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Growth and Flowering of China Aster (*Callistephus chinensis*) Cv. Arka Aadya Influenced by Organic and Inorganic Nutrients

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ABSTRACT

Background: Arka Aadya is a early-flowering high yielding spray type variety of China aster which is used as loose flower. Nutrition plays a major role in growth and yield of flowers. But continuous use of the inorganic fertilizer in the crop field deteriorates the soil health and also reduces the soil microbial activities, soil organic content and cause environmental imbalance while the use of the organic manures improves soil structure, improves nutrient exchange capacity and maintains soil health. Considering the above circumstances, the study has been undertaken to determine the effect of organic and inorganic nutrients on growth and flowering of China Aster cv. Arka Aadya.

Methods: In this field study during November 2024 to April 2025, different combinations of organic and inorganic source of nitrogen were observed to find out the effect of organic and inorganic nutrients on growth and flowering of China Aster (*Callistephus chinensis)* cv. Arka Aadya. The experiment was laid out in R.B.D. with three replications and nine treatment combinations of Urea, Neem cake and Mustard oilcake.

Result: The results revealed that number of leaves and plant spread were found effective under treatment T_4 *i.e.* 50% N (Urea) + 50% N (Mustard oil cake). Similarly flowering characters like bud initiation, colour development and full bloom stage were found earliest in treatment T_1 *i.e.* 100% N (Urea). Whereas other parameters like fresh weight, dry weight, diameter and shelf life of the flower were found best in treatment T_4 *i.e.* 50% N(Urea) + 50% N (Mustard oil cake) and treatment T_4 was found promising for all the yield characters of China Aster cv. Arka Aadya.

Key words: China aster, Mustard oil cake, Neem cake.

INTRODUCTION

The China Aster (Callistephus chinensis), a famous annual blooming plant of Asteraceae family, is native to China and widely grown globally (Navalinskien *et al*., 2005). It is also a major flower crop in North America, Switzerland, Europe, Japan, the USSR and Siberia. Arka Aadya variety of China Aster is released by IIHR, Bangalore, which is floriferous, early-flowering and high-yielding in nature. The flowers are pink and yield a greater number of branches and flowers perplant, accompanied by an extended flowering time. They possess field tolerance to lodging and don't need further staking. They are advised for the cultivation of loose flowers and growing for bedding purposes (Kumar *et.al*., 2014).

The major varietal feature in quality of flowers is significantly affected via soil, climate, or nutritional elements. Nutrition greatly impacts growth and yield of flowers. Nitrogen is a crucial fertilizer for development and plant growth. However, frequent use of inorganic fertilizer in crop fields degrades soil health, lowers soil organic matter and microbial activity and imbalances the environment (Alan *et al.,* 2007). Unlike chemical fertilizers, organic manures enhance nutrient exchange capacity, improve soil structure, or preserve soil health (Mitra, 2010). Complete organic farming could be a beneficial method of enhancing the quality of agricultural products. Though it might be impossible to uphold food quality in commercial agriculture, since its primary focus is mostly on yield. Meeting nutrient requirements of crops entirely through organic nutrients is impossible. Given these conditions, integrated soil fertility management strategies that utilize chemical and organic fertilizers together might be a viable solution for successful, commercial, sustainable agriculture. Moreover, they are environmentally sustainable, readily accessible and cost-effective.

When organic and inorganic nitrogen sources were combined, the combined benefits exceeded those of applying inorganic fertilizer alone (Gantait and Pal, 2009). To produce flowering plants with an optimal quantity of shoots and leaves, a proper fertilizer combination is necessary. This improves the quality of the flowers produced and increases the flowering period. Considering above circumstances, research on effects of organic and inorganic nutrients on

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growth and flowering of China aster cv. Arka Aadya has been carried out with the objective of finding out the promising combination of the organic and inorganic nutrients for better growth and flowering of China Aster.

MATERIALS AND METHODS

The current findings entitled, "Effect of organic and inorganic nutrients on growth and flowering of china aster (*Callistephus chinensis*) cv. Arka Aadya" has been performed at "Agricultural Research Station, Binjhagiri, Chhatabara, Faculty of Agricultural Sciences, Siksha 'O' Anusandhan deemed to be University, Bhubaneswar, Odisha" throughout Rabi 2024-2025 examines effect of varying doses of inorganic and organic nutrients in growth and flowering of China Aster. The R.B.D. experiment had nine treatments and three replications. The seeds of Arka Aadya variety of China Aster have been collected from IIHR, Bangalore and were sown in nursery beds prepared near the experimental field. Seedlings of 30 days old were uprooted from the nursery bed, treated with fungicidal solution of Bavistin 2 g/L for 20 minutes and then transplanted at a spacing of 40 cm × 30 cm from row to row and plant to plant to accommodate thirty plants per plot of 2m x 1.8m size in the main field as per the layout which consists of 27 number of plots. The treatments were T_1: 100% N(Urea), T_2: 75%N(Urea)+25% N(Mustard oil cake),T_3: 75% N(Urea) + 25% N(Neem cake), T_4: 50% N(Urea) + 50% N(Mustard oil cake), T_5:50%N(Urea) + 50% N(Neem cake), T_6: 25% N (Urea)+ 75% N(Mustard oil cake),T_7:25%N(Urea)+75%N (Neemcake), T_8:100% N(Mustard oil cake), T_9: 100% N(Neem cake). Standard cultural practices recommended for China Aster were practices uniformly for all the experimental plots (Fig 1).

Full dose of Phosphorous (SSP) and Potash (MOP) @ 60Kg each per ha along with half dose (*i.e.*, 100% and 75%) and full dose (*i.e.*, 25%, 50%) of Urea based on treatment requirement were applied after establishment of the seedlings, *i.e.*, 7 days of transplanting. The second top dressing was done with half dose (*i.e.*, 100% and 75%) and full dose (*i.e.*, 25%, 50%) each of Neem cake and Mustard oil cake based on treatment requirement immediately after pinching, which was done 30 days after transplanting. Then the last top dressing was done with remaining quantities of Urea, Neem cake and Mustard oil cake as required in the treatment. Irrigation was given from time to time. Regular weeding, earthing up and plant protection procedures were carried out. These operations were common for all handling. Observations have been documented upon subsequent growth and quality parameters: number of secondary branches (no.), stem girth (cm), plant spread (cm^2), number of leaves per plant (no.), plant height (cm), days to first bud emergence (days), days to full bloom stage (days) and days to color development stage (days), dry weight of flower (g), Length of flower stem (cm), fresh weight of flower (g), Number of flowers per plant (no.), Diameter of flower (cm), Shelf life of flower (days), Yield per plant (g). yield per plot (Kg), flower yield per hectare (ton). The data recorded for various parameters under study were analyzed by the method of analysis of variance as described by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Plant growth parameters like plant girth, number of secondary branches, number of leaves and plant spread were observed best under treatment T_4 *i.e.* 50% N(Urea) + 50% N (Mustard oil cake) as the combined application of mustard oil cake and urea shown in (Table 1) (Fig 2). Availability of more nutrients resulted in better root and shoot growth and ultimately resulted in a proliferation of more numbers of branches per plant. Similar findings were also reported by Abhipsha *et al*. (2018) and Sunitha *et al*. (2007) in marigold. Plants treated with full dose of nitrogen as neem cake proved less effective compared to other treatments as it has adverse effects on beneficial organisms and maintained least amount of total nitrogen in the soil (Das and Mukherjee, 1990). These results are in agreement with the findings of Gantait and Pal, 2009 in Chrysanthemum. The plant height was found best under treatment T_2 *i.e.* 75% N(Urea) + 25% N (Mustard oil cake)

Fig 1: Field view of China Aster cv. Arka Aadya.

shown in (Table 1) due to the beneficial effect of the combined application of mustard oil cake and urea as the oil cake not only supplied nitrogen but also contained micronutrients. Oil cake contains some percentage of oil, which prevents rapid conversion of organic nitrogen into available form. A mixture of organic and inorganic nitrogenous fertilizers was found very effective in increasing plant height, which is in confirmation with Ghosh and Pal (2010). Similar findings were also observed by Basantia *et al.*, 2006 in African marigold, Raju *et al*., 2024 in Wheat and Thakur *et al*., 2025 in French bean.

Flowering characters like days taken to bud initiation, days taken to colour development and days taken to full bloom stage are found earliest in treatment T_1 *i.e.* 100% N (Urea) and observed as late in treatment T_9 *i.e.* 100% N (Neem cake) shown in (Table 2). The earliness in flowering could be attributed due to easy availability, uptake of nutrients by plants and simultaneous transport of growth promoting substance like cytokinin to the axillary bud resulting in breaking of apical dominance that leads to transformation of plant parts from vegetative to reproductive stage. The result is in close conformity with findings of Vishnu *et al.*, 2016 in African marigold. Similar results were also observed by Gantait and Pal, 2009 who found that plants treated with full dose of recommended nitrogen solely through urea produced earliest flowering as compared to other treatments. Fresh weight, dry weight, flower diameter and shelf life of the flower were found best in treatment T_4 *i.e.* 50% N(Urea) + 50% N (Mustard oil cake) due to the combined application of mustard oil cake and urea (Table 3). Availability of more nutrients resulted in better root and shoot growth and ultimately resulted in large sized flowers. The results are in agreement with the findings of Ghosh and Pal, 2010. Similar findings were also reported by Abhipsha *et al.* (2018) and Sunitha *et al.* (2007) in Marigold. The increased shelf life could be attributed due to optimum nutrient availability from different inorganic and organic sources which might have resulted in greater development of water conducting tissue with high level water retention in cells of flowers thereby lowering the desiccation. Similar results have been reported in Bohra *et al*. (2019) in China aster and Ranjan and Bohra (2023) in Marigold. The longest stalk length of the flower was noticed in treatment T_2 *i.e.* 75% N(Urea) + 25% N (Mustard oil cake) due to the beneficial effect of the combined application of mustard oil cake and urea as the oil cake not

Table 1: Effect of different treatments on various growth characters of China Aster.

Treatment No.	Treatments	Plant height (cm)	Stem girth (cm)	Number of branches (no.)	Number of leaves (no.)	Plant spread (cm²)
T_1	100% N (Urea)	55.42	3.20	13.86	322.26	1299.47
T_2	75% N (Urea) + 25% N (Mustard oil cake)	59.26	3.13	13.8	342.93	1245.89
T_3	75% N (Urea) + 25% N (Neem cake)	58.75	2.99	13.2	339.66	1136.90
T_4	50% N(Urea) + 50% N (Mustard oil cake)	54.98	3.46	16.53	382.33	1561.13
T_5	50% N(Urea) + 50% N (Neem cake)	54.74	3.32	15.2	374.66	1448.75
T_6	25% N (Urea)+ 75% N (Mustard oil cake)	54.58	2.92	12.2	317.4	1133.24
T_7	25% N(Urea) +75% N (Neem cake)	48.58	2.60	12.06	287.4	1065.70
T_8	100% N (Mustard oil cake)	41.29	2.42	11.73	255.73	964.1
T_9	100% N (Neem cake)	40.95	2.2	11	228.86	924.51
	SE(m) ±	0.77	0.54	12.97	0.22	46.44
	CD at (5%)	2.33	1.63	38.89	0.68	139.22

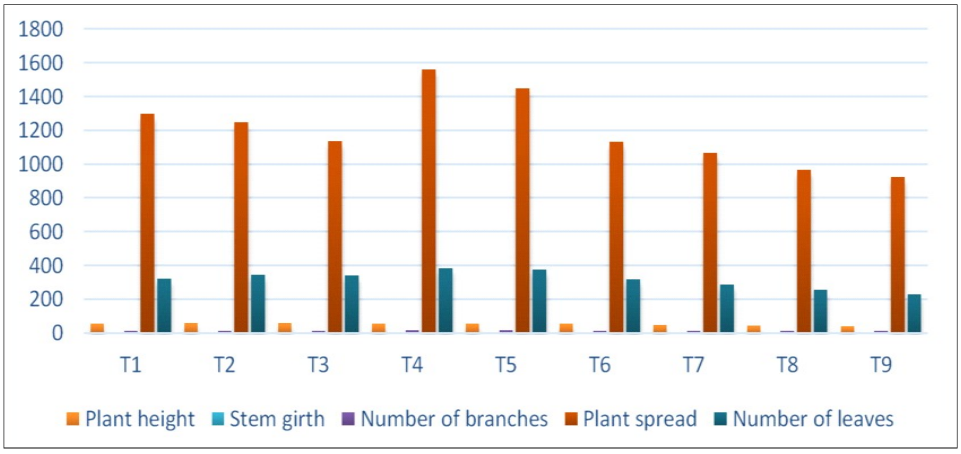

Fig 2: Effect of different treatments on various growth characters of China Aster cv. Arka Aadya.

only supplied nitrogen but also contained micronutrients. As nitrogen present in the oilcake is slow-releasing, nitrogen supply to the plant continued throughout the growing period. Similar results were obtained by Ghosh and Pal, 2010. Neem cake also helps in improving physical, chemical and biological properties of the soil. The above results are corroborated with the findings of Pansuriya and Chauhan (2015) in Gladiolus and Yadav *et al.* (2023) in tuberose.

Yield characters like number of flowers per plant, yield per plant (weight basis), yield per plot and yield per hectare were found best in the treatment T_4 *i.e.* 50% N(Urea) + 50% N (Mustard oil cake) shown in (Table 4) (Fig 3). The result might be due to the fact that chlorophyll synthesis is

Table 2: Effect of different treatments on days taken to bud initiation, colour development and full bloom stage of China Aster.

Treatment No.	Treatments	Days taken to bud initiation stage	Days taken to colour development stage	Days taken for full bloom stage
T_1	100% N (Urea)	53.53	4.33	5.63
T_2	75% N (Urea) + 25% N (Mustard oil cake)	54.86	4.60	5.80
T_3	75% N (Urea) + 25% N (Neem cake)	55.00	4.66	6.06
T_4	50% N(Urea) + 50% N (Mustard oil cake)	56.20	4.73	6.13
T_5	50% N(Urea) + 50% N (Neem cake)	56.20	4.8	6.10
T_6	25% N (Urea)+ 75% N (Mustard oil cake)	56.53	4.73	6.20
T_7	25% N(Urea) +75% N (Neem cake)	57.26	4.93	6.26
T_8	100% N (Mustard oil cake)	57.46	5.13	6.46
T_9	100% N (Neem cake)	57.53	5.26	6.53
	SE(m) ±	0.22	0.18	0.05
	CD at (5%)	0.68	0.56	0.17

Table 3: Effect of different treatment on various flowering parameters of China Aster.

Treatment No.	Treatments	Diameter of flower(cm)	Stalk length (cm)	Fresh weight of flower (g)	Dry weight (g)
T_1	100% N (Urea)	3.55	11.03	2.93	0.93
T_2	75% N (Urea) + 25% N (Mustard oil cake)	3.8	14.62	2.53	0.95
T_3	75% N (Urea) + 25% N (Neem cake)	3.6	11.56	2.33	0.97
T_4	50% N(Urea) + 50% N (Mustard oil cake)	4.17	10.74	3.86	1.09
T_5	50% N(Urea) + 50% N (Neem cake)	3.96	10.15	3.33	0.98
T_6	25% N (Urea)+ 75% N (Mustard oil cake)	3.48	10.02	3.26	0.92
T_7	25% N(Urea) +75% N (Neem cake)	3.43	9.82	3.20	0.87
T_8	100% N (Mustard oil cake)	3.26	9.70	2.2	0.85
T_9	100% N (Neem cake)	2.72	8.34	2.1	0.73
	SE(m) ±	0.10	0.30	0.19	0.02
	CD at (5%)	0.31	0.91	0.59	0.07

Table 4: Effect of different treatments on yield parameters of China Aster.

Treatment No.	Treatments	No of flowers per plant (no.)	Yield/ plant (g)	Yield/ plot (kg)	Yield/ ha (ton)
T_1	100% N (Urea)	31.06	110.54	2.52	6.99
T_2	75% N (Urea) + 25% N (Mustard oil cake)	33.93	104.34	2.60	7.22
T_3	75% N (Urea) + 25% N (Neem cake)	32.66	91.01	2.27	6.30
T_4	50% N(Urea) + 50% N (Mustard oil cake)	43.4	167.63	4.17	11.53
T_5	50% N(Urea) + 50% N (Neem cake)	42.06	140.06	3.50	9.72
T_6	25% N (Urea)+ 75% N (Mustard oil cake)	30.86	78.06	2.10	5.83
T_7	25% N(Urea) +75% N (Neem cake)	29.6	68.64	1.84	5.11
T_8	100% N (Mustard oil cake)	29.33	65.08	1.74	4.83
T_9	100% N (Neem cake)	27.73	59.02	1.72	4.77
	SE(m) ±	0.76	0.19	0.0016	0.0042
	CD at (5%)	2.28	0.57	0.0049	0.0126

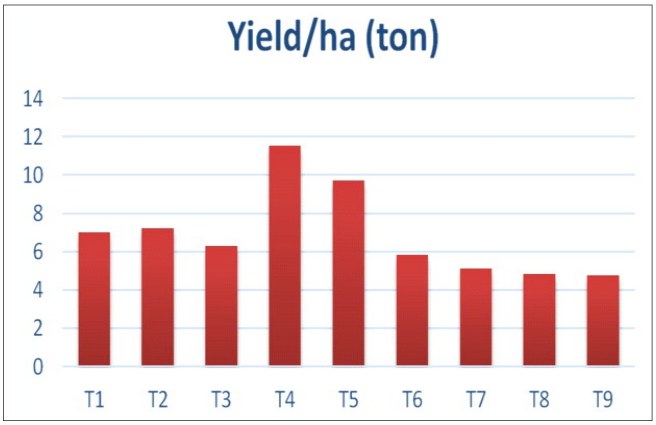

Fig 3: Effect of different treatments on yield per hectare of China Aster cv. Arka Aadya.

markedly accelerated by exogenous application of nitrogenous fertilizer as phosphorus (0.31%) and potassium (4.36%) were maximum when nitrogen was applied as 50% N as mustard oil cake along with 50% N as urea resulting in luxuriant growth of plant and accelerate the flower production. The results are in accordance with the findings of Ghosh and Pal, 2010 in African marigold.

CONCLUSION

The current findings revealed that, among various combinations of Mustard oil cake, Urea tested and Neem cake, ratio comprising 50% nitrogen as Urea combined with 50% nitrogen as Mustard oil cake was the most effective for all growth characters except height. Whereas application of 100% nitrogen as urea was found effective in flowering characters like days taken to bud initiation, days taken to colour development and days taken to full bloom stage. Application of 50% nitrogen as urea combined with 50% nitrogen as Mustard oil cake was found effective in the shelf life of the flower. Flower diameter, FW, DW and longest stem length of flower have been noticed in application of 75%N as urea or 25%N as mustard oil cake. All the yield attributing characters were found best in application of urea as 50%N combined with Mustard oil cake as 50%N. Thus, outcomes showed that application of nitrogen in organic form, along with inorganic form, showed significant improvement in yield, flowering and growth attributes of China aster cv. Arka Aadya as compared to organic and inorganic form of nitrogen alone.

Conflict of intrest

The authors have declared that no conflict of interest exists.

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