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Effect of Ghanjeevamrit on growth and flower yield attributes of China aster (*Callistephus chinensis* L. Nees) under organic production system

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Abstract
A field experiment was conducted on China aster cv. Kamini during 2022 at Instructional Horticultural Farm, COA, IGKV, Raipur (C.G.). This experiment was laid out in open field in a Randomized Block Design with 10 treatments which replicated thrice. Different treatment combination of organic manures and biofertilizers was applied to assess the growth and yield characteristics of China aster. Among the various organic treatment combinations, application of 100% RDF through FYM + Ghanjeevamrit@250 kg/ha + *Azotobacter*@2 kg/ha + PSB@ 2 kg/ha (T5) was significantly increasing the plant growth characters *viz.* plant height (39.2 cm), plant spread (19.9 cm in N-S and 24.4 cm in E-W), number of primary branches plant^{-1} (12.40), number of leaves plant^{-1} (126.4)) and flower and yield parameters *viz.* days taken to first flower bud appearance (96.27 days), days taken to 50% flowering (122.4 days), diameter of flower (3.74 cm), number of flowers plant^{-1} (34.33), fresh weight of flowers plant^{-1} (41.67 g), average weight of flower plant^{-1} (1.30 g), flower yield plot^{-1} (0.50 kg), flowers yield ha^{-1} (41.67 q), period of flowering (14.17 days). From the above experiment, it may be judged that, the application 100% RDF through FYM + Ghanjeevamrit@250 kg/ha + *Azotobacter*@2 kg/ha + PSB@ 2 kg/ha (T5) enhanced the growth, flowering and yield of China aster.

Keywords: Biofertilizers, China aster, FYM, Ghanjeevamrit

Introduction
China aster (*Callistephus chinensis* L. Nees) is one of the most popular shallow rooted winters grown annual flowering plant, and a member of Asteraceae family. The crop is native to China and the ploidy level is diploid (2n=18). In garden, plants of China aster are used as pot plants, bedding plants, and for making mixed herbaceous border. It needs bright sunlight for a longer period for its growth and flowering (Bhattacharjee, 2006) [1].
One can get higher yield by using inorganic fertilizers but use of chemical fertilizers has adverse effects on the soil structure, environment, flora and fauna. Recently, there is fall in mineral fertilizers consumption due to unprecedented hike in price of fertilizers and also soil and water pollution has aggravated the problem of soil health (Bhatia and Gupta, 2007) [2] and the increasing costs of fertilizers prevent their use by poor farmers. Organic gardening is an emerging area in flower production, as it not only increases the yield but also improve the physical, chemical and biological properties of soil that enhance fertility, productivity and water holding capacity of soil. Organic production system, maintains the soil fertility, biological diversity and balance ecology of the environment.

Materials and Methods
The present investigation was carried out at Instructional Horticulture Farm, COA, IGKV, Raipur (C.G.) to find out the effect of organic manures and biofertilizers with three replications on vegetative and flowering traits of China aster (*Callistephus chinensis* L. Nees) cv. Kamini under organic production system. The experiment was laid out in the field in a Randomized Block Design with 10 treatments *i.e.* T_1 (100% RDF through FYM), T_2 (75% RDF through FYM), T_3 (50% RDF through FYM), T_4 (100% RDF through FYM + Ghanjeevamrit@ 250kg/ha), T_5 (100% RDF through FYM + Ghanjeevamrit@ 250 kg/ha + *Azotobacter*@ 2 kg/ha + PSB@ 2 kg/ha), T_6 (75% RDF through FYM + Ghanjeevamrit@250 kg/ha), T_7 (75% RDF through FYM + Ghanjeevamrit@ 250 kg/ha + *Azotobacter*@ 2 kg/ha + PSB@ 2 kg/ha), T_8 (50% RDF through FYM + Ghanjeevamrit@ 250 kg/ha), T_9 (50% RDF through FYM + Ghanjeevamrit@ 250 kg/ha + *Azotobacter*@2 kg/ha + PSB@ 2 kg/ha), T_{10}

(100% RDF through Chemical) which were replicated thrice. The different observations were recorded by various methods Plant height (cm), Plant spread (cm), Number of primary branches per plants, Number of leaves per plant, Number of days taken to first flower bud appearance, Number of days taken to 50% flowering, Number of flowers per plant, Diameter of flower (cm), Fresh weight of flower per plant (g), Average weight of flower weight per plant (g), Flower yield per plot (kg), Flower yield per ha (q), and Period of flowering (days).

Results and Discussion

Effect of Ghanjeevamrit on growth parameters

All the growth parameters were influenced significantly due to various treatments of organic manures and biofertilizers (Table 1). Results clearly indicated that a combined application of 100% RDF through FYM + Ghanjeevamrit@ 250 kg/ha + *Azotobacter*@ 2 kg/ha + PSB@ 2 kg/ha (T_5) proved to be beneficial in improving plant height (39.22 cm), plant spread (19.93 cm in N-S and 24.4 cm in E-W), number of primary branches per plant (12.40) and number of leaves per plant (126.4).

The above results got the support from the findings close proximity with the result of Singh *et al.* (2015) [7] in marigold, Khanna *et al.* (2016) [4] and Rana (2017) [6] in China aster.

Effect of Ghanjeevamrit on flower and yield parameters

Perusal of data in table 2 clearly showed that, various flower and yield parameters at different stages were significantly influenced greatly by the treatments. Application of 100% RDF through FYM + Ghanjeevamrit@250 kg/ha + *Azotobacter*@ 2 kg/ha + PSB@ 2 kg/ha (T_5) resulted in minimum days taken to first flower bud appearance (96.27 days), minimum days taken to 50% flowering (122.4 days), diameter of flower (3.74 cm), number of flowers plant^{-1} (34.33), fresh weight of flowers plant (41.67 g), average weight of flower plant^{-1} (1.30 g), flower yield plot^{-1}(0.50 kg), flowers yield ha^{-1} (41.67 q), and period of flowering (14.17 days).

Our results on yield parameter of flowers are in agreement with that of Khanna *et al.* (2016) [4] in China aster, Premkumar *et al.* (2016) [5] and Chandel *et al.* (2020) [3] in chrysanthemum.

Increased in growth parameters as well as yield parameters, might be due to combined application of organic manures and biofertilizers. FYM and Ghanjeevamrit acts as a source of essential nutrients and enzymes in the vegetative growth of plant which showed best results in growth parameters. Simultaneously, *Azotobacter* and PSB stimulated plant metabolic activity and convert soil nutrients from unavailable form to available form and helps in easy uptake of nutrients to plants.

Table 1: Effect of Ghanjeevamrit on growth parameter

Treatments	Plant Height(cm)	Plant Spread(cm)	Number of primary branches plant^{-1}	Number of leaves plant^{-1}
T1	33.853	17.800	7.933	99.033
T2	29.100	14.600	6.267	82.100
T3	25.093	13.767	5.00	75.400
T4	37.747	21.353	10.533	121.00
T5	39.227	24.493	12.067	126.700
T6	34.493	18.300	9.00	103.633
T7	35.933	18.867	9.733	110.367
T8	31.660	15.113	7.200	86.167
T9	33.300	15.947	7.667	89.767
T10	36.767	19.473	10.200	115.167
SEm±	1.34	0.77	0.38	3.56
CD (0.05)	3.97	2.28	1.12	10.58

Table 2: Effect of Ghanjeevamrit on flower and yield parameter

Treatments	Days taken to first flower bud appearance	Days taken to 50% flowering	Number of flowers plant^{-1}	Diameter of flower (cm)	Fresh weight of flowers plant^{-1} (g)	Average weight of flowers plant^{-1} (g)	Flower yield plot^{-1} (kg)	Flower yield ha^{-1} (q)	Period of flowering (days)
T1	107.067	125.400	24.667	3.288	35.07	1.03	0.421	35.07	12.33
T2	118.000	139.233	17.400	2.515	27.40	0.82	0.326	27.40	11.60
T3	121.000	144.367	15.400	2.457	24.87	0.74	0.298	24.87	10.33
T4	101.267	116.367	30.667	3.587	40.17	1.27	0.482	40.17	13.93
T5	99.233	113.933	34.333	3.737	41.67	1.30	0.500	41.67	14.17
T6	106.633	122.933	25.000	3.427	36.40	1.15	0.437	36.40	12.67
T7	104.933	120.700	26.000	3.450	37.73	1.23	0.453	37.73	13.27
T8	117.400	137.867	22.000	3.121	30.87	0.89	0.394	30.87	12.00
T9	113.133	132.033	22.667	3.203	34.13	0.97	0.409	34.13	12.30
T10	103.000	118.367	30.000	3.533	39.47	1.26	0.473	39.47	13.57
SEm±	4.00	4.41	0.90	0.15	1.32	0.04	0.02	1.32	0.45
CD (0.05)	11.88	13.11	2.68	0.44	3.92	0.13	0.05	3.92	1.35

Conclusion

It is concluded that, the use of 100% RDF through FYM + Ghanjeevamrit@250 kg/ha + *Azotobacter*@ 2 kg/ha + PSB@ 2 kg/ha influenced in realizing better plant growth, and good quality flower yield and above mentioned all the parameters of China aster.

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