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Effect of FYM, vermicompost and poultry manure on vegetative growth, spike quality and flower yield of gladiolus (*Gladiolus grandiflora* L)

Cilumpalli Tharun Kumar and SS Saravanan

Abstract
The present experiment was carried out during October 2018 to February 2019 in Research Field of Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Randomized Block Design (RBD), with ten treatments, replicated thrice. the treatments were T_1 (100% RDF), T_2 (80%RDF+V.C 20%), T_3 (60%RDF+V.C 40%), T_4 (40%RDF+ V.C 60%), T_5 (80%RDF+ Poultry manure 20%), T_6 (60%RDF+ Poultry manure 40%), T_7 (40%RDF+ Poultry manure 60%), T_8 (80%RDF+ FYM 20%), T_9 (60%RDF+ FYM 40%) and T_{10} (40%RDF+ FYM60%). From the present experiment it is found that treatment Combination T_{10} (40% RDF+ FYM 60%) was found to be the best treatment in terms of Plant growth, Yield and Quality of Gladiolus as compared to others and significantly gave higher Cost Benefit Ratio and minimum was recorded in treatment T_1 (100%RDF) in all the parameters.

Keywords: Gladiolus, FYM, vermicompost and poultry manure

Introduction
Gladiolus is a popular flowering plant grown all over the world, from South Africa to West Asia. The term gladiolus was coined by Pliny the Elder *(A.D-23-79)* deriving from the Latin word "Gladius", because of its sword-like leaves. It is popularly known as sword lily. It was introduced into cultivation at the end of the 16th century (Parthasarathy and Nagaraju, 1999) [11]. The modern hybrids are botanically known as *Gladiolus grandiflorus belonging* to family Iridaceae bearing chromosome number 60. It is also known as "Queen of Bulbous Crops". Owing to its unsurpassing beauty and economic value it is considered to be a profitable floricultural crop. Flowers have for long been imported in India for three main considerations namely aesthetic, economic and social. It is even widely grown as specimen for exhibition. It is mainly cultivated for cut flower which fetches good price in the Indian market besides having export market as well. Unlike other export oriented cut flower, it can be raised under open field conditions and still produces exportable quality spikes (Singh, 1997). It is easy to grow and is commonly grown for garden use and for cut flower (Aswath and Parthasarthy, 1996) [1]. Though India has suitable agro-climatic conditions for gladiolus cultivaton, it is grown only in an area of 9370ha with a production of 7067.95 lakh spikes. (NHB, 2015).
There is a great variability in plant height, flower colour and shape, rounded to flattened corms and narrow to broadly sword like leaves (Safiullah and Ahmed, 2001) [14]. They are among the most beautiful flowers, blossoming from October to March in plains and during June to September in the hills. They can be grown in a wide range of soils from light sandy to clay loam. It prefers sunny situation with pH between 5.5 6.5. They grow well both in pot and in beds and the magnificent spikes brighten the garden and room as cut flower. It is the next most important cut flower crop in the country. Earlier it was considered a crop for temperate regions and its growing was restricted to the hilly areas, particularly in the north-eastern region, which still continues to supply the planting material to most parts of the country. However, with improved agronomic techniques and better management, the northern plains of Delhi, Haryana, Punjab, Uttar Pradesh, as well as Maharashtra and Karnataka have emerged as the major areas for production of gladiolus

Materials and Methods
The Experimental was conducted in Randomized Block Design (RBD) with 10 treatments of FYM, Vermicompost and Poultry manures with three replications in the Departmental Research field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during October, 2018 to February, 2019. Total number of treatments were ten *viz.* T_1 (100%RDF), T_2 (80%RDF+V.C 20%), T_3 (60%RDF+V.C 40%), T_4

(40%RDF+ V.C 60%), T_5 (80%RDF+ Poultry manure 20%), T_6 (60%RDF+ Poultry manure 40%), T_7 (40%RDF+ Poultry manure 60%), T_8 (80%RDF+ FYM 20%), T_9 (60%RDF+ FYM 40%) and T_{10} (40%RDF+ FYM60%).

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 ºC- 48 ºC and seldom falls as low as 4ºC- 5ºC. The relative humidity ranges between 20 to 94%. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Results and Discussion

The present investigation entitled "Effect of FYM, Vermicompost and Poultry Manure on Vegetative Growth, Spike Quality and Flower Yield of Gladiolus (*Gladiolus grandiflora* L)" was carried out during October 2018 to February 2019 in Departmental Research Field of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the effect of FYM, Vermicompost and Poultry manures on growth, yield and quality of Gladiolus, have been discussed and interpreted in the light of previous research work done in India and abroad. The experiment was conducted in Randomized block design with 10 treatments, and three replications.

The results of the experiment are summarized below.

A. Growth Parameters

In terms of days to sprouting treatment T_{10} (40% RDF+ FYM 60%) has recorded minimum numbers of days to sprouting with (7.67) days. which is found to be statistically at par with T_9 (60%RDF+ FYM 40%), T_7 (40% RDF+ Poultry manure 60%), T4 (40%RDF+ V.C 60%) days. Where is here treatment T_1 Control (100% RDF) recorded maximum days to sprouting (10.00).

In terms of sprouting percentage treatment T_7 (40%RDF+ Poultry manure 60%) recorded maximum percentage of sprouting (100%) followed by treatment T_{10} (40%RDF+ FYM60%) (100.00%) and the minimum percentage recorded in to T_1 (100%RDF) with (77.77%).

The earliness in sprouting may be due to the inoculation with bacterial mixtures provided a more balanced nutrition for plants and optimum absorption of organic and inorganic by corms enhanced the physiological process and improved the germination. Which promotes the sprouting by enhanced cell division and enlargement, leading to proper germination. Results are in consonance with finding of Kumar *et al*. (2014) [7], Chaudhari *et al.* (2014) and Sharma *et al*. (2008) [15]

In terms of plant height at 30, 60 and 90 DAS was found to be significant among the treatments. the maximum plant height (42.34, 72.16 and 102.63 cm) at 30, 60 and 90 days respectively was recorded in T_{10} with (40% RDF+ FYM 60%) which is found to be statistically at par with T_7 (40% RDF + Poultry manure 60%) and T_9 (60% RDF+ FYM 40%) and T_4 (40% RDF+ V.C 60%) whereas the minimum plant height (34.30, 61.07 and 70.13 cm) at 30, 60 and 90 days, was recorded in T_1 (100% RDF) (T1) control. The increased plant height obtained at higher doses on different days after planting was better by the combined application of inorganic, organic Fertilizers. The vermicompost, FYM and poultry manure might acts as a source of macro and micronutrients (Zn, Fe, Cu, Mn), enzymes and growth hormones in the early crop growth phase, which in turn encouraged vigorous growth and resulted in increased plant height. These results are in confirmation with finding of Kumar (2004), Chaudhari *et at*. (2013) [3], and Rathore *et al*. (2010) [13].

In terms of number of leaves per plant (5.78, 7.98 and 12.44) at 30, 60 and 90 days respectively was recorded in treatment T_{10} with (40% RDF+ FYM 60%) which is found to be statistically at par with treatments T_7 (40% RDF + Poultry manure 60%) and T_9 (60% RDF+ FYM 40%) and T_4 (40% RDF+ V.C 60%) whereas, the minimum number of leaves per plant (4.22, 6.17 and 10.11) at 30, 60 and 90 days was recorded in T1 (100% RDF) (T1) control. 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 similar findings were reported by Chaudhari *et al.* (2014), kumar (2014) [7], and Narendra *et al.*, (2013) [10]

B. Floral Parameters

In terms of Days to spike initiation minimum days to take for early spike initiation (48.67) Days was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+ Poultry manure 60%) and T_4 (40% RDF+ V.C 60%) whereas, the maximum (67.33 days) was delayed to take for spike initiation recorded treatment in T_1 (100%RDF). The earliness in spike initiation by the application of organic and inorganic in combination may be due to optimum availability of nutrients to the plant due to which plant completed their vegetative growth soon resulting in taking less number of days taken for spike initiation similar finding were reported by kumar (2014) [7] and Narendra *et al*. (2013) [10]

In terms of Days Taken For First Floret Opening the minimum (70.00 days) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+ Poultry manure 60%) and T_4 (40% RDF+ V.C 60%) whereas the maximum (86.00 days) for first floret opening was recorded treatment in T_1 (100%RDF). The availability of organic and inorganic nitrogen and other essential nutrients for longer period at optimum level resulting in minimum days to take for first floret open, similar were reported by Kumar (2014) [7] and Meena *et al*. (2014) [9]

C. Quality Parameters

In terms of Spike Length, the maximum spike length (81.30cm) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par withT_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+ Poultry manure 60%) and T_4 (40% RDF+ V.C 60%) and T_2 (80%RDF+ V.C 20%) whereas the minimum spike length (68.00cm) was recorded treatment in T_1 (100% RDF). The increase in spike length may be due to combined effect of RDF with organic which helped the plant to produce maximum spike length. Also the availability of Organic and inorganic nitrogen and other essential nutrients for longer period at optimum level resulting in more maximum spike length in treatment T10. Similar finding were reported by Vasantha *et al.* (2014), Narendra *et al*. (2013) [10] and Jha *et al.* (2013).

In terms of Rachis Length the maximum Rachis length (48.95cm) was recorded in T_{10} (40% RDF+ FYM 60%) which

is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+ Poultry manure 60%) and T_4 (40% RDF+ V.C 60%) and T_2 (80%RDF+ V.C 20%),Whereas minimum Rachis length (68.00cm) was recorded in treatment in T_1 (100%RDF). The increase in Rachis length in treatment T10 might be due to better nutrient availability, translocation of higher amount of photosynthesis and maintenance of proper physiological activities of the plant, result in more food which is turn might have been utilized for better development of rachis and spike length. The above finding are similar by Wasim *et al.* (2014) [16], and Kumar *et al.* (2014) [7]

In terms of Number of Florets per Spike the maximum number of florets per spike (14.88) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+ Poultry manure 60%) and T_4 (40% RDF+ V.C 60%) and T_2 (80%RDF+ V.C 20%) whereas, minimum Number of florets per spike (12.11) was recorded treatment in T_1 (100%RDF). Number of floret per spike was also more in the treatment T10 this may be due to the influence of nutrients availability for longer period similar finding were reported by Narendra *et al*. (2013) [10], Kumar *et al*. (2011) [8] and Bhalla *et al.* (2006) [2]

In terms of Floret Diameter the maximum diameter of floret (10.57 cm) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+ Poultry manure 60%) and T_4 (40% RDF+ V.C 60%)(10.36 cm) and T_2 (80%RDF+ V.C 20%) whereas,. the minimum diameter (8.23 cm)) was recorded treatment in T_1 (100%RDF). The increase in flower characters like floret diameter in treatments T10 might due to the easy availability of nutrients, plants were able to absorb them effectively. Organic fertilizers might have supplied plant nutrients directly to the plant and also had solubilizing effect on fixed form of nutrients increasing floret diameter and stimulation and enhancing floret size. The above findings are similar by Meena *et al.* (2014) [9], Rahul *et al.* (2013) and Godse *et al*. (2006) [6]

In terms of Vase life, the maximum vase life of spike (13.93 days) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+ Poultry manure 60%) and T_4 (40% RDF+ V.C 60%) and T_2 (80%RDF+ V.C 20%) Whereas. Minimum vase life of the spike (9.10 days) was recorded T_1 (100% RDF).

D. Yield Parameters

In terms of Number of Spikes per Plant the maximum Number of spikes per plants (2.10) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+Poultry manure 60%) and T_6 (60%RDF+Poultry manure 40%) whereas, the minimum Number of spikes per plant (1.24) was recorded treatment in T_1 (100%RDF). Similar finding previously also reported by Vasantha *et al.* (2014), Chaudhari *et al.* (2013) [3] and Rahul *et al.* (2013).

In terms of Number of Spikes per plot the maximum Number of spikes per plot (105) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+Poultry manure 60%) and T_6 (60%RDF+Poultry manure 40%) whereas, the minimum Number of spikes per plot (62) was recorded treatment in T_1 (100%RDF).

In terms of Spikes Yield Per Hectare the maximum (349998.6 spike/ha) was recorded in T_{10} (40% RDF+ FYM 60%) which is found statistically T_9 (60%RDF+ FYM 40%) and T_7 (40%RDF+Poultry manure 60%) and T_6 (60% RDF + Poultry manure 40%) whereas, the minimum spikes yield per hectare (206665.84) was recorded treatment in T_1 (100%RDF). The greater spike yield per hectare might be due to an optimum combination of fertilizers and manures. The similar increase in flower yield due to increase in number of sprouts and spike length similar finding are reported by Radhika *et al*. (2010) [12] and Dalve *et al.* (2009) [5]

In terms of Number of Corms Per Plant the maximum Number of corms per plants (2.73) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_4 (40%RDF+ V.C 60%) whereas, Minimum Number of corms per plant (1.67) was recorded treatment in T_1 (100%RDF).

In terms of Number of Corms per Plot the maximum Number of corms per plot (68.21) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_4 (40%RDF+ V.C 60%) whereas, Minimum Number of corms per plot (41.75) was recorded treatment in T_1 (100%RDF).

In terms of Corms Yield Per Hectare the maximum Number of corms per hectare (303335.24) was recorded in T_{10} (40% RDF+ FYM 60%) which is found to be statistically at par with T_9 (60%RDF+ FYM 40%) and T_4 (40%RDF+ V.C 60%) whereas, Minimum Number of corms per hectare (185556.49) was recorded treatment in T_1 (100%RDF).

In terms of economics the Maximum Gross return, net returns and cost benefit ratio (Rs. 2053328.24), (Rs. 1406105.24) and (1:2.17) respectively from corm and spike was found in the T_{10} (40% RDF+ FYM 60%) followed by T_9 (60%RDF+ FYM 40%) with Rs. 1793882.13 gross return, Rs. 1166404.13 net return and 1:1.85 cost benefit ratio where as minimum was recorded in treatment T_1 (100%RDF).

Table 1: Effect of FYM, Vermicompost and Poultry manures on Days taken for sprouting, Sprouting %, Plant height (cm), Number of leaves/plant, Spike initiation (DAS), Days taken for first floret open, Spike length (cm) and Rachis length (cm) of Gladiolus (*Gladiolus grandiflorus* L.).

Treatment Symbol	Treatment Details	Days taken for sprouting	Sprouting %	Plant Height (cm)			Number of leaves per plant			Spike initiation (DAS)	Days taken for First floret to open	Spike length (cm)	Rachis length (cm)
				30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS				
T_1	100%RDF	10.00	77.77	34.30	61.07	70.13	4.22	6.17	10.11	67.33	86.00	68	33.56
T_2	80%RDF+ V.C 20%	9.00	96.29	36.34	61.87	92.863	4.27	6.21	10.55	62.26	75.33	74.19	43.86
T_3	60%RDF+ V.C 40%	8.20	88.88	35.34	62.43	76.42	4.33	6.22	9.55	64.67	85.66	69.76	34.20
T_4	40%RDF+ V.C 60%	8.00	96.29	39.14	70.72	98.587	5.00	7.00	12.00	60.33	73.00	74.95	45.61
T_5	80%RDF+ Poultrymanure20%	9.33	96.29	36.84	62.35	71.730	4.33	6.21	10.33	66.67	82.66	69.19	40.65
T_6	60%RDF+ Poultrymanure40%	9.33	96.29	36.49	62.63	74.673	4.27	6.20	10.33	66.33	75.66	68.44	34.56
T_7	40%RDF+ Poultrymanure60%	8.00	100.00	39.42	69.69	99.193	4.75	6.66	11.89	57.67	73.66	73.71	42.83
T_8	80%RDF+ FYM 20%	8.33	92.59	36.07	61.98	74.350	4.33	6.00	10.22	63.33	85.33	65.82	34.76
T_9	60%RDF+ FYM 40%	8.00	88.88	38.36	70.95	98.533	4.89	7.10	12.11	61.67	73.00	73.78	47.24
T_{10}	40%RDF+ FYM60%	7.67	100.00	42.34	72.16	102.063	5.78	7.98	12.44	48.67	70.00	81.3	48.95
F-test		S	NS	S	S	S	S	S	S	S	S	S	S
SE(m)		0.67	-	1.53	2.82	8.96	0.75	0.60	0.57	1.86	1.60	3.50	2.30
C.D. at 5%		1.87	N/A	4.24	8.90	24.224	1.39	1.20	1.23	5.58	4.28	10.48	6.92

Table 2: Effect of FYM, Vermicompost and Poultry manures on Number of floret/spike, Diameter of floret (cm), Vase life (days), Number of spike/plant, Number of spikes/Plot, Number of spike/ha, Corms/Plant, Corms/Plot, Corms/ha and Cost benefit ratio of Gladiolus (*Gladiolus grandiflorus* L.).

Treatment Symbol	Treatment Details	Number of floret/ spike	Diameter of floret (cm)	Vase life (days)	Number of spikes/ plant	Number of spikes/ plot	Number of spikes/ ha	Corms/ plant	Corm/ plot	Corm/ha	Cost Benefit Ratio
T_1	100%RDF	12.11	8.23	9.10	1.24	62	206665.84	1.67	41.75	185556.49	1.15
T_2	80%RDF+ V.C 20%	14.58	9.80	12.80	1.40	70	233332.4	2.17	54.26	261112.62	1.38
T_3	60%RDF+ V.C 40%	12.22	8.54	13.37	1.33	66.5	221665.78	2.38	60.00	216667.16	1.17
T_4	40%RDF+ V.C 60%	13.77	10.36	10.40	1.40	70	233332.4	2.51	62.74	285591.56	1.33
T_5	80%RDF+ Poultrymanure20%	12.44	8.49	11.66	1.37	68.5	228332.42	2.33	58.24	258854.39	1.25
T_6	60%RDF+ Poultrymanure40%	12.55	8.45	12.10	1.70	85	283332.2	2.33	58.24	258887.5	1.73
T_7	40%RDF+ Poultrymanure60%	13.55	9.82	13.53	1.66	83	276665.56	1.93	48.25	264444.28	1.63
T_8	80%RDF+ FYM 20%	12.56	8.43	12.20	1.36	68	226665.76	2.27	56.76	252223.51	1.27
T_9	60%RDF+ FYM 40%	12.88	9.58	12.63	1.81	90.5	301665.46	2.57	64.25	285554.83	1.85
T_{10}	40%RDF+ FYM60%	14.88	10.57	13.93	2.10	105	349998.6	2.73	68.21	303335.24	2.17
F-test		S	S	S	S	S	S	S	S	S	
SE(m)		0.80	0.52	0.53	0.22	7.09	24012	0.11	2.4	10444.47	
C.D. at 5%		2.28	1.56	1.59	0.68	22	73,333	0.34	7.2	31333.43	

Conclusion

Based on the present investigation it is concluded that the treatment Combination T_{10} (40% RDF+ FYM 60%) was found to be the best treatment in terms of Plant growth, Yield and Quality of Gladiolus as compared to others and significantly gave higher Cost Benefit Ratio and minimum was recorded in treatment T_1 (100%RDF) in all the parameters.

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