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Postharvest life of gladiolus cv. Jester Gold as influenced by different doses of nitrogen, phosphorus and potassium

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ABSTRACT

The influence of different doses of nitrogen, phosphorus and potassium on gladiolus cv. Jester Gold was studied in a field trail experiment conducted by factorial randomized block design. The effect of nitrogen (20, 40, 60, 80 g/m^2) with phosphorus (5, 10, 20 g/m^2) and potassium (15, 20, 25 g/m^2) and control applied to the plants on post-harvest life of cut gladiolus spikes were studied under laboratory conditions. Longevity of first floret (4.36 days) was increased by application of $N_{80}P_5$ g/m^2. A dose $N_{60}K_{20}$ g/m^2 and $N_{80}P_{10}$ g/m^2 was producing bigger first (10.57cm) and third (8.86cm) fully opened floret, respectively. Application of N_{80} K_{20} g/m^2 resulted into maximum fully opened florets (12.18) and total florets/spike (13.18) in the vase. Effective useful life (7.81 days), vase life (12.64days), water uptake on 3rd day (35.75 ml) and at senescence (63.24 ml) in the vase was increased by the use of $N_{60}P_{20}$g /m^2. A fertilizer dose of $N_{80}P_{20}$ g/m^2 resulted into maximum increment of in spike length at senescence (2.73 cm), fresh weight of spike at harvest (35.89 g), at 3rd (46.23 g/m^2) and at 5th day (48.50 g) in the vase.

Key words: Gladiolus, nitrogen, phosphorus, potassium, vase-life.

INTRODUCTION

Gladiolus is one of the most important bulbous cut flower commercially grown for its varying colour of florets and its lasting quality in the vase. Pre-harvest factors including environment, fertilization and management influences the post-harvest life of cut flowers. Nitrogen phosphorus and potassium are three basic nutrient requird by the plants for its proper growth and development. Several workers have been reported an improvement in growth, flowering and quality due to adequate supply of these primary nutrients. The post-harvest life of cut gladiolus has also been reported to be affected by nitrogen, phosphorus and potassium doses (Deswal and Patil, 3; Anserwadekar and Patil, 1; De, 4). Therefore, an experiment was conducted with a view to study the effects of different doses of nitrogen, phosphorus and potassium on postharvest life and quality of gladiolus cv. Jester Gold.

MATERIALS AND METHODS

The present investigation was carried out on Gladiolus cultivar Jester Gold in RBD with three replication in the Division of Floriculture and Landscaping, IARI, New Delhi for two year in the *rabi* season. Treatments consisted of four levels of nitrogen (20, 40, 60, 80 g/m^2), three levels of phosphorus (5, 10, 20 g/m^2) and three levels of potassium (15,20, 25 g/m^2) and one control without fertilizer. Nitrogen was applied with phosphorus and potassium separately. In all, there were 25 treatments. Thirty corms of gladiolus cv. Jester Gold ranging between 2.5-3.0 cm dia. were planted at a depth of 5 cm and 40 × 20 cm apart in the first fortnight of October. Each experimental plot having a net plot size 1.5 m × 1.5 m surrounded by a bund to prevent the movement of water and nutrients. Nitrogen was applies through calcium ammonium nitrate (CAN), phosphorus through single super phosphosphate (SSP) and potassium thorough muriate of potash (MOP). Half dose of nitrogen and full dose of phosphorus and potassium were applied at the time of planting and remaining half dose of nitrogen was applied at spike emergence to all the treatments.

To access the post-harvest life and quality of cut gladiolus, four spikes from each treatment were harvested between 8 am and 9 am during the February to March each year. The spike were cut at the stage when 0-3 basal florets showed colour and a cut was made with a sharp knife at the base of the stem at the point just above the fourth leaf from the base. The cut ends were immediately dipped in cold water and brought to the laboratory. All the leaves except three immediately below the basal florets were removed. In each treatment, two spikes were put into two 500 ml glass

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jars containing an initial amount of 300 ml distilled water. The experimental design was factorial RBD.

RESULTS AND DISCUSSION

On the perusal of data presented Table 1 indicated that diameter of 5th fully opened floret in vase and number of unopened florets/spike was not influenced by the different doses of nitrogen, phosphorus and potassium. A higher dose of nitrogen with low dose of phosphorus $N_{80}P_5$ g/m^2 resulted into maximum longevity of first floret (4.36 days). Fertilizer dose of $N_{60}P_{10}$ g/m^2 and $N_{80}P_{10}$ g/m^2 also increase significantly longevity of first floret (4.24 days) while minimum longevity recorded in control (3.21days). Application of $N_{60}K_{20}$ g/m^2 and $N_{60}K_{25}$ g/m^2 produced significantly bigger fully opened first floret (10.57and 10.40 cm, respectively) over control (6.16 cm). Biggest first floret (8.86 cm) in vase was found by the application of $N_{80}P_{10}$ g/m^2 followed by $N_{80}K_{15}$ g/m^2 (8.48 cm), whereas control exhibited smallest first floret (6.53cm). Application of higher dose of nitrogen and medium dose of potassium, $N_{60}K_{20}$ g/m^2 and $N_{80}K_{20}$ g/m^2 produced significantly higher number of fully opened florets (12.18 and 11.78, respectively) over the control (6.46). Higher nitrogen doses with phosphorus produced plants with fewer unopened florets. There were no significant differences of nitrogen, phosphorus and potassium on number of unopened florets. A fertilizer dose of $N_{80}K_{20}$ g/m^2 produced significantly more number of total florets (13.81) followed by $N_{80}K_{25}$ g/m^2 (13.72) over control (10.11).

The improvement in quality of gladiolus spikes in terms of total number of florets per spikes, increase in diameter and number of fully opened first and third floret due to CAN application can be attributed to Ca^{++} calmodulin binding in the cells, which regulates different activities in plant metabolism. Application of $N_{60}P_{20}$ g/m^2 produced significantly longer effective useful life of the spike (7.81 days) over control (5.41 days). Higher doses

Table 1. Vase-life of gladiolus cv. Jester Gold as affected by different doses of nitrogen, phosphorus and potassium.

Treatment (g/m^2)	Longevity of Ist floret (days)	Diameter (cm) of fully opened floret			Fully opened floret/ spike	Unopened floret/ spike	Total florets/ spike	Effective useful (days) life	Vase life (days)	Increase in spike length (cm) at senescence
		1st	3rd	5th						
$N_{20}P_5$	3.80	8.64	7.30	6.34	9.09	3.31	12.40	6.81	11.31	1.43
$N_{20}P_{10}$	3.87	8.53	7.19	6.43	9.32	3.30	12.62	7.08	11.48	1.42
$N_{20}P_{20}$	3.91	8.92	7.20	6.66	9.68	3.03	12.71	7.21	11.59	1.42
$N_{40}P_5$	3.75	9.17	7.36	6.44	10.49	2.35	12.84	7.45	11.34	1.99
$N_{40}P_{10}$	3.92	9.27	7.68	6.64	10.42	2.83	13.25	7.47	11.45	2.00
$N_{40}P_{20}$	3.96	9.79	7.89	6.68	11.35	2.01	13.36	7.57	11.76	1.99
$N_{60}P_5$	4.01	9.55	7.59	6.78	11.14	2.31	13.45	7.62	12.01	2.45
$N_{60}P_{10}$	4.24	9.69	7.91	6.78	11.24	2.30	13.54	7.62	12.35	2.45
$N_{60}P_{20}$	4.08	9.82	8.38	6.82	12.18	2.31	13.67	7.81	12.64	2.45
$N_{80}P_5$	4.36	9.79	7.97	6.18	11.23	2.31	13.50	7.60	12.39	2.71
$N_{80}P_{10}$	4.24	9.88	8.86	6.41	11.35	2.29	13.64	7.67	12.43	2.71
$N_{80}P_{20}$	3.95	9.95	7.85	6.68	11.58	2.05	13.13	7.75	12.50	2.73
$N_{20}K_{15}$	3.32	9.30	7.66	6.40	11.11	3.00	13.11	7.26	11.37	1.38
$N_{20}K_{20}$	3.43	9.04	7.19	6.58	10.98	2.31	13.29	7.13	11.40	1.38
$N_{20}K_{25}$	3.50	9.16	7.38	6.57	10.12	2.33	12.76	7.19	11.52	1.41
$N_{40}K_{15}$	3.84	8.71	7.31	6.48	10.17	2.05	13.22	7.55	11.50	1.97
$N_{40}K_{20}$	3.84	8.76	7.47	6.51	10.84	2.64	13.48	7.59	11.47	1.98
$N_{40}K_{25}$	3.95	8.37	7.15	6.59	11.14	2.34	13.48	7.72	11.56	1.97
$N_{60}K_{15}$	4.01	10.04	6.37	6.43	11.25	2.06	13.29	7.49	12.09	2.42
$N_{60}K_{20}$	4.15	10.57	6.31	6.49	12.18	2.32	13.50	7.58	12.15	2.43
$N_{60}K_{25}$	4.10	10.40	7.13	6.46	11.22	2.34	13.57	7.76	12.24	2.43
$N_{80}K_{15}$	3.55	10.34	8.48	6.92	10.92	2.66	13.58	7.68	12.48	2.61
$N_{80}K_{20}$	3.96	9.90	8.28	6.88	11.78	2.03	13.81	7.38	12.45	2.63
$N_{80}K_{25}$	3.82	10.20	7.99	6.93	11.08	2.64	13.72	7.52	12.45	2.64
Control	3.21	6.16	6.53	6.06	6.46	3.65	10.11	5.41	10.51	1.02
CD at 5%	0.05	0.21	0.20	NS	0.17	NS	0.30	0.15	0.36	0.30

of nitrogen with phosphorus and potassium increasing vase life of gladiolus cut spikes in comparison to lower doses. A progressive increase in vase life was noted with increasing nitrogen dose, with $N_{60}P_{20}$ g/m^2 producing the longest vase life (12.64 days) followed by $N_{80}K_{15}$ g/m^2 (12.48 days) over the control (10.51 days). The prolonged vase life of the spikes harvested from plants nourished with CAN which could be due to positive correlation between calcium content and lowered rate of respiration (Sharma *et al.,* 12). Halevy (7) and Gowda (6) also reported extended longevity of gladiolus and carnation due to calcium salts in vase solution. Increase in vase life may also be attributed to lowering the respiration activity and degree of dehydration of cut flowers and vase- life of flowers were ultimately prolonged with phosphorus application as has reported by Lodhi *et al.* (11) in chrysanthemum. Phosphorus application produces less succulent and softer flowers, thus the more deposition of carbohydrate in the cells, which help in increase of vase life. Findings are in conformity with the earlier results of Beach and Mussenbrock (2) and Katiyar and Bajpai (10) in carnation, and Hatibarua *et al.* (8) in gladiolus. Maximum increase in spike length at senescence (2.73 cm) was produced by the application of higher doses of nitrogen and phosphorus, i.e. $N_{80}P_{20}$ g/m^2 followed by $N_{80}P_5$ g/m^2 and $N_{80}P_{10}$ g/m^2 (2.71 cm). Similar beneficial effects of higher doses of primary nutrients on spike length were also reported by Dod *et al.* (5) and Jhon *et al.* (9).

Data presented in Table 2 indicted that water uptake and fresh weight of spike was significantly influenced by the different doses of nitrogen, phosphorus and potassium. Application of higher doses of $N_{60}P_{20}$ g/m^2 resulted into maximum water uptake on 3rd day in vase (35.75 ml) and at senescence (63.24 ml) followed by $N_{80}P_{20}$ g/m^2 (34.44 and 61.14 ml, respectively) over the control. This was obviously because of the higher water requirement to maintain the biochemical activities and

Table 2. Water uptake and fresh weight of spike as affected by different doses of nitrogen, phosphorus and potassium.

Treatment(g/m^2)	Water uptake (ml)		Fresh weight of spike (g)			
	at 3rd day	at senescence	at harvest	at 3rd day	at 5th day	at senescence
$N_{20}P_5$	26.44	51.81	33.06	34.31	36.77	21.18
$N_{20}P_{10}$	27.34	52.56	33.38	34.51	36.85	21.21
$N_{20}P_{20}$	24.71	53.67	33.77	35.32	37.91	21.28
$N_{40}P_5$	30.52	55.56	34.37	37.36	40.73	19.01
$N_{40}P_{10}$	31.22	56.77	34.38	37.63	40.12	21.33
$N_{40}P_{20}$	31.81	58.18	34.51	38.05	40.63	24.51
$N_{60}P_5$	33.70	60.22	35.23	37.40	42.76	21.23
$N_{60}P_{10}$	33.24	61.31	35.13	38.98	43.88	19.31
$N_{60}P_{20}$	35.75	63.24	35.76	43.41	44.62	21.18
$N_{80}P_5$	34.06	59.40	35.23	45.12	46.62	21.21
$N_{80}P_{10}$	34.38	60.13	35.56	44.79	46.53	21.24
$N_{80}P_{20}$	34.44	61.14	35.89	46.23	48.50	20.44
$N_{20}K_{15}$	27.43	51.76	33.11	35.37	36.18	19.65
$N_{20}K_{20}$	28.22	52.19	32.82	35.47	36.96	20.21
$N_{20}K_{25}$	28.73	52.60	33.09	35.44	34.91	19.85
$N_{40}K_{15}$	30.31	54.19	34.30	37.39	37.30	21.50
$N_{40}K_{20}$	31.78	55.20	34.53	37.48	37.52	19.25
$N_{40}K_{25}$	32.53	56.15	34.76	38.23	39.77	22.01
$N_{60}K_{15}$	33.03	58.10	34.82	39.82	41.90	19.40
$N_{60}K_{20}$	33.37	58.00	35.06	39.49	42.53	24.44
$N_{60}K_{25}$	33.45	59.01	35.32	41.19	41.23	21.36
$N_{80}K_{15}$	32.31	60.60	35.16	43.53	42.61	22.12
$N_{80}K_{20}$	33.48	60.82	35.23	42.66	44.24	19.01
$N_{80}K_{25}$	33.44	60.42	35.23	44.31	44.96	21.25
Control	24.53	48.17	24.51	27.18	25.82	16.28
CD at 5%	1.70	2.36	0.84	1.09	1.16	1.48

transpiration demand of longer spike with more number of florets per spike. Higher doses of $N_{80}P_{20}$ g/m^2 resulted into maximum fresh weight of spike at harvest (35.89 g), at 3rd day in vase (46.23 g) and at5th day in vase (48.50 g) followed by $N_{80}P_{10}$ g/m^2 (35.56g at harvest and 44.79 g at 3rd day in vase), while $N_{80}P_5$g/m^2 resulted into 46.62 g fresh weight of spike at 5th day in vase. However, least fresh weight at all the stages of observation was recorded under control. Maximum fresh weight remains in cut gladiolus cut spike at senescence (24.51 g) by the application of $N_{40}P_{20}$ g/m^2 followed by $N_{60}K_{20}$ g/m^2 (24.44 g). Nitrogen applied as CAN induced higher water uptake, on the other hand, could be attributed to ability of calcium in the form of calcium pectate to strengthen the xylem vessels of the flower stems, and thus facilitating water relations, ultimately improving vase life of cut gladiolus.

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