chemical properties which resulted in increasing the growth parameters. Flower yield parameters like number of flowers per plant and flower yield differed significantly by different dosage of Ghana jeevamrutha and panchagavya application (Table 3). Significantly maximum number of flowers per plant and flower yield (31.55/plant, 97.50 g/plant, 4.72 kg/plot and 7.00 t/ha, respectively) were recorded in G_4 (Ghana jeevamrutha applied @ 2000 kg/ha), P_3 (foliar application of panchagavya 1%) (30.18/plant, 90.73 g/plant, 3.79 kg/plot and 5.60 t/ha, respectively) and in the interaction treatment G_4P_3 (Ghana jeevamrutha applied @ 2000 kg/ha and foliar application of panchagavya @ 1%) (34.29/plant, 106.64 g/plant, 4.91 kg/plot and 7.27 t/ha, respectively) in pooled data. One of the ingredients of panchagavya was coconut water, which contains kinetin and it's foliar spray might have increased the biomass and yield in China aster. Similar observations were made by, Singh *et al*. (2007) [15] in tuberose and Sendhilnathan *et al.* (2021) [12] in celosia who opined that, panchagavya could have acted as stimuli in the plant system which in turn increased the production of growth regulator in cell system and the action of growth regulators in plant system stimulated the necessary growth and development leading to better yield. The beneficial effect of Ghana jeevamrutha was found on the production of more vigorous and extensive root system leading to increased vegetative growth and efficient sink formation. Further it led to greater sink size and greater carbohydrate translocation from vegetative to flowering period. It also increased biological efficiency of crop plants and enhanced enzyme activities in soil and promoted the recycling of soil nutrients in

Table 2: Growth parameters in China aster var. AAC-1 at different growth stages as influenced by Ghana jeevamrutha and foliar application of panchagavya

Treatment	Pooled data											
	Plant height (cm)			Plant spread (cm) (North-South)			Plant spread (cm) (East-West)			Number of primary branches		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
Factor A: Dosage of Ghana jeevamrutha (G)												
G_1: 500 kg/ha	15.94	38.97^{d}	48.97^{d}	11.48	20.77^{d}	23.48^{c}	11.48	16.62^{d}	22.23^{d}	3.08	4.18^{c}	5.76^{d}
G_2: 1000 kg/ha	15.17	40.17^{c}	50.53^{c}	12.28	21.09^{c}	24.63^{b}	12.28	18.40^{c}	24.26^{c}	3.22	5.47^{b}	7.14^{c}
G_3: 1500 kg/ha	15.62	40.91^{b}	51.44^{b}	14.40	21.68^{b}	25.72^{a}	14.40	19.17^{b}	25.07^{b}	3.24	6.16^{a}	8.10^{b}
G_4: 2000 kg/ha	16.63	42.53^{a}	52.84^{a}	15.15	23.34^{a}	26.22^{a}	15.15	21.65^{a}	25.90^{a}	3.44	6.49^{a}	10.34^{a}
S.Em±	0.92	0.20	0.20	1.45	0.27	0.25	1.45	0.09	0.02	0.21	0.14	0.15
C.D. @ 5%	NS	0.57	0.57	NS	0.80	0.78	NS	0.28	0.06	NS	0.40	0.43
Factor B: Foliar application of panchagavya (P)												
P_1: 0.3%	14.30	39.63^{c}	46.13^{c}	13.15	20.55^{b}	22.97^{c}	13.15	18.43^{c}	23.13^{c}	2.78	4.64^{c}	6.65^{c}
P_2: 0.5%	15.47	42.18^{b}	51.13^{b}	13.04	22.63^{a}	24.00^{b}	13.04	18.94^{b}	24.72^{b}	3.01	5.54^{b}	7.31^{b}
P_3: 1%	17.54	44.15^{a}	54.93^{a}	12.84	23.21^{a}	25.08^{a}	12.84	19.51^{a}	27.04^{a}	3.66	6.35^{a}	7.92^{a}
S.Em±	1.06	0.23	0.23	0.36	0.24	0.27	0.36	0.12	0.03	0.24	0.12	0.13
C.D. @ 5%	NS	0.66	0.66	NS	0.70	0.79	NS	0.32	0.10	NS	0.35	0.37
Interaction (G x P)												
G_1 P_1	14.18	35.86^{f}	44.80^{g}	12.26	18.15^{d}	21.51^{e}	11.66	20.32^{f}	22.66^{f}	3.00	5.16^{f}	6.34^{h}
G_1 P_2	13.78	36.76^{ef}	45.90^{fg}	12.15	18.74^{cd}	22.99^{de}	12.21	20.84^{ef}	23.15^{f}	2.70	5.31^{e}	6.56^{g}
G_1 P_3	13.88	37.63^{e}	48.40^{de}	12.55	19.10^{cd}	23.10^{cde}	12.05	21.00^{ef}	23.25^{ef}	2.90	5.48^{d}	6.82^{efg}
G_2 P_1	15.37	38.03^{e}	47.93^{ef}	13.19	19.00^{cd}	22.07^{cde}	13.00	21.12^{de}	23.50^{de}	2.94	6.17^{d}	7.15^{de}
G_2 P_2	15.32	38.83^{de}	48.73^{de}	13.47	19.67^{c}	23.19^{cd}	13.44	20.82^{de}	23.92^{de}	3.07	6.40^{c}	8.24^{de}
G_2 P_3	14.50	41.13^{cd}	51.40^{cd}	13.77	20.37^{b}	24.14^{cd}	13.20	20.95^{de}	24.18^{d}	3.20	6.60^{cd}	8.39^{bcd}
G_3 P_1	15.50	41.25^{cd}	51.23^{cd}	15.60	20.95^{b}	24.34^{bcd}	14.28	21.93^{de}	25.00^{cd}	3.12	7.15^{c}	8.58^{bcd}
G_3 P_2	16.54	42.60^{bc}	53.20^{c}	15.48	20.45^{bc}	25.06^{abc}	14.91	22.25^{cde}	25.80^{cd}	2.85	7.27^{bc}	9.01^{bcd}
G_3 P_3	17.50	42.90^{b}	53.37^{bc}	15.77	21.16^{bc}	25.40^{abc}	14.08	23.05^{cd}	26.14^{bc}	3.15	7.33^{bc}	9.02^{bc}
G_4 P_1	17.80	42.64^{b}	54.30^{bc}	16.38	22.56^{b}	26.11^{ab}	15.20	23.89^{bc}	26.66^{bc}	3.75	7.46^{ab}	9.77^{b}
G_4 P_2	17.46	43.34^{ab}	54.69^{a}	15.98	22.38^{b}	26.19^{ab}	15.33	24.36^{ab}	26.98^{ab}	3.84	7.70^{a}	10.33^{a}
G_4 P_3	17.98	46.88^{a}	57.37^{a}	16.34	23.30^{a}	27.35^{a}	15.75	25.33^{a}	28.00^{a}	3.92	7.72^{a}	10.84^{a}
S.Em±	1.85	0.39	0.39	1.56	0.24	0.21	1.26	0.19	0.04	0.45	0.08	0.25
C.D. @ 5%	NS	1.15	1.15	NS	0.72	0.64	NS	0.56	0.12	NS	0.24	0.74
INM	30.28	65.80	75.63	23.73	33.09	36.61	22.62	32.61	36.70	5.21	9.82	13.35
RPP	27.06	60.84	71.70	22.72	30.01	34.72	20.72	30.92	34.18	5.09	9.60	12.67
S.Em±	1.78	0.38	0.38	0.80	0.49	0.53	0.25	0.21	0.11	0.40	0.25	0.11
C.D. @ 5%	5.17	1.11	1.09	2.31	1.40	1.54	0.75	0.62	0.35	1.16	0.71	0.31

Note: INM: Integrated nutrient management (50% RDN through FYM (9 t/ha) + 50% RDN through inorganic fertilizer (45 kg N/ha) + 120 kg P/ha + K @ 60 Kg/ha + 20 t FYM/ha + *Azospirillum* @ 2.5 kg/ha + PSB @ 2.5 kg/ha RPP: Recommended package of practice (NPK @ 90:120:60 kg/ha + 20 t FYM/ha) DAT: Days after transplanting NS: Non-significant.

Table 3: Yield parameters in China aster var. AAC-1 as influenced by Ghana jeevamrutha and foliar application of panchagavya

Treatment	Number of flowers/plant			Flower yield/plant (g)			Flower yield/ plot (kg)			Flower yield/ hectare (t)		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Factor A: Dosage of Ghana jeevamrutha (G)												
G_1: 500 kg/ha	25.77^{d}	23.09^{d}	24.43^{d}	67.26^{d}	63.99^{d}	65.63^{d}	3.62^{d}	2.32^{d}	2.47^{d}	3.87^{d}	3.44^{d}	3.65^{d}
G_2: 1000 kg/ha	27.56^{c}	25.55^{c}	26.55^{c}	74.68^{c}	69.56^{c}	72.12^{c}	3.91^{c}	2.92^{c}	3.41^{c}	4.66^{c}	4.33^{c}	4.49^{c}
G_3: 1500 kg/ha	30.58^{b}	27.44^{b}	29.01^{b}	88.22^{b}	75.88^{b}	82.05^{b}	4.36^{b}	3.65^{b}	4.00^{b}	5.86^{b}	5.41^{b}	5.63^{b}
G_4: 2000 kg/ha	32.82^{a}	30.28^{a}	31.55^{a}	99.17^{a}	95.83^{a}	97.50^{a}	4.85^{a}	4.59^{a}	4.72^{a}	7.19^{a}	6.80^{a}	7.00^{a}
S.Em±	0.35	0.20	0.27	1.06	0.57	0.56	0.04	0.04	0.03	0.05	0.06	0.04
C.D. @ 5%	1.04	0.59	0.79	3.11	1.68	1.65	0.15	0.12	0.09	0.15	0.18	0.13
Factor B: Foliar application of panchagavya (P)												
P_1: 0.3%	26.66^{c}	25.64^{c}	26.15^{c}	63.55^{c}	60.62^{c}	62.91^{c}	4.09^{c}	3.12^{c}	3.27^{c}	5.05^{c}	4.62^{c}	4.84^{c}
P_2: 0.5%	29.39^{b}	27.18^{b}	28.28^{b}	88.57^{b}	76.42^{b}	82.48^{b}	4.24^{b}	3.34^{b}	3.47^{b}	5.32^{b}	4.95^{b}	5.13^{b}
P_3: 1%	31.49^{a}	28.88^{a}	30.18^{a}	100.37^{a}	81.09^{a}	90.73^{a}	4.30^{a}	3.65^{a}	3.79^{a}	5.80^{a}	5.40^{a}	5.60^{a}
S.Em±	0.31	0.18	0.23	0.92	0.50	0.49	0.03	0.03	0.03	0.05	0.05	0.04
C.D. @ 5%	0.90	0.57	0.69	2.69	1.45	1.43	0.09	0.10	0.08	0.13	0.15	0.11
Interaction (G x P)												
G_1 P_1	23.50^{e}	21.80^{d}	22.65^{h}	67.70^{j}	64.19^{i}	65.95^{i}	3.50^{h}	3.09^{h}	3.30^{j}	5.19^{h}	4.44^{h}	4.82^{j}
G_1 P_2	25.93^{de}	23.52^{cd}	24.73^{g}	68.17^{i}	66.33^{i}	67.25^{i}	3.61^{gh}	3.11^{h}	3.36^{ij}	5.35^{g}	4.56^{h}	4.96^{ij}
G_1 P_3	27.83^{de}	23.95^{bc}	25.89^{efg}	68.96^{hi}	66.30^{h}	67.63^{h}	3.65^{g}	3.18^{h}	3.42^{i}	5.41^{g}	4.71^{h}	5.06^{i}
G_2 P_1	25.87^{de}	24.13^{cd}	25.00^{g}	70.47^{hi}	68.27^{g}	69.37^{h}	3.75^{g}	3.21^{g}	3.48^{h}	5.56^{g}	4.76^{g}	5.16^{h}
G_2 P_2	27.37^{cd}	25.43^{bc}	26.40^{fg}	73.10^{gh}	70.07^{g}	71.59^{g}	3.98^{f}	3.44^{f}	3.71^{g}	5.90^{f}	5.10^{f}	5.50^{g}
G_2 P_3	29.43^{bc}	27.10^{bc}	28.27^{cd}	74.17^{fg}	73.17^{f}	73.67^{f}	4.01^{e}	3.51^{e}	3.76^{f}	5.94^{f}	5.20^{e}	5.57^{f}
G_3 P_1	27.47^{bcd}	25.13^{bc}	26.30^{def}	75.08^{ef}	71..87^{f}	73.48^{f}	4.21^{de}	3.65^{d}	3.93^{e}	6.21^{e}	5.78^{d}	5.99^{e}
G_3 P_2	30.47^{b}	28.10^{b}	29.29^{cde}	79.93^{de}	75.07^{e}	77.50^{e}	4.35^{d}	3.95^{d}	4.15^{e}	6.44^{e}	5.85^{cd}	6.14^{e}
G_3 P_3	32.23^{ab}	29.10^{ab}	30.17^{b}	82.97^{d}	80.72^{d}	81.85^{d}	4.51^{c}	4.01^{c}	4.26^{d}	6.68^{d}	5.89^{c}	5.28^{d}
G_4 P_1	33.73^{ab}	31.52^{ab}	32.63^{c}	93.70^{c}	90.19^{c}	91.95^{c}	4.81^{b}	4.49^{c}	4.65^{c}	7.13^{c}	5.91^{c}	6.52^{c}
G_4 P_2	34.80^{a}	31.65^{ab}	33.23^{ab}	99.73^{b}	95.21^{b}	97.47^{b}	4.99^{a}	4.60^{a}	4.79^{a}	7.31^{b}	6.07^{b}	6.69^{b}
G_4 P_3	36.87^{a}	33.70^{a}	34.29^{a}	109.10^{a}	104.17^{a}	106.64^{a}	5.02^{a}	4.80^{a}	4.91^{a}	7.44^{a}	7.11^{a}	7.27^{a}
S.Em±	0.61	0.39	0.47	1.84	0.99	0.97	0.06	0.07	0.05	0.09	0.10	0.08
C.D. @ 5%	1.79	1.15	1.37	5.39	2.91	2.86	0.18	0.20	0.15	0.27	0.30	0.23
INM	50.21	45.21	47.61	149.21	140.32	144.77	7.10	6.55	6.83	10.85	9.71	10.28
RPP	45.96	40.10	42.98	141.32	138.21	139.77	6.78	5.94	6.36	10.01	8.80	9.40
S.Em±	1.05	0.46	0.59	1.84	1.57	1.62	0.12	0.22	0.17	0.17	0.31	0.25
C.D. @ 5%	3.54	1.35	1.72	5.34	4.56	4.86	0.34	0.67	0.52	0.53	0.95	0.76

Note: INM: Integrated nutrient management (50% RDN through FYM (9 t/ha) + 50% RDN through inorganic fertilizer (45 kg N/ha) + 120 kg P/ha + K @ 60 Kg/ha + 20 t FYM/ha + *Azospirillum* @ 2.5 kg/ha + PSB @ 2.5 kg/ha RPP: Recommended package of practice (NPK @ 90:120:60 kg/ha +20 t FYM/ha)

Table 4: Flower diameter, individual flower weight, shelf life and vase life in China aster var. AAC-1 as influenced by Ghana jeevamrutha and foliar application of panchagavya

Treatment	Flower diameter (cm)			Individual flower weight (g)			Shelf life (Days)			Vase life (Days)		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Factor A: Dosage of Ghana jeevamrutha (G)												
G_1: 500 kg/ha	3.71^{c}	3.62^{d}	3.67^{d}	2.50^{c}	2.57^{d}	2.53^{d}	1.98^{b}	2.37^{b}	2.17^{b}	4.46^{c}	6.22^{c}	5.34^{d}
G_2: 1000 kg/ha	4.03^{b}	4.70^{c}	4.37^{c}	2.58^{c}	2.61^{c}	2.59^{c}	2.03^{b}	2.50^{b}	2.26^{b}	5.93^{b}	6.98^{b}	6.46^{c}
G_3: 1500 kg/ha	4.45^{a}	5.32^{b}	4.89^{b}	2.77^{b}	2.98^{b}	2.87^{b}	2.64^{a}	2.78^{a}	2.73^{a}	7.14^{a}	7.19^{b}	7.16^{b}
G_4: 2000 kg/ha	4.75^{a}	5.83^{a}	5.29^{a}	3.12^{a}	3.51^{a}	3.31^{a}	2.68^{a}	2.81^{a}	2.76^{a}	7.20^{a}	8.30^{a}	7.72^{a}
S.Em±	0.09	0.10	0.10	0.09	0.05	0.07	0.07	0.07	0.06	0.15	0.14	0.06
C.D. @ 5%	0.25	0.29	0.27	0.26	0.14	0.20	0.20	0.21	0.17	0.43	0.42	0.18
Factor B: Foliar application of panchagavya (P)												
P_1: 0.3%	3.73^{c}	4.13^{c}	4.13^{c}	2.39^{c}	2.52^{c}	2.46^{c}	2.01^{c}	2.40^{c}	2.20^{c}	5.68^{c}	6.58^{c}	4.13^{c}
P_2: 0.5%	4.02^{b}	4.75^{b}	4.39^{b}	2.62^{b}	2.73^{b}	2.68^{b}	2.36^{b}	2.62^{b}	2.49^{b}	6.09^{b}	7.21^{b}	6.65^{b}
P_3: 1%	4.96^{a}	5.32^{a}	5.14^{a}	2.94^{a}	2.95^{a}	2.95^{a}	2.63^{a}	2.83^{a}	2.73^{a}	6.76^{a}	7.73^{a}	7.24^{a}
S.Em±	0.07	0.09	0.08	0.08	0.04	0.06	0.06	0.06	0.05	0.13	0.13	0.07
C.D. @ 5%	0.22	0.25	0.24	0.22	0.12	0.17	0.17	0.18	0.15	0.37	0.37	0.20
Interaction (G x P)												
G_1 P_1	3.33^{e}	3.43^{e}	3.38^{e}	2.33^{c}	2.41^{def}	2.37^{de}	1.80^{f}	2.17^{d}	1.99^{f}	3.97^{f}	5.37^{f}	4.67^{g}
G_1 P_2	3.53^{de}	3.67^{e}	3.60^{e}	2.35^{c}	2.45^{def}	2.40^{de}	1.90^{f}	2.30^{cd}	2.10^{ef}	4.30^{f}	6.03^{ef}	5.17^{g}
G_1 P_3	3.97^{de}	3.77^{e}	3.87^{e}	2.39^{c}	2.51^{de}	2.45^{cd}	2.00^{ef}	2.33^{cd}	2.17^{ef}	5.10^{e}	6.37^{bc}	5.74^{fg}
G_2 P_1	3.67^{de}	4.43^{d}	4.05^{d}	2.45^{c}	2.54^{cde}	2.50^{c}	2.00^{ef}	2.47^{cd}	2.24^{ef}	5.60^{e}	6.73^{cde}	6.17^{f}
G_2 P_2	3.87^{cd}	4.57^{d}	4.22^{cd}	2.53^{c}	2.61^{cd}	2.57^{c}	2.13^{bcd}	2.50^{bcd}	2.32^{def}	5.83^{de}	7.07^{cd}	6.45^{ef}
G_2 P_3	4.17^{c}	5.09^{c}	4.63^{c}	2.63^{bc}	2.71^{bc}	2.67^{bc}	2.15^{bcd}	2.58^{cd}	2.37^{def}	6.37^{cd}	7.13^{c}	6.75^{de}
G_3 P_1	3.67^{de}	4.59^{d}	4.13^{d}	2.70^{bc}	2.73^{bc}	2.72^{cd}	2.20^{def}	2.63^{b}	2.42^{cde}	6.47^{cd}	7.20^{bc}	6.84^{de}
G_3 P_2	4.10^{c}	5.17^{c}	4.64^{c}	2.71^{bc}	2.78^{bcd}	2.75^{bc}	2.20^{def}	2.70^{bc}	2.45^{bcd}	6.59^{cd}	7.27^{bc}	6.93^{de}
G_3 P_3	4.52^{bc}	5.60^{bc}	4.89^{bc}	2.73^{abc}	2.99^{b}	2.86^{b}	2.63^{abc}	2.83^{ab}	2.73^{b}	7.03^{bc}	7.87^{ab}	7.45^{bc}

$G_4 P_1$	4.27^{bc}	5.51^{bc}	5.06^{ab}	2.77^{abc}	2.78^{b}	2.78^{ab}	2.67^{abc}	2.87^{ab}	2.77^{bc}	7.43^{ab}	8.00^{ab}	7.72^{ab}
$G_4 P_2$	4.57^{b}	5.73^{a}	5.15^{a}	3.80^{a}	3.01^{a}	2.91^{a}	3.07^{a}	3.11^{a}	3.09^{a}	7.63^{a}	8.23^{a}	7.93^{a}
$G_4 P_3$	5.12^{a}	5.86^{a}	5.49^{a}	2.89^{a}	3.11^{a}	3.00^{a}	3.27^{a}	3.50^{a}	3.39^{a}	7.93^{a}	8.50^{a}	8.22^{a}
S.Em±	0.15	0.17	0.16	0.06	0.05	0.06	0.12	0.13	0.11	0.25	0.25	0.12
C.D. @ 5%	0.43	0.50	0.47	0.18	0.15	0.17	0.36	0.39	0.33	0.74	0.73	0.34
INM	6..52	6.70	6.61	3.32	3.51	3.42	2.82	2.90	2.86	7.20	6.73	6.97
RPP	6.11	6.52	6.32	3.22	3.49	3.36	2.10	2.27	2.33	5.80	6.83	6.32
S.Em±	0.14	0.18	0.16	0.18	0.02	0.12	0.15	0.13	0.12	0.24	0.25	0.18
C.D. @ 5%	0.42	0.51	0.47	0.52	0.07	0.36	0.44	0.37	0.33	0.69	0.73	0.35

Note: INM: Integrated nutrient management (50% RDN through FYM (9 t/ha) + 50% RDN through inorganic fertilizer (45 kg N/ha) + 120 kg P/ha + K @ 60 Kg/ha + 20 t FYM/ha + *Azospirillum* @ 2.5 kg/ha + PSB @ 2.5 kg/ha RPP: Recommended package of practice (NPK @ 90:120:60 kg/ha +20 t FYM/ha)

the ecosystem, improvement in the absorptive power of cat ions and anions present on soil particles. Similar findings were also reported by Kumar *et al*. (2011) [5].

It was found that significantly maximum number of flowers per plant and flower yield were recorded in INM (47.61/plant, 144.77 g, 6.83 kg and 10.28 t/ha, respectively) and RPP (42.98/plant, 139.77 g/plant, 6.36 kg kg/plot and 9.40 t/ha, respectively) than all other interaction treatments in pooled data. Higher yield in INM was due to Inoculation of *Azospirillum* and PSB enhanced the cell division and enlargement and also produced growth hormones, which is possible reason for increased growth. *Azospirillum* through atmospheric nitrogen fixation, better root proliferation, uptake of nutrients and water. More photosynthesis enhanced food accumulation which might have resulted in better growth and subsequently higher number of flower per plant and hence, more number of flower yield per hectare. Besides this, increase in flower yield may be attributed to increased availability of phosphorus and its greater uptake by PSB. The results were in confirmatity with Jogi *et al*. (2020) [4] in China aster. The increased yield in RPP was due to application of nutrients through FYM and fertilizers might be attributed to the quick release and availability of nutrients in required quantity with the application of both fertilizers and organic manures (FYM). Further, FYM acts as store house of various micro and macro nutrients that are released during the process of mineralization. Further, the earlier workers reiterated the importance of integrated nutrient management to maintain long term soil fertility for sustenance of crop yield (Anusha *et al*., 2018) [2].

In pooled data, the flower diameter, and individual flower weight was recorded significantly more in G_4 (Ghana jeevamrutha applied @ 2000 kg/ha) *i.e.*, 5.29 cm and 3.31 g and respectively, P_3 (foliar application of panchagavya @ 1%) *i.e.*, 5.14 cm and 2.95 g, respectively and the interaction of Ghana jeevamrutha applied @ 2000 kg/ha and foliar application of panchagavya @ 1 per cent (G_4P_3) *i.e.*, 5.49 cm and 3.00 g, respectively than other dosages of Ghana jeevamrutha and foliar application of panchagavya. This might be due to the response of crop to organic manures which might have helped in promotion of cell proliferation efficiently.

The maximum flower diameter and individual flower weight was recorded higher in INM (6.61 cm and 3.42 g, respectively) and RPP (6.32 cm and 3.36 g, respectively) than rest of the interaction treatments of Ghana jeevamrutha and panchagavya application (Table 4). Application of biofertilizer helps in proper uptake of nutrients by plants and their better translocation to the flowers (Tayeng, 2010) [17]. Chemical fertilizers helps in cell division and cell enlargement are accelerated by ample supply of nitrogen which initiates meristematic activity in crop. This might be due to accelerated mobility of photosynthates from the source to the sink as influenced by the growth hormone released or synthesized due to the sources of fertilizers. These results are in conformity with those of Sutagundi, (2000) [16] and Shukla *et al.* (2014) [14].

Shelf life (3.39 days) and vase life (8.22 days) of a flower is an important parameter which decides the keeping quality of flowers. In the present investigation Ghana jeevamrutha applied @ 2000 kg per hectare and foliar application of panchagavya @ 1 per cent recorded significantly higher shelf life and vase life of flower than other levels. The higher shelf life and vase life of China aster flowers might be due to application of organic manures which influenced flower longevity due to the increased nutrient uptake by plant and greater development of water conducting tissues (Singh *et al*, 2015). Panchagavya and jeevamrutha are organic substances that can promote growth and boost immunity. It has a vital role in extending the shelf life and vase life, and reduce the loss of moisture content from flowers. The results are in conformity with the finding of Sendhilnathan *et al.* (2017) [13] in marigold.

Conclusion

From the present investigation it can be concluded that, application of Ghana jeevamrutha @ 2000 kg per hectare and foliar application of panchagavya @ 1 per cent resulted in significantly higher vegetative growth, flower weight, flower diameter, more shelf life and flower yield per hectare. However, INM and RPP registered significantly highest flower yield per hectare with good vegetative growth, flower weight and flower yield per hectare.

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