Environment and Ecology 40 (4) : 2125—2131, October–December 2022
ISSN 0970-0420

Effect of Organic Manure and Inorganic Fertilizer on Growth, Yield, and Quality of Gladiolus (*Glandiolus gradioflorus* L.) cv Princess Margaret Rose

Praveen Kumar, V. M. Prasad, Vijay Bahadur, Deepanshu

Received 4 July 2022, Accepted 22 August 2022, Published 19 October 2022

ABSTRACT

A field experiment was carried out at horticulture experimental field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, SHUATS, Prayagraj (UP) in the month of October to March during *rabi* season, 2021-2022 for studying the effect of organic manure and inorganic fertilizers on growth, yield and quality of gladiolus. The experiment was laid out in Randomized Block Design (RBD) with 3 replications. The treatment in each replication was randomly allotted. There are 10 treatments having one variety were used in this experimental design. The treatments comprised of 20t/ha FYM, 10t/ha Vermicompost and 4t/ha poultry manure with 75% RDF, 50% RDF and 25% RDF in different combinations including control (100% RDF, N:P: K 120:150:150 kg/ha). The results revealed that among all the treatments, application of (75% RDF + 25% Vermicompost) in treatment (T_2) produced significantly tallest plant (68.07 cm) with more number of leaves per plant (8.87), took minimum days to emergence of shoot (11.80 days), minimum days to emergence of spike (65.93), maximum length of spike (76.07 cm), number of spike per plant (1.40), number of florets per plant (14.07), Vase life in normal tap water (14.80 days), number of spike per hectare (2.02 lakhs), number of corms per plant (1.60), diameter of corms (8.34 cm), weight of largest corms (82.67 g), number of corms per hectare (2.30 lakhs), number of cormels per plant (26.87), number of cormels per hectare (38.69 lakhs), as compared to control (T_0).

Keywords Gladiolus, Princess margaret rose, Vermicompost, FYM, Poultry manure.

Praveen Kumar[1]*, V. M. Prasad[2], Vijay Bahadur[3], Deepanshu[4]

[1]Department of Horticulture, SHUATS, Prayagraj 211007
[2]Professor, Department of Horticulture, SHUATS, Prayagraj
[3]Associate Professor, Department of Horticulture, SHUATS, Prayagraj
[4]Assistant Professor, Department of Horticulture, SHUATS, Prayagraj

Department of Horticulture, Naini Agriculture Institute

Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj 211007, Uttar Pradesh, India

Email: praveen.97702@gmail.com
*Corresponding author

INTRODUCTION

The modern gladiolus hybrids are botanically known as *Gladiolus grandioflorus.* Widely grown as a cut flower in the world and referred to as the "Queen of Bulbous" flowers. It occupies fourth place in the international trade after rose, carnation and chry-

santhemum, in the cut flower industry (Tirkey *et al.* 2017). For good performance, it prefers a sandy loam soil, rich in organic matter. The soil pH range of 6.5 to 7.0 is ideal for growth and spike production. It is a winter season crop but can be grown during rainy season in low rainfall areas with mild climate. In India it is mainly cultivated in the state of Jammu and Kashmir, Darjeeling, Kalimpong in West Bengal, Chaubattia and Udham Singh Nagar in Uttarakhand, Meerut, Varanasi and Lucknow in Uttar Pradesh, Bangaluru in Karnataka, Delhi, Ooty in Tamil Nadu, Pune in Maharashtra and Shimla in Himachal Pradesh. Organic manure has great potential to boost the yield and can play an important role in enhancing flower and corm yield. Application of farmyard manure found beneficial for plant growth, flowering and corm yield parameters and considered to best for growing a successful crop (Gupta *et al.* 2008).Vermicompost also acts as chelating agent besides being a rich source of micronutrients and regulates the availability of metabolic micronutrients like iron and zinc in the plants. It is cost-effective and is known to increase the plant growth and yield by providing nutrients in the most accessible forms. Poultry manure, sometimes called chicken manure, is an excellent soil amendment that provides nutrients for growing crops and also improves soil quality when applied wisely, because it has high organic matter content combined with available nutrients for plant growth. Contain substantial amount of calcium and phosphorus due to high level of mineral supplement in their diet.

MATERIALS AND METHODS

A field experiment was carried out at horticulture experimental field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, SHUATS, Prayagraj (UP) in the month of October to March during winter season, 2021-2022 for studying the effect of organic manure and inorganic fertilizers on growth, yield and quality of Gladiolus. The experiment was laid out in Randomized Block Design (RBD) with 3 replications. The treatment in each replication was allotted randomly in the plots of 1 m x 1 m and having spacing of 25 cm plant to plant and 25 cm row to row. The treatments were T_0 (100% RDF), T_1 (75% RDF + 25% FYM), T_2 (75% RDF + 25% Vermicompost), T_3 (75% RDF + 25% Poultry manure), T_4 (50% RDF + 50% FYM), T_5 (50% RDF + 50% Vermicompost), T_6 (50% RDF + 50% Poultry manure), T_7 (25% RDF + 75% FYM), T_8 (25% RDF + 75% Vermicompost), T_9 (25% RDF + 75% Poultry manure). Standard cultural practices recommended for Gladiolus was followed uniformly for all the experimental plots.

Application of organic manure and inorganic fertilizers, after executing the plan of lay-out, the recommended dose of NPK fertilizers @ 120:150:150 kg/ha, FYM (20t/ha), Vermicompost (10t/ha) and Poultry manure (4t/ha) were applied to the crop as basal and entire dose according to treatment except nitrogen were applied in to two split doze. Whereas the half dose of nitrogen was applied at time of planting and other half was applied after 30 days of sowing. The phosphorus were given through Di ammonium phosphate (46% P_2O_5) and potash were given through Murate of potash (60% K_2O), while was given nitrogen through both Urea (46% N) and Di ammonium phosphate (18% N). All the inputs were applied treatment-wise before planting of corms. Irrigation was given from time to time as per prevailing weather conditions. Weeding, hoeing, earthing up and plant protection measures were done regularly from time to time. These operations were common for all the treatments. Observations were recorded on following growth and quality parameters i.e. Plant height (cm), number of leaves per plant, days to emergence of shoot, days to emergence of spike, length of spike (cm), number of spikes per plant, number of florets per spike, vase life (days) and yield parameters like number of spike per plant, number of spike per hectare, number of corms per plant, diameter of corms (cm), weight of largest corms (g), number of corms per hectare, number of cormels per plant, number of cormels per hectare.

RESULTS AND DISCUSSION

Plant height (cm)

The result revealed that the effect of organic manure and inorganic fertilizer was significantly increasing the plant height at 30 DAS, 60 DAS, and 90 DAS

Table 1. Effect of organic manure and iorganic fertilizer on plant growth and flower quality of Gladiolus.

Treatment	Plant height (cm) 30 DAS	60 DAS	90 DAS	No. of leaves 30 DAS	60 DAS	90 DAS	Days to emergence of shoot	Days to emergence of spike	Days to first floret opening	Number of floret per spike	Length of spike (cm)	Vase life (Days)
T_0 100% RDF (Control)	27.78	53.19	63.60	2.27	6.13	6.73	13.40	71.60	76.53	12.27	67.20	7.33
T_1 75% RDF + 25% FYM	26.84	52.30	62.67	2.20	6.00	6.67	13.67	71.93	78.07	12.00	66.67	9.93
T_2 75% RDF+25% Vermicompost	36.21	59.13	68.07	3.73	7.80	8.80	11.80	65.93	73.00	14.07	76.40	14.80
T_3 75% RDF+25% Poultry manure	31.01	56.13	65.80	2.60	6.73	6.93	12.53	69.60	75.47	12.93	72.73	11.73
T_4 50% RDF + 50% FYM	25.19	51.68	61.95	2.13	5.87	6.53	14.13	72.60	78.73	11.87	66.07	8.73
T_5 50% RDF+ 50% Vermicompost	33.07	58.60	67.14	3.60	7.40	8.53	12.13	67.53	73.80	13.40	75.20	13.73
T_6 50% RDF+50% Poultry manure	29.77	55.80	64.63	2.53	6.27	6.87	12.93	69.73	75.80	12.53	71.27	11.60
T_7 25% RDF+ 75% FYM	24.19	51.50	61.47	2.00	5.53	6.47	14.87	72.60	80.60	11.27	65.07	8.27
T_8 25% RDF+75% Vermicompost	32.77	57.93	66.01	2.73	6.80	8.27	12.27	68.47	74.87	13.07	73.40	12.80
T_9 25% RDF+75% Poultry manure	28.91	55.27	63.93	2.33	6.20	6.80	13.13	70.80	76.13	12.40	68.33	11.40
F-test	S	S	S	S	S	S	S	S	S	S	S	S
SEd (±)	2.47	2.00	1.68	0.30	0.44	0.37	0.49	1.16	1.35	0.37	2.12	0.55
CD at (5%)	5.19	4.21	3.52	0.63	0.92	0.77	1.04	2.44	2.83	0.77	4.46	1.15
CV	10.23	4.45	3.18	14.10	8.32	6.21	4.63	2.03	2.16	3.57	3.70	6.07

was obtained as 36.21 cm, 59.13 cm, and 68.07 cm respectively in Treatment T_2 (75% RDF + 25% Vermicompost) shown in (Table 1). The increase in plant height due to application of vermicompost increased microbial biomass, humic materials and other plant growth influencing substances such as plant growth hormone, produced by microorganism during vermicomposting and dehydronagnose activity in soil Aracon *et al.* (2005). These findings are in close conformity with Gaur *et al*. (2006) in Gladiolus.

Number of leaves per plant

The result revealed that the effect of organic manure and inorganic fertilizer was significantly increasing the plant height at 30 DAS, 60 DAS, and 90 DAS was obtained as 3.73, 7.80, and 8.80 respectively in Treatment T_2 (75% RDF + 25% Vermicompost) shown in (Table 1). The combined effect of organic and inorganic fertilizers might have role in activation of Photosynthetic system for enhanced biological efficiency, enabling synthesis of maximum photosynthetic and their translocation and assimilation resulting in increase of number of leaves. Leaves are the photosynthetic part of plant, the yield of crop is directly correlated with number of leaves. This might be due to the increased availability of nitrogen, which is an important constituent of chlorophyll and protein thus causing more growth. These finding were in conformity Preetham *et al*. (2017) in Tuberose.

Days to emergence of shoot

Application of organic and inorganic fertilizers combination resulted in early emergence of spike. The minimum days taken to emergence of shoot (11.80) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (12.13) and maximum days to emergence of shoot was observed by T_7 (25% RDF + 75% FYM) was (14.13) shown in (Table 1). The earliness in shoot emergence by the application of vermicompost in combination of inorganic fertilizer may be due to optimum availability of nutrients to the plant due to the fact that the vermicompost is a rich source of plant micronutrients (N, P, and K), vital micronutrients (Fe, B, Zn and Me) and secondary elements. The vermicompost improves physico-chemical properties, drainage, porosity and aeration of soil. The results are in agreement with Gharat (2004) in China aster.

Days to emergence of spikes

The days to emergence of spike differed significantly due to application of organic manure and inorganic fertilizer. The minimum days to emergence of spike (65.93) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (67.53) and maximum

days to emergence of spike was observed by T_7 (25% RDF + 75% FYM) was (72.93) shown in (Table 1). The beneficial effect of combined application of organic manure and inorganic fertilizer was possible as because vermicompost contains essential plant nutrients like N, P, K, Ca, Fe, S, Mg, Zn, Mo, Cu, Mn, Cobalt and Boron in a balanced amount in addition to biofertilizers, which gave rise to earlier flowering. The results are conformity with findings of Keisam *et al.* (2014) in Gladiolus and Kumar *et al*. (2020) in China aster.

Length of spikes (cm)

The length of spike differed significantly due to application of organic manure and inorganic fertilizer. The maximum length of spike (76.40) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (75.20) and minimum length of spike was observed by T_7 (25% RDF + 75% FYM) was (65.87) shown in (Table 1). The significant result depicted above may be due to the balanced supply of nitrogen from vermicompost and organic sources which promote the translocation of phytohormones to the shoots resulting in longer spike. The results are in confirmation with the findings of Ghisewad *et al*. (2016) in Gladiolus and Srivastava *et al.* (2014) in Tuberose.

Days to first floret open

The minimum days to first floret open (73.00) was observed in treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (78.73) and maximum days to first floret open was observed in T_7 (25% RDF + 75% FYM) was (80.60) shown in (Table 1). This might be due to application of organic manures which led to improved soil texture by making soil loose thereby vermicompost increasing the water holding capacity which encouraged early growth and development of corms and indirectly helped in early emergence of spike. The readily available nutrients from 75% RDF might have helped in building up of nutrition in corms, which might have improved the early vegetative growth of the plant which in turn had indirectly helped in early emergence of spike. This result is in agreement with the findings of Srivastava *et al.* (2014) in Tuberose and Kuotsu *et al*. (2018) in Gladiolus.

Number of spikes per plant

The number of spike per plant differed significantly due to application of organic manure and inorganic fertilizer. The maximum number of spikes per plant (1.40) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (1.37) and minimum number of spikes per plant was observed by control T_0 (100% RDF) was (0.93) shown in (Table 1). The increase in yield clearly indicates effect of inorganic fertilizer integrated with organic manure. The inclusion of vermicompost with chemical fertilizer greatly helped in improving the yield attributes because of fact that vermicompost application most probably increased the level of growth promoting substances and nutrients availability forms in the soil to plant system and therefore helped in enhancing the uptake of nutrients and accumulation of more photosynthates in plant sink, viz., cut spike. Increased yields might be due to increased nitrogen fixing capacity of *Azosprillum*. Vermicompost serves as a source of humic and fulvic acids, which significantly influences the activity of Azosprillum, also improves the level of growth promoting substances and increases the vegetative growth as well as reproductive growth and flower yield. The obtained results are in accordance with the earlier findings of Choudhury and Sarangi (2020) in Tuberose and Koiremba *et al.* (2020) in Kombirei.

Number of florets per spike

The maximum number of florets per spike (14.07) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (13.40) and minimum number of florets per spike was observed by T_7 (25% RDF + 75% FYM) was (11.27) shown in (Table 1). An improvement in flowering attributes by organic manure and inorganic fertilizer application might be due to the fact that vermicompost is nutritive fertilizer helps in availability of macro and micro-nutrients levels in soil to plant system and also improve level of growth promoting substances. As a result, their combined

Table 2. Effect of organic manure and inorganic fertilizer on yield of spikes and corms in Gladiolus.

	Treatment	Number of spikes per plant	Number of corms per plant	Number of cormels per plant	Weight of largest corm (g)	Diameter of corms (cm)	Number of spike per hectare (lakhs)	Number of corm per hectare (lakhs)	Number of corme per hectare (lakhs)
T_0	100% RDF (Control)	0.93	1.03	12.47	43.33	5.21	1.34	1.49	17.95
T_1	75% RDF + 25% FYM	1.10	1.20	16.27	56.67	5.93	1.58	1.73	23.42
T_2	75% RDF + 25% Vermicompost	1.40	1.60	26.87	82.67	8.34	2.02	2.30	38.69
T_3	75% RDF + 25% Poultry manure	1.20	1.30	22.40	72.00	7.05	1.73	1.87	32.26
T_4	50% RDF + 50% FYM	1.07	1.13	15.13	51.67	5.53	1.55	1.63	21.79
T_5	50% RDF + 50% Vermicompost	1.37	1.53	24.81	78.00	8.17	1.97	2.21	35.72
T_6	50% RDF + 50% Poultry manure	1.17	1.27	20.87	64.67	6.52	1.68	1.82	30.05
T_7	25% RDF + 75% FYM	1.00	1.10	13.19	50.00	5.43	1.44	1.58	18.99
T_8	25% RDF + 75% Vermicompost	1.27	1.47	23.87	74.00	7.97	1.82	2.11	34.37
T_9	25% RDF + 75% Poultry manure	1.13	1.23	18.73	62.67	6.24	1.63	1.78	26.98
	F-test	S	S	S	S	S	S	S	S
	SEd±	0.12	0.09	1.15	2.41	0.32	0.17	0.12	1.65
	CD (5%)	0.25	0.18	2.41	5.06	0.66	0.36	0.26	3.48
	CV %	12.64	8.22	7.23	4.64	5.83	12.64	8.22	7.23

application helped in stimulating the vegetative and reproductive phase of the plants. The results of the study are also in agreement with the findings of Choudhury and Sarangi (2020) in Tuberose and Kumar *et al.* (2018) in Gladiolus.

Number of spikes per hectare (lakhs)

The maximum number of spikes per hectare (2.02) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (1.97) and minimum number of spikes per hectare was observed by control T_0 (100% RDF) was (1.34) shown in (Table 2). The increase in yield clearly indicates effect of inorganic fertilizer integrated with organic manure. The inclusion of vermicompost with chemical fertilizer greatly helped in improving the yield attributes because of fact that vermicompost application most probably increased the level of growth promoting substances and nutrients availability forms in the soil to plant system and therefore helped in enhancing the uptake of nutrients and accumulation of more photosynthates in plant sink, viz., cut spike. Increased yields might be due to increased nitrogen fixing capacity of *Azosprillum.* Vermicompost serves as a source of humic and fulvic acids, which significantly influences the activity of Azosprillum, also improves the level of growth promoting substances and increases the vegetative growth as well as reproductive growth and flower yield. The obtained results are in accordance with the earlier findings of Kumar *et al*. (2018) in gladiolus.

Vase life (Days)

The vase life of flowers were calculated by harvesting the flower at full open stage and keeping them at room temperature, the number of days were counted when petals lost turgidity and changed the color. The effect of different doses of organic manures and inorganic fertilizers on the vase life of Gladiolus under simple water was investigated and the maximum vase life (14.80) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (13.73) and minimum vase life was observed by T_0 (100% RDF) was (7.33) shown in (Table 1). On the basis of present studies it can be inferred that in respect of cultivation of Gladiolus nutrition in the form of 75% RDF + 25% vermicompost per hectare was effective for obtaining better vase life of *gladiolus*. There was improvement in the soil pH towards the vase life of flowers in treatment RDF + Vermicompost at 75% and 25% might be increased. It also may be due to differences in their source and nutrients composition as well as timing of nutrients availability to the flowering plants.

The results of the study are also in agreement with the findings of Prasad *et al*. (2017) in Asiatic lily and Sisodia and Singh (2015) in Gladiolus.

Number of corms per plant

The number of corms per plant differed significantly due to application of organic manure and inorganic fertilizer. The maximum vase life (1.60) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (1.53) and minimum number of corms per plant was observed by control T_0 (100% RDF) was (1.03) shown in (Table 2). It is evident from data that combined use of organic manure and inorganic fertilizer as compared with the application of in organic fertilizer. The treatment 75 % RDF + 25% vermicompost receiving optimum amount of nitrogen and phosphorus which promotes better vegetative growth and produce more number of corms per plant. The results of the study are also in agreement with the findings of Tirkey *et al.* (2017) in Gladiolus, Kumar *et al*. (2018) in Gladiolus and Priyadarshini *et al*. (2018) in Gladiolus.

Diameter of corms (cm)

The maximum diameter of corms (8.34) was observed in treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (8.17) and minimum diameter of corms was observed in T_0 (100% RDF) was (5.21) shown in (Table 2). The increase in the diameter of the corm could be due to the better soil environment with the application of organics such as vermicompost. This application of organics might have resulted in higher uptake of the nutrients into the plants. This higher uptake of nutrients resulted in good vegetative growth and sufficient amount of photosynthates could have accumulated which were transferred into the corms at the end of the crop growth period. The results of the study are also in agreement with the findings of Priyadarshini *et al*. (2018) in Gladiolus and Sisodia and Singh (2015) in Gladiolus.

Weight of largest corm (g)

The maximum weight of largest corms (82.67) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (78.0) and minimum weight of largest corm was observed by control T_0 (100% RDF) was (43.33) shown in (Table 2). The result indicates that the application of combination of inorganic fertilizers with organic manures were found highly beneficial due to healthy vegetative growth have responsible for higher photosynthesis which might account for increasing weight of corms. The results were in agreement with Sisodia and Singh (2015) in Gladiolus.

Number of corms per hectare (lakhs)

The maximum number of corms per hectare (2.30) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (2.21) and minimum number of corms per hectare was observed by control T_0 (100% RDF) was (1.49) shown in (Table 2). It is evident from data that combined use of organic manure and inorganic fertilizer as compared with the application of in organic fertilizer. The treatment 75 % RDF + 25% vermicompost receiving optimum amount of nitrogen and phosphorus which promotes better vegetative growth and produce more number of corms per plant. The results of the study are also in agreement with the findings of Sable (2018) in Gladiolus, Priyadarshini *et al.* (2018) in Gladiolus and Kumar *et al.* (2018) in Gladiolus.

Number of cormels per plant

The maximum number of cormels per plant (26.87) was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (24.81) and minimum number of cormels per plant was observed by control T_0 (100% RDF) was (12.47) shown in (Table 2). In gladiolus the number of cormels per plant seems to be influenced by different substitutions of inorganics with organics. Better nutrient uptake, more growth attributes and dry matter accumulation in the above treatments might have resulted in more cormel production. The result was in accordance with Pansuriya *et al.* (2016) in Gladiolus.

Number of cormels per hectare (lakhs)

The maximum number of cormels per hectare (38.69)

was observed by treatment T_2 (75% RDF + 25% Vermicompost) followed by T_5 (50% RDF + 50% Vermicompost) was (35.72) and minimum number of cormels per hectare was observed by control T_0 (100% RDF) was (17.95) shown in (Table 2). In gladiolus the number of cormels per hectare seems to be influenced by different substitutions of inorganics with organics. Better nutrient uptake, more growth attributes and dry matter accumulation in the above treatments might have resulted in more cormel production. The result was in accordance with Sable (2018).

CONCLUSION

According to the present investigation it is concluded that Treatment T_2 (75% RDF + 25% Vermicompost) was found most effective in terms of better growth, spike yield, corm yield, quality and shelf life of flower.

REFERENCES

Aracon NQ, Lee S, Edwards CA, Atiyeh R, Morgan AJ, Blackshaw RP, Butt KR, Frederickson J, Morgan JE, Pierce TG. Weeks JM (2005) Effects of humic acids derived from cattle, food and paper- waste vermicomposts on growth of green house plants. 7th International symposium on Earth work Ecology, cardiff. Wales, 1-6. *Pedobiologia* 47(5-6): 741-744.

Choudhury S, Sarangi D (2020) Effect of organic manures, inorganic fertilizers and biofertilizers on vegetative and floral characters of tuberose (*Polianthes tuberosa* L.) cv Single. *J Pharmacog Phytochem* 2020 9 (4): 3084-3086.

Gaur A, Misra RL, Kumar PN, Sarkar J (2006). Studies on nutrient management in gladiolus. Paper presented in the "National Symposium on Ornamental Bulbous Crops" held on 5-6 December, 2006 at S.V.B.P.U. of Ag. and T. Modipuram, Meerut UP, pp 107.

Gharat SN (2004) Effect of organic and inorganic fertilizers on growth, yield and vase life of China aster (*Callistephus chinensis* (L.) Nees) MSc (Agric) thesis. Marathwada Agricultural University, Parbhani, MS (India).

Ghisewad SK, Sable PB, Rohidas SB (2016). Effect of organic and inorganic fertilizers on growth and flower quality of gladiolus cv. H.B. PITT. *Asian J Hort* 11(2) : 275-279DOI 10.15740/HAS/TAJH/11.2/275-279.

Gupta P, Rajwal N, Dhaka VK, Rajwal D (2008) Effect of different levels of vermicompost, NPK and FYM on performance of Gladiolus (*Gladiolus grandiflorus* L.) cv happy end. T*he Asian J Hortic* 3 (1) :142-143.

Keisam P, Manivannan K, Kumar SR (2014) Effect of organic nutrients on growth, flowering and yield of gladiolus (*Gladiolus grandiflorus* L.). *Asian J Hort* 9 (2) : 416-420.

Koiremba K, Thokchom R, Thongbam M (2020) Response of Biofertilizers and Vermicompost on Growth, Flowering and Yield of Kombirei (Iris bakeri Wall.). *Int.J.Curr.Microbiol. App.Sci.* 9(11) : 1846-1852.

Kumar M, Kasera S, Mishra S, Singh NV, Singh D (2018) Effect of organic manure and inorganic fertilizers on Plant growth and Spike yield of Gladiolus (*Gladiolus grandiflora)* CV Plumtart. *Int J Curr Microbiol App Sci Special Issue*-7: 1430-1435.

Kumar S, Marak BS, Momin KCH (2020) Effects of organic manures and bio-fertilizers on growth, flowering and yield of china aster (*Callistephus chinensis* L. Nees var. kamini). *Bangladesh J Bot.* 49(4): 1111-1117.

Kuotsu NR, Keditsu R, Hemanta L (2018) Response of Organic and inorganic nutrient sources on the growth and flowering of gladiolus (*Gladiolus primulinus*) cv. Candyman. *Int J Curr Microbiol App Sci* 7(05): 2537-2547.

Prasad L, Saravanan S, Lall D, Singh VK. (2017) Effect of organic manure and inorganic fertilizer on plant growth and flower yield of Asiatic Lily (*Lilium longiflorum*) sp. *Zephyranthes Environ Ecol* 35 (2A): 929-932.

Preetham SP, Srivastava R, Bintory MA (2017) Effect of Organic manures and bio fertilizers on vegetative growth in tube rose (*Polyanthus tuberosa*) var. Shringar *Int J Pure App. Biosci*. 5(6) : 996-999.

Priyadarshini V, Rao AVD, Suseela T, Bharti S (2018) Effect of substitution of nutritional source through organics and bio inputs on corm and cormel production in gladiolus (*Gladiolus grandiflorus* L.) cv. American Beauty *Int J Curr. Microbiol App Sci* 7(12): 1505-1509.

Sable PB (2018).Effect of organic and inorganic fertilizer on yield and vase life of gladiolus cv HB Pitt *J Soils Crops* 28 (1) : 199-203.

Sisodia A, Singh AK (2015) Effects of farmyard manure, vermi compost and *trichoderma* on flowering and corm attributes in gladiolus. *Bangladesh J Bot* 44(2): 309-314.

Tirkey P, Kullur LR, Prasad VM (2017) Effect of organic and inor ganic source of NPK on growth and yield parameters of gladiolus (*Gladiolus grandiflorus*) cv. Jester. *J Pharmacog Phytochem* 6(5) : 1004-1006.