



## Effect of Nitrogen and Phosphorus on Growth, Flowering and Yield of Cut *Chrysanthemum* cv. Thai Chen Queen

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### Abstract

An investigation was carried out to study the effect of nitrogen and phosphorus on growth, flowering and yield of cut chrysanthemum cv. Thai Chen Queen. The experiment was laid out in randomized block design (RBD) with factorial concept comprising of twelve treatment combinations with four levels of nitrogen, viz., 100 kg N/ha (N<sub>1</sub>), 150 kg N/ha (N<sub>2</sub>), 200 kg N/ha (N<sub>3</sub>) and 250 kg N/ha (N<sub>4</sub>) and three levels of phosphorus, viz., 50 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>1</sub>), 75 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>2</sub>) and 100 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>3</sub>). The treatments were replicated four times. The results indicated that application of 200 kg N/ha (N<sub>3</sub>) to cut chrysanthemum was most effective to increase plant height whereas, plants receiving 150 kg N/ha significantly improved vegetative growth as well as quality and yield of flowers. Application of 75 kg P<sub>2</sub>O<sub>5</sub>/ha was found promising for growth, quality as well as yield parameters.



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### Introduction


Chrysanthemum (*Chrysanthemum morifolium* Ramat.) is a very popular commercial flower grown for cut flowers, loose flowers as well as pot plant all over the world. As Rose is called as the flower of West, chrysanthemum is called as flower of East and also said to be 'Queen of East'. In recent years,

demand of chrysanthemum for use in amenity horticulture has steadily increased not only for their aesthetic beauty and a long lasting quality but also for their good prospect of marketing as cut flowers and potted plants to many countries in the world (Bose *et al.*, 2007).<sup>1</sup> For maximization of yield and quality of flower crop, various management practices

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like irrigation, plant density per unit area, season of growing, proper dose of manures and fertilizers, plant protection, etc. are to be properly followed. Balanced fertilizer application is an essential criteria for quality production of crops. It has been established that there is positive correlation between fertilizer usages and flower productivity. Cut chrysanthemum is a heavy feeder and has large requirement of nutrients. In the current scenario, lower productivity and inferior flower quality of chrysanthemum is due to inefficient use of fertilizers. It has been established that the nutrition plays an important role in improvement of vegetative growth and flower yield in chrysanthemum (Chezhiyan *et al.*, 1986).<sup>2</sup> For obtaining good growth and quality flowers in cut chrysanthemum, application of nitrogen and phosphorus has been found very effective. Thus arriving at an optimum dose of nitrogen and phosphorus is expected to boost the flower production in cut chrysanthemum. Keeping these points in view, the present investigation entitled "Effect of nitrogen and phosphorus on flower yield and quality of cut chrysanthemum cv. Thai Chen Queen" was carried out.

## Materials and Methods

### Experimental Site

The experiment was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, NAU, Navsari, geographically situated at 20°57' N latitude and 72°54' E longitude at an altitude of about 11.83 meter above the mean sea level during October 2017 to March 2018 to study the effect of nitrogen and phosphorus on flower yield and quality of cut chrysanthemum. The soil of experimental site was heavy clay, moderate drainage and good water holding capacity with pH of 7.4, 0.58 % organic carbon, 241 kg/ha available N, 40.25 kg/ha available P<sub>2</sub>O<sub>5</sub> and 280 kg/ha available K<sub>2</sub>O.

### Experimental Design and Treatments

The experiment was laid out in randomized block design with factorial concept consisting four levels of nitrogen *viz.*, 100 kg N/ha (N<sub>1</sub>), 150 kg N/ha (N<sub>2</sub>), 200 kg N/ha (N<sub>3</sub>) and 250 kg N/ha (N<sub>4</sub>) and three levels of phosphorus *viz.*, 50 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>1</sub>), 75 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>2</sub>) and 100 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>3</sub>). The treatments were replicated four times. Forty days old healthy terminal rooted plants were transplanted in raised

beds at spacing of 30 cm x 30 cm. Two equal doses of nitrogen in the form of urea was applied during transplanting of chrysanthemum and one month after transplanting as top dressing whereas, full dose of phosphorus in the form of single super phosphate (SSP) was applied at the time of transplanting as per treatment. Potassium at the rate of 100 kg/ha was applied in the form of muriate of potash at the time of transplanting as common basal dose.

### Sampling and Measurement of Parameters

Five plants were selected randomly from each plot for recording various growth, quality and yield parameters *viz.*, flower diameter (cm), flower stem length (cm), fresh weight of flower (g), vase life (days) and number of flower stems per plant whereas, number of flower stems per hectare was estimated and recorded on the basis of net plot area. The data was statistically analyzed by standard method of analysis of variance technique appropriate to the Randomized Block Design with factorial concept as described by Panse and Sukhatme (1985).<sup>3</sup>

## Results and Discussion

The data presented in Table 1 revealed that different levels of nitrogen and phosphorus had significant effect on growth parameters of cut chrysanthemum cv. Thai Chen Queen.

### Growth Parameters

#### Effect of Nitrogen

The results revealed that application of 200 kg N/ha (N<sub>3</sub>) significantly improved plant height (45.32 cm) in cut chrysanthemum. The increase in plant height might be due to the fact that nitrogen is a constituent of protein which is essential for formation of protoplasm thus affecting the cell division and cell enlargement and ultimately better vegetative growth. The results are in agreement with the findings of Patel (2004),<sup>4</sup> Chawla *et al.*, (2007)<sup>5</sup> and Joshi *et al.*, (2013)<sup>6</sup> in chrysanthemum.

Moreover, application of nitrogen at 150 kg N/ha (N<sub>2</sub>) significantly enhanced maximum leaf area (16.01 cm<sup>2</sup>), plant spread in N-S (27.59 cm) and E-W (26.88 cm) directions and number of branches (8.73) at full bloom stage. Application of nitrogen at 150 kg N/ha (N<sub>2</sub>) also increased fresh weight of plant

(669.7 g) and dry weight of plant (163.20 g) at the end of experimentation. Being the constituent of protein and nucleic acid, nitrogen is helpful in promoting plant growth (Haque and Jakhro 2001).<sup>7</sup>

**Table 1: Effect of nitrogen and phosphorus on growth parameters of cut chrysanthemum cv. Thai Chen Queen**

Treatments	At full bloom stage				At the end of experiment		
	Plant height (cm)	Leaf area (cm <sup>2</sup> )	Plant spread N-S (cm)	Plant spread E-W (cm)	No. of branches per plant	Fresh weight of plant (g)	Dry weight of plant (g)
<b>Nitrogen (N)</b>							
N <sub>1</sub> - 100 kg N/ha	36.66	12.22	21.60	21.08	6.12	347.91	85.58
N <sub>2</sub> - 150 kg N/ha	44.15	16.01	27.59	26.88	8.73	669.71	163.20
N <sub>3</sub> - 200 kg N/ha	45.32	15.14	26.64	25.99	7.83	567.55	127.82
N <sub>4</sub> - 250 kg N/ha	41.52	13.20	24.60	24.01	6.98	498.35	122.59
S.Em. ±	1.24	0.47	0.74	0.73	0.19	16.88	3.69
C.D. (P=0.05)	3.56	1.35	2.11	2.11	0.54	48.60	10.62
<b>Phosphorus (P)</b>							
P <sub>1</sub> - 50kg P <sub>2</sub> O <sub>5</sub> /ha	40.13	13.34	23.28	22.72	6.69	414.68	102.00
P <sub>2</sub> - 75 kg P <sub>2</sub> O <sub>5</sub> /ha	44.00	14.92	26.34	25.68	8.10	610.13	141.80
P <sub>3</sub> - 100 kg P <sub>2</sub> O <sub>5</sub> /ha	41.61	14.17	25.69	25.07	7.46	537.84	130.58
S.Em. ±	1.07	0.41	0.64	0.64	0.16	14.62	3.20
C.D. (P=0.05)	3.09	1.17	1.83	1.83	0.47	42.08	9.20

### Effect of Phosphorus

Application of 75 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>2</sub>) to chrysanthemum significantly increased vegetative growth parameters. The results of the present investigation revealed that at the full bloom stage, plant height (44.00 cm), leaf area (14.92 cm<sup>2</sup>), plant spread in N-S and E-W directions (26.34 and 25.68 cm, respectively) and number of branches per plant (8.10). Moreover, at the end of experimentation fresh weight of plant (610.13 g) and dry weight of plant (141.80 g) were found maximum with the application of 75 kg P<sub>2</sub>O<sub>5</sub>/ha (P<sub>2</sub>). The possible reason of increase in different vegetative growth characters of chrysanthemum might be due to application of phosphorus, attributed to the established fact that it is one of the major elements and being a constituent of nucleoprotein, it is known to play a leading role in photosynthesis, cell division and tissue formation (Arnon, 1959).<sup>8</sup>

### Flower Quality and Yield Parameters

#### Effect of Nitrogen

The data presented in Table 2 revealed that different levels of nitrogen and phosphorus had significant effect on quality and yield parameters of cut chrysanthemum cv. Thai Chen Queen. The results indicated that the application of 150 kg N/ha significantly improved the quality with respect to flower stem length (38.90 cm), fresh weight of flower stem (24.56 g), flower diameter (11.11 cm) and vase life (8.03 days) during second picking of harvesting. The increase in length of flower stem may be attributed to excessive growth on radial aspect of plant as observed through increase in plant height with higher nutrient application. Earlier reports showed that increased application of nitrogen significantly increased stem length in chrysanthemum (Patel and Chaudhari, 2011),<sup>9</sup> in China aster (Gaikwad *et al.*, 2004)<sup>10</sup> and in bird

of paradise (Disha, 2016).<sup>11</sup> Improvement in fresh weight might be due to improved vegetative growth of plant under appropriate level of nitrogen which caused more storage of carbohydrates resulting improved fresh weight.

**Table 2: Effect of nitrogen and phosphorus on quality and yield parameters of cut chrysanthemum cv. Thai Chen Queen**

Treatments	At second picking of harvesting					
	Flower diameter (cm)	Flower stem length (cm)	Flower stem weight (g)	Vase life (days)	No. of Flower stems per plant (Nos.)	No. of Flower stems per ha. ('000 Nos.)
<b>Nitrogen (N)</b>						
N <sub>1</sub> - 100 kg N/ha	9.97	28.75	19.04	6.98	5.13	367.12
N <sub>2</sub> - 150 kg N/ha	11.11	38.90	24.56	8.03	7.10	507.87
N <sub>3</sub> - 200 kg N/ha	10.53	35.60	23.15	7.02	6.40	457.06
N <sub>4</sub> - 250 kg N/ha	10.31	32.33	20.90	6.82	5.78	413.71
S.Em. ±	0.26	0.74	0.55	0.18	0.13	9.59
C.D. (P=0.05)	0.76	2.12	1.59	0.52	0.38	27.62
<b>Phosphorus (P)</b>						
P <sub>1</sub> - 50kg P <sub>2</sub> O <sub>5</sub> /ha	9.98	31.07	19.75	6.64	5.56	397.82
P <sub>2</sub> - 75 kg P <sub>2</sub> O <sub>5</sub> /ha	10.79	36.56	23.64	7.66	6.64	474.30
P <sub>3</sub> - 100 kg P <sub>2</sub> O <sub>5</sub> /ha	10.67	34.05	22.35	7.34	6.11	437.19
S.Em. ±	0.23	0.64	0.48	0.16	0.11	8.31
C.D. (P=0.05)	0.66	1.83	1.38	0.45	0.33	23.92

The increase in the size of flower may be contributed by meristematic activity of metabolites from vegetative growth of plants. Similar results were obtained by Chauhan (2012)<sup>12</sup> in golden rod and Ahirwar *et al.*, (2012)<sup>13</sup> in African marigold. The improvement in vase life might be due to nitrogen which produces carbohydrates that extend the vase life but with increase in nitrogen, depletion of carbohydrates causing digestion of proteins which might reduce sugar content, an important factor to extend vase life in chrysanthemum as stated by Disha (2016)<sup>11</sup> in bird of paradise and Patel and Chaudhari (2011)<sup>9</sup> in chrysanthemum.

Significantly highest number of flower stems per plant (7.10) and per hectare (507.87 thousand) were noted with the application of 150 kg N/ha in

chrysanthemum. The increase in number of flowers and yield with application of nitrogen might be due to the fact that applied nitrogen had significantly increased the growth parameters like number of branches, which might have synthesized more plant metabolites and ultimately led to increased flower production (Chan, 1959).<sup>14</sup> These findings are in close conformity with Chawla *et al.*, (2007),<sup>5</sup> Patel and Chaudhari (2011),<sup>9</sup> Satar *et al.*, (2012)<sup>15</sup> and Joshi *et al.*, (2013)<sup>6</sup> in chrysanthemum.

#### Effect of Phosphorus

At the time of second picking of flowers significantly maximum flower stem length (36.56 cm), fresh weight of flower (23.64 g), diameter of flower (10.79 cm) and vase life of flower (7.66 days) were recorded in plants receiving 75 kg P<sub>2</sub>O<sub>5</sub> per ha.

The improvement in flower quality characters might be due to the fact that growth stimulating compounds formed in plants increase the absorption of nutrients and accumulation of carbohydrates improving the source to sink relationship with greater partitioning coefficient which might improve the quantitative characters. These results are in accordance with the findings by Joshi *et al.*, (2013)<sup>6</sup> in chrysanthemum, Chauhan (2012)<sup>12</sup> in golden rod and Naik (2015)<sup>16</sup> in African marigold. The results revealed that application of 75 kg P<sub>2</sub>O<sub>5</sub>/ha significantly increased number of flower stems per plant (6.64) and per ha (474.30 thousand) in chrysanthemum. Number of flowers per plant and flower yield was increased with the application of phosphorus might be due to improvement in various vegetative parameters of cut chrysanthemum. The findings are in agreement with Gaikwad *et al.*, (2004)<sup>10</sup> in China aster, Chawla *et al.*, (2007),<sup>5</sup> Satar *et al.*, (2012)<sup>15</sup> and Joshi *et al.*, (2013)<sup>6</sup> in chrysanthemum.

### Conclusion

The overall results of this present study revealed that improved vegetative growth with improved

quality and yield flowers was obtained with 150 kg N per ha. Furthermore, 75 kg P<sub>2</sub>O<sub>5</sub> per ha was found superior for cut chrysanthemum cv. Thai Chen Queen for vigorous growth with maximum quality flower production of cut chrysanthemum.

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### Conflict of Interest

Authors declare no conflict of interest.

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