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Effect of NPK on Physico- Chemical Parameters of Gladiolus (*Gladiolus hybridus* Hort.) cv. White Prosperity

Chouhan, Preeti; Vidhya Sankar M. and Vijay Rathor

KNK College of Horticulture, Mandsaur, RVSKVV, Gwalior (M.P.)

Abstract- It can be concluded from the investigation that the application of N, P, K and their interaction significantly improves the physiological as well as bio-chemical parameters in gladiolus. The application of $N_2P_2K_2$ (4.5:2.7:2.25 g/plant) was observed to be the best in respect of vase life of spike, earliest first flower bud appearance, number of florets per spike and longest vase life of spike and highest nitrogen content in leaves. The application of $N_2P_2K_1$ (4.5:2.7:1.8 g/plant) was found to be the best in respect of longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum diameter of florets, maximum length of florets, the maximum chlorophyll content in leaves, anthocyanin content in petals and potassium content in leaves and $N_2P_1K_1$ (4.5:1.8:1.8 g/plant) was found to be the best in respect of high phosphorus content in leaves.

I. INTRODUCTION

Gladiolus botanically known as *Gladiolus hybridus* Hort. belongs to family Iridiaceae. The herbaceous plant sprouts from axillary buds of an underground structure, the corm, a condensed vertical root stock covered with dried leaf bases. The inflorescence spike bears up to 25 florets arranged alternately on the axis. Gladiolus is commonly known as 'sword lily' because it has sword-shaped foliage. Gladiolus is one of the four famous cut flowers in the world (Bai *et al.,* 2009). Its magnificent inflorescence with a variety of colours has made it attractive for use in herbaceous borders, beddings, pots and for cut flowers. It has a great economic value and wide market in the country. In India, It is next to rose in Indian flower trade. Gladiolus responds well to balanced nutrition for better growth and maximum flower production. Inadequate plant nutrition causes serious disorders and may eventually lead to decline of plant vigour and yield.

Nitrogen is the one of the most important nutrients producing growth and yield responses in gladiolus. Leaf analysis indicates that the leaves should contain on a dry weight basis 2.5 -3.0% nitrogen or more for optimum yield. The quantity of phosphorus required by gladiolus is about one-tenth of the nitrogen expressed in terms of foliar analysis. Gladiolus requires about 3-4% potassium in the leaves on a dry weight basis for the best yield and quality of flowers. Foliar nutrition with NPK in addition to soil application significantly affects vegetative growth and floral characters (Roy *et al.,* 1995). Nutrition plays an important role in the overall growth performance of the gladiolus crop. Plant analysis has been found to be a useful diagnostic tool to work out the amount of fertilizers to be applied.

II. MATERIALS AND METHODS

The experiment was laid out at the K.N.K. College of Horticulture, Mandsaur (M.P.) during Kharif & Rabi seasons of 2012-2013 on the Gladiolus flower cv. White Prosperity. The experiment was laid out in factorial completely randomized design with three replications. Two levels each of nitrogen (3.6 and 4.5 g N/pot) phosphorus (1.8 and 2.7 g P/Pot) and potassium (1.8 and 2.25 g K/Pot) were applied. The observations on different physiological parameters and bio-chemical parameters were recorded. The pots were filled by the medium (soil: sand: FYM – 1:1:1) @ 5 kg/ pot. One healthy corm was planted in one pot. Nutrients were applied as full dose of P, K and half dose N at planting time and two split doses of N at 30 and 60 days after planting. For the vase life, cut flowers were kept in flask containing distilled water and the numbers of days up to wilting was counted. Length of spike was calculated by measuring the length from the base of spike to the last of the florets. Diameter and length of floret was measured by electronic digital caliper in cm, horizontal at full bloom stage. Chlorophyll content in leaves was measured by spad meter instrument. For the anthocyanin contents in the petals the alcohol extract of the sample is treated with HCI in aqueous methanol followed by anthocyanin reagent. The colour intensity is measured colorimetrically at 525nm. In order to work out the percentage of N, P and K in gladiolus plant, the samples were analyzed for their NPK content. Nitrogen was estimated by Kjeldal method; P in wet digested samples by ammonium molybdate method (Chapman and Pratt, 1961) and K by flame photometer (Holiday and Preedy, 1953).

III. RESULTS AND DISCUSSION

Effect of N, P, K and their interaction on physiological parameters:

In the study different physiological parameters were significantly influenced by the different treatments levels of N, P and K application as compared to control. The longest vase life of spike, earliest first flower bud appearance, longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum number of florets per spike, maximum diameter of florets and maximum length of florets were recorded by N_2,(4.5 g/plant) application. These results are in congruence with Mishra (2004), Kumar and Misra (2003) in gladiolus and Kumar *et al.* (2009) in tuberose. The longest vase life of spike, earliest first flower bud appearance, longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum number of florets per spike, maximum diameter of florets and maximum length of florets were recorded

by P_2,(2.7 g/plant) application. These finding of the study are in close agreement with the findings of Hossian *et al*. (2011) in gladiolus. Amin *et al.* (2012) and Patel *et al.* (2006) in tuberose. The longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum diameter of florets and maximum length of florets were recorded by K_1,(1.8 g/plant), while the earliest first flower bud appearance, maximum number of florets per spike and longest vase life of spike were recorded by K_2,(2.25 g/plant). These results were in agreement with Barman *et al*. (2005) in gladiolus.

In the investigation the longest vase life of spike, earliest first flower bud appearance and maximum number of florets per spike were recorded by $N_2P_2K_2$, (4.5:2.7**:**2.25 g/plant), longest duration of flowering, the maximum number of spikes per plant, maximum length of spike, maximum diameter of florets, maximum length of florets were recorded by $N_2P_2K_1$,(4.5:2.7**:**1.8 g/plant). These findings are in close conformity with the findings of Deo-Shankar and Dubey (2005), Sharma and Singh (2007) and Rajhansa *et al.* (2010) in gladiolus.

Effect of N, P, K and their interaction on biochemical parameters:

In the study different bio-chemicals parameters were significantly influenced by the different treatments levels of N, P and K application as compared to control. The maximum chlorophyll content in leaves, anthocyanin content in petals, nitrogen content in leaves, phosphorus content in leaves and potassium content in leaves were recorded with the application of N_2 (4.5 g/plant). These findings are in close conformity with the findings of Singh *et al.* (2010), Sewedan *et al.* (2012) in gladiolus and Chavan *et al*. (2010) in china aster. The maximum chlorophyll content in leaves, anthocyanin content in petals, nitrogen content in leaves, phosphorus content in leaves and potassium content in leaves were recorded with the application of P_2,(2.7 g/plant). The maximum chlorophyll content in leaves, phosphorus content in leaves and potassium content in leaves were recorded by K_1,(1.8 g/plant), while anthocyanin content in petals, nitrogen content in leaves, were recorded by K_2,(2.25 g/plant). These result also supported with Pal and Ghose, (2010) in Marigold.

In the investigation the maximum chlorophyll content in leaves, anthocyanin content in petals and potassium content in leaves were recorded by $N_2P_2K_1$ (4.5**:**2.7**:**1.8 g/plant), the maximum nitrogen content in leaves were recorded by $N_2P_2K_2$ (4.5**:**2.7**:**2.25 g/plant) and the maximum phosphorus content in leaves were recorded by $N_2P_1K_1$ (4.5**:**1.8**:**1.8 g/plant). These findings are in close conformity with the findings of El-Naggar (2009) in carnation, Naik and Barman (2006) in orchid.

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AUTHORS

First Author – Chouhan, Preeti, KNK College of Horticulture, Mandsaur, RVSKVV, Gwalior (M.P.)
Second Author – Vidhya Sankar M, KNK College of Horticulture, Mandsaur, RVSKVV, Gwalior (M.P.)
Third Author – Vijay Rathor, KNK College of Horticulture, Mandsaur, RVSKVV, Gwalior (M.P.)

Table- 1: Effect of N, P, K levels and their interaction on vase life of spike (Days), number of days for first flower bud appearance, duration of flowering (days) and number of spikes per plant

Treatment Control/Rest	Vase life of spike (Days)	Number of days for first flower bud appearance	Duration of flowering (days)	Number of spikes per plant
Control	6.50	78.33	8.00	1.01
Rest treatments	7.93	78.81	9.88	1.23
F test	**SIG**	**SIG**	**SIG**	**SIG**
N_1	7.54	78.08	9.47	1.18
N_2	8.33	75.54	10.29	1.28
S.Em.±	**0.087**	**0.121**	**0.064**	**0.007**
C.D. at 5%	**0.260**	**0.359**	**0.200**	**0.022**
P_1	7.66	77.58	9.50	1.18
P_2	8.20	76.04	10.26	1.27
S.Em.±	**0.087**	**0.121**	**0.064**	**0.007**
C.D. at 5%	**0.260**	**0.359**	**0.200**	**0.022**
K_1	7.70	77.16	10.00	1.24
K_2	8.16	76.45	9.76	1.22
S.Em.±	**0.087**	**0.121**	**0.064**	**0.007**
C.D. at 5%	**0.260**	**0.359**	**0.200**	**0.022**
$N_1P_1K_1$	7.16	78.00	9.06	1.14
$N_1P_1K_2$	7.66	78.00	8.82	1.10
$N_1P_2K_1$	8.16	77.83	9.62	1.20
$N_1P_2K_2$	7.16	78.50	10.37	1.29
$N_2P_1K_1$	7.33	77.50	10.45	1.30
$N_2P_1K_2$	8.50	76.83	9.65	1.20
$N_2P_2K_1$	8.16	75.33	10.88	1.34
$N_2P_2K_2$	9.33	72.50	10.18	1.27
S.Em.±	**0.175**	**0.242**	**0.134**	**0.015**
C.D. at 5%	**0.521**	**0.719**	**0.400**	**0.045**

Table- 2: Effect of N, P, K levels and their interaction on length of spike (cm), number of florets per spike, diameter of florets (cm) and length of florets (cm)

Treatment Control/Rest	Length of spike (cm)	Number of florets per spike	Diameter of florets (cm)	Length of florets (cm)
Control	60.80	7.16	7.09	7.59
Rest treatments	74.02	9.29	8.63	9.13
F test	**SIG**	**SIG**	**SIG**	**SIG**
N_1	71.10	8.70	8.29	8.79
N_2	76.95	9.87	8.97	9.47
S.Em.±	**0.459**	**0.100**	**0.055**	**0.053**
C.D. at 5%	**1.365**	**0.297**	**0.159**	**0.159**
P_1	71.30	8.62	8.31	8.81
P_2	76.75	9.95	8.95	9.45
S.Em.±	**0.459**	**0.100**	**0.055**	**0.053**
C.D. at 5%	**1.365**	**0.297**	**0.159**	**0.159**
K_1	74.85	9.12	8.73	9.23
K_2	73.20	9.45	8.54	9.04
S.Em.±	**0.459**	**0.100**	**0.055**	**0.053**
C.D. at 5%	**1.365**	**0.297**	**0.159**	**0.159**
$N_1P_1K_1$	68.40	8.50	7.98	8.48
$N_1P_1K_2$	66.20	8.66	7.72	8.22
$N_1P_2K_1$	72.00	9.00	8.40	8.90
$N_1P_2K_2$	77.80	8.66	9.07	9.57
$N_2P_1K_1$	78.40	9.16	9.14	9.64
$N_2P_1K_2$	72.20	8.16	8.42	8.92
$N_2P_2K_1$	80.60	9.83	9.40	9.90
$N_2P_2K_2$	76.60	12.33	8.93	9.43
S.Em.±	**0.918**	**0.200**	**0.107**	**0.107**
C.D. at 5%	**2.730**	**0.595**	**0.319**	**0.319**

Table- 3: Effect of N, P, K levels and their interaction on nitrogen,phosphorus, potassium and chlorophyll content in leaves (%) and anthocyanin pigment content in petals (mg/100g)

Treatment Control/Rest	Nitrogen content in leaves (%)	Phosphorus content in leaves (%)	Potassium content in leaves (%)	Chlorophyll content in leaves (spad value)	Anthocyanin pigment content in petals (mg/100g)
Control	0.93	0.13	2.33	64.51	0.33
Rest treatments	1.33	0.15	2.83	77.72	0.44
F test	**SIG**	**SIG**	**SIG**	**SIG**	**SIG**
N_1	1.21	0.14	2.72	74.65	0.40
N_2	1.44	0.16	2.94	80.79	0.47
S.Em.±	**0.024**	**0.001**	**0.017**	**0.475**	**0.009**
C.D. at 5%	**0.073**	**0.004**	**0.052**	**1.412**	**0.027**
P_1	1.18	0.15	2.73	74.86	0.39
P_2	1.47	0.16	2.94	80.58	0.48
S.Em.±	**0.024**	**0.001**	**0.017**	**0.475**	**0.009**
C.D. at 5%	**0.073**	**0.004**	**0.052**	**1.412**	**0.027**
K_1	1.27	0.16	2.86	78.59	0.43
K_2	1.38	0.15	2.80	76.86	0.44
S.Em.±	**0.024**	**0.001**	**0.017**	**0.475**	**0.009**
C.D. at 5%	**0.073**	**0.004**	**0.052**	**1.412**	**NS**
$N_1P_1K_1$	1.14	0.14	2.62	71.82	0.37
$N_1P_1K_2$	1.10	0.12	2.53	69.51	0.35
$N_1P_2K_1$	1.32	0.16	2.76	75.60	0.38
$N_1P_2K_2$	1.29	0.14	2.98	81.69	0.51
$N_2P_1K_1$	1.30	0.17	3.00	82.32	0.45
$N_2P_1K_2$	1.20	0.16	2.76	75.81	0.40
$N_2P_2K_1$	1.34	0.15	3.08	84.63	0.52
$N_2P_2K_2$	1.94	0.16	2.93	80.43	0.50
S.Em.±	**0.049**	**0.003**	**0.035**	**0.951**	**0.018**
C.D. at 5%	**0.147**	**0.009**	**0.104**	**2.825**	**0.055**