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INFLUENCE OF NITROGEN AND POTASSIUM ON GROWTH AND YIELD OF GLADIOLUS CORMS

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Abstract

A field experiment on "influence of nitrogen and potassium on growth and yield of gladiolus corm" was conducted at Horticulture Section, College of Agriculture, Nagpur (Maharashtra), India; during 2012-2013 with sixteen treatment combinations in factorial randomized block design. The treatment comprised of four levels of nitrogen (0, 150, 300 and 450 kg ha^{-1}) and four levels of potassium 90, 75, 150 and 225 kg ha^{-1}). The results of the experiment revealed that plant height, shoots $plant^{-1}$, number of cormels $plant^{-1}$ and ha^{-1}, diameter of corm, weight of corms $plant^{-1}$ and weight of cormels $plant^{-1}$ were recorded significantly higher with 450 kg nitrogen ha^{-1} and 225 kg potassium ha^{-1}. However, in respect of corm yield, the treatment combination of 300 kg ha^{-1} of nitrogen with 225 kg ha^{-1} of potassium produced significantly maximum number of corms $plant^{-1}$ and ha^{-1}.

Key words : Corms, cormels, gladiolus, growth, nitrogen, potassium.

Introduction

Gladiolus is very popular and important bulbous ornamental flowering plant of the world. It is known as queen of bulbous flowers. It belongs to the family Iridaceae and is a native of Mediterranean region. It is excellent for cut flowers as it lasts long in flower vase and has magnificent inflorescence with variety of colours. Production of healthy and vigorous corms and cormels depend on many factors, of which nutrient supply is an important one. Gladiolus requires nutrients throughout the period of growth, corm development and flowering. So, application of nutrients in an optimum levels is essential. There is a good scope of increasing the yield and vigorous corm and cormel production of gladiolus by the use of appropriate amount of nitrogen and potassium under the agro-ecological conditions of Vidarbha region. Keeping these in view, the present study was undertaken to investigate the effects of nitrogen and potassium on yield and quality of gladiolus corms and cormels.

Materials and Methods

A field experiment was conducted at Farm No. 16, Horticulture Section, College of Agriculture, Nagpur (Maharashtra), India during 2012-2013. The experiment was laid out in factorial randomized block design with three replications. Four nitrogen levels were used *viz*., 0 kg N ha^{-1}, 150 kg N ha^{-1}, 300 kg N ha^{-1} and 450 kg N ha^{-1} and four levels of potassium *i.e.* 0 kg K_2O ha^{-1}, 75 kg K_2O ha^{-1}, 150 kg K_2O ha^{-1} and 225 kg K_2O ha^{-1}. After preparing the land, the field was laid out with the beds of 45 cm spaced ridges and furrows and the rested, cold stored, best quality and uniform sized corms of gladiolus variety 'American Beauty' were planted after treating with fungicide for 20 minutes at a spacing of 45 × 15 cm. Fertilizer dose of nitrogen, phosphorus and potassium was applied in the form of urea, single super phosphate and muriate of potash, respectively. A recommended dose of phosphorus *i.e.* 200 kg ha^{-1} was applied for all the treatment plots as a full dose at the time of bed preparation before planting. The dose of potassium was applied as per the treatment as a full dose at the time of bed preparation, however, the dose of nitrogen was splitted in three equal splits and was applied at 2 leaf, 4 leaf and 6 leaf stages as per the treatment, respectively. The recommended cultural and plant protection measures were followed.

Results and Discussion

Growth

Growth parameters *viz*. plant height and shoots $plant^{-1}$ (table 1) were significantly influenced by nitrogen and potassium levels. Significantly maximum height of

plant and shoots plant^{-1} were found with 450 kg nitrogen ha^{-1}, which was statistically at par with 300 kg nitrogen ha^{-1}, however, height of plant and shoots plant^{-1} were noted minimum with 0 kg nitrogen ha^{-1}. The favorable effect of higher levels of nitrogen *i.e.* 450 and 300 kg N ha^{-1} in promoting height of plant and shoots plant^{-1} might be due to the fact that the increase in nitrogen level enhanced the chlorophyll formation and thereby increased photosynthesis and synthesis of reserve food material, which ultimately promotes vegetative growth. Similar increase in vegetative growth with increased level of nitrogen was also found by Rajwal and Singh (2006) and Devi and Singh (2010) in tuberose.

Among the different levels of potassium, significantly maximum plant height and shoots plant^{-1} were found with 225 kg potassium ha^{-1}, which was followed by 150 kg potassium ha^{-1}, however, plant height and shoots plant^{-1} were noted minimum with 0 kg potassium ha^{-1}. The increase in growth parameters with higher dose of potassium might be due to improvement in efficiency of nitrogenous fertilizers and active involvement of potassium in the development of chlorophyll. Similar results were also obtained by El-Naggar (1999) in tuberose.

The interaction effect of nitrogen and potassium was found non significant in respect of growth parameters studied in his experiment.

Corm yield

Corm yield parameters *viz*. corms plant^{-1}, corms ha^{-1}, cormels plant^{-1} and cormels ha^{-1} (table 1) were significantly influenced by nitrogen and potassium levels. Significantly maximum corms plant^{-1}, corms ha^{-1}, cormels plant^{-1} and cormels ha^{-1} were found with 450 kg nitrogen ha^{-1}, which was statistically at par with 300 kg nitrogen ha^{-1}, however, minimum corms plant^{-1}, corms ha^{-1}, cormels plant^{-1} and cormels ha^{-1} were noted with 0 kg nitrogen ha^{-1}. The favorable effect of higher levels of nitrogen in promoting corms and cormels yield might be due to the fact that the higher level of nitrogen provides better growth and development of plant and helps in translocation of photosynthates from source to sink (corms) which might have been resulted in to higher yield of corms. Devi and Singh (2010) and Khan *et al.* (2012b) also reported that increasing nitrogen levels resulted in superior yield of bulbs in tuberose and cormels in freesia, respectively.

Significantly maximum corms plant^{-1}, corms ha^{-1}, cormels plant^{-1} and cormels ha^{-1} were found with 225 kg potassium ha^{-1}, which was followed by 150 kg potassium ha^{-1}, however, all these parameters were recorded minimum with the application of 0 kg potassium ha^{-1}. Yield of corms and cormels in gladiolus was increased with every increment of potassium application up to the level of 225 kg potassium ha^{-1} as better vegetative growth might have increased photosynthesis resulting in assimilation of more carbohydrates and their translocation in to the corms and this might be the probable cause for increase in corms and cormels yield. Similar increase in corm yield due to higher dose of potassium was also reported by Barman *et al*. (2005) and Zubair (2011) in gladiolus.

An interaction effect of nitrogen and potassium on number of corms plant^{-1} and ha^{-1} was found to be significant (table 2). The treatment combination of 300 kg of nitrogen with 225 kg of potassium had recorded significantly maximum number of corms plant^{-1} and hectare^{-1}, which was significantly superior than other treatment combinations except 300 kg N ha^{-1} with 150 kg K_2O ha^{-1}, 450 kg N ha^{-1} with 225 kg K_2O ha^{-1} and 300 kg N ha^{-1} with 150 kg K_2O ha^{-1} whereas, the treatment combinations of 0 kg N ha^{-1} with 0 kg K_2O ha^{-1} and 0 kg N ha^{-1} with 75 kg K_2O ha^{-1} had counted minimum number of corms plant^{-1} and hectare^{-1}. The highest yield of corms were noted with the application of 300 kg N and 225 kg K_2O ha^{-1}, which might have been due to the combine effect of the optimum levels of both the nutrients. These results are in harmony with those obtained by Khan *et al*. (2012a) in gladiolus.

Corm quality

An effect of nitrogen and potassium on various quality parameters *viz*. diameter of corm, weight of corm and cormels etc. (table 1) was found to be significant. Significantly maximum diameter of corm and weight of corms and cormels plant^{-1} were found with 450 kg nitrogen ha^{-1}, which was statistically at par with 300 kg nitrogen ha^{-1}, however, minimum diameter of corm and weight of corms and cormels plant^{-1} were noted with 0 kg nitrogen ha^{-1}. The increase in quality parameters with higher rates of nitrogen may be due to positive effect of nitrogen in stimulation of vegetative growth and increase in translocation and accumulation of organic matter in the new corms and finally reflexes on corm and cormels quality. Similar trend was also found by Kumar *et al*. (2006) and Sewedan *et al*. (2012) in gladiolus and Khalaj and Edrisi (2012) in tuberose.

Various quality parameters *viz*. diameter of corm, weight of corm and cormels plant^{-1} were found significantly maximum with 225 kg potassium ha^{-1}, which was followed by 150 kg potassium ha^{-1}, however, minimum diameter of corm, weight of corm and cormels were noted with 0 kg potassium ha^{-1}. The increase in diameter of corm, weight of corms and cormels plant^{-1} with increase in level of potassium might be due to the

Table 1 : Growth and yield of corms and cormels in gladiolus as influenced by nitrogen and potassium.

Treatment	Plant height (cm)	Shoots plant^{-1}	Corms plant^{-1}	Corms ha^{-1} (lakh)	Cormels plant^{-1}	Cormels ha^{-1} (lakh)	Diameter of corm (cm)	Weight of corms plant^{-1} (g)	Weight of cormels plant^{-1} (g)
Nitrogen (N)									
N_0-0 kg N ha^{-1}	50.40	2.70	2.02	2.30	23.85	27.26	3.68	53.02	6.05
N_1-150 kg N ha^{-1}	52.35	2.90	2.30	2.63	26.12	30.76	4.18	60.11	6.99
N_2-300 kg N ha^{-1}	55.51	3.37	2.90	3,31	29.37	33.56	4.45	63.71	7.76
N_3-450 kg N ha^{-1}	56.68	3.62	3.06	3.50	31.73	36.27	4.63	66.48	8.04
F test	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**
SE(m)±	1.40	0.11	0.07	0.08	0.97	1.11	0.14	1.59	0.31
CD at 5%	4.04	0.30	0.21	0.24	2.81	3.21	0.41	4.58	0.88
Potassium (K)									
K_0-0 kg K_2O ha^{-1}	51.16	2.63	2.14	2.45	24.83	28.38	3.83	51.33	6.31
K_1-75 kg K_2O ha^{-1}	52.56	3.05	2.40	2.74	26.18	29.92	4.08	59.39	6.89
K_2-150 kg K_2O ha^{-1}	53.49	3.32	2.75	3.14	28.92	33.05	4.30	63.60	7.35
K_3-225 kg K_2O ha^{-1}	57.63	3.58	2.98	3.41	31.93	36.49	4.73	68.99	8.29
F test	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**
SE(m)±	1.40	0.11	0.07	0.08	0.97	1.11	0.14	1.59	0.31
CD at 5%	4.04	0.30	0.21	0.24	2.81	3.21	0.41	4.58	0.88
Interaction effect (N × K)									
F test	**NS**	**NS**	**Sig.**	**Sig.**	**NS**	**NS**	**NS**	**NS**	**NS**
SE(m)±	2.80	0.21	0.14	0.16	1.95	2.22	0.28	3.18	0.61
CD at 5%	-	-	0.41	0.49	-	-	-	-	-

Table 2 : Corm yield in gladiolus as influenced by interaction effect of nitrogen and potassium.

Treatment combinations	Corms plant^{-1}	Corms hectare^{-1} (lakh)
N_0K_0	1.87	2.13
N_0K_1	1.87	2.13
N_0K_2	1.93	2.21
N_0K_3	2.40	2.74
N_1K_0	1.93	2.21
N_1K_1	2.13	2.44
N_1K_2	2.40	2.74
N_1K_3	2.73	3.12
N_2K_0	2.13	2.44
N_2K_1	2.60	2.97
N_2K_2	3.40	3.89
N_2K_3	3.47	3.96
N_3K_0	2.63	3.01
N_3K_1	3.00	3.43
N_3K_2	3.27	3.73
N_3K_3	3.33	3.81
F test	**Sig.**	**Sig.**
SE(m)±	0.14	0.16
CD at 5%	0.41	0.49

fact that potassium promotes larger size of corms and cormels by increasing water accumulation in the underground plant parts resulting in higher weight of corms and cormels. These results are in conformity with those of Barman *et al*. (2005) in gladiolus.

The interaction effect of nitrogen and potassium was found non significant in respect of corms quality parameters studied in his experiment.

Conclusion

The maximum plant height and shoots plant^{-1} of gladiolus were obtained due to the application of nitrogen 450 kg ha^{-1} and potassium 225 kg ha^{-1}. Corm yield plant^{-1} and hectare^{-1} in gladiolus was maximum with the treatment combination of 300 kg N ha^{-1} and 225 kg K_2O ha^{-1}. Cormels yield plant^{-1} and ha^{-1} and weight of cormels, Diameter and weight of corm were found to be maximum with the application of 450 kg N ha^{-1} and 225 kg K_2O ha^{-1}.

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