



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(9): 275-280
Received: 11-07-2026
Accepted: 15-08-2026

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Influence of nano urea, nano dap and recommended dose of fertilizers on vegetative growth attributes of china aster (*Callistephus chinensis* (L.) Nees) cv. Arka Archana

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i9d.6511>

Abstract

A field experiment was conducted during 2025–26 at the Floriculture Research Farm, College of Horticulture and Research Station, Sankara, Patan, Durg (Chhattisgarh) to evaluate the effect of nano fertilizers in combination with the recommended dose of fertilizers (RDF) on the vegetative growth of China aster (*Callistephus chinensis* (L.) Nees) cv. Arka Archana. The experiment was laid out in a Randomized Block Design with twelve treatments and three replications. Nano urea and nano DAP were applied as foliar sprays at 30 and 60 days after transplanting (DAT). Results revealed that treatment T₁₁ (100% RDF + Nano urea @ 2 ml L⁻¹ + Nano DAP @ 2 ml L⁻¹) recorded the maximum plant height (40.00 cm), number of leaves per plant (148.00), plant spread in North–South direction (44.50 cm), plant spread in East–West direction (41.50 cm), stem diameter (8.00 mm) and number of branches per plant (15.90) at 120 DAT. The lowest values for all parameters were recorded in the absolute control (T₀). It is concluded that application of 100% RDF as basal dose along with two foliar sprays of nano urea and nano DAP @ 2 ml L⁻¹ each at 30 and 60 DAT is superior for enhancing vegetative growth of China aster under Chhattisgarh conditions.

Keywords: China aster, nano urea, nano DAP, recommended dose of fertilizers, vegetative growth

Introduction

China aster (*Callistephus chinensis* (L.) Nees) belongs to the family Asteraceae and is one of the important commercial flower crops grown in India. It is cultivated mainly for cut flowers and loose flowers. The crop is also valued in landscape gardening because of its attractive flower colours and reasonably good keeping quality. In Chhattisgarh, China aster is grown in several districts and has good market demand (Tripathi, 2014) ^[14].

Vegetative growth parameters such as plant height, number of leaves, plant spread, stem diameter and number of branches form the foundation for better flowering and yield. A well-grown plant is able to support a larger number of quality flowers (Ghormade *et al.*, 2018) ^[4]. Therefore, any improvement in vegetative growth directly influences the commercial success of the crop.

Most farmers rely on the recommended dose of fertilizers (RDF) for growing China aster. However, conventional fertilizers suffer from low nutrient-use efficiency due to leaching, volatilization and fixation losses. In recent years, nano fertilizers have attracted attention because of their small particle size and better absorption by plant foliage. Nano urea contains nitrogen in nano form (approximately 30–50 nm), which is absorbed more efficiently through stomata and cuticle and improves nitrogen-use efficiency by reducing losses. Nano DAP supplies both nitrogen and phosphorus in nano-sized particles, which enhances root development, energy transfer and early establishment of the crop. Foliar application of these nano fertilizers can supply nutrients more efficiently than conventional sources (Qureshi *et al.*, 2018) ^[12]. Keeping these points in view, the present investigation was carried out to evaluate the combined effect of RDF and nano fertilizers on vegetative growth attributes of China aster cv. Arka Archana under Chhattisgarh conditions.

Materials and Methods

The experiment was conducted during 2025–26 at the Floriculture Research Farm of the College of Horticulture and Research Station, Sankara, Patan, Durg under Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Durg, Chhattisgarh. The climate of the experimental area is sub-tropical. The trial was laid out in a Randomized Block Design with twelve treatments and three replications. Seedlings of China aster variety Arka Archana were transplanted at a spacing of 30 cm × 30 cm. The treatments were as follows:
T₀ – Control (No fertilizer)
T₁ – RDF 100%
T₂ – RDF 75%
T₃ – Nano urea @ 4 ml L⁻¹
T₄ – Nano DAP @ 4 ml L⁻¹
T₅ – RDF 75% + Nano urea @ 2 ml L⁻¹
T₆ – RDF 75% + Nano urea @ 4 ml L⁻¹
T₇ – RDF 75% + Nano DAP @ 2 ml L⁻¹
T₈ – RDF 75% + Nano DAP @ 4 ml L⁻¹
T₉ – RDF 50% + Nano urea @ 2 ml L⁻¹ + Nano DAP @ 2 ml L⁻¹
T₁₀ – RDF 50% + Nano urea @ 4 ml L⁻¹ + Nano DAP @ 4 ml L⁻¹
T₁₁ – RDF 100% + Nano urea @ 2 ml L⁻¹ + Nano DAP @ 2 ml L⁻¹

RDF was applied as a basal dose according to the treatments. Nano urea and nano DAP were given as foliar sprays at 30 and 60 days after transplanting. Observations on plant height, number of leaves per plant, plant spread (North–South and East–West), stem diameter and number of branches per plant were recorded at 30, 60, 90 and 120 DAT from five plants selected randomly in each plot. The data were analysed statistically as per the Randomized Block Design and critical difference (CD) was calculated at the 5% level of significance.

Results and Discussion

Plant height

Plant height showed significant variation among the treatments at all growth stages (Table 1 and Figure 1). The tallest plants were recorded in T₁₁ (RDF 100% + Nano urea @ 2 ml L⁻¹ + Nano DAP @ 2 ml L⁻¹) with values of 14.00, 28.00, 36.00 and 40.00 cm at 30, 60, 90 and 120 DAT, respectively. Treatment T₆ followed closely and was statistically at par with T₁₁ during the later stages. The shortest plants were observed in the absolute control (T₀). The superior height under T₁₁ can be explained by the dual supply of nitrogen and phosphorus through soil-applied RDF and foliar nano fertilizers. Nano-sized particles are known to enter the leaf tissue more readily and support continuous cell division and elongation. Parallel observations have been reported by Jyothsna *et al.* (2024) ^[5] in sunflower and Maske *et al.* (2025) ^[8] in chilli under nano fertilizer application.

Table 1: Effect of treatments on plant height (cm) of China aster

Treatment	30 DAT	60 DAT	90 DAT	120 DAT
T ₀	6.50	11.50	13.34	14.99
T ₁	13.50	19.00	24.50	28.04
T ₂	8.50	15.50	19.00	21.50
T ₃	6.80	13.00	15.50	17.50
T ₄	7.00	12.50	14.50	16.50
T ₅	11.20	22.00	28.00	32.50
T ₆	12.42	26.50	34.00	38.00
T ₇	11.50	20.50	26.50	30.50
T ₈	12.00	24.00	31.25	35.50
T ₉	9.00	16.57	20.50	23.50
T ₁₀	9.30	17.50	22.00	25.00
T ₁₁	14.00	28.00	36.00	40.00
SEm±	0.37	0.59	0.81	0.95
CD (P=0.05)	1.08	1.74	2.39	2.79

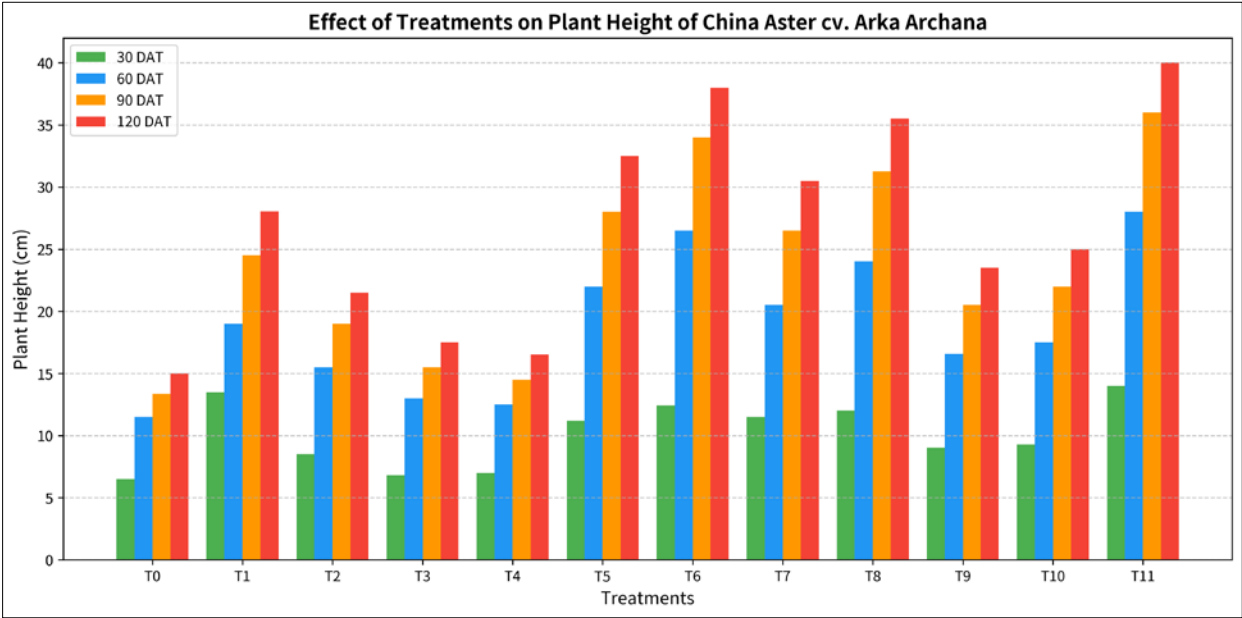


Fig 1: Effect of different treatments on plant height of China aster cv. Arka Archana

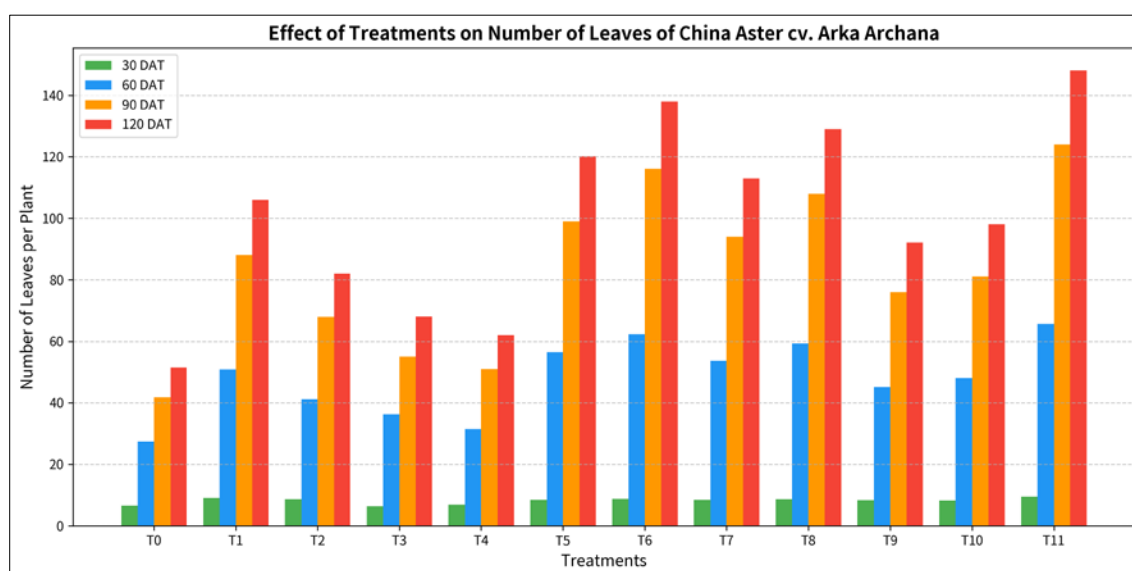
Number of leaves per plant

Leaf production was markedly influenced by nutrient management (Table 2 and Figure 2). The highest number of leaves per plant (148.00 at 120 DAT) was obtained in T₁₁. Treatment T₆ also produced a comparatively higher leaf count and remained at par with T₁₁ at 90 and 120 DAT. Control plants recorded the lowest leaf number throughout the crop period. Since

nitrogen is a structural component of chlorophyll and proteins, its efficient supply through nano urea along with basal RDF appears to have stimulated greater leaf initiation and expansion. These results are in agreement with the observations of Qureshi *et al.* (2018) ^[12] on the beneficial role of nano-fertilizers in enhancing foliage development.

Table 2: Effect of treatments on number of leaves per plant of China aster

Treatment	30 DAT	60 DAT	90 DAT	120 DAT
T ₀	6.50	27.30	41.70	51.47
T ₁	9.07	50.80	88.00	106.00
T ₂	8.64	41.10	67.97	82.00
T ₃	6.30	36.30	55.00	68.00
T ₄	6.83	31.53	51.00	62.00
T ₅	8.44	56.43	99.00	120.13
T ₆	8.67	62.30	116.03	138.00
T ₇	8.42	53.60	94.03	113.00
T ₈	8.58	59.33	108.03	128.97
T ₉	8.30	45.10	75.97	92.20
T ₁₀	8.20	48.00	81.03	98.00
T ₁₁	9.46	65.70	124.00	148.00
SEm±	0.25	2.83	3.62	4.14
CD (P=0.05)	0.73	8.30	10.61	12.14

**Fig 2:** Effect of different treatments on number of leaves of China aster cv. Arka Archana

Plant spread

Both North–South and East–West plant spread responded positively to the combined nutrient treatments (Tables 3 and 4; Figures 3 and 4). At 120 DAT, the maximum spread was measured in T₁₁ (44.50 cm North–South and 41.50 cm East–West). The control treatment produced the narrowest canopy.

Balanced availability of nitrogen and phosphorus under T₁₁ appears to have encouraged better lateral growth and branching, resulting in a wider plant frame. Similar improvement in plant spread of China aster with adequate nutrition was earlier noted by Ghormade *et al.* (2018) ^[4].

Table 3: Effect of treatments on plant spread North–South (cm) of China aster

Treatment	30 DAT	60 DAT	90 DAT	120 DAT
T ₀	7.00	12.50	15.50	18.00
T ₁	14.20	21.00	28.00	31.50
T ₂	9.00	16.50	21.50	24.00
T ₃	7.30	14.00	18.00	20.50
T ₄	7.50	13.50	17.00	19.50
T ₅	11.80	23.50	31.50	36.00
T ₆	13.20	27.50	37.00	42.00
T ₇	12.20	22.50	30.00	34.00
T ₈	12.70	25.50	34.50	39.00
T ₉	9.50	17.50	23.00	26.00
T ₁₀	9.80	18.50	24.50	27.50
T ₁₁	14.80	29.00	39.00	44.50
SEm±	0.36	0.77	1.01	1.04
CD (P=0.05)	1.04	2.26	2.97	3.05

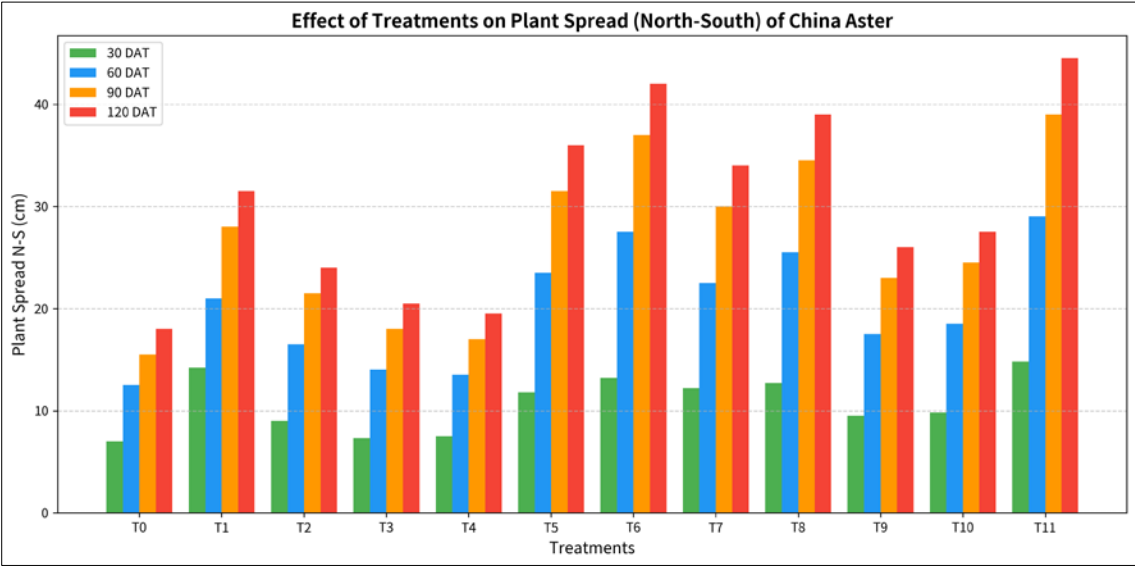


Fig 3: Effect of different treatments on plant spread (North–South) of China aster

Table 4: Effect of treatments on plant spread East–West (cm) of China aster

Treatment	30 DAT	60 DAT	90 DAT	120 DAT
T ₀	6.50	11.50	14.50	17.00
T ₁	13.50	19.50	26.00	29.50
T ₂	8.50	15.50	20.00	22.50
T ₃	6.80	13.00	17.00	19.50
T ₄	7.00	12.50	16.00	18.50
T ₅	11.20	22.00	29.50	33.50
T ₆	12.60	25.50	34.50	39.00
T ₇	11.60	21.00	28.00	31.50
T ₈	12.10	24.00	32.00	36.50
T ₉	9.00	16.50	21.50	24.50
T ₁₀	9.30	17.50	23.00	26.00
T ₁₁	14.10	27.00	36.50	41.50
SEm±	0.31	0.71	0.80	0.62
CD (P=0.05)	0.90	2.07	2.34	1.81

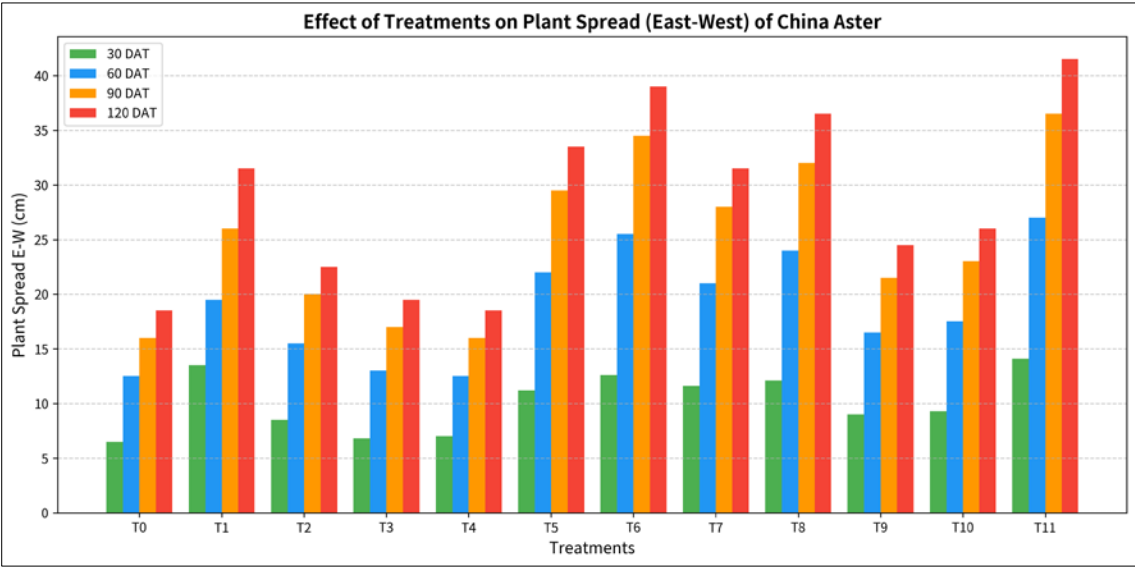


Fig 4: Effect of different treatments on plant spread (East–West) of China aster

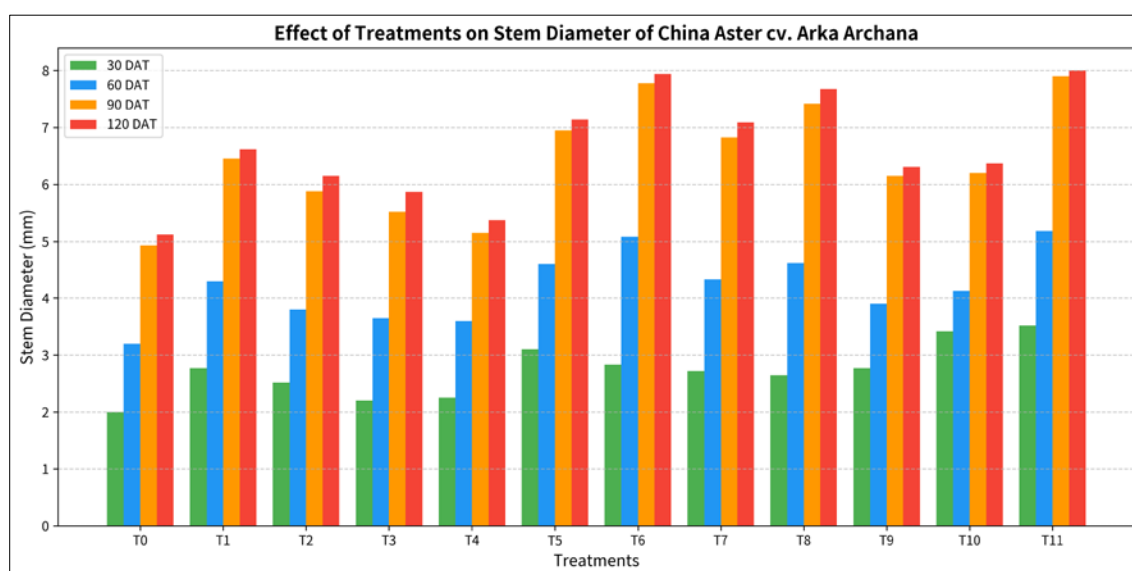
Stem diameter

Stem diameter increased progressively with crop age and was significantly affected by the treatments (Table 5 and Figure 5). The thickest stems (3.60, 6.40, 7.50 and 8.00 mm at 30, 60, 90 and 120 DAT, respectively) were recorded under T₁₁. Treatments

T₆ and T₈ also produced relatively thicker stems, while the control remained the lowest. The increase in stem girth under combined RDF and nano fertilizer application may be linked to improved photosynthate accumulation and better development of supportive tissues in the stem.

Table 5: Effect of treatments on stem diameter (mm) of China aster

Treatment	30 DAT	60 DAT	90 DAT	120 DAT
T ₀	1.80	2.90	3.60	4.20
T ₁	3.20	4.80	5.90	6.50
T ₂	2.40	3.70	4.50	5.10
T ₃	2.00	3.20	4.00	4.60
T ₄	2.10	3.10	3.80	4.40
T ₅	3.00	5.20	6.40	7.10
T ₆	3.40	6.00	7.20	7.70
T ₇	2.90	5.00	6.10	6.80
T ₈	3.30	5.60	6.80	7.40
T ₉	2.50	4.10	5.00	5.60
T ₁₀	2.60	4.30	5.30	5.90
T ₁₁	3.60	6.40	7.50	8.00
SEm±	0.08	0.14	0.17	0.18
CD (P=0.05)	0.24	0.41	0.50	0.53

**Fig 5:** Effect of different treatments on stem diameter of China aster

Number of branches

Branching started becoming distinct from 60 DAT onwards and showed clear treatment differences (Table 6 and Figure 6). The maximum number of branches per plant (15.90) at 120 DAT was recorded in T₁₁, which was significantly superior to all other treatments. Better nutrient status under this treatment appears to

have reduced apical dominance and favoured the outgrowth of lateral buds, leading to a higher branch count. Treatments receiving only nano fertilizers or reduced RDF produced fewer branches, indicating that both basal and foliar nutrition are important for optimum branching.

Table 6: Effect of treatments on number of branches per plant of China aster

Treatment	60 DAT	90 DAT	120 DAT
T ₀	4.83	6.53	7.29
T ₁	6.11	9.42	11.04
T ₂	5.39	8.41	9.68
T ₃	5.32	7.04	8.44
T ₄	5.10	6.88	8.14
T ₅	6.96	10.60	11.80
T ₆	8.66	12.57	14.17
T ₇	6.71	10.02	11.20
T ₈	7.04	11.12	12.57
T ₉	5.69	9.00	10.18
T ₁₀	5.95	9.17	10.44
T ₁₁	9.93	13.84	15.90
SEm±	0.21	0.37	0.33
CD (P=0.05)	0.63	1.07	0.97

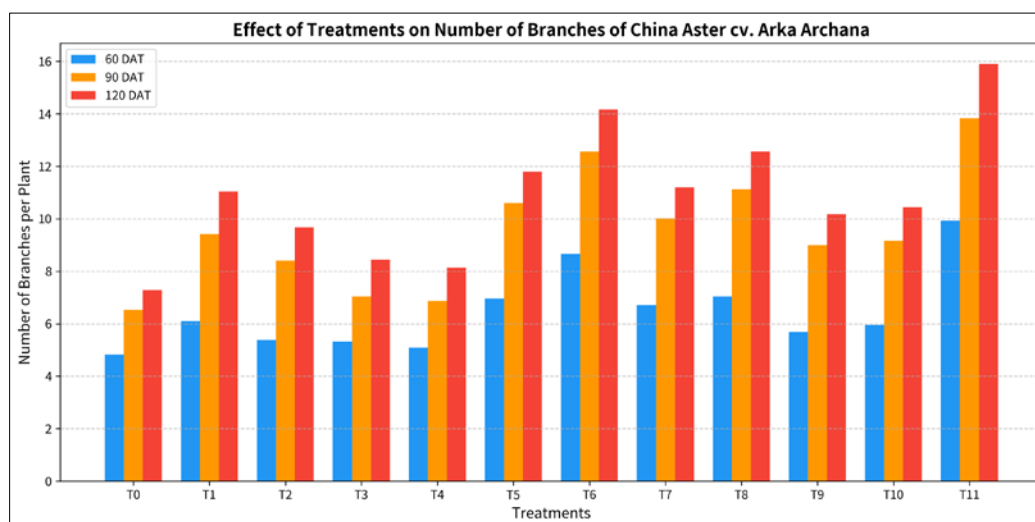


Fig 6: Effect of different treatments on number of branches of China aster

Conclusion

The present investigation demonstrated that vegetative growth of China aster cv. Arka Archana is significantly influenced by the combined application of recommended dose of fertilizers and nano fertilizers. Among the twelve treatments evaluated, T₁₁ (100% RDF + Nano urea @ 2 ml L⁻¹ + Nano DAP @ 2 ml L⁻¹) consistently produced the tallest plants, maximum number of leaves, widest plant spread, highest number of branches and thickest stems at 120 DAT. The improved performance under this treatment can be attributed to the efficient and continuous supply of nitrogen and phosphorus through both soil and foliar routes. Based on the overall results, application of 100% RDF as basal dose along with two foliar sprays of nano urea and nano DAP @ 2 ml L⁻¹ each at 30 and 60 days after transplanting is recommended for obtaining better vegetative growth of China aster under Chhattisgarh conditions.

Acknowledgement

The authors are thankful to the Department of Floriculture and Landscaping, College of Horticulture and Research Station, Sankara, Patan, Durg and Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Durg, Chhattisgarh for providing the necessary facilities for conducting the experiment.

Conflict of Interest

The authors declare that there is no conflict of interest regarding this paper.

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