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EFFECT OF NITROGEN AND PHOSPHORUS LEVELS ON GROWTH, FLOWERING AND YIELD OF CHINA ASTER (*CALLISTEPHUS CHINENSIS* L. NEES)

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Abstract

A field experiment was conducted at Main Experimental Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.), India; during winter season of 2012-13. The experiment was laid out in randomized block design in a factorial arrangement having two factors nitrogen and phosphorus levels in four treatments. Nitrogen (0, 100, 200 and 300 kg ha^{-1}) and phosphorus levels (0, 100, 150 and 200 kg ha^{-1}) had studies on growth and flowering character of China aster. Nitrogen and phosphorus treatments enhanced significantly the vegetative attributes and increased flower quality and yield of China aster.

Key words : Nitrogen, phosphorus, China aster.

Introduction

China aster (*Callistephus chinensis* L. Nees) is one of the most popular and valuable seasonal flowers belong to family Asteraceae (compositeae). It is excellent for use as loose flower, cut flower and in landscaping under mild climate. China aster grown almost throughout the year, but under North Indian conditions it can be grown only in winter season. It can easily be grown in the open fields and lath houses for the production of cut flower. Cut flower last long and one used in vases and floral decoration. When aster is grown in large mass, they make very showy bedding plants and are valuable for filling up the gap in mixed herbaceous border. Flowers are blue violet lavender, roses, white etc. China aster is one of the most important traditional flowers in India and has maximum use for traditional purposes. The commercial importance of China aster increasing in India especially in Karnataka, Tamil Nadu, West Bengal and Maharashtra.

Materials and Methods

The experiment was conducted at Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.), India; during the year 2012-13. The experiment was laid out in randomized block design in a factorial arrangement having two factors nitrogen and phosphorus levels in four treatments with 16 treatment combinations. Nitrogen (0, 100, 200 and 300 kg ha^{-1}) and phosphorus levels (0, 100, 150 and 200 kg ha^{-1}) had studies on growth and flowering character of China aster. Seeds were sown in the nursery beds in October 2012 and one month old seedlings were transplanted at 30 × 30 cm distances in well prepared field. Calculated doses of nitrogen and phosphorus were applied in the experimental plots as per the treatment combinations. Full dose of phosphorus was applied in the form of single super phosphate (SSP) as basal dressing at time of field preparation. Nitrogen was applied in two split doses in the form of urea. Half dose of nitrogen was applied at the time of transplanting and remaining half dose was applied by top dressing at 30 days of transplanting. Data on various growth and flowering parameters were recorded and analyzed statistically as per the method given by Gomez and Gomez (1984).

Results and Discussion

(i) Effect of nitrogen

A perusal of data (table 1) reveals that various growth and flowering characteristics were influenced significantly due to different levels of nitrogen. Increasing levels of nitrogen upto 300 kg ha^{-1} significantly increased the plant

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Table 1 : Effect of nitrogen, phosphorus and their interactions on growth, flowering and yield of China aster (*Callistephus chinensis* L. Nees).

Treatments	Plant height (cm)	Plant spread (cm)	No. of primary branches/ plant	No. of leaves/ plant	Length of flower stalk (cm)	No. of flower / plant	Flower weight (g)	Flower diameter (cm)	Flower Yield /plant (g)	Flower Yield (q)/h)
N_0 (0 kg/ha)	44.49	21.17	17.79	96.38	17.64	19.98	2.47	6.48	50.37	55.96
N_1 (100 kg/ha)	50.51	24.00	19.84	123.64	20.21	29.43	4.39	6.79	134.54	149.43
N_2 (200 kg/ha)	54.51	26.72	22.24	133.31	24.94	32.29	4.83	7.03	158.93	176.50
N_3 (300 kg/ha)	57.04	28.67	23.23	142.30	27.56	34.76	5.22	7.33	184.16	204.61
S. Em.	0.88	0.37	00.40	1.67	0.37	0.45	0.08	0.11	2.18	2.45
CD(P=0.05)	2.57	1.05	1.17	4.84	1.09	1.29	0.23	0.32	6.29	7.09
P_0 (0 kg/ha)	43.91	22.90	18.73	100.03	17.65	21.66	3.31	6.49	75.47	83.85
P_1 (100 kg/ha)	50.03	24.03	20.21	119.68	20.23	27.79	4.15	6.81	120.92	134.29
P_2 (150 kg/ha)	54.97	26.39	21.70	134.59	25.29	32.40	4.60	7.10	156.46	173.83
P_3 (200 kg/ha)	57.64	27.22	22.48	141.33	27.18	34.60	4.84	7.23	175.15	194.53
S. Em.	0.88	0.37	00.40	1.67	0.37	0.45	0.08	0.11	2.18	2.45
CD(P=0.05)	2.57	1.05	1.17	4.81	1.09	1.29	0.23	0.32	6.29	1.09
$N_0 P_0$	40.33	18.50	16.33	80.50	12.33	14.50	2.10	6.33	30.36	33.73
$N_0 P_1$	42.73	20.37	17.17	89.40	15.40	18.40	2.38	6.38	43.96	48.85
$N_0 P_2$	46.27	22.40	18.47	105.53	20.53	22.30	2.60	6.58	57.92	64.35
$N_0 P_3$	48.63	23.40	19.20	110.10	22.30	24.70	2.80	6.61	69.23	76.92
$N_1 P_0$	42.40	20.60	18.63	90.50	14.37	20.3	2.95	6.32	59.89	66.54
$N_1 p_1$	46.57	23.50	19.43	120.57	17.57	27.37	4.14	6.72	113.37	125.76
$N_1 P_2$	55.20	25.33	20.20	138.40	23.30	33.67	4.95	6.73	164.84	183.15
$N_1 P_3$	57.87	26.57	21.10	145.10	25.60	36.37	5.50	7.20	200.06	222.28
$N_2 P_0$	44.60	23.27	19.50	110.60	20.50	25.27	3.95	6.55	99.81	110.89
$N_2 P_1$	54.10	25.60	21.67	130.17	22.27	30.33	4.86	6.95	147.11	163.45
$N_2 P_2$	58.13	28.60	23.40	142.40	27.63	35.47	5.21	7.25	184.78	205.29
$N_2 P_3$	61.20	29.30	24.40	150.07	29.37	38.10	5.29	7.38	204.01	226.37
$N_3 P_0$	48.30	26.23	20.43	118.50	23.40	26.57	4.25	6.75	111.81	124.23
$N_3 P_1$	56.73	26.60	22.57	138.60	25.57	35.07	5.21	7.20	179.21	199.12
$N_3 P_2$	60.27	29.23	24.73	152.03	29.72	38.17	5.65	7.65	218.28	242.53
$N_3 P_3$	62.87	29.60	25.20	160.07	31.47	39.23	5.75	7.71	227.32	252.57
S. Em.		0.73				0.89	0.16	0.22	4.34	4.91
CD(P=0.05)	NS	2.11	NS	NS	NS	2.58	0.45	.64	12.55	14.19

height (57.04 cm), plant spread (28.67 cm), number of primary branches (23.23) and number of leaves (142.30). The growth parameters were increased due to higher photosynthesis and N is a very important consistent of nucleic acid protoplasm and in might have increased carbohydrate synthesis, amino acids etc. from which the phytohormones like auxins, gibberellins, cytokines have been synthesized resulting in increased plant growth. These results are in closer conformity with those of Agrawal *et al*. (2002) and Sharma *et al*. (2006) in marigold and Nagaich *et al*. (2003) and Muktanjali *et al*. (2004) in China aster. Like growth characteristics number of flower per plant (34.76), length of flower stalk (27.56 cm), flower weight (5.22g), flower diameter (7.33 cm) and flower yield per plant (184.16g) and per hectare (204.61q) were found maximum by application of 300 kg N ha^{-1} followed by 200 kg N ha^{-1}. Flowering characters influenced because nitrogen in very important constituent of chlorophyll content of leaf might have increased carbohydrate synthesis amino acid etc. from which the phyto-hormones like auxins, gibberellins, cytokins have been synthesized. Similar result were also reported by Yadav *et al.* (2000)) in marigold and Nath *et al.* (2010) in China aster.

(ii) Effect of phosphorus

Application of phosphorus upto 200 kg ha^{-1} also resulted significant influenced in the growth and flowering attributes of China aster (table 1). Plant height (57.64

cm), plant spread (27.22 cm), number of primary branches (22.48) and number of leaves (141.33) were maximum with the application of phosphorus 200 kg ha^{-1} followed by 150 kg ha^{-1}. Growth characters influenced due to phosphorus application as it is the essential component of protoplasm and chlorophyll which caused conversion of photosynthates into phospholipids resulting adequate vegetative growth. 200 kg ha^{-1} phosphorus also caused significant and favorable influences on flowering parameters. Number of flowers per plant (34.60), largest size of flower and length of flower stalk (7.23 & 27.18 cm), maximum flower yield per plant and per hectare (175.15g and 194.53g, respectively) were obtained with the application of phosphorus 200 kg ha^{-1}. Remarkable increase in yield and other flowering parameters may be assigned to higher vegetative growth which might have resulted in higher photosynthates and ultimately the yield and quality. Results are in conformity with Mohit *et al.* (2008), Muktanjali *et al*. (2004) and Nath *et al.* (2010) in China aster.

(iii) Interaction effects of nitrogen and phosphorus

Data illustrated in table 1 showed that most of the vegetative and flowering attributes studies were increased non significantly with increasing level of nitrogen (upto 300 kg ha^{-1}) and phosphorus (upto 200 kg ha^{-1}) due to their interaction effects simultaneously. Application of 300 kg N +200 kg P was the most favorable combination to perform highest values regarding plant height (62.87 cm), number of primary branches (25.20) and number of leaves (160.07) per plant while plant spread (29.60) was recorded significant effects. It might be due to synergistic activities of all the growth nutrients, which played active role in enlarging plants cell and tissues, consequently increased vegetative growth. The findings are inconformity with the reports of Agrawal *et al*. (2002) in marigold and Muktanjali *et al.* (2004) and Mohit *et al.* (2008) in China aster. The interactive effects of higher levels of nitrogen and phosphorus also found to be significant in case of increasing number of flower per plant (39.23), flower diameter (7.71 cm), flower weight (5.75g) and flower yield per plant and per hectare 227.32g and 252.57g, respectively). Increase in most of the quality and yield attributing traits of China aster was due the synergistic effects of most of the essential growth elements which increased the plant growth and yield contributing attributes by synthesis of assimilates and their translocation to sink. The results regarding yield attributes due to interaction of nitrogen and phosphorus are in consonance with Agrawal *et al*. (2002**)** and Baboo *et al*. (2003) in Marigold and Muktanjali *et al*. (2004) in China aster.

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