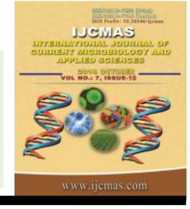
Int.J.Curr.Microbiol.App.Sci (2018) *7*(10): 2991-2997

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 10 (2018)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2018.710.347

Effect of Nitrogen and Phosphorous on Growth of China Aster [*Callistephus chinensis* (L.) Nees]

Ashish S. Ghormade[1*], B.P. Sharma[1], Sourabh Garg[2] and O.P. Kantwa[3]

[1]Department of Floriculture, Dr. YSP UHF, Nauni – Solan, India
[2]Division of Horticulture, Rajasthan Agricultural Research Institute, Durgapura – Jaipur, India
[3]Department of horticulture, SHUATS, Allahabad, UP, India

***Corresponding author*

Keywords

China aster [*Callistephus chinensis* (L.) Nees.], *Callistephus hortensis*

Article Info

Accepted:
20 September 2018
Available Online:
10 October 2018

A B S T R A C T

The present investigations were undertaken at experimental farm of department of Floriculture and Landscaping, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during the years 2012-2013. The China aster cv. 'Kamini' was selected for conducting the investigations. The experiment was laid out in RBD (Factorial) with 20 treatments and 3 replications. Tallest plant (83.32 cm) obtained with a combined application of 30 g N/m^2 and 25 g P_2O_5/m^2 (N_2P_3) that proved to be at par with N_2P_1, N_2P_2 and N_4P_3 whereas minimum plant height (46.42 cm) recorded in plants without nitrogen and phosphorus dose (N0P0). A combined dose of nitrogen and phosphorus significantly improved the plant spread. Maximum plant spread (76.00 cm) found in those plants with a combined dose of 30 g N/m^2 and 25 g P_2O_5/m^2 (N_2P_3) and proved to be significantly higher over all other treatments. Maximum number of branches per plant (7.01) recorded with 30 g N/m^2 (N_2) that proved superior over other treatments including control (N0). Largest leaf area (21.72 cm^2) found with a combined application of 30 g N/m^2 and 25 g P_2O_5/m^2 (N2P3) and it proved to be at par with N_3P_1. However, minimum leaf area (9.82 cm^2) recorded in plants supplied with 40 g N/m^2 and 25 g P_2O_5/m^2 (N_4P_3).

Introduction

China aster [*Callistephus chinensis* (L.) Nees.], belongs to family Asteraceae and is a native of China and Europe. The genus *Callistephus* derived its name from two greek words '*Kalistos*' and '*Stephos*' meaning 'most beautiful' and 'a crown', respectively. Cassini described the China aster as *Callistephus hortensis*. It was first named by Linnaeus as *Aster chinensis*, and Nees changed this name to *Callistephus chinensis*. China aster is a very popular annual flower crop and is mainly cultivated for production of cut flowers, loose flowers, as pot plant and for bedding plant purposes in landscape. It is gaining fast popularity in India because of its easy cultural practices, diversity of colours and varied uses. Evolution of aster flowers brought a new range of colours starting from white, rose, red, lavender, magenta and blue to their innumerable variations (Desai, 1967). The plants of China aster are erect and attain a maximum height of 60-80 cm depending upon the genotypes.

Out of various factors influencing the growth of China aster, balanced nutrition is very important. The growth and development of production plants, generally, depends on their judicious feeding right from very beginning. China aster is a heavy feeder and hence has larger requirements for nitrogen, phosphorus and potassium. The emphasis at an early stage for vegetative growth should be especially on nitrogen. Gaikwad *et al.,* (2004) were of the opinion that the plant growth during initial seven weeks needs maintenance of higher levels of nitrogen. Plants do need phosphorus throughout the growing period and it should be applied as a basal dose.

There is a vast scope of growing China aster in Himachal Pradesh throughout the year except in severe winters and scorching summer months for the purpose of cut flowers and loose flower production. There is scanty informations on the effect of nitrogen and phosphorus on growth of China aster particularly in North Indian conditions. However, no systematic work has been conducted on NPK studies of this crop which influences overall health and quality of the plants. Therefore, this study can be helpful to the farmers in order to increase flower production. The present work is being undertaken on cultivar 'Kamini' which is in a great demand in the Indian florist trade So, keeping in view the above facts, the present studies have been planned with the objective to optimize the dose of nitrogen and phosphorus for growth of China aster [*Callistephus chinensis* (L.) Nees].

Materials and Methods

The present investigations were undertaken at experimental farm of department of Floriculture and Landscaping, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during the years 2012-2013. The China aster cv. 'Kamini' was selected for conducting the investigations. The experiment details are as followed:

Nitrogen levels: 5 (Through: Urea) - 0 g/m^2(Control), 25.0 g/ m^2, 30.0 g/ m^2, 35.0 g/ m^2 and 40.0 g/ m^2

Phosphorus levels: 4 (Through: SSP) - 0.0 g/ m^2, 15.0 g/ m^2,20.0 g/ m^2, 25.0 g/ m^2

Total No. of treatments: 5×4=20 (T_1 to T_{20})
No. of replications: 3
Plot size: 1×1 square meter
Design: RBD (Factorial)

The Plant height recorded at 50 per cent of flowers opening. It was recorded from ground level to the top of inflorescence using meter scale. The plant spread of the plants was recorded as the average distance measured in centimetres in East-West and North-South directions of the plant with a metre scale at peak flowering. Total number of axillary branches per plant were counted at peak flowering. At peak flowering, the leaves were collected randomly at different heights from the plant. The leaf area measured with the help of Leaf Area Meter.

The statistical analysis was carried out for each observed character under the study using MS-Excel and OPSTAT packages. The observations recorded on various growth and flowering parameters were subjected to analysis of variance (ANOVA) using Randomized block design RBD (factorial) as described by Gomez and Gomez (1984).

Result and Discussion

It is evident from perusal of Table 1 that nitrogen application significantly improved the plant height. Tallest plant (74.38 cm) found with an application of30 g N/m^2 (N_2) and it was found to be at par with N1 and N3. Minimum plant height (55.63 cm) was recorded in those plants without application of nitrogen (N0). Application of phosphorus doses did not influence the plant height. Tallest plant (83.32 cm) obtained with a combined application of 30 gN/m^2 and 25 g P_2O_5/m^2 (N_2P_3) that proved to be at par with N_2P_1, N_2P_2 and N_4P_3 whereas minimum plant height (46.42 cm) recorded in plants without nitrogen and phosphorus dose (N0P0). Table 2 reveals that nitrogen application significantly improved plant spread. Maximum plant spread (60.33 cm) noticed in those plants supplied with 30 g N/ m^2 (N_2) and it was significantly higher over all other treatments. However, minimum plant spread (49.13 cm) recorded in control (N0). Plant spread was not significantly improved with different doses of phosphorus. A combined dose of nitrogen and phosphorus significantly improved the plant spread. Maximum plant spread (76.00 cm) found in those plants with a combined dose of 30 g N/ m^2 and 25 g P_2O_5/ m^2 (N_2P_3) and proved to be significantly higher over all other treatments. Whereas, the minimum plant spread (42.34 cm) was recorded in plants without nitrogen and phosphorus (N0P0).

It is envisaged from the data of Table 3 that the nitrogen doses influenced the number of branches per plant. Maximum number of branches per plant (7.01) recorded with 30 g N/m^2 (N2) that proved superior over other treatments including control (N0). Application of phosphorus did not influence the number of branches per plant. Combined applications of nitrogen and phosphorus did not affect the number of branches per plant. Data pertaining to leaf area as influenced by various levels of nitrogen and phosphorus have been presented in Table 4 Largest leaf area (15.87 cm^2) recorded with 30 g N/m^2 (N2) and found to be at par with N3 and N4. Minimum leaf area (11.22 cm^2) observed in those plants without application of nitrogen (N0).Leaf area was not influenced with different doses of phosphorus. Largest leaf area (21.72 cm^2) found with a combined application of 30 g N/m^2 and 25 g P_2O_5/m^2 (N_2P_3) and it proved to be at par with N3P1. However, minimum leaf area (9.82 cm^2) recorded in plants supplied with 40 g N/m^2 and 25 g P_2O_5/m^2 (N_4P_3).

Plants of maximum height with greater plant spread, number of branches and leaf area recorded with application of 30 g N/m^2 in China aster cv. ‘Kamini’ (Tables 1, 2, 3 and 4, respectively). It is evident that nitrogen is one of the major key elements for the plant growth and increase in nitrogen supply accelerates the synthesis of chlorophyll and amino acids which enhanced the vegetative growth in terms of plant height, stem length, number of leaves etc. (Mengel and Kirkby, 1987; Devlin, 1973). There is a general agreement that all the nutrient amendments made to soils, N fertilizer application has the most important effects in terms of increasing crop productivity. Although crops usually respond to N fertilizers, there is not much always the case. Response of N depends on soil conditions, the particular crop species and the plant nutrients supplied, in general.

The results got the support from the findings of various workers in China aster *viz.* Monish *et al.,* (2008) observed improvement for growth parameter *viz.* plant height, number of leaves of China aster cv. ‘Poornima’ with 300 kg N/ha (30 g N/m^2). Maximum plant spread and number of branches noticed with 200 kg N/ha (20 g N/m^2) in China aster cv. ‘Phule Ganesh White’ (Gaikwad *et al.,* 2004). Jamkhande *et al.,* (2004) reported an increase in the vegetative growth of China aster cv. ‘Local’ with 150 kg N/ha (15 g N/m^2). In the initial stages, nitrogen improved the vegetative growth of chrysanthemum (Hosoya *et al.,* 1978). Also, the beneficial effect of nitrogen application in China aster have been reported by different workers *viz.* Kumar *et al.,* (2003); Singh and Sangama (2000) and Maheshwar (1977). Other than China aster, improvement have been noticed for various growth parameter with an application of 5 kg of FYM and 30 g of N/m^2 in chrysanthemum standard cv. 'Snow Ball' and spray cv. 'Ajay' (Sharma, 2003). The beneficial effect of nitrogen application in chrysanthemum have been reported by various workers *viz.* Jhon and Paul (1999); Sawaan *et al.,* (1999); De and Barman (1997); Mostafa (1996); Lodhi and Tiwari (1993) and Rao *et al.,* (1992). A reduction noticed for plant height, plant spread, number of branches per plant and leaf area (Tables 1, 2, 3 and 4, respectively) in China aster cv. 'Kamini' as the level of nitrogen increased from 30 to 40 g N/m^2.

Table.1 Effect of nitrogen, phosphorus and their interactions on plant height (cm) of China aster cv. 'Kamini'

Phosphorous Nitrogen	P0 (0.0 g/m^2)	P1 (15.0 g/m^2)	P2 (20.0 g/m^2)	P3 (25.0 g/m^2)	Mean
N0 (0.0 g/m^2)	46.42	57.00	64.94	54.16	55.63
N1 (25.0 g/m^2)	61.79	59.97	63.69	64.29	62.44
N2 (30.0 g/m^2)	65.32	76.29	72.58	83.32	74.38
N3 (35.0 g/m^2)	65.20	65.09	55.14	62.64	62.02
N4 (40.0 g/m^2)	70.58	67.04	66.12	74.09	69.46
Mean	61.86	65.08	64.50	67.70	

CD0.05 - N: 5.35 P: NS N × P: 10.70

Table.2 Effect of nitrogen, phosphorus and their interactions on plant spread (cm) of China aster cv. 'Kamini'

Phosphorous Nitrogen	P0 (0.0 g/m^2)	P1 (15.0 g/m^2)	P2 (20.0 g/m^2)	P3 (25.0 g/m^2)	Mean
N0 (0.0 g/m^2)	42.34	51.22	47.87	55.09	49.13
N1 (25.0 g/m^2)	58.79	55.24	47.72	48.04	52.45
N2 (30.0 g/m^2)	48.43	61.59	55.30	76.00	**60.33**
N3 (35.0 g/m^2)	55.26	56.36	55.97	59.73	56.83
N4 (40.0 g/m^2)	51.75	53.38	69.50	58.39	58.26
Mean	51.32	55.56	55.27	**59.45**	

CD0.05 - N: 6.86 P: NS N × P: 13.72

Table.3 Effect of nitrogen, phosphorus and their interactions on number of branches/plant of China aster cv. 'Kamini'

Phosphorous Nitrogen	P0 (0.0 g/m^2)	P1 (15.0 g/m^2)	P2 (20.0 g/m^2)	P3 (25.0 g/m^2)	Mean
N0 (0.0 g/m^2)	5.37	4.68	4.40	5.72	5.04
N1 (25.0 g/m^2)	5.10	5.21	5.45	4.63	5.10
N2 (30.0 g/m^2)	6.98	8.20	6.37	6.52	**7.01**
N3 (35.0 g/m^2)	4.95	5.04	5.61	5.30	5.22
N4 (40.0 g/m^2)	5.97	5.49	5.51	4.75	5.43
Mean	5.67	**5.72**	5.47	5.38	

CD0.05 - N: 0.78 P: NS N × P: NS

Table.4 Effect of nitrogen, phosphorus and their interactions on leaf area (cm^2) of China aster cv. 'Kamini'

Phosphorous Nitrogen	P0 (0.0 g/m^2)	P1 (15.0 g/m^2)	P2 (20.0 g/m^2)	P3 (25.0 g/m^2)	Mean
N0 (0.0 g/m^2)	10.37	9.83	12.95	11.73	11.22
N1 (25.0 g/m^2)	13.31	10.02	14.51	13.63	12.87
N2 (30.0 g/m^2)	16.24	14.50	11.00	21.72	15.87
N3 (35.0 g/m^2)	15.83	16.69	12.39	14.87	14.95
N4 (40.0 g/m^2)	12.49	15.11	15.96	9.82	13.34
Mean	13.65	13.23	13.36	14.35	

CD0.05 - N: 2.65 P: NS N × P: 5.30

It indicated that the nitrogen requirement of these plants was met out with 30 g N/m^2 only and thus further increase in nitrogen may not prove beneficial to these plants. These results got the support from the findings of Jhon and Paul (1999) and Lodhi and Tiwari (1993) in chrysanthemum, however, the difference observed in the rates of the nitrogen applications reported by various workers seemed to be due to the variety soils in use and their varying fertility status.

Although phosphorus levels exhibited non-significant effects for various growth parameter of China aster cv. 'Kamini', yet plants with more plant height, spread and leaf area recorded with 25 g P_2O_5/m^2 (Tables 1, 2 and 4, respectively) and maximum number of branches noticed with 15 g P_2O_5/m^2 (Table 3). Increase in N uptake noticed with the application of higher levels of phosphorus that resulted in vigorous growth (Balyan and Singh, 1984).

Beneficial effects of phosphorus on the growth were probably being the resultant of the increased synthesis of metabolites in the presence of directly applied phosphorus to these plants. Since phosphorus is found in nucleic acids and is involved through ATP in the activation of amino acids for the synthesis of proteins, thus importance of this element is well documented (Devlin, 1973). These results obtained are in agreement with Monish *et al.*, (2008) who found taller plants in China aster cv. 'Poornima' using 200 kg P_2O_5 per hectare (20 g P_2O_5/m^2) in comparison to lower levels. Gaikwad *et al.*, (2004) reported increase in plant height, spread and number of branches with 150 kg/ha phosphorus (15 g P_2O_5/m^2) in China aster cv. 'Phule Ganesh White'. Plants supplied with 50 or 100 kg P_2O_5/ha (5 or 10 g P_2O_5/m^2) observed with more plant height and number of branches with increasing rates of phosphorus in China aster cv. 'Local' (Jamkhande *et al.*, 2004). Bose and Das (1966) found plant height of

China aster to be maximum with increasing levels of phosphorus. Similarly, number of branches and leaves/plant increased with the higher levels of phosphorus. Beneficial effects of phosphorus for growth of plants have been reported by other workers *viz.*, Singh and Sangama (2000) and Mantur (1988) in China aster. Other than China aster, phosphorus application at 45 g N/m^2 obtained taller plants while more numbers of branches per plant with 30 g P_2O_5/m^2 in chrysanthemum cv. 'Flirt' (Lodhi and Tiwari, 1993). Kofranek (1980) found 150 g of single super phosphate (SSP) as an optimal dose for promoting the growth of plants of chrysanthemum.

The combined effects of nitrogen and phosphorus applications seemed to be more consistent and have influenced various growth parameters under study. Increasing level of nitrogen along with phosphorus significantly increased the plant height, plant spread, number of branches per plant and leaf area of China aster cv. 'Kamini'. A combined dose of 30 g N/m^2 and 25 g P_2O_5/m^2 produced taller plants with maximum plant spread as well as leaf area (Tables 1, 2 and 4, respectively) and number of branches per plant found to be higher with 30 g N/m^2 and 15 g P_2O_5/m^2 (Table 3).

The beneficial effect of N×P interactions are well understood and under present investigations also the superiority was manifested with increasing levels of nitrogen (0-40 g N/m^2) corresponding to the increasing levels of phosphorus (0-25 g P_2O_5/m^2) or this could be due to the cumulative effects of nitrogen and phosphorus on growth of the plants in one direction. The results got the support from the findings of various workers in China aster *viz.* Monish *et al.,* (2008) reported taller plants of China aster cv. 'Poornima' with more number of branches fertilized with the application of 300 kg N/ha (30 g N/m^2) and 200 kg P_2O_5/ha (20 g P_2O_5/m^2).

Jitendra kumar *et al.,* (2003) also observed the similar trend for the plant height and number of branches per plant in China aster with 300 kg/ha (30 g/m^2) N and P each. Singh and Sangama (2000) found the plants of greatest plant height and plant spread with the highest level of N and phosphorus application in China aster cv. 'Kamini'.

Similar effects of nitrogen × phosphorus have been reported in China aster by other workers namely Jamkhande *et al.,* (2004); Gaikwad *et al.,* (2004); Nethra *et al.,* (1999); Mantur (1988); Narayana Gowda (1985) and Maheshwar (1977). Other than China aster, Dorajeerao *et al.,* (2012) and Chezhiyan *et al.,* (1986) found taller plants, maximum number of branches and leaf area with simultaneous increase both in nitrogen and phosphorus levels in chrysanthemum.

References

Balyan DS and Rajendra Singh. 1984. Uptake of different levels of nitrogen, phosphorus and zinc in cauliflower. *Crop Research* (Hissar): 54-58

Bose TK and Das SM. 1966. Studies on the nutrition of ornamental plants. I. Effects of nitrogen, phosphorus and potassium on growth and flowering of Aster, Salvia and Zinnia. *Indian Journal of Horticulture,* 23: 88-97

Chezhiyan N, Nanjan K and Abdul Khader JBM Md. 1986. Studies on nutrient requirement of *Chrysanthemum indicum* cv. Co-I. *Sounth Indian Horticulture,* 34 (3):173-178

De LC and Barman D. 1997. Growth and flowering of chrysanthemum (*Chrysanthemum morifolium* Ramat.) as effected by nitrogen and genotypes. *Indian Journal of Hill Farming,* 10(1-2): 51-55

Desai BL. 1967. Seasonal flowers. ICAR: New Delhi. 237p

Devlin RM. 1973. Plant Physiology Ind. Ed. New Delhi East-West Press. 446p

Dorajeerao AVD, Mokashi AN, Patil VS, Venugopal CK, Lingaraju S and Koti RV. 2012. Effect of graded levels of nitrogen and phosphorus on growth and yield of garland chrysanthemum (*Chrysanthemum coronarium* L.). *Karnataka J. Agric. Sci.,* 25 (2): 224-228

Gaikwad SA, Patil SSD, Patil GD. 2004. Effect of different levels of nitrogen and phosphorus on the growth and flower production of China aster (*Callistephus chinensis* (L.) Nees). *Journal of Maharashtra Agricultural Universities,* 29(2):140

Gomez LA and Gomez AA. 1984. Statistical procedure for agricultural research. John Wiley and Sons, Singapore, 680p

Hosoya T, Murai C and Hiruma H. 1978. Bull. Saintama Hort. Exp. Sta. 7: 49-53

Jamkhande Muktanjali, Paithankar DH, Warade AD, Mohariya Anjali, Ambare TP.2004.Effect of graded levels of nitrogen and phosphorus on growth and flower productionof China aster cv. Local. *Advances in Plant Sciences,* 1:163-165

Jhon AQ and Paul TM. 1999. Response of *Chrysanthemum morifoltum* Ramet to different levels of nitrogen and Phosphorus. *Applied-Biological-Research*, 1: 1, 35-38

Jitendra kumar, Chauhan SS, Singh PV. 2003. Response of N and P fertilization on China aster. *Journal of Ornamental Horticulture*, 6(1): 82

Kofranek AM. 1980. Chrysanthemum In: Introduction to Floriculture (ed. R.A. Larson). Acad. Press. Inc.

Kumar J, Chauhan SS and Singh PV. 2003. Response of N and P fertilization on China aster. *Journal of Ornamental Horticulture*, 6 (1): 82

Lodhi AKS and Tiwari GN. 1993. Nutritional requirement of chrysanthemum under field condition. *Fertilizer News*, 38(3): 39-45

Maheshwar DL. 1977. Influence of nitrogen and phosphorous on growth and flower production of China aster (*Callistephus chinesis* (L.) Nees.). M. Sc. (Agri.) Thesis. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Bangalore

Mantur SM. 1988. Studies on nutrition, growth regulators and soil salinity on flower and seed production in China aster (*Callistephus chinensis* Nees) cv. Ostrich plume mixed.Ph. D. Thesis, University of Agricultural Sciences, Dharwad

Mengel K and Kirkby EA. 1987. Principles of plant nutrition (4th ed.). Panima Publishing Corporation, New Delhi, pp. 667

Mohit Monish, Kumar Vijay Umrao, Tyagi AK and Meena PM. 2008. Effect of nitrogen and phosphorus levels on growth, flowering and yield of China aster. *Agric. Sci. Digest*, 28 (2): 97 – 100

Mostafa MM. 1996. Effect of nitrogen and potassium nutrition on chrysanthemum plants. *Alexanderia Journal of Agricultural* Research, 41(2): 225-235

Narayana Gowda, J V. 1985. Investigations on horticultural practices in the production of China aster (*Callistephus chinensis* (L.) Nees) cv. 'Vicksbranching'. Ph.D. Thesis, University of Agricultural Sciences, Bangalore

Nethra NN, Jayaprasad KV and Radha DK. 1999. China aster (*Callistephus chiensis* (L.) Nees) cultivation using vermicompost as organic amendment. *Crop Research*, 17 (2):209-215

Rao DVR, Balasubramanyam SA, Reddy, KB and Suryanarayana V. 1992. Effect of different spacings and nitrogen levels on growth and flower yield of chrysanthemum *(Chrysanthemum indicum* L.) cv. Kasturi. *South Indian Horticultur*, 40(6): 323-328

Sawaan J, Abuzahre T, Khader S and Basher EA. 1999. Effect of different N amounts and forms on growth and flowering of chrysanthemum (*Chrysanthemum morifolium*Ramat.) under glass house conditions. *Dirasat Ag Sciences*, 26(3): 364-370

Sharma BP. 2003. Effect of NPK on growth and flowering of of chrysanthemum. Ph.D. Thesis submitted to Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh

Singh KP and Sangama. 2000. Effect of graded level of N and P on China aster (*Callistephus chinensis)* cultivar Karnini. *Indian-Journal-of-Horticulture*, 57(1):87-89

How to cite this article:

Ashish S. Ghormade, B.P. Sharma, Sourabh Garg and Kantwa, O.P. 2018. Effect of Nitrogen and Phosphorous on Growth of China Aster [*Callistephus chinensis* (L.) Nees]. *Int.J.Curr.Microbiol.App.Sci.* 7(10): 2991-2997. doi: https://doi.org/10.20546/ijcmas.2018.710.347