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FLOWERING, SEED YIELD AND QUALITY OF CHINA ASTER AS INFLUNCED BY APPLICATION OF NITROGEN AND PHOSPHORUS

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Abstract

A field experiments was conducted at Horticulture Section, College of Agriculture, Nagpur (Maharashtra), India during *rabi* season of 2013-2014 to know the response of nitrogen and phosphorus on flowering, seed yield and quality parameters of China aster cv. Poornima. The experiment was laid out in Factorial Randomized Block Design with three replication and sixteen treatments combinations, which comprised of four levels of nitrogen (0, 100, 150 and 200 kg ha^{-1}) and phosphorus (0, 50, 75 and 100 kg ha^{-1}). The results revealed that nitrogen and phosphorus levels significantly influenced the flowering, yield and quality parameters in China aster. Flowering parameters were delayed *viz*., days to first flower bud initiation, days to opening of first flower, days to 50 per cent flowering, days to first harvesting with the treatment 200 kg nitrogen and 75 kg phosphorus ha^{-1}. Whereas, seed yield and quality parameters *viz*., weight of flower, diameter of fully open flower, number of seed g^{-1}, test weight of seed and germination per cent of seed were recorded significantly maximum with nitrogen 200 kg and phosphorus 75 kg ha^{-1}.

Key words : China aster, nitrogen, phosphorus, flowering, quality.

Introduction

China aster botanically called as *Callistephus chinensis* (L.) Ness is an upcoming new potential cut flower crop belonging to the family Asteraceae. It is annual flower crop grown in many part of the world for cut flowers. It has many commercial varieties, which are useful in landscape garden for colorful effect in herbaceous borders, bedding, potted plant in home garden for display, making bouquets, button holes and garlands. The wide spectrum of colour ranges (blue, purples, pink and white) available in aster with long vase life has made aster a very popular cut flower. Nutrients play an important role in the improvement of vegetative growth, flowering, seed yield and quality parameters in China aster (Chezhiyan *et al*., 1986). At present, due to lack of scientific knowledge, growers are not able to boost the productivity of China aster. In view of this fact and over-riding need was felt to conduct research on to find out the of nitrogen and phosphorus fertilizers for higher seed production in China aster. Hence, this study was conducted to optimizes the response of nitrogen and phosphorus on flowering, seed yield and quality of China aster.

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Materials and Methods

An investigation entitled, "flowering, seed yield and quality of china aster as influnced by application of nitrogen and phosphorus" was carried out at the farm of Horticulture section, College of Agriculture, Nagpur during *rabi* season 2013-14. The experiment was laid out in Factorial Randomized Block Design with 16 treatment combinations. Treatment combinations comprised with four different level of nitrogen (0, 100, 150 and 200 kg ha^{-1}) and four different level of phosphorus (0, 50, 75 and 100 kg ha^{-1}). The field was prepared by ploughing and harrowing. Flat beds of size 1.2 m × 1.8 m were prepared and transplanting of one month old healthy China aster seedlings of variety Poornima was done at spacing of 30 cm × 30 cm. Various observations *viz*., days to first flower bud initiation from the date of transplanting, opening of first flower, 50 per cent flowering, were recorded at flowering time, days to first harvesting, weight of flower, diameter of fully open flower, number of seed g^{-1}, test weight of seed and germination per cent of seed was recorded after harvesting of flowers. Collected data were statistically analyzed.

Results and Discussion

Effect of nitrogen

The data presented in table 1 revealed that the application of nitrogen significantly influenced the flowering parameters. Days to first flower bud initiation (59.29 days), opening of first flower (10.97 days), 50 per cent flowering (69.49 days) and days to first harvesting of mature flowers (96.66 days) were significantly delayed with application of 200 kg nitrogen ha^{-1} followed by 100 kg nitrogen ha^{-1} and 150 kg nitrogen ha^{-1}. Whereas, days to first flower bud initiation from the date of transplanting (52.05 days), opening of first flower (52.05 days), 50 per cent flowering (61.16 days) and days to first harvesting (91.86 days) were recorded significantly early in control treatment. Results showed that, the late induction of flowers with increased application of nitrogen might be due to more synthesis of protein and protoplasm from carbohydrates deciding to less accumulation of stored carbohydrates in vegetative parts. Since, the nature of the protoplasm is hydrated, plants become succulent and as result delay in flower bud formation takes place. The results are in the close conformity with the results of Chavan *et al*. (2010). They recorded maximum number of days to open first flower with the application of nitrogen at 300 kg ha^{-1} in China aster cv. Phule Ganesh White. Also, Sharma *et al*. (2010) reported an application of nitrogen at 300 kg ha^{-1} delays flowering in marigold (*Tagetes erecta* linn.).

As regards seed yield and quality parameters (table 2) indicated that application of higher dose of nitrogen was significantly influenced the seed yield and quality parameters. Weight of flower (4.86 g), diameter of fully open flower (6.25 cm), seed yield $plant^{-1}$ (3.14 g), number of seed g^{-1} (511.73), test weight of seed (1.821g) and germination per cent (70.16%) was recorded significantly maximum with the application of 200 kg nitrogen ha^{-1} followed by 150 kg nitrogen ha^{-1} and 100 kg nitrogen. While, weight of flower (2.69 g), diameter of fully open flower (5.31 cm), seed yield $plant^{-1}$ (2.13g), number of seed g^{-1} (415.17), test weight (1.660 g) and germination per cent of seed (55.05%) were recorded minimum in control treatment. This might be due to nitrogen being a synthesis of protein as supposed to be reason for increase of flower weight. The results are in the close conformity with the results of Saman and Kirad (2013). They reported an application of nitrogen at 150 kg ha^{-1} had recorded maximum test weight of seed in calendula. Singh *et al*. (2013) stated that an application of nitrogen 150 kg ha^{-1} had recorded maximum weight of flower in African marigold.

Effect of phosphorus

The data presented in table 1 revealed that the application of phosphorus had significantly influenced the flowering parameters. Phosphorus 75 kg ha^{-1} observed delayed in flowering parameters *viz*., flower bud initiation (56.70 days), opening of first flower (10.26 days), 50 per cent flowering (65.91 days) and days to first harvesting (94.22) was delayed in which was found to be at par with treatment phosphorus 100 kg ha^{-1}. Whereas, days to first flower bud initiation from the date of transplanting (55.00 days), opening of first flower (9.59 days), 50 per cent flowering (63.66 days) and days to first harvesting (92.87 days) was recorded early in the control treatment. This might be due to phosphorus is essential component of protoplasm and chlorophyll materials, which caused conversion of photosynthates and phospholipids resulting adequate vegetative growth results in delayed in flowering. This findings were close conformity by Mohit *et al*. (2008). They reported an application of phosphorus at 200 kg ha^{-1} recorded delays initiation of flower bud in China aster cv. Poornima. Kishore *et al*. (2010) reported that an application of phosphorus at 80 kg ha^{-1} had recorded maximum number of days to first flower bud initiation in African marigold cv. Pusa Narangi Gainda.

The data presented in table 2 indicated that the application of 75 kg phosphorus ha^{-1} significantly influenced the seed yield and quality parameters *viz*., weight of flower, diameter of fully open flower, seed yield $plant^{-1}$, number of seed g^{-1}, test weight of seed and germination per cent of seed. Significantly maximum weight of flower (3.94 g), diameter of fully open flower (5.88 cm), seed yield $plant^{-1}$ (2.80 g), number of seed g^{-1} (469.17), test weight of seed (1.751 g) and germination per cent of seed (62.73%) were recorded with application of application of 75 kg phosphorus ha^{-1}, which was found at par with 100 kg phosphorus ha^{-1}. However, weight of flower (3.28 g), diameter of fully open flower (5.63 cm), seed yield $plant^{-1}$ (2.46 g), number of seed g^{-1} (442.06), test weight of seed (1.687 g) and germination per cent of seed (59.62) were recorded minimum in the control treatment. This might be due to possible role of phosphorus is absorption of food materials. These findings are in close conformity with the result of Masaye and Rangwala (2009) revealed that an application of 100 kg phosphorus ha^{-1} had recorded maximum diameter of flower in China aster cv. Poornima. Also, Joshi *et al*. (2013) stated that an application of phosphorus 150 kg ha^{-1} had resulted maximum fresh weight of flower in chrysanthemum.

Interaction effect

The data presented in table 1 indicated that the interaction effect of nitrogen and phosphorus on flowering

Table1 : Effect of nitrogen and phosphorus on flowering parameters of China aster.

Treatments	Days to first flower bud initiation from date of transplanting (days)	Opening of first flower bud (days)	50% flowering (days)	Days to first harvesting of mature flower (days)
Nitrogen levels (N)				
N_0 - 0 kg nitrogen ha^{-1}	52.05	8.92	61.16	91.86
N_1 - 100 kg nitrogen ha^{-1}	54.80	9.82	63.33	92.29
N_2 - 150 kg nitrogen ha^{-1}	57.50	10.35	66.00	93.53
N_3 - 200 kg nitrogen ha^{-1}	59.29	10.97	69.49	96.66
SE (m) ±	0.22	0.06	0.41	0.30
CD at 5%	0.66	0.19	1.19	0.88
Phosphorus levels (P)				
P_0 - 0 kg phosphorus ha^{-1}	55.00	9.59	63.66	92.87
P_1 - 50 kg phosphorus ha^{-1}	55.42	9.96	64.83	93.56
P_2 - 75 kg phosphorus ha^{-1}	56.70	10.26	65.91	94.22
P_3 -100 kg phosphorus ha^{-1}	56.51	10.24	65.58	93.70
SE (m) ±	0.22	0.06	0.41	0.30
CD at 5%	0.66	0.19	1.19	0.88
Interaction effect (N × P)				
N_0P_0	49.87	8.13	60.00	91.73
N_0P_1	51.27	9.07	61.00	91.80
N_0P_2	53.00	9.10	61.67	91.90
N_0P_3	54.07	9.37	62.00	91.93
N_1P_0	54.33	9.43	62.67	91.97
N_1P_1	54.47	9.63	63.00	92.30
N_1P_2	55.07	10.20	63.67	92.45
N_1P_3	55.53	10.03	64.00	92.51
N_2P_0	56.93	10.13	64.67	92.99
N_2P_1	57.00	10.27	66.00	93.45
N_2P_2	57.87	10.47	66.67	93.47
N_2P_3	58.20	10.53	66.67	94.23
N_3P_0	58.37	10.67	67.33	94.88
N_3P_1	58.97	10.90	69.33	96.25
N_3P_2	59.53	11.27	71.33	98.97
N_3P_3	59.23	11.03	70.00	96.56
SE (m) ±	0.45	0.13	0.82	0.61
CD at 5%	1.32	0.38	2.38	-

parameters was found to be significant. Significantly delayed in first flower bud initiation (59.53 days), days to first flower bud opening (11.27 days) and days required for 50 per cent flowering (71.33 days) was recorded in treatment combination of nitrogen 200 kg and phosphorus 75 kg ha^{-1}, which was found to be at par with treatment combinations nitrogen 200 kg and phosphorus 100 kg ha^{-1}. Whereas, significantly early first flower bud initiation (49.87 days), days required for opening of first flower bud (8.13 days) and days required for 50 per cent flowering (60.00 days) was recorded in control treatment. This might be due to the effect of nitrogen and phosphorus the synergistic effects of most of essential growth of plant and delay flowering of China aster. The findings are in conformity with the results of Kishore *et al*. (2010). They revealed that, an application of nitrogen at 150 kg ha^{-1} in combination with phosphorus at 80 kg ha^{-1} had recorded maximum duration of flowering in African marigold cv. Pusa Narangi Gainda. Wani *et al*. (2013) also, reported that 30 g/m^2 nitrogen and 20 g/m^2 phosphorus noted maximum flowering duration in China aster cv. American Beauty.

Table 2 : Effect of nitrogen and phosphorus on seed yield and quality parameters of China aster.

Treatments	Weight of flowers (g)	Diameter of fully open flower (g)	Seed yield plant^{-1} (g)	No. of seed g^{-1}	Test weight of seed (g)	Germination %
Nitrogen levels (N)						
N_0 - 0 kg nitrogen ha^{-1}	2.69	5.31	2.13	415.17	1.600	55.05
N_1 - 100 kg nitrogen ha^{-1}	3.13	5.57	2.49	423.08	1.693	58.05
N_2 - 150 kg nitrogen ha^{-1}	3.79	6.02	2.81	466.56	1.708	62.47
N_3 - 200 kg nitrogen ha^{-1}	4.86	6.25	3.14	511.73	1.821	70.16
SE (m) ±	0.091	0.05	0.04	4.77	0.016	0.44
CD at 5%	0.26	0.16	0.13	13.7	0.047	1.27
Phosphorus levels (P)						
P_0 - 0 kg phosphorus ha^{-1}	3.28	5.63	2.46	442.06	1.687	56.62
P_1 - 50 kg phosphorus ha^{-1}	3.48	5.78	2.58	445.00	1.691	61.04
P_2 - 75 kg phosphorus ha^{-1}	3.94	5.88	2.80	469.17	1.751	62.73
P_3 -100 kg phosphorus ha^{-1}	3.77	5.85	2.72	460.31	1.745	62.45
SE (m) ±	0.091	0.05	0.04	4.77	0.016	0.44
CD at 5%	0.26	0.16	0.13	13.7	0.047	1.27
Interaction effect (N × P)						
N_0P_0	2.60	5.17	1.83	412.00	1.630	54.20
N_0P_1	2.70	5.30	2.14	414.67	1.670	54.50
N_0P_2	2.70	5.37	2.22	415.00	1.670	55.70
N_0P_3	2.73	5.40	2.34	416.67	1.671	55.80
N_1P_0	2.77	5.43	2.42	417.00	1.685	57.30
N_1P_1	3.23	5.47	2.47	420.00	1.690	57.50
N_1P_2	3.27	5.57	2.56	427.67	1.696	58.10
N_1P_3	3.27	5.77	2.49	430.00	1.703	59.70
N_2P_0	3.50	5.80	2.72	445.00	1.705	59.90
N_2P_1	3.57	6.07	2.78	450.00	1.707	61.80
N_2P_2	4.00	6.10	2.84	482.00	1.710	63.70
N_2P_3	4.10	6.10	2.91	489.25	1.713	64.50
N_3P_0	4.30	6.10	2.87	491.91	1.730	66.77
N_3P_1	4.40	6.13	2.94	498.00	1.730	69.16
N_3P_2	5.80	6.67	3.58	552.00	1.927	73.30
N_3P_3	4.93	6.13	3.15	505.00	1.897	71.40
SE (m) ±	0.183	0.11	0.09	9.55	0.03	0.88
CD at 5%	0.52	0.32	0.26	27.5	0.09	2.05

However, days to first harvesting of first mature flower for seed purpose was found to be non significant.

The data presented in table 2 indicated that, the interaction effect due to nitrogen and phosphorus on seed yield and quality parameters was found to be significant. Significantly maximum weight of fresh flower (5.80 g), diameter of fully opend flower (6.67 cm), seed yield plant^{-1} (3.58 g), number of seed g^{-1} (552.00), test weight (1.751 g) and germination per cent (73.30%) were recorded in treatment combination of nitrogen 200 kg and 75 kg phosphorus ha^{-1}, which was found at par with treatment combinations nitrogen 200 kg and 100 kg phosphorus ha^{-1} and nitrogen 200 kg and 50 kg phosphorus ha^{-1}. However, weight of flower (2.60 g), diameter of fully opend flower (5.17 cm) seed yield plant^{-1} (1.83ng), number of seed g^{-1} (179.92), test weight (1.687 g) and germination per cent (54.20%) was recorded minimum in control treatment. This might be due to synergistic activities of all the growth nutrients, which played active role in enlarging plats cell and tissues, consequently increased vegetative growth. Ahirwar *et al*. (2012) reported that, an application of nitrogen and phosphorus each at 100 kg ha^{-1} had maximum fresh weight of flower in African marigold during winter season under Jabalpur conditions. Saman and Kirad (2013) observed that nitrogen 150 kg ha^{-1} and phosphorus 80 kg ha^{-1} had maximum test weight in calendula.

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