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Effect of different growing media on growth, flowering and corm yield of gladiolus cultivars (*Gladiolus grandiflorus* L.)

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Abstract
The present investigation entitled "Effect of Different Growing Media on Growth, Flowering and Corm Yield of Gladiolus Cultivars (*Gladiolus grandiflorus* L.)" was under taken in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, during Rabi season (2016-2017). The experiment was laid out in Factorial Randomized Block Design (FRBD) with 12 treatments and each treatment was replicated thrice. The treatments consisted of different growing media (Farm Yard Manure @ 2kg/m^2, Vermicompost @ 1kg/m^2 and Sawdust @ 1kg/m^2) and 4 varieties (Deepest Red, Jessica, Amsterdam and Esta Bonita). Early spike emergence (55.27) was found in Jessica Variety with application of FYM @ 2kg whereas spike length was maximum (94.00 cm) in variety Esta Bonita. Regarding number of florets per spike (14.83), number of daughter corms (65.16) per plant was found to be best in variety Amsterdam when FYM@2kg was applied whereas number of cormels (59.57) was found to be maximum in variety Deepest Red.

Keywords: Growing media, Spike, Florets, Daughter corms, Cormels

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. 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". Unlike other export oriented cut flower it can be raised under open field conditions and still produces exportable quality spikes. It is easy to grow and is commonly grown for garden use and for cut flower (Aswath and Parathasarthy, 1996) [1]. In the international cut-flower trade gladiolus occupies fourth place (Bhattacharjee and De, 2010) [4]. Gladiolus is grown commercially from corms both for the flowering spikes and for corm production and it is principally propagated by natural multiplication of new corms and cormels (Memon *et al.*, 2009; Hartman *et al.*, 1990; Ziv and Lilien-kipnis, 1990) [12, 16]. However, owing to their low rate of multiplication and to a high percentage of spoilage of corms during storage, there is an insufficient supply of planting material (Memon *et al.*, 2012; Singh and Dohare, 1994) [11, 15]. In such a case, propagation may be done by cutting the corms into several pieces to increase the number of planting material. The segment of corm to be used as a propagule should have at least one eye and a portion of basal plate or root zone. Better results can be obtained when radial cuts are made the corms are cut 7 to 10 days before planting. Small corms can be divided into 3 to 4 pieces while the large one can be divided into 7 to 10 pieces (Gromov, 1972) [5] which helps in providing benefits to the growers in increasing the planting materials.

Materials and Methods
Experimental site and duration
A field experiment entitled "Effect of Different Growing Media on Growth, Flowering and Corm Yield of Gladiolus Cultivars (*Gladiolus grandiflorus* L.)" was conducted at Horticultural Experimental Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, during Rabi season of 2016-17 from November to April.

Experimental design
4 x 3(4 varieties x 3 growing media) factorial experiment was laid out in a Factorial Randomized Block Design with 3 replications.

Treatments of the experiment
Gladiolus variety (V_1: Deepest Red; V_2: Jessica; V_3: Amsterdamand; V_4: Esta Bonita) and growing media (C_0: Farm Yard Manure@ 2kg/m^2; C_1: Vermicompost@1kg/m^2; C_2: Sawdust@1kg/$m^{2)}$ were used in the experiment.

Plot size
The size of unit plot was 2 m x 2m.

Procedure for the application of treatments
Bavastin was applied to the segments and whole corm to prevent fungus. Then the segments and whole corms are treated with GA_3 to break dormancy.

Planting of the corms
Corms were planted at 5 cm depth in the plot maintaining 30cm x 20 cm spacing. In each plot, 20 corms were planted.

The different treatment combinations are as follows
T_1 (V_1C_0) Deepest Red + Farm Yard Manure@ 2kg/m^2; T_2 (V_1C_1) Deepest Red + Vermicompost@1kg/m^2; T_3 (V_1C_2) Deepest Red + Sawdust@1kg/m^2; T_4 (V_2C_0) Jessica + Farm Yard Manure@ 2kg/m^2; T_5 (V_2C_1) Jessica + Vermicompost@1kg/m^2; T_6 (V_2C_2) Jessica + Sawdust@1kg/m^2; T_7 (V_3C_0) Amsterdam + Farm Yard Manure@ 2kg/m^2, T_8 (V_3C_1); Amsterdam + Vermicompost@1kg/m^2; T_9 (V_3C_2) Amsterdam + Sawdust@1kg/m^2; T_{10} (V_4C_0) Esta Bonita + Farm Yard Manure@ 2kg/m^2; T_{11} (V_4C_1) Esta Bonita + Vermicompost@1kg/m^2; T_{12} (V_4C_2) Esta Bonita + Sawdust@1kg/m^2

Results and Discussion
Floral Parameters
Number of Days taken for Spike Emergence
Interaction effect revealed that in (Table 1) minimum number of days taken for spike emergence (55.27) was recorded in T4 followed by T_1 (72.33) whereas maximum number of days was in T_{12} (100.43). sawdust@1kg helps the plant for growth and development with supplying storage nutrients in the corm which is the ultimate result of minimum days for emergence of spike. Similar findings were also found by Bhat *et al.,* (2009) [2] in gladiolus.

Spike length (cm)
Interaction effect revealed that in (Table 1) maximum spike length (94.00cm) was recorded in T_{10}followed by T_7 (83.40 cm). The spike length was found to be minimum in T_6 (41.91cm). This might be due to the higher amount of stored food material from large corm which resulted in larger spike length. Similar results were also reported by Dod *et al.,* (1989) [14] and Bhattacharjee (1981) [3].

Number of florets per spike
Interaction effect revealed that in (Table 2) maximum number of florets per spike (14.83) was recorded in T_7followed by T_{10} (12.63) whereas minimum in T_6 (7.63).Plant height and spike length had direct influence on number of florets per spike and improvement in spike length and plant height directly increased number of florets per spike. Similar findings were given by Mahesh *et al.,* 2011 [10].

Diameter of basal floret (mm)
Interaction effect revealed that in (Table 2) maximum diameter of basal floret (125.42mm) was recorded in T_{10} followed by T_7 (112.62mm). The diameter was minimum in T_6 (67.74mm). Diameter of florets indicating that with the increment of plant height this associated character could be improved (Kumar *et al.,* 2011) [7].

Yield Parameters
Weight of daughter corms (g)
Interaction effect revealed that in (Table 3) maximum weight of daughter corms (52.85g) was recorded in T_7 followed by T_{10} (48.43g) whereas minimum in T_6 (18.93). This may be attributed to the good vegetative growth of plants in initial stages, which provides good amount of photosynthetic for storage in corms. It may be mentioned here that when the FYM@2kg was applied or when sawdust@1kg were applied, the innermost corms developed on the terminal bud were larger and heavier than the outer corms which were smaller and lighter, implying that the available food materials were first translocated to the central corms and thereafter to the laterals. Similar results were given by Mahasen *et al.,* 2015 [8].

Number of Cormels per plant
Interaction effect revealed that in (Table 3) maximum number of cormel formed per plant (59.57) was recorded in T_1 followed by T_7 (41.73) whereas minimum in T_5 (16.50). The result is in an agreement with the findings of Joshi *et al.,* (2011).
On the basis of present investigation early spike emergence was found in V_2 (Jessica) whereas spike length was best in V_4 (Esta Bonita) followed by V_3 (Amsterdam). Regarding number of florets per spike, no. of daughter corms per plant was found to be best in V_3 (Amsterdam). FYM@2kg was applied found to be best in terms of all vegetative and floral parameters but in terms of corms and cormel production growing media were found to be better. So growing media can be used for commercial gladiolus production and this might reduce the cost for planting materials.

Table 1: Effect of Different Growing Media on Growth, Flowering and Corm Yield of Gladiolus Cultivars (*Gladiolus grandiflorus* L.).

Growing Media (C)	Days to Spike Emergence				Spike Length (cm)			
	Varieties (V)				Varieties (V)			
	V_1	V_2	V_3	V_4	V_1	V_2	V_3	V_4
C_0	72.33	55.27	78.83	83.27	71.15	55.74	83.39	94.00
C_1	70.50	63.67	81.50	98.33	68.89	43.05	76.50	90.92
C_2	67.93	65.53	84.90	100.43	65.89	41.91	72.13	86.59
Comparison		F test	S.Ed(+)	C.D (5%)	F test	S.Ed(+)		C.D. (5%)
Due to Varieties		S	0.52	1.08	S	1.48		3.07
Due to Growing media		S	0.45	0.94	S	1.28		2.56
Interaction (V x C)		S	0.90	1.88	S	2.56		5.32

Table 2: Effect of Different Growing Media on Growth, Flowering and Corm Yield of Gladiolus Cultivars (*Gladiolus grandiflorus* L.)

Growing Media (C)	No of florets per spike				Diameter of basal floret(mm)			
	Varieties (V)				Varieties (V)			
	V_1	V_2	V_3	V_4	V_1	V_2	V_3	V_4
C_0	12.27	10.93	14.83	12.63	88.21	76.73	112.62	125.42
C_1	11.83	9.28	14.47	11.93	82.34	71.64	108.10	122.55
C_2	10.87	7.63	13.73	11.20	78.16	67.74	105.53	119.00

Comparison	F test	S.Ed(+)	C.D (5%)	F test	S.Ed(+)	C.D. (5%)
Due to Varieties	S	0.27	0.58	S	0.71	1.49
Due to Growing media	S	0.24	0.50	S	0.62	1.29
Interaction (V x C)	S	0.48	1.00	S	1.24	2.58

Table 3: Effect of Different Growing Media on Growth, Flowering and Corm Yield of Gladiolus Cultivars (*Gladiolus grandiflorus* L.)

Growing Media (C)	Weight of daughter corms (g)				Number of Cormels per plant			
	Varieties (V)				Varieties (V)			
	V_1	V_2	V_3	V_4	V_1	V_2	V_3	V_4
C_0	24.77	28.82	52.85	48.43	59.57	18.07	41.73	33.80
C_1	24.43	22.37	43.50	45.90	39.33	16.50	28.30	28.63
C_2	20.93	18.93	40.17	41.20	36.87	18.63	24.83	20.40

Comparison	F test	S.Ed(+)	C.D (5%)	F test	S.Ed(+)	C.D. (5%)
Due to Varieties	S	0.48	0.98	S	0.43	0.89
Due to Growing media	S	0.41	0.86	S	0.37	0.77
Interaction (V x C)	S	0.83	1.71	S	0.75	1.55

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