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Effect of Organic Manures and Biofertilizers on Growth, Flowering and Yield of Gladiolus (*Gladiolus hybridus* Hort) cv. Pusa Srijana

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted on "Effect of organic manures and biofertilizers on growth, flowering and yield of gladiolus *(Gladiolus hybridus* Hort*)* cv. Pusa Srijana". The observations were recorded on various growth, flowering and yield contributing characters. Based on the results obtained from the present investigation, it is concluded that the T_7 (RDF + Vermicompost + Azotobacter @ 5Kg/ha+ PSB @ 5Kg/ha) was found superior followed by T_6 (RDF + Vermicompost + Azotobacter @ 4.5Kg/ha+ PSB @ 4.5Kg/ha) and T_5 (RDF + Vermicompost + Azotobacter @ 4Kg/ha+ PSB @ 4Kg/ha) in growth and flowering with higher yield factors. In this investigation the T_7 was found most suitable for cultivation for better yield per hectare of corms, cormels and spike and best returns in terms of economics of the crop with high net returns and Benefit cost ratio.

Keywords: Gladiolus; vermicompost; azotobacter; PSB; yield; corms; cormels; spike; economics; BC ratio.

1. INTRODUCTION

The total world area under bulbous crops is around 50,000 ha out of which over 3500 ha is in India (Raj, 2005). Gladiolus stands 4th in the international cut flower trade after rose, carnation and chrysanthemum. Gladiolus can be cultivated on all types of soil having good structure and

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drainage. In soil by adding organic manures and microbial agents make easy uptake of nutrients when crop required comparing to chemical fertilizers (Vanilarasu and Balakrishnamurthy, 2014). Azotobacter is one of the most important non symbiotic nitrogen fixing micro-organism. So many experiments were conducted have shown a positive response to Azotobacter application on a wide range of crops. It is observed that, the 1t of Azotobacter is equivalent to 40 tonnes of nitrogen. Considering minimum fixation of 20 kg N/ha from application of Azotobacter culture 0.5 kg/ha, the bio-inoculants can save 25 to 35% of the requirement of inorganic nitrogen per hectare (Vyas et al. 1998). A review indicated that biofertilizers (Azotobacter, Azospirillum, Phosphorous Solubilizing Bacteria and Arbuscular Mycorhyzae fungi) not only help in improving the nutrient uptake by the plants, releasing of growth hormones and antibiotics but also improves the quality of produce along with reduced cost of production (Choudhary, 2010). Phosphorus Solubilizing Microorganisms (PSMS) have been documented to produce metal chelating agents i.e., siderophores, which have a great impact on plant growth promotion, iron nutrition and phytopathogen suppression (Chincholkar et al. 2000)

2. MATERIALS AND METHODS

2.1 Experimental Site

The present investigation was conducted during October, 2021-March, 2022 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom, University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh). All the facilities necessary for cultivation, including labour were made available in the department. Prayagraj is situated at an elevation of 78 meters above sea level at 25.87˚ North latitude and 81.15˚ E longitudes. This region has a sub-tropical climate prevailing in the South-East part of U.P. with both the extremes in temperature, i.e., the winter and the summer. In cold winters, the temperature sometimes is as low as 0˚C in December – January and very hot summer with temperature reaching up to 46˚C in the months of May and June. During winter, frosts and during summer, hot scorching winds are also not uncommon. The average rainfall is around 1013.4 (cm) with maximum concentration during July to September months with occasional showers in winters. The meteorological data for the experimental period collected from Meteorological Observatory at College of Forestry and Environment, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

In terms of number of days to sprouting, the maximum days to sprouting (14.22) was recorded in the treatment T0 and minimum days to sprouting (7.0) was found for the treatment T7 similar result was reported by Chaudhary (2013). In terms of sprouting % the maximum sprouting% (97.14) was recorded in the treatment T7 and minimum sprouting% (85) was found for the treatment T0 similar results were observed by Mogal et al. [1]. In terms of 7 leaf stage the maximum days taken to 7 leaf stage (63.53) was recorded in the treatment T0 and minimum days taken to 7 leaf stage (44.76) was found for the treatment T7 according to Srivastava and Govil [2]. In terms of plant height recorded (30DAP) highest was recorded in T7 (52.86cm) whereas lowest was recorded in treatment T0 (33.56 cm) similar results were reported by Mukesh et al. [3] and Mogal et al. [1].

Plant height (45 DAP) was recorded highest in T7 (78.3cm) whereas lowest in T0 (52.53 cm) similar results were reported by Mukesh et al. [3] and Mogal et al. [1]. Plant height (75DAP) highest was recorded in T7 (103.23cm) whereas lowest in T0 (76.06cm) respectively similar results were reported by Mukesh et al. [3] and Mogal et al. [1].

3.2 Floral Parameters

In terms of days to 50 % flowering the maximum days to 50% flowering (121.62) was recorded in the treatment T0 and minimum days (108) was found for the treatment T7 similar results were reported by Mogal et al. [1]. In terms of number of florets/spike the maximum number of florets/spike (15.39) was recorded in the treatment T7 and minimum florets (7.58) was found for the treatment T0 similar with Godse et al. [4]. In terms of diameter of 1^{st} & 2^{nd} flower the maximum diameter (11.13cm & 9.7cm) was recorded in the treatment T7 and minimum diameter of 1^{st} & 2^{nd} flower (8.07cm & 7.43 cm) was found for the treatment T0 similar results were reported by Mukesh et al. [5]. In terms of spike length the maximum (84.96 cm)

Chart 1. Treatment details

Treatment	Treatment details
T_0	RDF only
T_1	Vermicompost + azotobacter @2kg/ha + PSB @2kg/ha
T_2	Vermicompost + azotobacter @2.5kg/ha + PSB @2.5kg/ha
T_3	Vermicompost + azotobacter @3kg/ha + PSB @3kg/ha
T_4	Vermicompost + azotobacter @3.5kg/ha + PSB @3.5kg/ha
T_5	Vermicompost + azotobacter @4kg/ha + PSB @4kg/ha
T_6	Vermicompost+ azotobacter @4.5kg/ha + PSB @4.5kg/ha
T_7	Vermicompost +azotobacter @5kg/ha + PSB @5kg/ha

** RDF (150kg: 120kg: 120kg per ha) is common in all the treatments with Vermicompost (8t/ha)*

Table 1. Growth parameters

Treatments	Sprouting (no of days)	Sprouting %	Days to 7 leaf stage	Plant height 30 days (cm)	Plant height 45 days (cm)	Plant height 75 days (cm)
T0	14.22	85	63.53	33.56	52.53	76.06
T_1	14.17	88.39	58.16	38.63	59.96	80.36
T_2	13.87	88.72	57.33	43.63	66.33	83.36
T_3	13.07	90.13	56.65	41.7	67.16	85.86
T_4	11.59	91.84	56.26	45.13	67.53	85.86
T_5	11.26	93.98	51.14	46.13	70.16	94.83
T_6	9.2	96.14	48.4	46.63	72.2	96.33
T_7	7	97.14	44.76	52.86	78.3	103.23
SEM±	0.31	0.43	1.02	2.61	2.96	2.66
CD (5%)	0.92	1.26	3.00	7.65	8.65	7.77
CV	4.60	0.82	3.25	10.4	7.67	5.21

Table 2. Floral parameters

Treatments	50% flowering	No. of florets/spike	Diameter of 1st flower (cm)	Diameter of 2nd flower (cm)	Spike length (cm)	Spike weight (gm)	Shelf life in days
T0	121.62	7.58	8.07	7.43	64.4	60.16	5.66
T_1	121	10.1	8.17	7.56	66.76	62.4	6.44
T_2	120.66	13.95	8.37	8	75.76	63.13	7.28
T_3	116	10.89	9.43	8.53	77.86	69.23	9.32
T_4	114.66	11.69	10.2	8.66	76.96	64.36	10.14
T_5	113.36	12.52	10.53	9.13	81.46	75.8	12.83
T_6	112.33	13.79	10.77	9.4	84.26	83.73	14.29
T_7	108	15.39	11.13	9.7	84.96	84.16	14.79
SEM±	0.51	0.28	0.53	0.39	3.44	4.51	0.20
CD (5%)	1.48	0.82	1.56	1.13	10.06	13.20	0.59
CV	0.75	4.06	9.66	7.80	7.78	11.11	3.47

Table 3. Yield attributing characters

Treatments	No. corms / plant	Weight of corms / plant (gm)	No. of cormels / plant	Weight of cormels / plant (gm)
T0	1.33	30.4	19.69	12.65
T_1	1.77	31.71	21.08	12.71
T_2	2.2	33.48	21.85	15.00
T_3	2.23	44.05	22.77	16.05
T_4	2.42	46.00	24.12	17.25
T_5	2.46	46.95	25.19	18.75
T_6	2.79	49.32	26.21	19.80
T_7	3.00	52.00	26.45	21.32
SEM±	0.13	0.39	0.19	0.23
CD (5%)	0.38	1.15	0.57	0.66
CV	9.92	1.68	1.44	2.35

Table 4. Yield parameters

Treatment	No. of corms/ha	Yield of cormels (q/ha)	No. of spikes/ha
T0	126112.5	11.94	94444.35
T_1	174601	12.48	98211.01
T_2	217138.1	14.79	98585.09
T_3	223784	16.08	100151.8
T_4	247689.4	17.61	102048
T_5	257816.7	19.59	104422.1
T_6	298072.8	21.15	106822.1
T_7	324293.2	23.02	107940.6
SEM±	13009.75	0.25	479.62
CD (5%)	38060.32	0.73	1403.14
CV	9.86	2.52	0.82

was recorded in the treatment T7 and minimum length (64.4cm) was found for the treatment T0 similar results were reported by Mukesh et al. [5]. In terms of spike weight the maximum (84.16gm) was recorded in the treatment T7 and minimum weight (60.16gm) was found for the treatment T0 respectively similar results were reported by Dalve et al. [1].

3.3 Vase Life

In terms of vase life maximum vase life (14.79 days) was recorded in the treatment T7 and minimum vase life (5.66 days) was found for the treatment T0 respectively similar results were reported by Mukesh et al. [3] and Mogal et al. [1].

3.4 Yield Attributing Characters

In terms of number of corms/plant maximum (3) was recorded in the treatment T7 and minimum number of corms/plant (1.33) was found for the treatment T0 similar results were reported by Dalve et al. [1]. In terms of weight of corms/plant maximum weight of corms (52.0 gm) was recorded in the treatment T7 and minimum weight of corms/plant (30.4 gm) was found for the treatment T0 similar results were reported by Dalve et al. [1]. In terms of number of cormels/plant maximum (26.45) was recorded in the treatment T7 and minimum number [6-12]. of cormels/plant (19.69) was found for the treatment T0 similar results were reported by Dalve et al. [1].

In terms of weight of cormels/plant maximum (21.32 gm) was recorded in the treatment T7 and minimum weight of cormels/plant (12.65 gm) was found for the treatment T0 respectively reported similar results were reported by Dalve et al. [1].

3.5 Yield Parameters

In terms of number of corms/hectare maximum (324293.2) was recorded in the treatment T7 and minimum number of corms/hectare (126112.5) was found for the treatment T0 reported similar results were reported by Dalve et al. [1]. In terms of yield of cormels (q/ha) maximum (23.02 q/ha) was recorded in the treatment T7 and minimum yield of cormels (q/ha) (11.94 q/ha) [13-19] was found for the treatment T0 reported similar results were reported by Dalve et al. [1]. In terms of number of spikes/hectare (107940.6) was recorded in the treatment T7 and minimum number of spikes/hectare (94444.35) was found for the treatment T0 respectively reported similar results were reported by Dalve et al. [1].

3.6 Economics

Economically best treatment was T7, gave the highest net return up to 2026917.00 Rs/ha as well as B:C ratio 4.37, and T0 lowest net return was at 864101.00 Rs/ha as well as B:C ratio 2.43.

4. CONCLUSION

In this study, T7 was found superior combination in days to sprouting, 50% sprouting, days taken to 7 leaf stage, maximum plant height (30,45,75DAP), 50% flowering, florets/spike, flower diameter, length & weight of spike, vase life, number of corms, weight of corms, number of cormels, weight of cormels with high net return and B:C ratio. From this it can be concluded that the T7, was the most promising treatment amongst all the other treatments.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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