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# RESPONSE OF CHINA ASTER (*Callistephus chinensis* L. Nees) CV. POORNIMA TO DIFFERENT LEVELS OF NITROGEN AND PHOSPHORUS IN MEDIUM BLACK SOIL

**Pooja Maheta, N. D. Polara, Jyotika Rathod, A. V. Barad* and Nilima Bhosale[1]**

*College of Agriculture, Junagadh Agricultural University, Junagadh-362001, Gujarat*
[1]*Deptt.of Horticulture, Agriculture College, Baramati-Pune (Maharashtra)*
**Corresponding Author's E-mail: avbarad55@gmail.com*

**ABSTRACT :** The present investigation was carried out at Horticulture Research Station, Jambavadi Farm, Junagadh Agricultural University, Junagadh (Gujarat) during October 2014 to March 2015. The experiment was laid out in Factorial Randomized Block Design. The treatments comprised with two factors (1) nitrogen with four levels *i.e.,* 150 kg N $ha^{-1}$($N_1$), 200 kg N $ha^{-1}$($N_2$), 250 kg N $ha^{-1}$ ($N_3$), 300 kg N $ha^{-1}$ ($N_4$) and three levels of phosphorus *i.e.* 100 kg $P_2O_5$ $ha^{-1}$ ($P_1$), 150 kg $P_2O_5$ $ha^{-1}$ ($P_2$), 200 kg $P_2O_5$ $ha^{-1}$ ($P_3$) with three replications. Both the highest levels of N and P significantly improved growth parameters *i.e.* plant height (51.56 cm), plant spread (328.67 $cm^2$), secondary branches per plant (17.67), fresh weight (137.22 g) and dry weight (69.78 g) in treatment $N_4$ (300 kg N $ha^{-1}$) whereas, in case of phosphorus the plant height (47.08 cm), plant spread (316.00 $cm^2$), number of branches per plant (16.92), fresh weight (137.00 g) and dry weight (72 g) were noted maximum in treatment $P_3$ (200 kg $P_2O_5$ kg $ha^{-1}$). Maximum flowering span (71.00 days), number of flowers per plant (24.78) and yield of flowers (22.67 t $ha^{-1}$) were registered in 300 kg N $ha^{-1}$ treatment. Similarly, maximum flowering span (62.50 days), number of flowers per plant (23.58) and yield of flowers (22.08 t $ha^{-1}$) were registered in $P_3$ (200 kg P $ha^{-1}$). Thus, for cultivation of China aster in medium black soil the fertilizer application at the rate of 300 kg N $ha^{-1}$ in two splits (first half as basal application and remaining half at 30 days after transplanting) and 200 kg $P_2O_5$ $ha^{-1}$ as basal dose has been found to be the best.

***Keywords :*** *China aster, nitrogen, phosphorus, growth, flowering, yield.*

China aster (*Callistephus chinensis* L. Nees) is annual flower crop which belongs to the family Asteraceae. The genus *Callistephus* derived its name from Greek word '*Kalistos*,'means the most beautiful and 'stephus', means a crown, referring to the flower head. In present days, China aster has been developed from single form of wild species, *Callistephus chinensis* L.Nees. The original plant had single flowers with two to four rows of blue, violet, white ray florets. China aster is one of the most popular of all garden annuals grown throughout the world. It can easily be grown in open field as well as under lathhouse, polyhouse and net house for the production of cut flowers. The vase life of China aster cut flowers, in general, is more than other annuals grown as cut flowers, China aster is also grown for bedding and potting purpose. The dwarf Pompon and Lilliput types can be grown in window boxes and in mixed borders. China aster is excellent as a cut flower. It is widely cultivated in many parts of the country and especially around Bangalore for this purpose. In India, it is being grown on a large scale in Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra and West Bengal.

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## MATERIALS AND METHODS

The experiment was concluded with two factors considering different levels of nitrogen and phosphorus to study their effect on in growth, flowering and flower yield of China aster. The treatments comprised with two factors *viz.,* Nitrogen 150 kg N $ha^{-1}$ ($N_1$), 200 kg $ha^{-1}$ ($N_2$), 250 kg $ha^{-1}$ ($N_3$), 300 kg $ha^{-1}$ ($N_4$) and (II) Phosphorus in three levels *viz.* 100 kg P2O5 $ha^{-1}$ ($P_1$), 150 kg $P_2O_5$ $ha^{-1}$ ($P_2$), 200 kg $P_2O_5$ $ha^{-1}$ ($P_3$) in Factorial Randomized Block Design with three replications. The trial was conducted in Department of Horticulture, Fruit Research Station, Jambuvadi Farm, Junagadh Agricultural University, Junagadh (Gujarat). The agro techniques including land preparation, application of manure and fertilizers, planting material, sowing, transplanting, weeding, staking, irrigation, plant protection measures were followed up to stage of harvest. The collection of experimental data, sampling procedure etc. were adopted as per the scientific method. Five plants in each treatment were randomly selected for measuring the different parameters. Necessary observations like plant height, plant spread, and number of branches per plant, fresh weight and dry weight of plant, flowering

span and flower yield were recorded and analyzed statistically.

## RESULTS AND DISCUSSION

### Growth

Significant variation was noted in growth parameters as affected by nitrogen application (Table 1). Maximum plant height (51.56 cm), plant spread (328.67 $cm^2$), secondary branches per plant (17.67), fresh weight (137.22 g) and dry weight (69.78 g) were recorded in in treatment $N_4$ (300 kg N $ha^{-1}$), whereas, in case of phosphorus the plant height (47.08 cm),plant spread (316.00 $cm^2$), number of branches per plant (16.92), fresh weight (137.00 g) and dry weight (72 g) were noted maximum in treatment $P_3$(200 kg $P_2O_5$ kg $ha^{-1}$). Interaction effects with different levels of nitrogen and phosphorus (N × P) was found non-significant for all growth parameters. The results obtained are in agreement with the findings of Singh and Sangama (10) who reported significant effect nitrogen application on plant height of China aster Kumar and Kumar (5), Chavan (1) and Sonalnath *et al.* (12) had also reported similar results in China aster. Maximum plant spread was obtained under the highest level of nitrogen $N_4$ (300 kg N $ha^{-1}$) which might be due to formation of new cells at localized region called meristem and increased in size and more number of cells may produced seems in complete as it should correlated to nitrogen. The result was also confirmed with finding of Singh and Sangama (10) and Masaye and Rangawa (7) in China aster

### Flowering and yield

The similar trend to growth was observed for flowering and yield parameters also (Table 2) where minimum days required for opening first flower buds (62.78) and number of days required for 50 per cent flowering (68.00) were recorded in treatment $N_1$ (150 kg N $ha^{-1}$). Whereas, maximum days required for opening first flower buds (79.11) and days required for 50 per cent flowering (88.67) were noted treatment $N_4$ (300 kg N $ha^{-1}$). Maximum flowering span (71.00 days), number of flowers per plant (24.78) and yield of flowers (22.67 t $ha^{-1}$) were registered in same treatment. In case of phosphorus application, the minimum days required for opening first flower buds (66.67) and days required for 50 per cent flowering (73.50) were registered in treatment $P_1$ (100 kg N $ha^{-1}$), whereas maximum days required for opening first flower buds (71.58) and days required for 50 per cent flowering (79.42) were observed in treatment $P_3$ (200 kg N $ha^{-1}$). Maximum flowering span (62.50 days), number of flowers per plant (23.58) and yield of flowers (22.08 t $ha^{-1}$) were also registered in $P_3$ (200 kg P $ha^{-1}$). Interaction effect of different levels of nitrogen and phosphorus (N × P) was found non-significant for all parameters except yield t $ha^{-1}$. In present case, the nitrogen at higher levels might have favoured the amino acid metabolism of expenses of carbohydrate metabolism resulting in delayed flowering with the application of higher doses of nitrogen as reported by Muktanjli *et al.* (8) in China aster. Similar findings were also reported by Singh *et al.* (11) in carnation, Joshi and Barad (4) in Chrysanthemum and Sehrawat *et al.* (9) in marigold.

The flower yield increased as rate of phosphorus increased from 100 to 200 kg $P_2O_5$ $ha^{-1}$. In this case, accelerated phosphorus helped the plant to set forth optimum growth. Moreover, phosphorus fertilization also enhanced translocation and pertaining to vegetative to floral parts resulting in improved flower yield. Similar results were found by Kumar and Kumar (5) in China aster. Increase in flowering span and number of flowers per plant was observed as phosphorus level increased from 100 to 200 kg $P_2O_5$ $ha^{-1}$. Similar results were found by Kumar *et al.* (6) in China aster and Dixit *et al.* (2) in chrysanthemum.

The interaction of higher level of N×P increased vegetative growth so, ultimately higher photosynthetic activity occurred and more photosynthesis might may be produced at the source that are used at the sink and increased yield attributes and fresh weight of flower. The result regarding yield attributes are in consonance with Kumar and Kumar (5) and Sonalnath *et al*. (12) in China aster and Gowda *et al.* (3) in tuberose.

## CONCLUSION

From the results of the experimental data, it could be concluded that for cultivation of China aster in medium black soil the fertilizer application at the rate of 300 kg N $ha^{-1}$ in two splits (first half as basal application and remaining half at 30 days after transplanting) and 200 kg $P_2O_5$ $ha^{-1}$ as basal dose has found to be the best for optimum growth, flowering and yield in China aster cv. Poornima under South Saurashtra Agroclimatic conditions during winter season.

**Table 1: Effect of nitrogen and phosphorus on plant height, plant spread, number of branches per plant, fresh and dry weight of plant of China aster cv. Poornima.**

| Treatments | Plant height (cm) | Plant spread (cm) | No. of branches/ plant | Fresh weight of plant (g) | Dry weight of plant (g) |
|---|---|---|---|---|---|
| **Nitrogen (kg N $ha^{-1}$)** | | | | | |
| **$N_1$ = 150** | 42.44 | 261.11 | 14.44 | 107.22 | 62.22 |
| **$N_2$ = 200** | 42.67 | 263.33 | 14.67 | 113.67 | 64.78 |
| **$N_3$ = 250** | 44.68 | 305.78 | 15.67 | 127.11 | 73.67 |
| **$N_4$ = 300** | 51.56 | 328.67 | 17.67 | 137.22 | 69.78 |
| **C.D. (P=0.05)** | 3.34 | 25.63 | 1.85 | 11.28 | 6.22 |
| **Phosphorus (kg $P_2O_5$ $ha^{-1}$)** | | | | | |
| **$P_1$ = 100** | 42.25 | 276.25 | 14.50 | 114.00 | 64.25 |
| **$P_2$ = 150** | 46.75 | 276.92 | 15.42 | 117.83 | 66.42 |
| **$P_3$ = 200** | 47.08 | 316.00 | 16.92 | 132.00 | 72.17 |
| **C.D. (P=0.05)** | 2.89 | 21.85 | 1.60 | 9.97 | 5.39 |
| **Interaction (N × P)** | | | | | |
| **C.D. (P=0.05)** | NS | NS | NS | NS | NS |
| **C.V. %** | 7.52 | 8.91 | 12.13 | 9.51 | 9.41 |

**Table 2: Effect of nitrogen and phosphorus on days required for open first flower bud, days required for 50% flowering, flowering span, number of flowers per plant and yield of flower of flower in China aster cv. Poornima.**

| Treatments | Days required for open first flower buds (days) | Days required for 50 % flowering | Flowering span (days) | Number of flower per plant | Yield of flower (t $ha^{-1}$) |
|---|---|---|---|---|---|
| **Nitrogen (kg N $ha^{-1}$)** | | | | | |
| **$N_1$ = 150** | 62.78 | 68.00 | 53.44 | 20.22 | 19.33 |
| **$N_2$ = 200** | 65.56 | 72.11 | 55.78 | 21.89 | 20.00 |
| **$N_3$ = 250** | 66.11 | 74.78 | 59.33 | 22.22 | 21.22 |
| **$N_4$ = 300** | 79.11 | 88.67 | 71.00 | 24.78 | 22.67 |
| **C.D. (P=0.05)** | 4.60 | 5.42 | 4.74 | 2.16 | 1.59 |
| **Phosphorus (kg $P_2O_5$ $ha^{-1}$)** | | | | | |
| **$P_1$ = 100** | 66.67 | 73.50 | 57.17 | 21.25 | 20.00 |
| **$P_2$ = 150** | 66.92 | 74.75 | 60.00 | 22.00 | 20.33 |
| **$P_3$ = 200** | 71.58 | 79.42 | 62.50 | 23.58 | 22.08 |
| **C.D. (P=0.05)** | 3.99 | 4.70 | 4.10 | 1.87 | 1.37 |
| **Interaction (N × P)** | | | | | |
| **C.D. (P=0.05)** | NS | NS | NS | NS | 2.76 |
| **C.V. %** | 6.88 | 7.31 | 8.09 | 9.91 | 7.83 |

**Table 3: Interaction effect of nitrogen and phosphorus (N × P) on yield of flower per ha (t $ha^{-1}$ha-1) of China aster cv. Poornima.**

| Phosphorus ($P_2O_5$ kg $ha^{-1}$) / (Nitrogen kg N $ha^{-1}$) | $P_1$ = 100 kg $ha^{-1}$ | $P_2$ = 150 kg $ha^{-1}$ | $P_3$ = 200 kg $ha^{-1}$ |
|---|---|---|---|
| **$N_1$ = 150** | 19.00 | 19.33 | 19.63 |
| **$N_2$ = 200** | 21.00 | 19.33 | 19.67 |
| **$N_3$ = 250** | 20.00 | 20.33 | 23.33 |
| **$N_4$ = 300** | 20.00 | 22.33 | 25.67 |
| **C.D. P=0.05)** | 2.76 | | |
| | | | |

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