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RESPONSE OF AN ELITE CULTIVAR OF ZINNIA (*Zinnia elegans* cv. GIANT DAHLIA FLOWERED) TO VARYING LEVELS OF NITROGENOUS FERTILIZER

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ABSTRACT

Vegetative and floral characteristics of *Zinnia elegans* cv. Giant Dahlia flowered were studied in floriculture research area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, during 2002 in response to nitrogen application (0, 33, 67 and 100 kg ha^{-1}) under natural agro-climatic conditions of Faisalabad. Maximum growth rate (6.49 cm $week^{-1}$), plant height (51.53 cm), number of lateral shoots per plant (7.39), size of lateral shoots (25.02 cm) and leaf area (20.5 cm^2) was recorded in plants supplied with 100 kg N ha^{-1}. Leaf N %age (2.6), maximum number of flowers per plant (15.62) and maximum flower diameter (7.99 cm) was recorded in plants which received 67 kg N ha^{-1}. Application of nitrogen @ 100 kg ha^{-1} delayed flower initiation in treated plants than those receiving low levels of this fertilizer. Flowers of excellent quality were produced when supplied with 67 and 100 kg N ha^{-1}. Nitrogen application @ 100 kg ha^{-1} promoted vegetative growth while moderate dose (67 kg N ha^{-1}) improved floral characteristics such as number of flowers per plant and flower diameter alongwith leaf N %age in Zinnia cv. Giant Dahlia flowered.

INTRODUCTION

Zinnia, the most popular summer annual used extensively in borders, beds and edges, is also grown as a specialty cut flower and is a good source of foreign exchange if grown extensively. Flowers are multi-colored having pink, rose, cherry lavender, purple, red, orange, salmon, golden, yellow, white, cream or light green colours (Reilly, 1978). Zinnia flowers for longer periods and can withstand hot, dry spells by growing vigorously in hot weather, if irrigated properly.

Production of superior quality flowering plants needs special attention like proper nutrition, irrigation and other cultural practices such as hoeing, weeding, pinching etc. Proper amount of N, P and K is required for optimum growth and flower production. It is well established that different cultivars of zinnia showed varying responses to exogenous nitrogen, e.g., excellent quality Zinnia plants were produced when fertilizer (20-10-5) granules were incorporated into the soil during potting @ 10 g per 1400 cc of soil (Kofranek and Lunt, 1962). In contrast, John *et al.*, (1991) observed that Zinnia cv. Giant Flower Crimson produced maximum plant height, number of branches per plant, number of flowers per plant and flower diameter, when supplied with 150 kg N ha^{-1}. Addition of supra-optimal levels of N in the growth medium delayed flowering but augmented plant growth, number of leaves, spike length and number of florets per spike in Gladiolus cv. 'Vinks Glory' (Shah *et al.,* 1984).

Application of N in two equal splits promote sprouting, spike emergence and flowering in gladiolus (Singh, 2000). While Dhaka *et al.*, (1999) reported that number of days required for emergence of first flower, bud and anthesis and duration and longevity of flowers responded positively to N and P application in zinnia. Similarly, Khan *et al.*, (2004) reported that *Zinnia elegans* cv. Meteor responded better to nitrogen application for improving its vegetative and floral characteristics. The present project was designed to optimize nitrogen application for the better growth of *Zinnia elegans* cv. Giant Dahlia Flowered plants to get maximum number of best quality flowers.

MATERIALS AND METHODS

The effect of different levels of nitrogen on growth and flowering of *Zinnia elegans* Jacq. cv. Giant Dahlia-flowered was studied in the Floriculture Research Area, Institute of Horticultural Sciences, University of Agriculture, Faisalabad, during 2002. The seeds were sown on finely prepared nursery beds. Seedlings, at two leaf stage, were transplanted in 3 m x 0.9 m plots spacing plants at 45 cm in rows which were 30 cm apart. Experiment was laid out in randomized complete block design having four treatments replicated thrice. Nitrogen was applied @ 0, 33, 67, 100 kg ha^{-1} while each of phosphorus and potassium was applied @ 33 kg ha^{-1}. In this experiment, phosphorus and potash was applied @ 8.91g each per plot constantly while nitrogen was applied according to treatments @ 0g, 8.91g, 18.09g and 27.00g. Whole phosphorus and potash in the form of single super phosphate and potassium sulphate, respectively, while half dose of nitrogen in the form of urea was applied at the time of

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transplanting and the remaining half dose of nitrogen after 30 days of transplanting because application of N in split doses not only enhance absorption by the plants and reduce leaching but also becomes available to the plants during initiation of flowers. Each treatment was comprised of ten plants making total of 120 plants in the experiment. Out of ten plants, five from each plot (treatment) were randomly selected for recording growth characteristics viz., plant growth rate per week, plant height, number of lateral shoots per plant and length of lateral shoots, and floral characteristics i.e. days to show first bloom, number of flowers per plant and flower diameter. Quality of flowers was assessed by grading i.e. excellent = 1, very good = 2, good = 3, fair =4 and poor = 5. The quality assessment was judged by a panel of three judges who visually checked the above mentioned rating criteria and average was computed on the basis of flower diameter, shape of petals, petal colour, occurrence of any insect/ disease etc. Leaf area was measured with the help of leaf area meter whereas leaf N contents were determined by using micro kjeldhal apparatus (Chapman and Parker, 1961).

Data collected were analyzed statistically by performing analysis of variance technique (Steel and Torrie, 1980) and interpreted according to Duncan's Multiple Range test at 5% level of probability.

RESULTS AND DISCUSSION

Nitrogen application at different rates significantly affected the growth rate of *Zinnia elegans* cv. Giant Dahlia flowered. Plants supplemented with nitrogen @ 100 kg N ha^{-1} grew at a rapid rate (6.49 cm $week^{-1}$) as compared to other treatments, although growth rate was statistically similar to plants receiving 67 kg nitrogen ha^{-1} (6.34 cm $week^{-1}$) as shown in Fig. 1. Plants grown without fertilizer application grew slowest (5.32 cm $week^{-1}$) of all the plants in different treatments, yet statistically similar to plants receiving 33 kg nitrogen ha^{-1}. Growth of plants increased gradually by increasing the nitrogen contents of the growing media. These results are in accordance with those of Trusushima and Date (1978).

Plant height was statistically affected by the rate of nitrogen application. Plants of maximum height (51.53 cm) were observed when supplied with 100 kg N ha^{-1}. Plants receiving nitrogen @ 67 and 33 kg N ha^{-1} were statistically of almost same height i.e. 48.49 cm and 46.91 cm, respectively. Plant height was minimum (41.83 cm) when grown without nitrogen as shown in Fig. 2. Plant height followed almost similar trend as growth rate per week, which indicates a positive correlation between these two parameters. Results revealed increase in plant height with a concomitant increase of nitrogen application. These results are supported by the findings of John *et al.* (1991) that application of 150 kg ha^{-1} of nitrogen alongwith 100 kg of each phosphorus and potassium resulted in plants of maximum height among all the treated plants (0, 50, 100 or 150 kg N ha^{-1}), in Zinnia cv. Giant flowered crimson.

Branching of Zinnia cv. Gaint Dahlia flowered differed significantly at different nitrogen levels. Minimum count of lateral shoots per plant was recorded in control, which had 3.49 lateral shoots per plant. While, maximum number of lateral shoots (7.39) $plant^{-1}$ was observed when nitrogen was applied @ 100 kg N ha^{-1}. Nitrogen application @ 33 and 67 kg N ha^{-1} resulted in 5.84 and 6.53 lateral shoots per plant, respectively, which were significantly different from each other (Fig. 1). Results indicate the increase in branching with increase in plant height, which in turn was affected by the rate of nitrogen application. There was positive correlation between plant height, branching and rate of nitrogen application, as evident from the findings of John *et al.* (1991) that increasing nitrogen application from 0 to 150 kg per hectare increased branching in Zinnia cv. Giant flowered crimson.

As for as length of lateral shoots is concerned, maximum length (25.02 cm) was observed in plants supplied with nitrogen @ 100 kg N ha^{-1}, followed by 22.80 cm, 22.71 cm and 21.57 cm in plants receiving 67, 33 and 0 kg (control) nitrogen ha^{-1} as shown in Fig. 2. Length of lateral shoots increased gradually with increase in rate of nitrogen application. Leaves of significantly different area were produced by the plants grown under different fertilizer levels. Maximum leaf area was observed in plants supplied with 100 kg N ha^{-1}, followed by the plants receiving 67, 33 and 0 kg N ha^{-1} (Fig. 5). Plants receiving higher dose of N (100 kg ha^{-1}) exhibited maximum leaf area as nitrogen enhances vegetative growth.

Leaf N % age was statistically affected by the rate of nitrogen application. Leaves with maximum N contents (2.6 %) were observed when plants were supplied with 67 kg N ha^{-1}. Plants receiving 100 kg and 33 kg N ha^{-1} were statistically similar regarding leaf N % age. Leaf N contents were minimum (1.1 %) in plants grown without nitrogen as shown in Fig. 5.

Appearance of first flower delayed with the increase in nitrogen application. Flower appeared earliest in plants fertilized with 67 kg N ha^{-1}, i.e. after 55.79

days, followed by 55.97 days in plants supplied with 33 kg N ha^{-1} (Fig. 3). Flower emergence was delayed in plants supplied with 100 kg N ha^{-1}, which indicates the negative impact of nitrogen on flower initiation. It happened because heavy N application led the plants towards enhancing vegetative growth rather than reproductive growth. High nitrogen application rate delayed flowering in Amaryllis (Nautiyal and Bajpai, 1979) supports our findings for Zinnia.

Plants raised under different nitrogen levels produced significantly different number of flowers $plant^{-1}$. Maximum number of flowers $plant^{-1}$ (16) was recorded in plants supplied with 67 kg N ha^{-1}. Least number of flowers i.e. 12 per plant was found when plants were given nitrogen @ 100 kg ha^{-1}, statistically similar to plants raised without fertilizer treatment (control), i.e. 12 flowers $plant^{-1}$ as shown in Fig. 3. Results indicate the negative impact of nitrogenous fertilizer on flowering, when applied above the optimum dose i.e. 67 kg ha^{-1}. Nitrogen application at a higher rate than optimum reduced the number of flowers $plant^{-1}$ in Alstroemeria (Mark *et al.,* 1998) supports our results for zinnia.

Flowers of significantly different size (diameter) were produced by plants grown under different fertilizer regimes. Flowers of maximum diameter (7.99 cm) were observed in plants supplied with 67 kg N ha^{-1}, followed by 7.46 cm, 6.38 cm in plants receiving 33 and 100 kg N ha^{-1}, respectively as shown in Fig. 4. Plants raised without nitrogen application had flowers of minimum diameter (5.87 cm). Higher as well as lower doses of nitrogen resulted in flowers of smaller diameter than the plants receiving moderate dose (67 kg ha^{-1}) of nitrogen. These results are in line with the findings of Jana and Pal (1991).

Excellent quality flowers (having large diameter, proper shape of petals, good petal colour and free from any insect/ disease) were produced by plants supplied with 67 and 100 kg N ha^{-1}. While, plants receiving nitrogen @ 33 kg ha^{-1} had flowers of good quality. Flowers of medium quality (having small diameter, poor shape of petals, comparatively dull petal colour etc.) were observed in plants raised without fertilizer use (Fig. 4). Results indicated that the plants receiving different doses of nitrogen produced superior quality flowers as compared to those grown without nitrogen. Improved flower quality in these treated plants might be due to phosphorous and potassium, especially the potash, which is well known for improving the quality of flowers, fruits and vegetables. These findings are in line with the results reported by Snyder *at el.,* (1970), Bylov *et al.,* (1977) and Samoilkenko (1983).

CONCLUSION AND RECOMMENDATIONS

Positive relationship occurs between nitrogen application rate and vegetative growth (plant growth rate, plant height and number and size of lateral shoots) i.e. growth increased with increasing the dose of nitrogen. But, flowering behavior was negatively correlated with nitrogen application. Optimum nitrogen application @ 67 kg N ha^{-1} resulted in optimum vegetative growth and best reproductive growth behavior. Therefore, optimum use of N fertilizer would help better towards vigorous growth of *Zinnia elegans,* to keep plants healthy and attractive and to obtain a large number of good quality blooms.

For producing excellent quality, healthy & large sized blooms and for vigorous growing zinnia plants, NPK should be applied @ 67: 33: 33 kg $ha^{-1}$for a plant population of 10,000.

Optimum phosphorus and potash dose (33 kg ha^{-1} of each) should be supplied in a single dose at the time of soil preparation before transplanting while nitrogen should be splitted in two equal doses, first half at the time of plantation followed by remaining half dose applied after one month for getting best results.

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