



Original Research Article

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Influence of Organic Manures and Removal of Spikes on Corm Production of Gladiolus (*Gladiolus x hybrida*) cv. “Priscilla”

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ABSTRACT

Keywords

Biodynamic compost, Gladiolus, Organic manure, Removal of spike, Vermicompost

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The present study on the influence of organic manures and removal of spikes on corm production of gladiolus (*Gladiolus x hybrida*) cv. “Priscilla” was carried out as a field experiment at SKUAST- Kashmir, Shalimar campus, Jammu and Kashmir during 2014-15. The experiment consists of twelve treatment combinations comprising of three different organic manures (FYM at 2.5 kg m⁻², biodynamic compost i.e. Dalweed at 1.5 kg m⁻² and vermicompost at 1 kg m⁻²) and removal of spike (10 days after spike emergence and at colour break), along with the control treatment (no organic manure and no removal of spike) replicated thrice in a Randomized Complete Block Design. Among organic manures, treatment M₂ (Biodynamic compost i.e. Dalweed at 1.5 kg m⁻²) revealed better vegetative characteristics (viz., plant height, number of leaves plant⁻¹ and leaf area plant⁻¹ recorded at 90 DAP; shoot dry weight and shoot RGR) and corm characteristics (corm dry weight, corm RGR, weight and diameter of the main corm plant⁻¹, and number of corms and cormels plant⁻¹). In case of removal of spike, treatment R₁ (Removal after 10 days of spike emergence) was found superior in recording maximum leaf area plant⁻¹ at 90 DAP, corm dry weight, corm RGR, weight and diameter of main corm and number of corms and cormels plant⁻¹.

Introduction

Gladiolus is an ornamental flowering plant of glamour and perfection. It is highly priced for its magnificent inflorescence with array of bright, beautiful and vivid colours used for cut flower production, herbaceous borders, beddings, rockeries, pots and also for indoor decoration. Very few flowering plants can match the panorama of colours and hues, shapes and sizes offered by this exquisite bulbous flowering crop. In domestic market, gladiolus surpasses any other flower although

it stands next to rose production (Arora *et al.*, 2002).

For the production of healthy and vigorous corms and cormels in gladiolus, nutritional requirement throughout the period of growth, corm development, and flowering is of utmost importance. Higher quantum of inorganic fertilizers is needed in the production of this crop and due to high cost of commercial fertilizers and poor purchasing strength of the marginal farmers, it is imperative to develop strategies for using organic manures to their

maximum potential with appropriate technology. The use of organic manure not only improves texture, structure, humus, color, aeration, water holding capacity and microbial activity of soil but its use also aids in enhancing the vegetative growth, quality flowering and for higher yield of corms and cormels. Spike removal, in general, causes corm thickening. Late flowering varieties develop larger corms due to spike removal although spike removal has no significant effect on early flowering varieties. Spike removal just after emergence or at beginning of flowering, did not significantly affect corm yield, but doubles the yield of cormels as compared to undisturbed plants.

Materials and Methods

Influence of organic manures and removal of spike was studied on the gladiolus cv. "Priscilla" in an experiment conducted at SKUAST- Kashmir, Shalimar campus, Jammu and Kashmir, India during 2014- 15. The experiment was carried out in a Randomized Complete Block Design with three replications. The corms of uniform grade were subjected to twelve treatment combinations of the Organic manures and Removal of spike i.e. T₁- Control [No manure + No removal of spike], T₂ [No manure + Removal of spike after 10 days of appearance], T₃ [No manure + Removal of spike at colour break], T₄ [Farm Yard Manure (FYM) at 2.5 kg m⁻² + No removal of spike], T₅ [FYM at 2.5 kg m⁻² + Removal of spike after 10 days of appearance], T₆ [FYM at 2.5 kg m⁻² + Removal of spike at colour break], T₇ [Biodynamic compost (Dalweed) at 1.5 kg m⁻² + No removal of spike], T₈ [Biodynamic compost (Dalweed) at 1.5 kg m⁻² + Removal of spike after 10 days of appearance], T₉ [Biodynamic compost (Dalweed) at 1.5 kg m⁻² + Removal of spike at colour break], T₁₀ [Vermicompost at 1 kg m⁻² + No removal of spike], T₁₁

[Vermicompost at 1 kg m⁻² + Removal of spike after 10 days of appearance] and T₁₂ [Vermicompost at 1 kg m⁻² + Removal of spike at colour break]. Recommended intercultural operations were followed to raise healthy gladiolus crop.

Data like plant height, number of leaves plant⁻¹ and leaf area plant⁻¹, shoot dry weight plant⁻¹, corm dry weight plant⁻¹, weight and diameter of the main corm plant⁻¹, total weight of the corms and cormels plant⁻¹, number of corms and cormels plant⁻¹, and propagation coefficient were calculated. Relative growth rate of shoot and corm were estimated using the following formula:

$$RGR = \frac{(\log w_2 - \log w_1)}{t_2 - t_1} \times 2.303$$

where,

w₁= dry weight of shoot/ corm plant⁻¹ at time t₁

w₂=dry weight of shoot/ corm plant⁻¹ at time t₂

The experimental data were subjected to statistical analysis and the variation among the treatment means was tested for significance by analysis of variance techniques as described by Gomez and Gomez (1984) for Randomized Complete Block Design (RCBD).

Results and Discussion

Effect of organic manures and removal of spike on vegetative characteristics

As shown in Table – 1, treatment M₂ recorded maximum plant height (67.33 cm), number of leaves plant⁻¹ (8.35) and leaf area plant⁻¹ (54.09 cm²) measured at 90 DAP. Whereas, minimum plant height (52.48 cm), number of leaves plant⁻¹ (6.05) and Leaf area plant⁻¹ (36.88 cm²) was registered by control treatment M₀. Significant differences were

observed on the effect of the organic manures on shoot dry weight recorded at different intervals. At 75 DAP, maximum and minimum shoot dry weight was revealed by treatment M_3 (6.54 g) and M_0 (5.13 g). Treatment M_2 recorded maximum shoot dry weight for 90 DAP (9.97 g) and 105 DAP (15.84 g), whereas, minimum shoot dry weight 6.84 and 9.02 g was recorded by M_0 (control) for 90 and 105 DAP, respectively. At 120 DAP shoot dry weight had shown a decreasing trend but maximum and minimum values were retained by treatment M_3 (12.64 g) and M_0 (7.75 g). Regarding shoot RGR, treatment M_2 recorded significantly maximum values for growth interval 75- 90 DAP ($0.027 \text{ g g}^{-1} \text{ day}^{-1}$) and 91- 105 DAP ($0.028 \text{ g g}^{-1} \text{ day}^{-1}$). However, minimum shoot RGR 0.016 and $0.019 \text{ g g}^{-1} \text{ day}^{-1}$ was recorded for the growth intervals 75- 90 and 91- 105 DAP by treatment M_0 , respectively. The organic manures increase the availability of nutrients to plants. By the utilization of these nutrients, plants show increase in the leaf number, leaf size and leaf area resulting in increased accumulation of dry matter in the leaves. The results are in conformity with the findings of Pradeep *et al* (2014), Gajbhiye *et al* (2013); and Gangadharan and Gopinath (2000) who have reported significant influence of organic manures on plant height, number of leaves plant^{-1} and leaf area plant^{-1} in different cultivars of gladiolus.

Removal of spike had no significant effect on the plant height and number of leaves plant^{-1} recorded at 90DAP. The findings revealed that at 90DAP, treatment R_1 (49.95 cm^2) and R_0 (41.71 cm^2) registered maximum and minimum leaf area plant^{-1} . Significantly maximum shoot dry weight 5.96, 8.41 and 12.28 g was recorded with R_0 at 75, 90 and 105 DAP, respectively. Minimum shoot dry weight was registered by treatment R_1 for 75 DAP (4.39 g), 90 DAP (5.66 g) and 105 DAP (7.53 g). However the increasing trend in

recording shoot dry weight declined at 120 DAP interval, R_0 (9.58 g) and R_1 (5.99 g) recording maximum and minimum values of shoot dry weight. The shoot RGR was found maximum by treatment R_0 for the growth intervals 75- 90 DAP ($0.028 \text{ g g}^{-1} \text{ day}^{-1}$) and 90- 105 DAP ($0.027 \text{ g g}^{-1} \text{ day}^{-1}$). However, the minimum shoot RGR (0.016 and $0.019 \text{ g g}^{-1} \text{ day}^{-1}$) was recorded under treatment R_1 for the growth intervals 75- 90 DAP and 91- 105 DAP. The probable cause of improvement in vegetative characteristics may be that the plants which received the treatment (removal of the spike) lead to the loss of larger photosynthetic part of the plant, thus removal of spike might result in decreased shoot dry matter, which eventually decreases the shoot RGR in comparison to the plants where no spike was removed. Also, the elimination of floral sink increases translocation of photosynthates to growing bulbs (Jhon and Khan, 2003), thus the photosynthates that accumulate in the bulb, encourage the increase in leaf area.

Interaction effect of Organic manures and Removal of spike on vegetative characteristics

Table- 2 reveals that there was no significant effect of the interaction of organic manures and removal of spike on plant height, number of leaves plant^{-1} and leaf area plant^{-1} . With regard to shoot dry weight, initially at 75 and 90 DAP, there was no significant interaction effect of organic manures and removal of spike. However, the treatment combination T_7 ($M_2 \times R_0$) recorded significantly maximum shoot dry weight 24.26 and 21.16 g at 105 and 120 DAP, respectively. However, minimum shoot dry weight 6.49 and 5.68 g was recorded at 105 and 120 DAP by treatment combination T_2 ($M_0 \times R_1$). The findings revealed that significantly maximum ($0.035 \text{ g g}^{-1} \text{ day}^{-1}$) and minimum ($0.018 \text{ g g}^{-1} \text{ day}^{-1}$) shoot RGR was recorded under

treatment combinations T₇ (M₂ x R₀) and T₂ (M₀ x R₁) for growth interval 91- 105 DAP.

Effect of organic manures and removal of spike on corm characteristics

Results revealed that organic manures significantly influenced the weight and diameter of main corm, as well as the number of corms and cormels plant⁻¹ of gladiolus cv. "Priscilla" (Table- 3). Significantly maximum weight of main corm plant⁻¹ (61.21 g), diameter of main corm plant⁻¹ (6.80 cm), number of corms plant⁻¹ (2.44) and number of cormels plant⁻¹ (36.67) was recorded under treatment M₂. However, minimum weight of main corm plant⁻¹ (35.33 g), diameter of main corm plant⁻¹ (5.71 cm), number of corms plant⁻¹ (1.04) and number of cormels plant⁻¹ (19.33) was registered by control treatment, M₀. The findings revealed that treatment M₂ recorded maximum corm dry weight for the growth periods of 75 DAP (8.83g), 90 DAP (12.46 g), 105 DAP (18.87 g) and 120 DAP (26.07 g). However, minimum values of corm dry weight (4.63, 5.97, 7.84 and 10.14 g) were recorded by treatment M₀ for the growth intervals of 75, 90, 105 and 120 DAP, respectively.

Significantly maximum corm RGR was recorded for 75- 90 DAP (0.022 g g⁻¹ day⁻¹), 91- 105 DAP (0.026 g g⁻¹ day⁻¹) and 106- 120 DAP (0.021 g g⁻¹ day⁻¹) under treatment M₂, whereas minimum corm RGR was recorded by M₀ for growth interval 75- 90 DAP (0.016 g g⁻¹ day⁻¹), 91- 105 DAP (0.018 g g⁻¹ day⁻¹) and 106- 120 DAP (0.016 g g⁻¹ day⁻¹). Organic manures are rich source of nutrients which ensure improved vegetative and corm growth that eventually increased the dry matter accumulation in corms. The results of the present study are in concurrence with the findings of numerous researchers (Kumari *et al.*, 2014, Pradeep *et al.*, 2014, Jha *et al.*, 2012, Godse *et al.*, 2006, and Gangadharan

and Gopinath, 2000), who achieved increased weight and diameter of corms plant⁻¹ as well as number of corms and cormels plant⁻¹ in response to application of organic manures while working on different cultivars of gladiolus. Apart from gladiolus, similar results were reported by Srivastava *et al.* (2014) in tuberose cv. "Shringar".

As shown in Table-3, removal of spike significantly influenced most of the corm characteristics of gladiolus cv. "Priscilla". However, weight and diameter of main corm was not significantly influenced by removal of spike. Significantly more number of corms (2.58) and cormels (38.92) were recorded by treatment R₁, and significantly less number of corms (1.42) and cormels (20.25) were registered under treatment R₀. Significantly superior corm dry weight was recorded by treatment R₁ for 75 DAP (8.59 g), 90 DAP (12.51 g), 105 DAP (18.35 g) and 120 DAP (25.32 g). However, minimum corm dry weight (5.22, 6.54, 8.53 and 10.83 g) was recorded by treatment R₀ for 75, 90, 105 and 120 DAP. The findings revealed that maximum corm RGR for the growth intervals 75-90 DAP (0.022 g g⁻¹ day⁻¹), 91- 105 DAP (0.024 g g⁻¹ day⁻¹) and 106- 120 DAP (0.021 g g⁻¹ day⁻¹) was registered by treatment R₁, whereas minimum corm RGR (0.014, 0.017 and 0.015 g g⁻¹ day⁻¹) was reported under treatment R₀ for 75-90 DAP, 91-105 SAP and 106-120 DAP, respectively. The removal of one of the two major sinks of the plant resulted in the translocation of all the dry matter into the corms, that otherwise would have been consumed for flower growth and development, thus resulting in increased corm dry weight as compared to control. The increase in number of corms plant⁻¹ may be a result of more resource allocation to the underground sink which could have otherwise been used by the developing flowers (Wang and Breen, 1984).

Table.1 Effect of organic manure and removal of spike on the vegetative characteristics of gladiolus (*Gladiolus x hybrida*) cv. "Priscilla"

Treatments*	Plant height (cm)	Number of leaves	Leaf area (cm ²)	Shoot dry weight				Shoot RGR		
				75 DAP	90 DAP	105 DAP	120 DAP	75-90 DAP	91-105 DAP	106-120 DAP
Organic manures										
M ₀	52.48	6.05	36.88	5.13	6.84	9.02	7.75	0.018	0.019	-0.010
M ₁	64.78	7.58	43.57	6.07	8.57	12.23	10.33	0.021	0.023	-0.010
M ₂	67.33	8.35	54.09	6.51	9.97	15.84	12.64	0.027	0.028	-0.018
M ₃	65.41	8.22	47.32	6.54	9.45	13.71	10.88	0.023	0.024	-0.016
C.D (p≤0.05)	5.26	1.13	5.23	0.78	1.26	1.19	1.92	0.004	0.004	N.S
Removal of spike										
R ₀	64.36	7.50	41.71	7.83	12.06	18.29	15.64	0.028	0.027	-0.016
R ₁	61.75	7.55	49.95	4.39	5.66	7.53	5.99	0.016	0.019	-0.009
R ₂	61.39	7.61	44.73	5.96	8.41	12.28	9.58	0.022	0.025	-0.015
C.D (p≤ 0.05)	N.S	N.S	4.53	0.67	1.09	1.03	1.06	0.003	0.004	N.S

*Treatments [Organic manures: M₀- No manure, M₁- FarmYard Manure @ 2.5 kg m⁻², M₂- Biodynamic compost/ Dalweed @ 1.5 kg m⁻² and M₃- Vermicompost @ 1kg m⁻²; Removal of spike: R₀- No removal, R₁- Removal after 10 days of spike emergence and R₂- Removal of spike at color break]

Table.2 Interaction effect of organic manures and removal of spike on the vegetative characteristics of gladiolus (*Gladiolus x hybrida*) cv. "Priscilla"

Treatment combinations	Plant height (cm)	Number of leaves plant ⁻¹	Leaf Area (cm ²)	Shoot dry weight (g)				Shoot RGR (g g ⁻¹ day ⁻¹)		
				75 DAP	90 DAP	105 DAP	120 DAP	75- 90 DAP	91-105 DAP	106-120 DAP
T ₁ (M ₀ x R ₀)	55.27	4.71	34.33	6.51	9.41	12.15	10.28	0.024	0.020	-0.011
T ₂ (M ₀ x R ₁)	51.60	6.19	40.73	4.00	4.88	6.49	5.68	0.013	0.018	-0.008
T ₃ (M ₀ x R ₂)	50.67	7.27	35.57	4.87	6.23	8.42	7.29	0.016	0.019	-0.010
T ₄ (M ₁ x R ₀)	64.13	7.62	39.63	8.24	12.50	17.96	15.12	0.028	0.024	-0.011
T ₅ (M ₁ x R ₁)	66.03	7.31	47.01	3.86	4.89	6.51	5.71	0.015	0.019	-0.009
T ₆ (M ₁ x R ₂)	64.17	7.80	44.06	6.10	8.34	12.25	10.16	0.021	0.026	-0.011
T ₇ (M ₂ x R ₀)	68.07	8.53	48.32	8.87	14.30	24.26	21.16	0.032	0.035	-0.022
T ₈ (M ₂ x R ₁)	67.97	8.47	62.39	4.76	6.46	8.58	6.31	0.020	0.019	-0.011
T ₉ (M ₂ x R ₂)	65.97	8.04	51.55	5.91	9.14	14.68	10.46	0.029	0.031	-0.022
T ₁₀ (M ₃ x R ₀)	69.97	9.13	44.57	7.73	12.03	18.81	15.99	0.030	0.030	-0.020
T ₁₁ (M ₃ x R ₁)	61.40	8.22	49.68	4.94	6.40	8.55	6.25	0.017	0.019	-0.009
T ₁₂ (M ₃ x R ₂)	64.87	7.33	47.73	6.94	9.02	13.77	10.46	0.024	0.022	-0.019
C.D (p≤ 0.05)	N.S	N.S	N.S	N.S	N.S	2.07	3.32	N.S	0.007	N.S

Table.3 Effect of organic manure and removal of spike on the corm characteristics of gladiolus (*Gladiolus x hybrida*) cv. "Priscilla"

Treatments*	Weight of main corm (g)	Diameter of main corm (cm)	No. of corms	No. of cormels	Corm dry weight (g)				Corm RGR(g g ⁻¹ day ⁻¹)		
					75 DAP	90 DAP	105 DAP	120 DAP	75-90 DAP	91-105 DAP	106-120 DAP
Organic manures											
M ₀	35.35	5.71	1.04	19.33	4.63	5.97	7.84	10.14	0.016	0.018	0.016
M ₁	51.47	6.01	2.07	29.78	6.33	8.18	10.93	14.13	0.017	0.019	0.016
M ₂	61.21	6.80	2.44	36.67	8.83	12.46	18.87	26.07	0.022	0.026	0.021
M ₃	58.15	6.38	2.11	32.78	6.35	9.39	12.98	17.55	0.018	0.021	0.019
C.D (p≤0.05)	6.50	0.50	0.28	2.60	0.55	1.01	1.52	2.53	0.002	0.002	0.002
Removal of spike											
R ₀	47.58	5.93	1.42	20.25	5.22	6.54	8.53	10.83	0.014	0.017	0.015
R ₁	54.41	6.52	2.58	38.92	8.59	12.51	18.35	25.32	0.022	0.024	0.021
R ₂	52.20	6.21	1.75	29.75	5.79	7.95	11.08	11.47	0.018	0.021	0.019
C.D (p≤ 0.05)	N S	N S	0.24	2.25	0.48	0.87	1.31	2.19	0.002	0.002	0.002

*Treatments [Organic manures: M₀- No manure, M₁- FarmYard Manure @ 2.5 kg m⁻², M₂- Biodynamic compost/ Dalweed 1.5 kg m⁻² and M₃- Vermicompost @ 1kg m⁻²; Removal of spike: R₀- No removal, R₁- Removal after 10 days of spike emergence and R₂- Removal of spike at color break]

Table.4 Effect interaction of organic manure and removal of spike on the corm characteristics of gladiolus (*Gladiolus x hybrida*) cv. "Priscilla"

Treatment combinations	Weight of main corm (g)	Diameter of main corm (cm)	No. of corms	No. of cormels	Corm dry weight (g)				Corm RGR($\text{g g}^{-1} \text{ day}^{-1}$)		
					75 DAP	90 DAP	105 DAP	120 DAP	75-90 DAP	91-105 DAP	106-120 DAP
T ₁ (M ₀ x R ₀)	32.27	5.38	1.00	16.33	3.07	3.69	4.59	5.63	0.012	0.015	0.014
T ₂ (M ₀ x R ₁)	37.68	6.11	1.13	22.00	6.68	8.86	11.87	15.71	0.018	0.019	0.019
T ₃ (M ₀ x R ₂)	36.13	5.64	1.00	19.67	4.13	5.34	7.06	9.09	0.017	0.019	0.017
T ₄ (M ₁ x R ₀)	45.58	5.79	1.47	21.33	4.94	6.12	7.75	9.47	0.014	0.016	0.013
T ₅ (M ₁ x R ₁)	55.00	6.37	2.87	38.00	8.39	11.23	15.51	20.88	0.019	0.022	0.020
T ₆ (M ₁ x R ₂)	53.82	5.88	1.87	30.00	5.73	7.19	9.51	12.06	0.017	0.019	0.016
T ₇ (M ₂ x R ₀)	58.17	6.74	1.67	24.67	7.74	9.83	13.28	17.43	0.016	0.020	0.018
T ₈ (M ₂ x R ₁)	63.64	6.84	3.53	50.33	10.90	16.75	27.26	38.74	0.028	0.033	0.023
T ₉ (M ₂ x R ₂)	61.80	6.81	2.13	35.00	7.84	10.79	16.08	22.04	0.021	0.027	0.021
T ₁₀ (M ₃ x R ₀)	54.39	5.83	1.53	18.67	5.12	6.50	8.50	25.95	0.016	0.018	0.016
T ₁₁ (M ₃ x R ₁)	61.32	6.77	2.80	45.33	8.41	13.19	18.76	25.95	0.021	0.024	0.022
T ₁₂ (M ₃ x R ₂)	58.74	6.53	2.00	34.33	5.47	8.47	11.67	15.91	0.017	0.021	0.021
C.D (p≤ 0.05)	N.S	N.S	0.48	4.51	N.S	N.S	2.63	4.38	N.S	0.002	N.S

The results are in harmony with those of Jhon and Khan (2003). Similar were the findings of Das (1998), who reported significantly increased corms plant⁻¹ in gladiolus. Also, the allocation of photosynthates to the main corm as a result of elimination of floral sink may be the probable cause of increase in number of cormels.

Interaction effect of organic manures and Removal of spike on corm characteristics

As shown in Table-4, the effect of interaction of organic manures and removal of spike was significant on number of corms and cormels plant⁻¹. Significantly maximum number of corms (3.53) and cormels (50.33) was recorded with treatment combination T₈ (M₂ x R₁) and minimum number of corms (1.00) and cormels (16.33) with treatment combination T₀ (M₀ x R₀). In case of weight and diameter of main corm plant⁻¹, interaction effect was not significant. The findings revealed that the effect of interaction was not significant on corm dry weight for initial 75 and 90 DAP. However, maximum (27.26 and 38.74 g) and minimum (4.59 and 5.63 g) corm dry weight was recorded by treatment combinations T₈ (M₂ x R₁) and T₁ (M₀ x R₀) for 105 and 120 DAP intervals, respectively.

Corm RGR was not significantly affected by the interaction of organic manures and removal of spike for growth intervals 75- 90 and 106- 120 DAP, however, for growth interval 91- 105 DAP maximum corm RGR (0.033 g g⁻¹ day⁻¹) and minimum RGR (0.015 g g⁻¹ day⁻¹) was registered for treatment combinations T₈ (M₂ x R₁) and T₀ (M₀ x R₀).

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