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Response of NPK through Drip Fertigation on Growth and Floral Parameters of Chrysanthemum

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ABSTRACT: A field experiment was carried out from early July to end of March during the years 2019-21 at Model Floriculture Centre, G.B. Pant University of Agriculture and Technology, Pantnagar to study the effect of NPK through drip fertigation on vegetative and floral growth of chrysanthemum with five treatment combination *viz,* T_1-100:150:100 kg NPK/ha/year, T_2-100:150:100 kg NPK/ha/year, T_3-100:150:100 kg NPK/ha/year, T_4-75:112.5:75 kg NPK/ha/year, T_5-75:112.5:75 kg NPK/ha/year at vegetative, bud and flowering stage. The treatment T_3 (NPK @ 100:150:100 kg/ha/year) recorded maximum plant height, number of primary branches, stem diameter, days to first flower appearance, number of buds per plant and flower yield per plant over rest of the treatments during both the years of investigation. The results suggested that application of NPK @ 100:150:100 kg/ha/year through drip fertigation helps to achieve higher vegetative and floral growth of chrysanthemum under *Tarai* region of Uttarakhand.

Keywords: NPK, fertigation, chrysanthemum, vegetative traits, floral attributes.

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora* Tzvelev.) is a popular flower crop that belongs to the Asteraceae family and is known as "Queen of the East". It has a diploid chromosome number of 2n = 18. It is a plant that grows in the Northern Hemisphere, primarily in Europe and Asia. Its origin, however, is said to be in China (Carter, 1990). It is commercially grown in West Bengal, North-Eastern States, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Rajasthan in India.

Chrysanthemum is an herbaceous perennial plant grows from a dwarf to a medium height, vigorous and also has beautiful blooms. It blooms for a period of around 1-2 months. Flower crops are very responsive to fertilizer application because they consume a large amount of nutrients from the soil. As a result, larger levels of chemical fertilizers in a balanced proportion are required to ensure optimum flower production. Flower crop fertilizer needs are critical to the growth, quantity and quality of flowering (Nikam *et al*., 2017). Nitrogen is a key component of protein, nucleic acid, and amino acids, as well as greater photosynthetic activity, vegetative development, and glucose consumption in plants (Rolaniya *et al*., 2017 and Mohanty *et al*., 2021). Phosphorus is an important constituent of nucleic acid, phospholipids, enzymes, energy storage and transfer for proper metabolism (Tisdale *et al.,* 1995). Potassium plays an important role in synthesis of amino acids, protein, disease resistance, respiration, transpiration, chlorophyll and improves quality of several flower crops (Luthra *et al.,* 1983). Fertigation is also increasingly being used in landscaping as dispenser units become more reliable and easier to use. It is a technique for supplementing nutrients or correcting nutritional deficiemein detected by plant tissue analysis. Vegetables, grasses, fruit trees, and ornamentals are

among the high-value crops that are commonly subjected to this technique.

Since a very little research work has been done in the past regarding to drip fertigation especially on flower crops in *Tarai* regions of Uttarakhand. Hence, present investigation was carried out to find out the effect of NPK through drip fertigation on vegetative and floral growth of chrysanthemum.

MATERIALS AND METHODS

A field experiment was carried out from early July to end of March during the years 2019-20 and 2020-21 at Model Floriculture Centre, G.B. Pant University of Agriculture and Technology, Pantnagar. The soil of experimental field is sandy-loam with adequate drainage and optimum water retention capacity.

All agronomic practices, viz., stalking, pinching, weeding, irrigation, disbudding and IPM were similar for all treatments during entire experiment period. Meteorological data during experiment period were collected from Pantnagar observatory G.B. Pant University of Agriculture and Technology, Pantnagar.

The soil at the experiment site was has a pH of 6.95 and organic carbon 0.52%. The experiment was plotted according to Randomized Block Design with five treatments and four replications per treatment *viz*, T_1-100:150:100 kg NPK/ha/year, T_2-100:150:100 kg NPK/ha/year, T_3-100:150:100 kg NPK/ha/year, T_4-75:112.5:75 kg NPK/ha/year, T_5-75:112.5:75 kg NPK/ha/year at vegetative, bud and flowering stage of chrysanthemum.

The field was divided into raised beds of height of 30 cm and width of 120 cm for allotment of various treatments. A spacing of 30 cm between the beds was provided for separation of treatments and replications and also for easy inter-cultural operation. Double row planting system was adopted with the spacing of 3 cm × 45 cm (row/plant). The drip irrigation system and *venturi* injector fertigation unit was installed as per the experimental layout and treatment plan. Water soluble fertilizers and straight fertilizers were applied as per the treatment combinations. Observations for growth and flowering characters were taken and subjected to statistical analysis under simple RBD using ANOVA.

Statistical analysis: The data generated from the present study were analyzed statistically to draw suitable inference as per standard ANOVA technique described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

A. Vegetative parameters

The growth characters differed significantly for the split application of different levels of NPK through drip fertigation (Table 1).

1. Plant height: In the year 2019-20, maximum plant height at 90 days after planting was recorded in treatment T_3 (55.41 cm) which was followed T_2 (49.23 cm), T_5 (49.06 cm) and T_4 (49.01 cm) and minimum in control T_1 (45.57 cm). In the year 2020-21, maximum plant height at 90 days after planting (57.81 cm) was recorded in T_3 treatment which was at par with T_2 (54.62 cm) and T_5 (52.71 cm) and minimum plant height (48.90) was found in control. The increase in the plant height with NPK through drip fertigation might be attributed to synthesis of amino acids, protein, starch and promoted various growth substance which in result, would have shown stimulatory action, in terms of cell elongation and consequently resulting in increased plant height (Rolaniya *et al.,* 2017). The above results are in accordance with the findings of Ganesh *et al.,* (2014); Rajan *et al.,* (2019) in chrysanthemum.

Table 1: Effect of different levels of fertigation on vegetative parameters in chrysanthemum cv. Thai Chain Queen.

Treatments combination	Plant height (cm)		No. of primary branches		Stem diameter (mm)	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
T_1 (Control)- N in 3 split, 33.3 % each, at planting, first pinching and one month after pinching, P and K: full dose as basal	45.57	48.90	13.45	10.56	16.35	16.58
T_2 - 25 % NPK as basal, rest 75 % NPK in three equal split at vegetative, bud and flowering stage	49.23	54.62	14.78	13.76	16.66	17.16
T_3 - 25 % NPK as basal, rest 75 % NPK in three split doses via. 40: 20: 20 % at vegetative stage and 30: 40: 40 % each, bud and flowering stage	55.41	57.81	15.96	14.29	17.75	18.10
T_4 - 25 % NPK as basal, rest 75 % NPK in three equal split doses at vegetative, bud and flowering stage	49.01	52.08	13.97	11.76	16.41	16.66
T_5 - 25 % NPK as basal, rest 75 % NPK in three split doses via. 40: 20: 20 % at vegetative stage and 30: 40: 40 % each, bud and flowering stage	49.06	52.71	14.34	11.98	16.59	17.06
SEm±	0.90	1.75	0.48	0.77	0.50	0.35
C. D. 5%	2.77	5.39	1.49	2.38	NS	NS

Fertilizer Dose: T_1, T_2 and T_3 with 100:150:100 kg NPK/ha (RDF) and T_4 and T_5 with 75:112.5:75 kg NPK/ha (75% RDF)

2. Number of primary branches/plant: The highest number of primary branches at 90 days after planting in 2019-20 were noticed in T_3 (15.96) which was at par with T_2 (14.78) and minimum number of primary branches (13.45) were noticed in control. During 2020-21, at 90 days after planting maximum number of primary branches/plant (14.29) were recorded in T_3 which was followed by T_4 (11.76) and the minimum in control (10.56). The possible reason for the increase in number primary branches can be due to availability of nutrient at different stages of plant growth through fertigation, terminal vegetative bud converted in to flower might have broken down the apical dominance of plant resulting in more number of axillary shoots (Joshi *et al.,* 2013). Similar finding were also recorded by Ganesh *et al.,* (2014) and Rajan *et al.,* (2019) in chrysanthemum.

3. Stem diameter: The higher diameter of stem during both the years was observed in T_3 (17.75 and 18.10 mm) and minimum (16.35 and 16.58 mm) in control. The maximum stem diameter with different levels of NPK might have increased the synthesis of proteins, carbohydrates, amino acids, etc. from which the phytohormones like auxins, gibberellins, cytokines have been synthesized and phosphorus being an essential component of protoplasm and chlorophyll caused conversion of photosynthates into phospholipids resulting in adequate vegetative growth thus increased stem diameter. Similar finding have also been presented by Shrikant, and Jawaharlal (2014) in gerbera var. Debora, Satar *et al.,* (2016), Nikam *et al.,* (2017) in chrysanthemum.

Floral parameters: The floral characters) differed significantly for the split application of different levels of NPK through drip fertigation (Table 2).

Table 2: Effect of different levels of fertigation on floral parameters in chrysanthemum cv. Thai Chain Queen.

Treatments combination	Days taken to first bud appearance (days)		Number of flower buds per plant	
	2019-20	2019-20	2019-20	2020-21
T_1 (Control)- N in 3 split, 33.3 % each, at planting, first pinching and one month after pinching, P and K: full dose as basal	57.04	54.58	12.17	12.96
T_2 - 25 % NPK as basal, rest 75 % NPK in three equal split at vegetative, bud and flowering stage	53.12	50.92	15.66	15.87
T_3 - 25 % NPK as basal, rest 75 % NPK in three split doses via. 40: 20: 20 % at vegetative stage and 30: 40: 40 % each, bud and flowering stage	52.67	48.24	20.32	17.33
T_4 - 25 % NPK as basal, rest 75 % NPK in three equal split doses at vegetative, bud and flowering stage	55.50	52.97	14.79	13.12
T_5 - 25 % NPK as basal, rest 75 % NPK in three split doses via. 40: 20: 20 % at vegetative stage and 30: 40: 40 % each, bud and flowering stage	54.37	51.50	15.44	14.37
SEm±	0.65	1.31	0.98	1.16
C. D. 5%	1.99	4.04	3.02	3.58

Fertilizer Dose: T_1, T_2 and T_3 with 100:150:100 kg NPK/ha (RDF) and T_4 and T_5 with 75:112.5:75 kg NPK/ha (75% RDF)

4. Days to taken to first flower bud appearance: During 2019-20 and 2020-21, it was observed that the earliest first bud appearance (52.67 and 48.24 days) was recorded in T_3 and delayed in control (57.04 and 54.58 days), respectively.

The positive effect of nutrients supplied through NPK fertilizers through drip fertigation on earliest first bud appearance might be ascribed the fact that nitrogen accelerate the development of reproductive phases, increases the protein synthesis and hence promotes the earlier floral primordial development (Acharya and Dashora, 2004). Phosphorus is a component of many energy rich compounds in plants and also increases entire root growth and helps in uptake of other nutrients resulting in early flowering (Singh *et al*., 2015). Potassium increases the rate of photosynthesis (Lauchli and Pfluger, 1978) and mobilization of sucrose to the shoots which have positive influence on flower initiation (Stockman *et al.,* 1983). These findings are in close agreement with finding of Pandey *et al.,* (2018) and Jawaharlal and Ganesh, (2020) in chrysanthemum.

5. Number of buds per plant: In the year 2019-20 and 2020-21, the maximum number of buds per plant (20.32 and 17.33) were found in T_3 which was followed by T_2 (15.66 and 15.87), T_4 (15.44 and 14.37) while minimum in control (12.17 and 13.12). The maximum numbers of buds per plant might be due to greater availability of nutrients at different levels of drip fertigation resulting increased growth and metabolic transport which lead to higher vegetative growth, which resulted in the production of more inflorescences per plant (Ganesh *et al.,* 2013). The present results find support from Reza *et al.,* (2011), Joshi *et al.,* (2013), Singh and Nigam (2015) and Nikam *et al.,* (2017) in chrysanthemum.

CONCLUSION

On the basis of results obtained in present investigation, it can be concluded that the application of NPK @ 100:150:100 kg /ha/year, at vegetative, bud and flowering stage through drip fertigation may positively accelerate the vegetative and reproductive stage as well as for commercial cultivation of chrysanthemum.

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Conflict of Interest: No conflict of interest.

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