J Agric. Res., 2018, Vol. 56(4):253-256
www.jar.com.pk
Agriculture Department
Government of Punjab

CORM AND CORMEL PRODUCTION OF GLADIOLUS (CV. AMSTERDAM) AS AFFECTED BY DIFFERENT NPK DOSES

*Muhammad Nasir Rasheed [1], Muhammad Saeed [*2] and Tahir Saeed [3]*

[1] Horticulturist, [2] Assistant Horticulturist, [3] Assistant Research Officer, Horticultural Research Sub-Station for Floriculture & Landscaping, AARI, Faisalabad, Pakistan.
*Corresponding author e-mail: msaeed456@yahoo.com

Article received on: 28/12/017
Accepted for publication: 10/12/2018

ABSTRACT

A study was conducted at Horticultural Research Sub-Station for Floriculture and Landscaping, AARI, Faisalabad, Pakistan to observe the effect of N, P and K on quality and production of corm and cormel of gladiolus (cv. Amsterdam) under agro-climatic conditions of Faisalabad (Pakistan) during the year 2015-16. Different NPK combinations i.e. 0, 10-10-10, 20-20-20, 30-30-30 g (in the form of urea, single super phosphate and sulfate of potash) were tried in four repeats in plots of 1 m^2 size. At the time of land preparation full quantity of P and K, and half quantity of N was applied. Remaining half quantity of N was applied at 4th leaf stage. FYM was added uniformly @ 5 tons per hectare during the preparation of soil. Measurements for size and weight of corms and cormels were noted after 150 days of gladiolus planting. The treatment combinations of urea, single super phosphate and sulphate of potash applied @ 10-10-10g gave the significant results with respect to maximum production of corms (1.95 per plant). Maximum production of cormels per plant (8.12), maximum average fresh weight of one corm (90.75 gm) and maximum average circumference of corms (31.50 cm) were also noted in same NPK dose. However, non-significant results were obtained for number of leaves produced. It is recommended that above-mentioned doses of urea, single super phosphate and sulfate of potash may be applied in the field to obtain optimum yield of corms and cormels of gladiolus under climatic conditions of Faisalabad.

KEYWORDS: Gladiolus; corm; cormel; NPK fertilizers; productivity; Pakistan.

INTRODUCTION

There is a great demand of cut flowers the world over. Cut flower production centers have moved to countries where the climates are favourable and production costs are low as compared to conventional growing countries such as Netherlands (Zhao *et al.*, 2008). From commercial point of view gladiolus holds the second position amongst cut flowers in the world. Gladiolus is a potential marketable crop in Pakistan and it has great economic importance with widespread markets located in various parts of the country. However, the task of year-round quality production of gladiolus cut flowers still remains to be achieved. In the past decade production of cut flowers has increased and this trend is likely to continue due to many factors. These factors may involve changes in peoples' living standards, increased rate of population and acknowledgement of higher returns on investment. All these factors have resulted in increased production of high value cut flower crops (Riaz *et al.*, 2007).

For successful cultivation of any cut flower crop at commercial scale, availability of quality planting materials is necessary. There is a vast scope of establishing the business of commercial production of gladiolus corm and cormels in the country. A number of factors affect the production of vigorous and healthy corms and cormels, of which nutrient supply is very important. Gladiolus responds well to chemical fertilizers. Nitrogen, phosphorus and potassium combined with micro-nutrients increase number and weight of corms and cormels (Afify, 1983; Shah *et al.*, 1984; Mukherjee *et al.*, 1998). Nutrient supply is required for gladiolus during the growth period, flowering and corm development. So, application of an optimum amount of appropriate nutrients becomes important. As compared to corms, cormels of gladiolus respond well to heavy doses of fertilizers (Mukhopadhaya, 1995). Increasing nitrogen enhances growth of plant, spike length, number of florets on spikes and number of leaves (Shah *et al.*, 1984). Corms and cormels production is affected by N deficiency. Therefore, the stored food present in old corms cannot be utilized properly by the plants (Mukhopadhyay, 1995). Phosphorus has a fundamental role in energy transportation in fat and protein metabolism (Obreza, 2001). Phosphorus is the most commonly used nutrient element next to N (Silberbush *et al.*, 2003). The role of potassium is that of a catalyst in many biosynthetic processes of the photosynthesis and amino acids and it helps develop resistance in plants against diseases. When doses of

K are not adequate, nutritional imbalance occurs and as a result higher doses of N do not prove useful for better flower quality (Mukhopadhyay, 1995). Also, N, P, and K affect the growth, flower quality and production of tubers in tuberose (Sultana *et al*., 2005). The height of flower stalk ascending from the corm may reach to a height of four feet. However, the differences amongst varieties are large (Hessayon, 2011). Plant growth is adversely affected by deficient and over doses of N (Sharma and Kumar, 2012). Khan *et al*. (2012) reported the production of largest corm (4.11 cm) and the highest corm number and cormel yield (1,20,000 and 1.66 t/ha, respectively) with the application of 150-200 NK ha^{-1}. Different manures and fertilizers significantly influence the growth of leaves (Gijbhiye *et al*., 2013). Zubair *et al*. (2013) did not find N effective on many parameters of yield and quality of gladiolus when applied @ 0, 100 and 200 kg ha^{-1}, Sabastian *et al.* (2018) recommended application of N and P @ 300 and 200 kg ha^{-1} respectively for getting required growth quality in gladiolus.

In Pakistan usually, recommendations about the use of fertilizers for quality corm production are meager pertaining to different types of soils. Same recommendations cannot be advised for all types of soils as the soils vary in their nutrient status. As a result, the farmers cannot get desirable quality corms and cormels for further cultivation of gladiolus. Cultivation of gladiolus is under practice in many areas of Punjab province and also in other parts of the country. Therefore, by using proper amount of N, P and K there is great possibility of increasing the yield of vigorous and healthy corms and cormels of gladiolus in the country.

The present study was undertaken under the agro-climatic conditions of Faisalabad (Pakistan) to explore the effect of N, P and K on growth and yield of corms and cormels' production of gladiolus obtained from healthy corms.

MATERIALS AND METHODS

This study was conducted at Horticultural Research Sub-Station for Floriculture and Landscaping, AARI, Faisalabad, Pakistan during the year 2015-16. Before the start of experiment soil analysis was carried out at Institute of Soil Chemistry & Environmental Sciences, Ayub Agricultural Research Institute, Faisalabad (Table 1). Healthy corms were procured from a reputed supplier of gladiolus corms. Large sized (10-12 grade) corms of gladiolus (cv. Amsterdam) were used as planting material. The experiment was laid out in RCBD with four replications having a net plot size of 1 m^2 with 12 corms per plot. The plot was thoroughly prepared by repeated working with spade. FYM was added @ 5 tons per hectare. The plot was then leveled and divided into equal sub blocks.

Table 1. Analysis of soil from the experimental site for various physical and chemical properties.

Properties	Soil depth	
	0-15 (cm)	15-30 (cm)
Texture	clay loam	clay loam
pH	7.91	7.71
EC (dSm^{-1})	1.51	1.25
Organic matter (%)	0.72	0.61
Available P (mg/kg)	8.23	6.95
Available K (mg/kg)	205	198
Zn (mg/kg)	0.65	0.60
Fe (mg/kg)	2.55	2.40
Exchangeable sodium (mmol/100 gm)	0.89	0.72

There were four NPK treatments in the experiment as given below:-

T_0 = Control, no fertilizer/no compost
T_1 = 10-10-10 g NPK/1m^2 bed
T_2 = 20-20-20 g NPK/1m^2 bed
T_3 = 30-30-30 g NPK/1m^2 bed

Corms were planted 15 cm apart with 30 cm distance between rows on small ridges. In order to prevent lodging, earthing up was repeated twice. Sources of fertilizers were urea for nitrogen, SSP for phosphorus and SOP for potash. Different levels of N and K were used as per treatments schedule. The entire amount of FYM, SSP and SOP were applied at the time of final land preparation as basal dose. Urea as a source of N was top-dressed in two equal splits at sowing time and at fourth leaf stage (Pant, 2005). Cultural operations like weeding, watering, hoeing and earthing up were done as and when required. The plants were not allowed to flower since this could affect the production and quality of corms and cormels. The spikes were cut off immediately after spike emergence to improve quality of corms and cormels. Harvesting of corms and cormels was done when leaves turned brown (Mukhopadhaya, 1995). Measurement for size and weight of corms and cormels were noted after 150 days of planting of gladiolus corms (Pant, 2005). Data on different growth and yield parameters i.e. number of corms per treatment cormels per treatement average of circumference per corm and average weight per corm were analyzed statistically and means were separated by LSD at P = 5%.

RESULTS AND DISCUSSION

Significant variations were observed on number of corms, corm weight, corm size and number of cormels due to NPK treatments (Table 2 and 3). However, a non-significant variation was observed for number of leaves. Overall there were 12 plants per treatment. It

can be observed that T_1 (10:10:10 g NPK/1 m^2 bed) produced maximum corms per treatment (23.50) whereas T_0 (control) produced the minimum (16.75) (Table 2). Maximum corms per plant and cormel production (8.12) was observed in T_1 (Table 3). Thus, the means of treatments had significant differences among them (P = 0.05).

Table 2. Effect of N, P and K on growth parameters of gladiolus.

Treatments	Growth parameters			
	No. of corms/ treatment	No. of cormels/ treatment	Ave. of circumference per corm (cm)	Ave. weight per corm (gm)
T_0 (Control)	16.75 b	36.25 c	19.50 b	65.00 c
T_1 10-10-10 (g/ 1 m^2 bed)	23.50 a	97.50 a	31.50 a	90.75 a
T_2 20:20:20 (g / 1 m^2 bed)	21.00 ab	66.75 b	22.25 b	80.50 b
T_3 (30:30:30 (g / 1 m^2 bed)	20.25 ab	38.75 c	21.00 b	67.75 c
P-value (0.05)	0.0395	0.0000	0.0003	0.0003
LSD value	4.32	3.86	8.76	9.44

Mean values not sharing same letter within same column differ significantly (p = 0.05).

Table 3. Effect of N, P and K on average production of corms and cormels per plant.

Treatments	No. of corms/plant	No. of cormels/plan
T_0 (Control)	1.39 b	3.02 c
$T_1$10:10:10 (g / 1 m^2 bed)	1.95 a	8.12 a
T_2 20:20:20 (g / 1 m^2 bed)	1.75 ab	5.56 b
T_3 30:30:30 (g / 1 m^2 bed)	1.68 ab	3.22 c
P-value (0.05)	0.0395	0.0000

The results about corm size (circumference) show that T_1 (10-10-10 g NPK) produced maximum size of corms (31.5 cm) (Table 2). The size of corms in all other treatments gave similar response and all were statistically at par ranging in size from 19.50 to 22.25 cm. Similar results were also reported by Zubair *et al*. (2013) who found maximum number of daughter corms as 1.6 $mother^{-1}$ in Jessica variety of gladiolus. The results of weight of corms produced in each treatment show that again the treatment T_1 produced corms of maximum weight (90.75 g). As the corms were of maximum size, so these gained maximum weight. The other treatments behaved similarly and were next to T_1. The results of number of corms per plant reveal that again T_1 treatment produced maximum number of corms (1.95) followed by T_2 (1.75). Similarly, more number of cormels per plant was also observed in T_1 (8.12) followed by T_2 (5.56). Bashir *et al*. (2016) observed that P is important for attaining better corm weight of gladiolus. Therefore, most probably the role of P is important for increase in corm weight and size.

According to the above results, treatment T_1 (10 g each of NPK) proved more useful as compared to other treatments. This treatment was followed by T_2 (20 g each of NPK) in all the cases. The exact amount of fertilizer requirement of gladiolus is difficult to state as it depends upon type of soil, fertility condition and salt contents of the soil. The effect of N improved when K added to the soil (Misra and Singh, 1998). Different gladiolus cultivars respond differently to nitrogen levels (Sidhu and Arora, 1989). Pant (2005) found good response of cormel yield by applying higher dose of P and lower dose of N. The results may also differ due to genetic variability of cultivar and variation in environmental conditions (Zubair, 2013). Thus, environmental conditions, fertility status of soil and cultivar response may alter the results pertaining to different characteristics.

It is concluded that two bags each of urea, SSP and SOP (100 kg each ha^{-1}) alongwith sufficient amount of FYM can give the desired results with respect to the production of corms and cormels provided the spikes are not allowed to grow. These cormels can further be used for the production of bigger corms if sown repeatedly in the following years. It is, therefore, suggested that keeping in view the above-mentioned factors good production of corms and cormels of gladiolus can be obtained under agro-climatic conditions of Faisalabad. However, these recommendations may vary due to soil, water and other environmental conditions. These recommendations are suited to those soils which are slightly saline with less than 1% organic matter. The addition of organic matter in the form of FYM or other forms will improve the quality of crop considerably.

REFERENCES

Afify, M. M. 1983. Effect of high fertilizer rates on the growth and flowering of three gladiolus cultivars. Kerleszefi Egyatem Kkozlemenyel. 47:75-82.

Bashir, M., I. Khan, R. W. K. Qadri, M. Tanveer, M. Zain and I. Ahmad. 2016. Growth and corm production of *Gladiolus grandifloras* L. 'Essential' under different

NPK regimes. J. Ornament. Pl. 6(1):11-19.
Hessayon, D.G. 2011. The Flower Expert. p:90-91. Transworld Publishers, 61-63 Uxbridge Road, London.
Khan, F.N., M.M. Rahman, A. J. M. S. Karim and K. M. Hossain. 2012. Effects of nitrogen and potassium on growth and yield of gladiolus corms. Bangladesh J. Agric. Res. 37(4):607-616.
Misra, R.L. and B. Singh. 1998. Gladiolus. *In:* Commercial Flowers. Bose, T. K. and L. P. Yadav (eds.). Naya Prokash, Calcutta, India. p. 266-353.
Moore, J., P. Harrison, M. Monfries, H. Simon, C. Clarke, R. Best, R. Whelan, J. Simpson, M. Massey and R. Bradley. 1980. The Complete Australian Gardener. Bay Books, Sydney and London. p: 421-422.
Mukherjee, S., S.C. Jona and T.K. Chatterjee. 1998. Effect of nitrogen and phosphorus dose on production of flowers and corms of gladiolus. Indian Agriculturist, 36(3):211-213
Mukhopadhyay, A. 1995. Gladiolus. Publication and Information Division. Indian Council of Agric. Res., Krishi Anusandhan Bhavan, New Delhi. p.1-83.
Obreza, T.A. 2001. Effects of P and K fertilization on young citrus tree growth. Cooperative Extension Service, Univ. of Florida, Institute of Food, Agri. Sci., Florida, p.1-3.
Pant, S.S. 2005. Effect of different doses of nitrogen and phosphorus on the corm and cormel development of gladiolus (*Gladiolus* sp.) cv. American Beauty. J. Inst. Agric. Anim. Sci. 26:153-157.
Riaz, T., S.N. Khan and A. Javaid. 2007. Scenario of gladiolus production in Punjab, Pakistan. Pak. J. Bot. 39:2389-2393.
Sabastian, K.S., K. Mathukmi, N. N. Moyon, J. Dakho and H. Athokpam. 2018. Influence of nitrogen and phosphorus on size and fresh weight of corm in *Gladiolus grandiflorus* L. cv. White Prosperity. Int. J. Curr. Microbiol. App. Sci. 7(05):2892-2898.
Shah, A., S. D. Lal and J. N. Seth. 1984. Effect of different levels of nitrogen and phosphorus on growth, flowering and corm yield of gladiolus cv. Vinks Glory. Progressive Horticulture. 16(3/4):305-307.
Sharma, S. and R. Kumar. 2012. Effect of nitrogen on growth, biomass and oil composition of clary sage (*Salvia sclare* L.) under mid hill of north western Himalayas. Intl. J. Natural Prod. Resources. 3(1):79-83.
Sidhu, G.S. and J.S. Arora. 1989. Response of gladiolus varieties to nitrogen application. Indian J. Horti. 46(2):250-254.
Silberbush, M., J.E. Ephrat, C. Alepkrov and J.B. Asher. 2003. Nitrogen and potassium fertilization interaction with carbon dioxide enrichment in hippeastrum bulb growth. Scientia Hort. 98:85-90.
Sultana, S., F.N. Khan, A.T.M. Farid, M.S. Mollah and M.A. Haque. 2005. Nutrient management for gladiolus. Bangladesh J. Agric. Environ. 1(2):7-12.
Zhao, J., Y. Zhao and Y. Yen. 2008. Development and countermeasures of flower industry in Yunnan, China. Ecol. Econ. 4:151-161.
Zubair, M., G. Ayub, N. Amin, A. Rab, M. Ahmad and N. Ara. 2013. Yield and quality cut flowers and corm production of gladiolus vary by cultivar at three levels of nitrogen fertility. Pak. J. Bot, 45(3):967-976.

CONTRIBUTION OF AUTHORS

S. No.	Author name	Contribution	Signatures
1.	Muhammad Nasir Rasheed	Overall supervised the experiment and critically reviewed	
2.	Muhammad Saeed	Statistical analyzed and arranged data	
3.	Tahir Saeed	Conducted research trial, collected data and reviewed the literature