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Effect of different horticultural techniques on quality flower production of *Gladiolus grandiflorus* cv. PDKV gold

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Abstract
The investigation entitled "Effect of different horticultural techniques on quality flower production of *Gladiolus grandiflorus* cv. PDKV Gold" was carried out during kharif season of the year 2017-18 and 2018-19 at Floriculture unit, Department of Horticulture, Dr. PDKV., Akola. Vegetative and flowering parameter of gladiolus as affected by different horticultural techniques such as corm sizes viz. jumbo size corm (> 5.1 cm), large sized corm (3.8 to 5.0 cm), medium (3.2 to 3.7 cm) small size corm (3.1 to 2.5 cm) mechanical removal of apical bud (3.8 to 3.2 cm), half corm division (3.2 to 3.7 cm), soaking of corms in 200 ppm GA_3 solution for 24 hr (3.2 - 3.7 cm) and clipping of leaves (3.2 to 3.7 cm) were evaluated under natural agro-climatic conditions of Akola. The experiment was laid out in accordance with Complete Randomized Design with eight treatments replicated three times. Regarding growth parameters it was observed that days required for sprouting of corm, number of shoots per corm, plant height, number of leaves per plant, (at 30, 60, 90 and 120 DAP) length and breadth of leaves, jumbo size corm perform the best as compared to medium, small corms and other treatments with maximum values (3.93 days), (2.03), (49.10, 91.63, 111.27 and 113.10 cm), (3.33, 6.13, 8.87 and 9.33 cm), (85.55 and 2.82 cm). Similar results were observed with flowering parameters. In flowering parameter such as minimum days for spike emergence, days to 1st floret opening, days to 50% flowering (77.78, 82.08, 87.13 days respectively) and maximum number of spikes plant^{-1} (1.67) and ha^{-1} (1.48 lakh) was recorded in jumbo size corm than large and small size corm. In case of quality parameter maximum length of spike (103.47 cm), diameter of spike (1.44 cm), length of rachis (55.80 cm), number of florets spike^{-1} (17.88), diameter of open floret (9.32 cm) and vase life of spike (10.95 days) was observed by plants raised from jumbo sized corm.

Keywords: Horticultural techniques, quality flower production, *Gladiolus grandiflorus*

Introduction
Gladiolus (*Gladiolus grandiflorus*) is among the leading cut flowers and occupies eighth position in international cut flower trade (Ahmad *et al*., 2008). It is frequently used as cut flower in different social and religious ceremonies (Mitra, 1992) [9]. Gladiolus is very much liked for its majestic spikes which contain attractive, elegant and delicate florets. These florets open in a sequence over long duration and hence have a good keeping quality of cut spikes. The spikes of gladiolus are popular in flower arrangement and for preparing high-class bouquets (Mukhopadhay and Yadav, 1995) [11].

There is a wide range of colours; self or bicolour, with or without central mark, varying from white to darkest crimson. There are many varieties of gladiolus available like White Friendship, T-210, Pink Parade, Traelor, Red Majesty, Aarti, Poonam, Hunting Song, Oscare, Praha. PDKV Roshani, Mukta, Appleuse and Blue Mist etc. In European countries during winter season, snow and frost check the flower production and there is dearness of fresh flowers in the market. We are fortunate by having temperate, subtropical and tropical climatic conditions in our country and can produce the fresh flowers round the year with little efforts and can export the commodity to outside the country but export of fresh flowers including gladiolus is quite insignificant from India.

Different factors such as size of corms and cormels, planting time and fertilizer management influence the production and quality of gladiolus flower (Arora and Khanna, 1990) [2]. Gladiolus is a corm which has solid shortened stem with buds systematically arranged under a paper-thin protective layer or scale usually one bud sprouts near the top of the corm when planted. It also produces cormlets. The basal roots are emerged and flower spike is visible and basal portion of shoot that begins to swell and develops into daughter corm.

The daughter corm continues to enlarge after flowering and then nutrition is directed downward for storage. The daughter corm does not flower in the same season (Hudson *et al*., 1981) [5]. The corm has direct effect on plant growth and flower quality (Sharga *et al*., 1984). Propagation of gladiolus is principally by the natural multiplication of new corms and cormels (Bose *et al*. 2003). However, its commercial cultivation is limited by low rate of multiplication. The low rate of corms and cormels production is one of the major constraints in commercial cultivation of gladiolus. Division of corms, removal of flower spike, leaf clipping, corm sizes, manual removal of apical bud and growth regulators GA_3 are some of the cultural tools to increase the corms and cormels production in gladiolus. Each technique has its own merits and limitations to act as satisfactory technique.

Hence, it is necessary to identify the suitable cultural practice/ practices for commercial cultivation of gladiolus and for higher quality flower production. Therefore, the present investigation was carried out on effect of different horticultural techniques on quality flower production of gladiolus with objective to study the effect of different horticultural techniques on quality flower production of gladiolus and to find out suitable horticultural techniques quality flower production of gladiolus.

Materials and Methods

The experiment was conducted at Floriculture Unit, Department of Horticulture Dr. PDKV, Akola during the year 2017-18 and 2018-19 to study the effect of different horticultural techniques on quality flower production of gladiolus and to find out suitable horticultural techniques for quality flower production of gladiolus. Different corm size was jumbo (>5.1 cm), large (3.8-5.0 cm), medium (3.2-3.7 cm) small (2.5- 3.1 cm) in diameter, mechanical removal of apical bud, half corm division (3.2 - 3.7 cm), soaking of corms in 200 ppm GA_3 solution for 24 hr (3.2 - 3.7 cm) and clipping of leaves (3.2 - 3.7 cm). There were 30 corms in each treatment planted 5 cm deep in 14 x 16 inches (30 x 35 cm) size black colour polyethylene bags which were filled with river soil + sand + FYM in 2:1:1 proportion. In each bag as per treatment single corm was planted. The size of main plot was 3m x 1m. First irrigation was given just after planting of corm and then subsequent irrigation was applied as per crop requirement. All standard cultural practices required for raising crop were practiced.

The experiment was laid out according to Completely Randomized Design with eight treatments replicated three times. Data were collected on various growth, flowering and quality parameter like days required for sprouting of corm, number of shoots per corm, plant height, number of leaves per plant, (at 30, 60, 90 and 120 DAP) length and breadth of leaves, minimum days for spike emergence, days to 1st floret opening, days to 50% flowering and maximum number of spikes plant-length of spike, diameter of spike, length of rachis, number of florets spike^{-1} diameter of open floret and vase life of spike was recorded. The data collected on various characters were statistically analyzed.

Results and Discussion

The results obtained from the present investigation as well as discussion have been summarized under following heading.

Growth parameters

The results clearly indicate a significance influence of corm size on growth in gladiolus. Jumbo size corms took significantly less number of days (3.93) for sprouting of corm. Bigger sized corms produced more number of shoots per corm (2.03), maximum plant height at 30, 60, 90 and 120 DAP (49.10, 91.63, 111.27 and 113.10 cm) and more number of leaves (3.33, 6.13, 8.87 and 9.33 cm) plant^{-1} at 30, 60, 90 and 120 DAP. Significant increase in plant height with increase in corm size might be due to more quantity of stored food materials available in jumbo and large corms, which might have helped in rapid vegetative growth of the plant. Also this may be due to more stored food material and sufficient hormone in whole corm which helped in early and rapid plant growth. Cutting of corm may also cause leaching of nutrients which results shorter plant.

Similar finding were reported by Mukhopadhyay and Yadav (1984) [10] and they observed height of plant significantly increased with the increase of corm size. These results were also supported by the Mahanta *et al*. (1998). Maximum length of leaf (85.55 cm) and breadth of leaf (2.82 cm) was recorded in jumbo size corm as compared to large, medium and small size corms. This could be due to higher amounts of stored food reserves in jumbo size corms.

Flowering parameters

Flowering parameter significantly influenced by different horticultural techniques is presented in Table 1. Minimum days for spike emergence, days to 1st floret opening and days to 50% flowering (77.78, 82.08, 87.13 days) was recorded in jumbo size corm followed by large size corm. Significantly maximum number of spikes plant^{-1} (1.67) and ha^{-1} (1.48 lakh) was recorded in jumbo size corm. However, significantly minimum number of spikes plant^{-1} (0.97) and ha^{-1} (1.09 lakh) were recorded by treatment T_4 i.e. small size corm. The number of spikes plant^{-1} in gladiolus increased with increase in size of corm. Flowers are important sink organs in bulbous flowering plants that depend on the reserves stored in the bulb for their initial growth and development. Large bulbs have higher reserves than small bulbs and this might have been the reason for production of maximum spikes with larger corms of gladiolus. The results are in accordance with Singh *et al.* (2011) [14] in gladiolus.

Quality parameters

Flower quality parameter significantly influenced by different horticultural techniques is presented in Table 2 and 3. The flower quality parameters length of spike (depicted in Fig. 1), diameter of spike, length of rachis (depicted in Fig. 2), number of florets spike^{-1} diameter of open floret and vase life of spike, the jumbo size corm exhibited significantly maximum values (103.47 cm, 1.44 cm, 55.80 cm,17.88, 9.32 cm and 10.95 days respectively) which was followed by large size corm treatment. It was observed that, jumbo and large sized corms produced thicker spikes of gladiolus. This might be due to presence of more food reserves in jumbo and large sized corms which ultimately helped in production of quality spikes. An increase in length of gladiolus spike with increase in corm size might be due to higher amount of stored food material present in the jumbo and large sized corms which promotes the vegetative and reproductive growth of gladiolus. Similar results were also reported by Mandal *et al.* (2009) [8] and Sarkar *et al.* (2014) [15] in gladiolus and Ahmad *et al.* (2009) in tuberose.

Table 1: Effect of different horticultural techniques on days required for sprouting, number of shoots per corm, length and breadth of leaf

Treatment	Days for sprouting of corm			Number of shoots corm^{-1}			Length of leaf (cm)			Breadth of leaf (cm)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
T_1	4.07	3.80	3.93	2.00	2.07	2.03	85.73	85.37	85.55	2.78	2.86	2.82
T_2	7.00	7.17	7.08	1.60	1.73	1.67	72.93	75.10	74.02	2.65	2.67	2.66
T_3	8.57	8.40	8.48	1.33	1.53	1.43	58.67	60.87	59.77	2.44	2.39	2.42
T_4	10.00	10.57	10.28	1.20	1.20	1.20	35.80	39.03	37.42	1.90	1.84	1.87
T_5	15.13	14.80	14.97	1.37	1.43	1.40	46.00	49.23	47.62	2.35	2.33	2.34
T_6	12.13	12.93	12.53	1.20	1.33	1.27	37.60	40.47	39.03	2.04	1.95	2.00
T_7	8.23	8.23	8.23	1.50	1.63	1.57	60.93	63.07	62.00	2.49	2.43	2.46
T_8	8.67	8.60	8.63	1.40	1.47	1.43	53.07	53.97	53.52	2.45	2.39	2.42
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.17	0.21	0.17	0.13	0.14	0.09	0.88	1.32	0.98	0.04	0.05	0.04
CD at 5%	0.51	0.65	0.51	0.39	0.42	0.28	2.66	3.96	2.95	0.12	0.16	0.12

Table 2: Effect of different horticultural techniques on length of spike, diameter of spike and length of rachis

Treatment	Length of spike (cm)			Diameter of spike (cm)			Length of rachis (cm)		
	2017- 18	2018-19	Pooled	2017- 18	2018-19	Pooled	2017- 18	2018-19	Pooled
T_1	101.30	105.63	103.47	1.41	1.47	1.44	54.67	56.93	55.80
T_2	87.90	92.77	90.33	1.20	1.19	1.20	48.33	51.43	49.88
T_3	67.87	72.30	70.08	1.08	1.02	1.09	41.20	45.00	43.10
T_4	25.33	37.57	31.45	0.57	0.64	0.61	26.33	30.40	28.37
T_5	38.00	48.80	43.40	0.87	0.88	0.87	36.93	40.20	38.57
T_6	44.73	55.33	50.03	0.90	0.83	0.87	31.13	38.83	34.98
T_7	68.73	72.97	70.85	1.10	1.27	1.13	41.53	44.33	42.93
T_8	61.07	70.40	65.73	1.04	1.01	1.03	38.40	41.57	39.98
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	2.20	1.51	1.42	0.05	0.04	0.04	0.97	0.80	0.65
CD at 5%	6.61	4.55	4.28	0.16	0.14	0.13	2.91	2.40	1.97

Table 3: Effect of different horticultural techniques on number of florets spike^{-1}, diameter of open florets and vase life of spike

Treatment	Number of florets spike^{-1}			Diameter of open floret (cm)			Vase life of spike (Days)		
	2017- 18	2018-19	Pooled	2017- 18	2018-19	Pooled	2017- 18	2018-19	Pooled
T_1	17.17	18.60	17.88	8.64	9.99	9.32	10.73	11.17	10.95
T_2	15.67	15.80	15.73	8.33	8.38	8.36	8.80	10.67	9.73
T_3	11.60	11.30	11.45	7.39	7.47	7.43	6.67	7.70	7.18
T_4	5.07	7.87	6.47	5.33	6.17	5.75	5.20	5.60	5.40
T_5	5.73	7.77	6.75	6.09	6.50	6.29	5.73	7.10	6.33
T_6	7.07	6.67	6.87	7.17	6.23	6.70	5.53	7.27	6.40
T_7	11.67	11.57	11.62	7.57	7.90	7.73	7.73	9.77	8.07
T_8	9.93	10.10	10.02	7.35	7.17	7.36	6.47	7.23	6.85
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SE (m)±	0.32	0.33	0.25	0.14	0.18	0.12	0.21	0.18	0.15
CD at 5%	0.96	1.00	0.76	0.43	0.55	0.36	0.65	0.54	0.46

Plate 1: Effect of different horticultural techniques on spike length (cm)

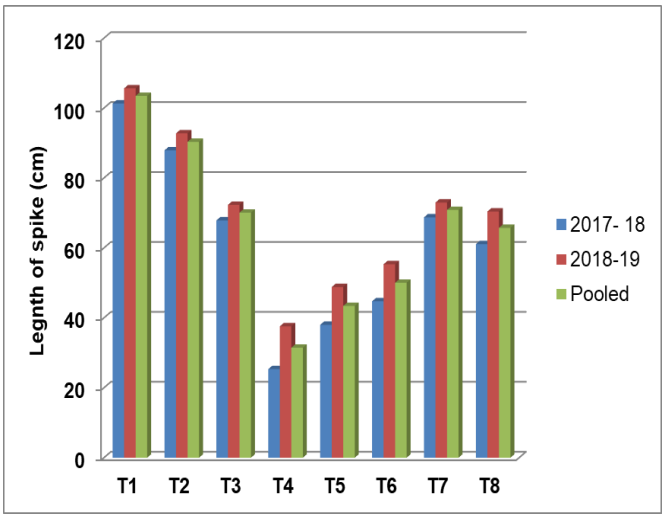

Fig 1: Effect of different horticultural techniques on length of spike (cm)

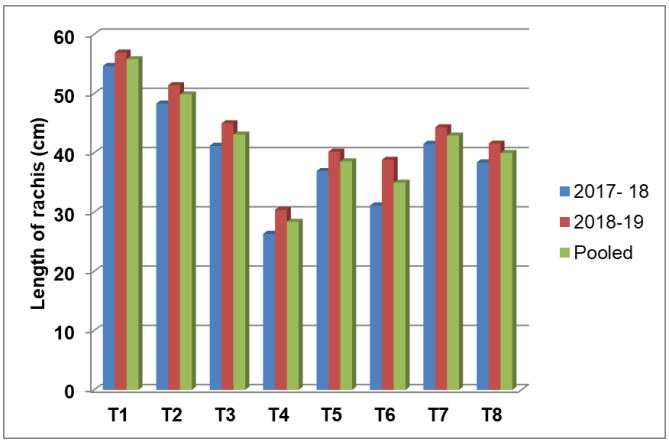

Fig 2: Effect of different horticultural techniques on length of rachis (cm)

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