

Original Research Article

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Effect of Nitrogen, Phosphorus and Potassium Level on Floral Characteristics of Chrysanthemum (*Chrysanthemum morifolium* Ramat) cv. Bidhan Madhuri

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ABSTRACT

The present investigation entitled Effect of nutrient management in chrysanthemum (*Chrysanthemum morifolium* Ramat cv. BidhanMadhuri) was carried out at BTCC, OUAT, Bhubaneswar during winter 2017-18. The experiment consists of eleven treatments having different combinations of Nitrogen (N), Phosphorous (P) and Potassium (K) fertilizers(kg/ha) which was replicated thrice in RBD experimental design. Among all the treatment, T₁₀ having a fertilizer combinations of N=120, P=125, K=140 kg/ha *i.e.* the optimum dose of fertilizer higher than that of the RDF found to be effective in producing luxuriant floral attributes *i.e.* minimum days taken for flower bud appearance(48.267 days), minimum days taken for flower bud opening (61.4days), maximum flower diameter(5.847cm), dry(1.173g) and high fresh weights of flower(3.256g), number of flowers(67.733), flowering duration (74.333days) and vase life period.(20.000days).Hence it can be recommended for obtaining optimum growth, desired flowering and yield attributes and this treatment having fertilizer combinations of N=120, P=125, K=140 kg/ha is suggested for Chrysanthemum crop in Bhubaneswar condition.

Keywords

Chrysanthemum,
Bud, Floral
attributes, Diameter

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Introduction

Chrysanthemum is one of the most important flowering plant, commercially grown in different parts of the world. It is a native of northern hemisphere mainly Europe and Asia. It belongs to family Asteraceae and is

commonly called as the “Queen of the East”. Flowers symbolize purity, peace, love, beauty and passion. It was first cultivated in China and then spread to Japan. Hence, Chrysanthemum became the floral emblem of the imperial family of Japan and subsequently regarded as the National flower of Japan.

Chrysanthemum is one of the most popular flowers grown in our country for its diversified beauty of colours, shapes, shades and keeping quality. It is highly suitable for beds, pots and for floral arrangement. In India, chrysanthemum is very popular as loose flower, cut flower as well as pot plant also. Chrysanthemum is mostly used in our country for making garlands, *veni*, bracelets and in flower decoration and religious offerings. On account of its good keeping quality, flowers can be transported to a distant market easily. In India, chrysanthemum occupies a place of pride, both as commercial flower crop and as a popular exhibition flower. Chrysanthemums are divided into two basic groups, garden hardy mums and exhibition type. The exhibition varieties can be used to create many amazing plant forms, such as large disbudded blooms, spray forms, and many artistically trained forms, such as thousand-bloom standard (trees), fans, hanging baskets, topiary, bonsai and cascades.

Though many factors influence successful production of chrysanthemum just like soil fertility, irrigation, plant density, plant protection measures, etc. but manurial schedule plays a major role in crop production. In modern days soil health is degraded due to many factors that is why crops grown in such soil without fertilization usually suffer from nutrient deficiency and the application of fertilizers becomes an essential tool to boost up the yield.

Improper nutrition leading towards nutrient imbalance in plant is a major factor contributing to low yield of flower. Under normal Agro-climatic conditions, the deficiency of major nutrients *viz.*, N, P and K is common and causes serious problems in flower production. Hence, this research has been taken to study the different floral characteristics of Chrysanthemum under different doses of N, P and K.

Materials and Methods

A field experiment entitled “Effect of nutrient management in chrysanthemum (*Chrysanthemum morifolium* Ramat) cv. Bidhan Madhuri was conducted at Biotechnology-cum-tissue culture center (BTCC) of O.U.A.T, Bhubaneswar. The terminal herbaceous cuttings of 4-5 cm length were taken from the healthy mother plants of cultivar BidhanMaduri by giving a cut just below a node with a sharp knife. After preparing the cuttings, they were inserted up to two third of its length in to fine sand medium. The healthy one month old rooted cuttings were transplanted in polythene bags consisting of soil. The well sprouted, rooted and healthy cuttings were uplifted from nursery beds and carefully transplanted in each plot at the spacing of 30× 30 cm with a density of 16 plants per plot having net plot size 1.3mx1.3m after 45 days in month of November. The experiment comprised of eleven (11) treatments replicated thrice and was laid out in a Randomized block design. Each treatment was composed of 16 plants and standard recommended packages of practices were followed in each treatment. Pinching was done in 15 days interval in each treatment. Fertilization was done according to treatment. Nitrogen was applied in two splits *i.e.* half at planting and rest half at 30 DAP. All Potassium and Phosphorus in all treatments were applied as basal. Numbers of days were counted from the date of transplanting to first flower bud initiation in randomly selected five plants and average was computed for each treatment to determine number of days taken for appearance of flower buds in each treatment. To determine numbers of days taken for first flower bud opening, days were counted from the date of transplanting to first flower opening in randomly selected five plants and average was computed for each treatment. Other data just like diameter of flowers, weight of the

flowers, and length of the flower stalk, floral duration and vase life were observed from five randomly selected flowers from each plot at full bloom stage. The data obtained were averaged and computed.

Results and Discussion

The earliest days taken for flower bud appearance was 48.267 days and earliest days taken for flower bud opening was 61.4 days obtained in treatment T₁₀ having fertilizer combination of N=120kg/ ha, P=125kg/ ha, K=140kg/ ha which was significantly superior over the rest treatments. This might be due to the reason that with optimum doses of NPK application, nutrient uptake efficiency of the plants also got increased and consequently, plants could put up requisite vegetative in lesser time due to which the flowering was advanced as compared to the recommended practices and other treatments where lower doses of NPK were applied.

These results are in conformity with the findings of Kumar (2001) in Chrysanthemum, Kumar and Rana (2003) in Carnation cv. Chaubad Yellow, Acharya *et al.*, (2004) and Ravindra *et al.*, (2018) in African marigold. This may be also due to optimum availability of nutrients which are necessary for the synthesis of protein and cytokinin consequently affects the cell division. Accumulation of carbohydrates coupled with a relatively lesser vegetative growth rate and promotes translocation of phytohormones to the shoots which probably induce early flower bud differentiation and eventual initiation of flowering. Such results are in agreements with findings of Ramesh *et al.*, (2002), Naggar (2009), Madhuri and Barad (2018) in Carnation.

The data recorded on flower diameter influenced by nutrient management revealed that maximum flower diameter (5.847cm)

was obtained in treatment number T₁₀ having fertilizer combination of N=120, P=125, K=140 kg/ha followed by treatment T₉ (5.667cm) having fertilizer combinations of N=120, P=125, K=120 kg/ha which were significantly superior than other treatments. Maximum flower diameter has been observed in treatment number T₁₀ due to adequate application of nutrients particularly Nitrogen which might have stimulated cell elongation, which would have been resulted to an increase in diameter of flower. However, minimum flower diameter *i.e.* 4.313 cm was found in control (T₁₁) treatment having fertilizer combinations of N=0, P=0, K=0 kg/ha. As the higher nitrogen level might have accelerated the photosynthetic activities by increasing the source size (number of branches and leaf area) thereby developing flowers with more photosynthates, which might have resulted in increased cell division and cell expansion of flower tissues that enhanced the flower size in term of flower diameter. The results are in agreement with findings of Singh and Sangama (2000), Kumar *et al.*, (2002) in Chrysanthemum, Singh *et al.*, (2004) in Gladiolus. Actually application of Nitrogen and Potassium at higher levels accelerated the photosynthetic activities by increasing the source size (number of branches and leaf area) and persistence of more number of green leaves for a longer period of time which helped in accumulation of more photo assimilates and increased turgor potential in plant tissue there by allowing the entry of more water in to the cells there by regulated the cell expansion in the floral tissue ultimately leading to an increase in the flower size in terms of flower diameter. Such kinds of results were obtained in Agrawal *et al.*, (2002), Kishore *et al.*, (2010) and Pal and Ghosh (2010) in African Marigold and Ravi *et al.*, (2017) in Chrysanthemum. Maximum fresh weight (3.256g) and dry weight (1.766g) were obtained in treatment T₁₀. This result may be

also due to the role of nitrogen as abundant supply of Nitrogen at higher level might have improved vegetative growth of plant which accelerated the photosynthetic activities of plants and caused more storage of carbohydrates resulting improved flower weights. This may be due to the reason that nitrogen application enhances metabolic process and results in increase flower weight. The results were obtained by Chauhan (2012) in golden rod and Ahirwar *et al.*, (2012) in African marigold.

Maximum flowering duration (74.333days) was obtained in treatment T₁₀ having fertilizer combination of N=120, P=125, K=140 kg/ha followed by treatment T₄(72.200) having fertilizer combinations of N=80, P=125, K=140 kg/ha which were significantly higher than all other treatments. However, minimum flowering duration (59.400) was obtained in control treatment (T₁₁) where no fertilizer was applied.

This might be due to increased vegetative growth of plants at higher nitrogen level that might have enhanced turgidity of flowers by increasing the rate of photosynthesis and other metabolic activities which in turn might have increased flowering span in annual chrysanthemum. These results are in line with the findings of Gaikwad *et al.*, (2004) in China aster. Mainly, Nitrogen was found most effective in extending the flowering duration and the result was close conformity with Muktanjali *et al.*, (2004) in marigold, Jauhari *et al.*, (2005) in gladiolus.

Maximum vase life period i.e. 20 days was obtained in treatment T₁₀ having fertilizer combination of N=120, P=125, K=140 kg/ha. This improvement in vase life period due to the Nitrogen which produces carbohydrates that extend the vase life but within 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) in Bird of paradise and Patel and Chaudhari (2011) in Chrysanthemum. Vase life of flower enhanced with nitrogen application as nitrogen is a very important constituent of nucleic acid, protoplasm and it might have increased carbohydrate synthesis, amino acids etc. from which phytohormones like auxins, cytokinin, giberellins have been synthesized resulting in enhancing the vase life and flower quality. These results are close conformity with those of Sonawane *et al.*, (2009), Kishore *et al.*, (2010) in gladiolus, Dhaked *et al.*, (2013) in Calendula and Somendra *et al.*, (2018) in snap dragon.

Maximum length of pedicel *i.e.* 14.443 cm was obtained in treatment T₁₀ having fertilizer combination of N=120, P=125, K=140 kg/ha. 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.

The enhanced pedicel length is due to higher level application of Nitrogen that causes improvement in plant metabolism *i.e.* higher amino acid production, chlorophyll formation at faster rate, transformation of carbohydrates, and translocation of phytohormones more quickly and efficiently. Minimum length of pedicel (11.250cm) was obtained in T₁₁ due to zero application. These results are in agreement with findings of Patel and Chaudhari (2011) in Chrysanthemum, Gaikwad *et al.*, (2004) in China aster and Disha (2016) in Bird of paradise, Ranjan *et al.*, (2019) in Chrysanthemum.

Maximum number of flowers per plant were obtained in treatment T₁₀ having fertilizer combinations of N=120, P=125, K=140 kg/ha which is influenced by the nutrients Nitrogen and Potassium.

Table.1 Effect of different levels of Nutrients on different flowering attributes

Treatments	Number of days taken for flower bud appearance	Number of days taken for flower bud opening	Flower diameter (cm)	Fresh weight (gm)	Dry weight (gm)	Duration of flowering	Vase life	Pedicle length (cm)	Number of flowers per plant
T1 (N=100, P=125, K=125)	53.267	67.866	4.987	2.875	0.960	66.733	16.667	13.197	58.367
T2 (N=80, P=125, K=100)	56.933	72.6	4.580	2.578	0.700	63.933	17.335	12.690	48.267
T3 (N=80, P=125, K=120)	56.600	72.266	4.633	2.735	0.853	68.267	17.667	12.973	56.067
T4 (N=80, P=125, K=140)	56.267	70.866	4.740	3.016	1.003	72.200	19.667	12.583	62.400
T5 (N=100, P=125, K=100)	52.467	67.533	4.913	2.548	0.683	62.467	16.000	13.647	45.600
T6 (N=100, P=125, K=120)	52.200	66.866	5.180	2.695	0.733	65.933	17.667	14.067	55.133
T7 (N=100, P=125, K=140)	51.733	66	5.233	3.052	1.163	71.000	19.333	14.213	64.867
T8 (N=120, P=125, K=100)	51.133	65.733	5.500	2.568	0.727	64.867	16.667	13.833	50.400
T9 (N=120, P=125, K=120)	50.333	64.6	5.667	2.733	0.780	68.800	18.000	14.737	57.367
T10 (N=120, P=125, K=140)	48.267	61.4	5.847	3.256	1.173	74.333	20.000	14.443	67.733
T11 (N=0, P=0, K=0)	58.933	77.666	4.313	1.766	0.627	59.400	14.333	11.250	42.000
SE(m)±	0.358	0.711	0.104	0.053	0.038	0.827	0.052	0.052	1.534
C.D. at 5%	1.064	2.113	0.308	0.159	0.113	2.136	0.154	0.154	4.556

Where, T1, T2, T3...T11 indicates the number of treatments.

Interaction had showed a significant influence on number of flowers per plant as in one hand, Nitrogen played a vital role in diverting food reserves to the site of flower bud differentiation which resulted in more number of flowers per plant and this might be due to the fact that applied Nitrogen has significantly increased growth parameters like number of branches, which might have synthesized more metabolites and ultimately led to increased flower production which findings are closed conformity with Chawla *et al.*, (2007), Patel and Chaudhari (2011), Satur *et al.*, (2012) and Joshi *et al.*, (2013) in *Chrysanthemum*. The yield of flowers per plant increased with the application of nitrogen mainly because of increased carbohydrate reserve for the development of floral primordial apart from the structural development of the plant. The present results were in the confirmation with the earlier findings of Agrawal *et al.*, (2002), Rajbeer and Jitendra (2009) in African marigold and Ravi *et al.*, (2017) in *Chrysanthemum*. On the other hand, Potassium also involved in acceleration of many enzymatic reactions which led to the more number of flowers per plant. Minimum number of flowers per plant (67.733) was obtained in control treatment (T₁₁) due to the zero level application of Nitrogen and Potassium. The results are in agreement with findings of Dorajeerao *et al.* (2012).

In conclusion, the results revealed that treatment T₁₀ having a fertilizer combination N=120, P=125, K=140 kg/ha was found to be more effective in increasing flowering attributes such as number of days taken for flower bud appearance, number of days taken for flower bud opening, flower diameter, number of flowers per plant, flower weight per plant, length of pedicel, duration of flowering and vase life period of flowers. So, it can be concluded that the optimum dose of fertilizer higher than the RDF T₁ (N=100 P=125 K=125 kg/ha) where Phosphorus

remains constant has resulted in incorporating a sound and luxuriant vegetative growth subsequently increasing the flower yield in *Chrysanthemum* in Bhubaneswar.

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