https://doi.org/10.29321/MAJ.10.A02708

Madras agric. J. (3): 194-199, March 1982

Effect of NPK and plant population density on the growth, flowering and corm yield of *Gladiolus grandiflora* Cv. H. B. Pitt*

K. S. DESWAL[1], V. K. PATIL[2] and K. W. ANSERWADEKAR[3]

Most effective nutritional dose with respect to the height of gladiolus plant was N (50 kg N/ha), P_0 and K_1 (50 kg K_2O/ha). The number of florets/spike increased significantly with the increase in N application. Application of P and K also showed significantly superior effect. Wider spaced plants (45×30 cm) produced significantly more number of florets/spike. Number of florets on hectare basis increased with the increasing level of N. Significantly greater number of florets was recorded with 50kg P_2O_5/ha. Interaction of N and spacing was significant. Per hectare data on weight of corm indicated signicant influence of N, K and closer spacing (30×30 cm). Weight of corms on hectare basis increased with increasing level of N. The optimum levels of fertilizer and spacing based on the results of this experiment are 100 kg N, 50 kg P_2O_5 and 50 kg K_2O per hectare and spacing of 30×30 cm.

Gladiolus (*Gladiolus grandiflora*) has been rated as the second most popular flower in the world especially from commercial point of view. Gladiolus is a small annual flowering plant, the spike of which is the major component of use for decoration in flower beds or pots or as cut flowers in vase. The cut flower of gladiolus has long keeping quality and can withstand transportation to long distances even when packed dry. Corm of gladiolus also enjoys great economic importance in gladiolus culture. Optimum spacing and fertilization are prerequisites in taking up the cultivation on commercial scale. Various workers outside India have studied the effect of nutrition (Kanturtzis, 1966; Skal'ska, 1970; Fernandes *et al.* 1974a, 1974b, and 1974c Cirrito, 1976) and spacing (Amritage, 1973; Fernandes *et al.* 1975 and El-Gamassy and El-Glende, 1962) on the corm yield of gladiolus. However, scant research efforts have been reported in India to produce gladiolus in large scale by providing optimum spacing and nutrition. Present research efforts aims at the standardization of these requirements for getting good returns from gladiolus.

MATERIAL AND METHODS

The field experiment was laid out in *Kharif* season of 1978-79 in medium black soil classified as vertisols The soil contained coarse sand 6.78%, fine sand 10.12%, silt 24.14%, clay 52.48% and classified as clayey. The soil had organic carbon to the extent of 0.41% available P 51.52 kg/ha, available K 130.70 kg/ha and pH 8.3 Split-plot design with fertilizers as main plot and spacing as subplot treatments was

* Part of M.Sc. (Ag.) thesis submitted by the first author to Marathwada Agricultural University, Parbhani.

1 to 3 Department of Horticulture, Marathwada Agricultural University, Parbhani.

adopted with three replications. The treatments comprised of three levels of N (0, 50, 100 kg/ha), two levels of phosphorus (0, 50 kg/ha) and two levels of potassium (0, 50 kg/ha). The subplot treatments consisted of two spacings (30×30 and 30×45 cm).

A basal dose of well rotten farm yard manure at the rate of 2 kg per square metre was applied. Full P and K and half N dose were broad-cast in the respective plots and properly mixed with soil. Remaining half dose of N was applied one month after planting of corms. Uniform H. B. Pitt gladiolus corms of medium size were dehusked and kept soaking in water for 24 hrs before planting. The corms were planted 5 cm deep on 9.6.78 by keeping the terminal buds upward. Only one corm at each hill was planted and was covered with soil. Irrigations were given as and when required.

RESULTS AND DISCUSSION

The final height (90th day after sowing) was significantly increased due to 50 and 100 kg N/ha, over no nitrogen (Table 1). Among levels of N, the dose of 100 kg/ha was significantly superior to 50 kg/ha. Application of K significantly increased the plant height but P application did not significantly increase the final height of gladiolus plant. The most effective nutritional dose with respect to the height of the gladiolus plant thus was 100 kg N/ha and 50 kg K_2O/ha. The application of P does not seem to be crucial under the given soil of the experimental field, which tested low in N having pH value of 8.3 and textural class clayey. In spacing also the wider spaced plants (30×45 cm) were significantly taller than closely spaced plants.

The interactions of N×P and N×P×K were significant, thereby showing that effect of N was enhanced in presence of P and that the individual response of N, P and K was increased in presence of all these three nutrients.

Number of florets/ha at full bloom:

The data (Table 2) showed that the number of flowere per hectare differed significantly with the levels of N. Significantly the highest number of florets was recorded at N_2 (100 kg N/ha) N_1 (50 kg N/ha) also gave significantly higher yield than N_0. Application of phosphorus (50 Kg P_2O_5/ha) gave significantly more number of flowers over P_0. A dose of 50 kg K_2O/ha was also significantly beneficial in the production of florets per hectare

Motial *et al.* (1979) carried out an experiment at National Botanic Garden, Lucknow and found no significant effect due to NPK application on the total number of buds per spike.

Closer spacing (30×30 cm) proved to be highly beneficial for flower production. In closer spacing 50 per cent more flowers were recorded compared to wider spacing.

In regard to the interaction effects, N×S showed significant influence on the number of florets/ha. $N_2 \times S_1$ recorded significantly the highest number of florets/ha followed by $N_1 \times S_1$, $N_0 \times S_1$, $N_2 \times S_2$. The $N_2 \times S_2$ was not statisti-

cally different from $N_1 \times S_2$; both these Interactions were significantly superior to $N_0 \times S_0$. From the data it is evident that narrower spacing with any level of N produced significantly greater number of florets per hectare over wider spacing with any level of N. This indicated profound influence of spacing in respect of florets production. Bankar and Mukhopadhyay (1980) from Indian Institute of Horticultural Research, Bangaloro reported significantly superior flower production from a spacing of 25×25 cm for Friendship variety of gladiolus.

Number of florets/spike at full bloom:

The data (Table 3) showed that the flowering was influenced by N. N_2 (100 kg/ha) was significantly superior to N_1 (50 kg N/ha) and N_0. Motial *et. al.* (1979) reported that in general the application of fertilizers delayed the emergence of spike. Application of P and K also showed significantly superior effect in the production of florets per spike. Wider spaced plants produced significantly higher number of florets/spike. At these optimum levels of nutrition and spacing, gladiolus tended to yield a bloom of about 13.3 to 13.7 florets per plant.

A significant interaction of N and S indicated that the wider spacing yielded more open florets in presence of N level. Bankar and Mukhopadhya (1980) also reported more number of florets with greater spacing.

Weight of corms per hectare:

Per hectare yield of corms differed significantly due to different treatments (Table 4). A Linear response in weight of corms was observed to the graded levels of N application. The corm yield was significantly increased as the N dose was increased. K application at the rate of 50 kg K_2O/ha gave significantly higher yield than no K. P effects were not significant. Kanturtzis (1966) and Watens (1966) obtained optimum corm yield by application of about 38 kg/ha of N and K_2O. El-Gamassy (1968) also observed beneficial effect of combined application of N and K in producing higher corm yield. Watens and Waltz (1961) reported linear response due to increasing N level from 4.8:8 to 16:8:8 at 2500 kg/ha. Amritage (1973) did not observe marked effect on corm yield by the application of P.

The interaction between N and P was significant. under fixed dose of P_0, increasing N levels showed significant linear response, while under fixed P_2 level, the increasing N levels did not show significant differences.

The results of this experiment when seen critically indicated that the maximum response of gladiolus was seen at N_2 (100 kg N/ha), K_1 (50 kg K_2O/ha) and closer spacing (30×30 cm). The effect of P was evident through the interaction with N or K or N and K both. This indicated that the full exploitation of yield potential and for the optimum development of plant, it would be desirable to add P in the nutritional programme of gladiolus.

Spacing also significantly influenced the corm yield on hectare basis.

The closer spacing was very beneficial in increasing the per hectare yield of corm. Amritage (1973) reported higher number of corms from reduced spacing. He got beneficial effect by increasing the plant population density to as much as 738000 plants/ha. In the present studies the highest population tried was to the extent of 111111 plants/ha. The recommendations based on the results of this experiment would be the application of fertilizers at the level of $N_2P_1K_1$ (N 100 kg, P_2O_5 50 kg, K_2O 50 kg/ha) and spacing of S_2 (30×30 cm). Based on the trend it may be suggested that there is a need to try still higher and more closely graded levels of N and K as well as still close spacings to pinpoint the optimum requirement for this crop.

REFERENCES

AMRITAGE, M. S. 1973. The fertility of gladiolus in Swaziland A preliminary report. *Misc. Rept. Malkerno Res. Stn. Swaziland* No. 19, pp. 21.

BANKAR, G. J. and MUKHOPADHYAY, A. 1980 Effect of corm size, depth of planting and spacing on the production of flowers and corms in gladiolus. *Indian J. Hort.* 37 (4): 408.

CIRRITO, M. 1978. Trials on fertilizing to increase the size of gladiolus corms. *Annali dell' Institute sperimentale per la Floricoturna.* 7 (1): 91-128 (Hort. Abst. 1978: 48 (7) 6676).

EL-GAMASSY, A. M. 1958. The relative effect of various fertilizer elements on growth and flowering of gladiolus corms and cormels. *Ann. agric. Sci. (Cairo)* 3: 97-107.

EL-GAMASSY, A. M. and EL-GLENDE, S. A. 1962. Effect of planting depth and spacing on the growth and flowering of two gladiolus varieties. *Ann. agric. Sci. (Cairo)* 7: 353-85.

FERNANDES, P. D., EYSINK, A. J. J. BIROGNI A. C., OLIVERINA, F. and DE, J. J. 1975. Studies on spacing of gladiolus corms. I. Variations in spacing within the row. *Cientifica,* 3 : 42-47 Abstr. Ornamental Hortic. 32: 4822).

FERNANDES, P. D., HAAG, H. P. and OLIVERA, G. D. 1947a. Mineral nutrition of ornamental plants. V. Studies on fertilization with nitrogen of *Gladiolus grandiflorus* Cv. Perusi. *Anais der Escola Superior de Agricultura "Luiz de quiroz" 32:* 621-34 (Abst. Ornamental Hortic, 3: 4777).

FERNANDES P. D. HAAG, H. P., SIMAO, S. and MATTOS, J. R. 1974b. *Anais der Escola Superior de Agricultura "Luiz de queiroz" 31:* 633-44 (Abstr. Ornamental Hortic. 3: 4779).

FERNANDES, P. D., HAAG, H. P., SIMAO, S., MATTOS, J. R, and DE, J. J. 1974c, Plants. VII. Studies on N, P and K fertilization on *Gladiolus grandiflora* Cv, Perusi. *Anais der Escola Superior de Agricultura "Luiz de queiroz" 31:* 645-66 (Abstr, Ornamentel Hortic 3: 4779).

HAMILTON, A. 1976. A history of the garden gladiolus. *Garden,* 101: 424-28.

KANTURTZIS, N. A. 1956. Manurial experiments on gladiolus. *Reprint Geoponik* No. 138/9, pp. 31-36.

MOTIAL, R. S., BASARIO, K. K., RAM PADARTH SINGH and SINGH R. S. 1979. Response of gladiolus to NPK fertilizer. *Plant Sci.* 11: 69-73.

SKAL'SKA, E . 1970. A study on timing fertilizer application to gladioli *Vidack Priace Vyknnecho Vzruhonicich* 5: 265-70.

WATENS, W. E. 1966. Nutrient requirements of gladiolus cormels on sandy soils of Florida. *Proc. Soil Sci. Fla.* 25: 59-63.

WATENS, W. E. and WALTZ, S. S. 1961. Inorganic nutrition of gladiolus. *A. R. Fla. agric. Expt. Stn,* pp. 309-10.

Table 1. Plant height 90 days after sowing.

	P_0	P_1	K_0	K_1	S_1	S_2	Mean
N_0	70.37	72.17	70.16	72.37	70.30	72.23	71.28
N_1	73.49	72.28	72.68	73.10	71.50	74.25	72.89
N_2	73.28	75.09	73.41	74.95	72.99	75.35	74.18
Mean	72.27	73.18	72.08	73.41	71.61	73.95	72.78
S_1	71.27	71.94	70.80	72.41	–	–	–
S_2	73.48	74.42	73.36	74.54	–	–	–
K_0	71.91	72.26	–	–	–	–	–
K_1	72.85	74.10	–	–	–	–	–

	N*	P	K*	S*
C. D.	1.357	N. S.	1.108	0.549

* Significant at 5% level
* Interaction NP and NPK are significant

Table 2 : Number of florets/ha (X × 100000)

	P_0	P_1	K_0	K_1	S_1	S_2	Mean
N_0	13.52	14.04	13.68	13.89	13.45	9.40	13.77
N_1	14.27	15.14	14.33	15.08	14.05	10.24	14.71
N_2	14.94	15.47	14.97	15.44	15.02	10.26	15.21
Mean	14.24	14.88	14.33	14.80	14.17	9.97	14.56
S_1	13.90	14.45	13.93	14.42	–	–	–
S_2	9.73	10.20	9.81	10.12	–	–	–
K_0	13.93	14.72	14.72	–	–	–	–
K_1	14.55	15.04	15.04	–	–	–	–

	N*	P*	K*	S*
C. D.	0.471	0.385	0.385	0.292

* Significant at 5% level
* Interaction NS is significant

TABLE : 3 Number of open florets 90 days of planting.

	P_0	P_1	K_0	K_1	S_1	S_2	Mean
N_0	3.4	3.4	3.3	3.5	3.2	3.7	4.3
N_1	3.4	3.8	2.8	4.5	3.4	4.0	3.7
N_2	4.8	5.3	4.7	5.4	4.6	5.5	5.0
Mean	3.9	4.2	3.6	4.4	3.7	4.4	4.0
S_1	3.3	4.1	3.2	4.2	–	–	–
S_2	4.5	4.3	4.1	4.7	–	–	–
K_0	3.4	3.8	–	–	–	–	–
K_1	4.3	4.6	–	–	–	–	–

	N*	P	K*	S
C. D.	1.00	N. S.	0.81	N. S.

* Significant at 5% level

* Interaction NKS is significant

TABLE: 4 Weight of corms (q/ha)

	P_0	P_1	K_0	K_1	S_1	S_2	Mean
N_0	122.22	166.66	144.44	144.44	144.44	96.29	144.44
N_1	166.66	166.66	144.44	177.77	144.44	118.51	165.66
N_2	200.00	188.88	177.77	211.11	166.66	148.14	188.88
Mean	166.65	177.77	155.55	177.77	155.55	118.51	166.66
S_1	155.55	155.55	144.44	155.55	–	–	–
S_2	118.51	125.92	111.11	125.92	–	–	–
K_0	155.55	155.55	–	–	–	–	–
K_1	166.66	188.83	–	–	–	–	–

	N	P	K	S	N×P
C. D.	17.77*	N. S.	14.44*	10.00*	25.55*

* Significant at 5% level

* Interaction N×P is significant