



Research Paper

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Effect of plant density, planting methods and mulching on floral and cormal parameters in gladiolus (*Gladiolus hybridus* L.)

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ABSTRACT : The experiments was conducted to study the effect of plant density, planting methods and mulching on floral and cormal parameters in Gladiolus (*Gladiolus hybridus* L) cv. American Beauty during both *Kharif* and *Rabi* seasons of 2007-08 and 2008-09. The experiments consisted of eight treatments with three replications, respectively were carried out by Randomized Complete Block Design. Days taken for spike emergence and first flower bud opening on the spike was, significantly less number of days (50.26 days) in T₇ (40x20 cm, paired row mulching) followed by T₁, T₃, T₅ (50.73, 51.27 and 51.63, respectively). The number of florets produced per spike, flower weight, flower yield per spike flower, yield per hectare recorded maximum in mulched plots with 30x20 spacing. There was increase in number of florets per spike, floret weight, floret yield per plot and per hectare was due to mulched plants *i.e.* T₁, T₃, T₅ and T₇ with single and paired row in both *Kharif* and *Rabi* season. The mulched plants like T₁, T₃, T₅ and T₇ with single row and paired row treatments showed significantly more number of corms, weight of corms, cormel number and cormel weight in mulched plots in both *Kharif* and *Rabi* seasons, respectively.

KEY WORDS : Planting density, Planting method, Mulching, Gladiolus

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Gladiolus (*Gladiolus hybridus* L.) commonly known as 'Sword Lily' is a member of the family Iridaceae and one of the most popular ornamental bulbous plants grown in many parts of the world for its bewitching flowers. The cultivation of gladiolus is highly remunerative (approximately a net profit of Rs. 2.0-2.5 lakhs/ha/crop) if cultivation is taken up as per the recommended agronomic practices. In India it is largely cultivated in the states of West Bengal, Uttar Pradesh, Karnataka, Himachal Pradesh and other states. In India, it occupies an area of 776 ha. It occupies fifth place in the international floriculture trade and potential money spinner for floriculture industry with an annual production about 120 million spikes per year. As a result more farmers are coming forward to take up this crop as a commercial venture. In Karnataka, gladiolus is grown on small scale in Kolar, Tumkur, Uttar Kannada, Dharwad and Bengaluru Rural and Urban districts. At present, the

productivity and quality of cut flowers produced in gladiolus are not to the expectations in the competitive market.

The productivity, quality of spikes and corms produced are known to influence by several factors such as cultivar, agro techniques, nutrition, disease incidence, plant density, method of planting etc. There is need to standardize agro techniques for higher productivity and quality. However, number of spikes plus corms and cormels produced plot⁻¹ was affected by plant spacing (Singh and Bijimol, 1999). The best commercial quality of gladiolus was obtained at a planting density of 25 plants mm⁻¹ (Klasman *et al.*, 1995) similar trend was observed in other crop (Sharma, 2001).

Soil moisture conservation and weed control are very much important in early stages of plant growth. Use of mulches especially black polythene mulch is a potential option not only for conserving soil moisture but also for checking the weed growth. Weeds compete with main plants

for water, nutrients, sunlight, space etc, and also serve as alternate hosts for some pest and disease causing pathogens. Mulching reduces the cost of weeding and avoids competition for nutrients there by it are possible to increase spike and corm yield in *Gladiolus*. The optimum spacing helps not only in obtaining good quality cut flowers but also in better utilisation of land. Providing good open position for sunlight, soil moisture conservation, weed control and availability of nutrients vital for successful crop production and quality (Sanjib *et al.*, 2002).

The proposed investigation will help to know the influence of plant density, method of planting, and mulching practices on floral and cormal yield in *Gladiolus*. Keeping this in view, a field investigation was conducted.

RESEARCH METHODS

The present study was carried out at the Precision Farming Development Centre (PFDC), Division of Horticulture, Gandhi Krishi Vignana Kendra, University of Agricultural Sciences, Bangalore during 2007-08 and 2008-09. The field experiments consisted of eight treatments, were carried out by following Randomized Complete Block Design with three replications. Different plant density, planting methods and with and without mulching were maintained as under:

Treatment details :

- T₁: 30 x 20 cm + single row + mulching
- T₂: 30 x 20 cm + single row + no mulching
- T₃: 40 x 20 cm + single row + mulching
- T₄: 40 x 20 cm + single row + no mulching
- T₅: 30 x 20 x 60 cm + paired row + mulching
- T₆: 30 x 20 x 60 cm + paired row + no mulching
- T₇: 40 x 20 x 80 cm + paired row + mulching
- T₈: 40 x 20 x 80 cm + paired row + no mulching

The crop was raised in open field condition by adopting the recommended package of practices with different plant density, method of planting and mulching in the experiment. The investigations were carried out during *Kharif* and *Rabi* seasons to know their influence on floral and cormal parameters of cut flowers. Healthy, uniform size, non-dormant (about to sprout) corms of the cv. American Beauty were selected for planting, the corms were cleaned by removing the dried scales, mud and were dipped in 0.1% carbendazim (Bavistin) solution for 30 minutes as a preventive measure to check infection for *Fusarium* wilt incidence. The treated corms were planted at a depth of 5 cm with different levels spacing and method of planting as per the treatment specification for the experiments and light irrigation was provided immediately after planting.

Observations were recorded on days to spike emergence, days to flowering, number of spike mother corm⁻¹, spike length (cm), number of florets plant⁻¹, number of

corms and cormels plant⁻¹, average weight of corm and cormel, diameter of corm and cormel, size of corms and cormel, were statistically analyzed as per the procedure outlined by Sundaraj *et al.* (1972). The result were compared at 5 per cent probability using Fishers' test.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

Floral parameters and flower bud opening:

The data on number of days taken for spike emergence and flower bud opening in *gladiolus* cv. American Beauty influenced by plant density, planting method and mulching during *Kharif* and *Rabi* seasons are presented in Table 1.

During *Kharif* 2007, the treatments did not differ significantly with respect to number of days taken for spike emergence. However, minimum days taken for spike emergence (50.26 days) was recorded in treatment T₇ (40 x 20 x 80 cm + paired row + mulching), where as maximum number of days (52.76) taken for spike emergence was recorded in T₆ (30 x 20 x 60 cm + paired row + no mulching). Similarly during *Rabi*-2008 significant differences were observed emergence (51.03) was recorded in T₁ (30 x 20 cm +single row + mulching). While maximum number of days taken for spike emergence (54.63) was recorded in T₅ (30 x 20x60 cm + paired row + mulching). In general there was a trend in early emergence of spikes in mulched plots as compared to non mulched plots.

Similarly, During *Kharif* -2007, number of days taken for first flower bud opening in a spike did not differ significantly among the treatments. However, the maximum number of days (57.33) was recorded in the treatment T₂ (30 x 20 cm + single row + no mulching). The minimum number of days taken for first flower bud opening in a spike (55.0days) was recorded in the treatment T₇ (40 x 20 x 80 cm + paired row + mulching). During *Rabi*-2008 the treatments differed significantly, The minimum number of days taken for opening of a first flower bud in a spike was (54.00) days in treatment T₇ (40 x 20 x 80 cm + paired row + mulching) followed by T₂. The maximum number of days (58.00) taken for opening of first flower bud in the spike was observed in treatment T₃ (40 x 20 cm +single row + mulching). However, in general during both the seasons the opening of first flower bud in spike was earlier in mulched plots as compared to non mulched plots irrespective of spacing and method of planting adopted.

Early spike initiation may be due to the better utilization of soil moisture, soil nutrients, less weed intensity throughout crop growth stage which might have enhanced the reproductive development of the plant. Similar findings were reported by Pawlowski (1966) in *petunia*, Wadsworth

and Butterns (1972) in chrysanthemum, Shiraz Anwar and Maurya (2005) in gladiolus.

Number of florets per spike, spike length (cm) and spike girth (cm) :

The data on number of florets per spike, spike length (cm) and spike girth (cm) in gladiolus cv. AMERICAN BEAUTY influenced by plant density, planting method and mulching during *Kharif* and *Rabi* seasons are presented in Table 2.

During *Kharif* 2007 no statistically significant differences were observed among the treatments with respect to number of florets produced per spike. However, the maximum number of florets per spike (11.93) was recorded in T₁-(30 x 20cm + single row + mulching). While the least number of florets per spike (9.10) was recorded in treatment T₂- (30 x 20 cm + single row + no mulching). During *Rabi*-2008, treatments differed significantly among themselves. The maximum (12.27) number of florets per spike was

recorded in treatment T₁-(30 x 20cm + single row+ mulching) followed by T₅. The minimum number of florets per spike was (9.33) observed in treatment T₄(40x20 cm +single row + no mulching). In general during both seasons, the number of florets produced per spike was more in mulched plots compared to non mulched plots irrespective of different spacing and method of planting adopted.

Spike length (cm):

The spike length varied from (79.60 to 88.93 cm), during *Kharif*-2007 the treatments did not differ significantly with respect to spike length. During *Rabi*-2008 the treatments differed significantly among the themselves. The maximum spike length (97.93 cm) was recorded in treatment T₁ (30 x 20 cm +single row + mulching), while minimum (87.00 cm) was recorded in treatment T₈ (40 x 20 x 80 cm +paired row + no mulching). The spike length was higher in mulched plots compared to non mulched plots

Table 1 : Effect of spacing, planting methods and plastic mulching on days taken for spike emergence and flower bud opening in gladiolus cv. AMERICAN BEAUTY

Treatments	No. of days taken for					
	Spike emergence			Flower bud opening		
	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean
T ₁ : 30 x 20 cm +single row + mulching	50.73	51.03	50.88	55.67	55.33	55.50
T ₂ : 30 x 20 cm +single row + no mulching	52.47	52.49	52.48	57.33	54.67	56.00
T ₃ : 40 x 20 cm +single row + mulching	51.27	52.53	51.90	55.67	58.00	56.64
T ₄ : 40 x 20 cm +single row + no mulching	52.56	53.74	53.15	57.00	57.00	57.00
T ₅ : 30 x 20 x 60 cm + paired row + mulching	51.63	54.63	53.13	55.33	55.00	55.17
T ₆ : 30 x 20 x 60 cm + paired row + no mulching	52.76	53.76	53.26	56.00	56.00	56.00
T ₇ : 40 x 20 x 80 cm +paired row + mulching	50.26	52.20	51.23	55.00	54.00	54.50
T ₈ : 40 x 20 x 80 cm +paired row + no mulching	52.05	53.61	52.83	56.00	56.00	56.00
S.E.±	-	1.23	-	-	0.87	-
C.D. (P=0.05)	-	3.84	-	-	2.65	-
F test	NS	*	-	NS	*	-

NS=Non-significant

Table 2 : Effect of spacing, planting methods and plastic mulching on number of florets produced per spike, spike length and spike stem girth in gladiolus cv. AMERICAN BEAUTY

Treatments	Number of florets per spike			Spike length (cm)			Spike girth (cm)		
	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean
	T ₁ : 30 x 20 cm +single row + mulching	11.93	12.27	12.10	88.93	97.93	93.43	0.65	0.69
T ₂ : 30 x 20 cm +single row + no mulching	9.10	9.73	9.42	79.60	92.93	86.27	0.48	0.55	0.52
T ₃ : 40 x 20 cm +single row + mulching	11.00	11.33	11.17	85.00	94.66	89.83	0.51	0.61	0.56
T ₄ : 40 x 20 cm +single row + no mulching	9.13	9.33	9.23	75.53	90.66	83.10	0.50	0.54	0.52
T ₅ : 30 x 20 x 60 cm + paired row + mulching	11.33	12.00	11.67	87.47	90.80	89.14	0.65	0.68	0.67
T ₆ : 30 x 20 x 60 cm + paired row + no mulching	9.73	9.73	9.73	75.20	95.53	85.37	0.51	0.54	0.53
T ₇ : 40 x 20 x 80 cm +paired row + mulching	11.00	11.33	11.17	88.33	93.00	90.67	0.60	0.63	0.62
T ₈ : 40 x 20 x 80 cm +paired row + no mulching	9.60	9.93	9.77	80.73	87.00	83.87	0.63	0.66	0.65
S.E.±	-	0.39	-	-	1.85	-	0.03	0.03	-
C.D. (P=0.05)	-	1.19	-	-	5.61	-	0.10	0.10	-
F test	NS	*	-	NS	*	-	*	*	-

NS=Non-significant

irrespective of spacing and method of planting adopted.

Spike girth (cm):

During *Kharif*-2007 the maximum spike girth (0.65) was recorded in treatment T₁ (30 x 20cm + single row + mulching) and T₅, which was at par with T₈ (0.63). While minimum spike girth (0.50) was recorded in treatment T₄ followed by T₃ and T₆, the treatments differed significantly with respect to spike girth.

During *Rabi* -2008 the treatments differed significantly with respect to spike girth. The maximum spike girth (0.69) was recorded in treatment T₁ (30 x 20cm +paired row + no mulching) which was at par with T₅. While minimum spike girth (0.54) was recorded in treatment T₄ and T₆ (40x20cm + single row + no mulching and 30 x 20 x 60cm + paired row + no mulching).

No. of florets opening at a time, floret length (cm) and floret diameter (cm):

The data on number of florets opening at a time, floret length (cm) and floret diameter (cm) in gladiolus cv. AMERICAN BEAUTY influenced by plant density, planting method and mulching differed significantly among the treatments during *Kharif* and *Rabi* season are presented in Table 3.

During *Kharif*-2007, the maximum number of florets opening at a time in a spike (1.34) was recorded in treatment T₆ (30 x 20x60 cm + paired row + no mulching). However, the minimum number of florets (1.00) was recorded in treatments T₅ and T₇. Similarly during *Rabi*-2008, maximum was recorded in treatment T₄ (1.33) followed by T₆ and T₈. However, the minimum number of florets opening at a time in a treatment T₁ (30 x 20 cm +single row + mulching).

During *Kharif* the significant differences were observed among the treatments. The maximum floret length (10.60 cm) was recorded in treatment T₁-(30 x 20 cm +

single row + mulching) followed by T₇ (10.44cm). While minimum floret length (8.73cm) was recorded in treatment T₆-(30 x 20x60cm +paired row + no Mulching). Similarly during *Rabi* -2008 the treatments differed significantly. The maximum floret length (10.70 cm) was recorded in treatment T₁-(30 x 20cm +single row +mulching). While minimum floret length (8.53cm) was recorded in treatment T₆-(30 x 2060 cm + paired row +no mulching). However, in general during both the seasons the floret length was found superior in mulched plots as compared to non mulched plots irrespective of spacing and method of planting.

During *Kharif* -2007 floret diameter recorded significant differences among the treatments. The maximum floret diameter (9.69 cm) was recorded in treatment T₅ (30 x 20x60 cm + paired row + mulching) and minimum floret diameter (8.62cm) was recorded in treatment T₆ (30 x 20x60cm + paired row + no mulching).

During *Rabi* -2008 also observed significant differences among the treatments. The maximum floret diameter (9.99 cm) was recorded in treatment T₈ (40 x 20 x 80 cm + paired row + no mulching), which was at par with T₆. The, minimum floret diameter (9.33 cm) was recorded in treatment T₂ (30 x 20 cm + single row + no mulching). In general, during both the seasons, the floret diameter was found superior in mulched plots compared to non mulched plots irrespective of spacing, and method of planting.

The least number of florets, weight of spike and floret yield was recorded in non mulched plants *i.e.* T₂, T₄, T₆ and T₈ during *Kharif* and *Rabi* seasons, respectively. This could be less availability of nutrients and moisture due to weed competition. Similar results have been reported by Nelmes and Roychewdhury (1989) in gladiolus and Sharma and Mohammed (2004) in Tuberose, Kwack *et al.* (1990) in canna hybrid in Huh *et al.* (1994) in carnation, Barman *et al.* (2005) who had applied polythene as a mulch.

Table 3 : Effect of spacing, planting methods and plastic mulching on number of florets opening at a time, floret length and floret diameter in gladiolus cv. AMERICAN BEAUTY

Treatments	No. of florets opening at a time			Floret length (cm)			Floret diameter (cm)		
	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean
T ₁ : 30 x 20 cm +single row + mulching	1.20	1.00	1.10	10.60	10.70	10.65	9.14	9.47	9.31
T ₂ : 30 x 20 cm +single row + no mulching	1.32	1.10	1.21	9.36	9.16	9.36	9.09	9.33	9.21
T ₃ : 40 x 20 cm +single row + mulching	1.10	1.30	1.20	10.12	9.98	10.05	9.25	9.79	9.52
T ₄ : 40 x 20 cm +single row + no mulching	1.32	1.33	1.32	9.19	9.17	9.18	9.02	9.69	9.36
T ₅ : 30 x 20 x 60 cm + paired row + mulching	1.00	1.20	1.10	10.11	10.01	10.06	9.69	9.72	9.71
T ₆ : 30 x 20 x 60 cm + paired row + no mulching	1.34	1.32	1.33	8.73	8.53	8.63	8.62	9.95	9.29
T ₇ : 40 x 20 x 80 cm +paired row + mulching	1.00	1.20	1.10	10.44	10.34	10.39	9.64	9.84	9.74
T ₈ : 40 x 20 x 80 cm +paired row + no mulching	1.31	1.32	1.31	9.71	9.61	9.66	9.03	9.99	9.51
S.E.±	-	-	-	0.35	0.35	-	0.39	0.42	-
C.D. (P=0.05)	-	-	-	1.07	1.24	-	1.19	1.26	-
F test	NS	NS	-	*	*	-	*	*	-

NS=Non-significant

Duration of spikes (days) and fresh weight of spike (g):

The data on duration of spike (days) and fresh weight of spike (g) in gladiolus cv. American Beauty influenced by plant density, planting method and mulching during *Kharif* and *Rabi* seasons are presented in Table 4.

During *Kharif* 2007, the treatments differed significantly. The maximum duration of spike (8.97 days) was recorded in treatment T₁ (30 x 20 cm +single row + mulching), while minimum (7.67 days) was recorded in treatment T₂ (30 x 20 cm +single row + no mulching) and T₄ (40x20 cm + single row + no mulching) and T₆. Similarly during *Rabi* 2008, the maximum duration of spike (9.33 days) was recorded in treatment T₈ (40 x 20 x 80 cm + paired row + no mulching). While minimum duration of spike (8.66 days) was recorded in treatment T₄ (40x20 cm +single row + no mulching) followed by T₆. In general during both the season, the duration of spikes were more in mulched plots when compared to non mulched plots.

During *Kharif*-2007, treatments differed significantly with respect to fresh weight of spike. The maximum fresh weight of spike (52.30 g) was recorded in treatment T₇ (40 x 20 x 80 cm + paired row + mulching), which was at par with T₃ and T₁. However minimum (36.93 g) spike weight was recorded in treatment, T₄ (40x20 cm +single row + no mulching) followed by T₆ (30 x 20x60 cm + paired row + no mulching). Similarly during *Rabi*-2008 significant differences were observed among the treatments with respect to fresh weight of spike. The maximum (58.83 g) was recorded in treatment T₇ (40 x 20 x 80 cm +paired row + mulching), which was at par with T₃ and T₁ (52.33 g and 50.50 g), respectively, while minimum (40.26 g) was recorded in T₄ (40 x 20 + single row + no mulching) followed by the treatment T₆ (42.36 g). In general the mulched plots had better result over non mulched plots in getting higher fresh weight of spikes irrespective of spacing and method of planting adopted.

Number of spikes per plant, spikes per plot and per hectare:

The data on number of spikes per plant, spikes per plot and per hectare in gladiolus cv. American Beauty as influenced by spacing, planting method and mulching during *Kharif* and *Rabi* seasons differed significantly in both *Kharif* and *Rabi* season are presented in Table 5.

During *Kharif*-2007, the maximum number of spike produced per plant (1.18) was recorded in treatment T₁ (30 x 20 + single row + mulching). However, the minimum was recorded in treatments T₂ (30 x 20 cm +single row + no mulching). Similarly during *Rabi*-2008, the maximum number of spikes per plant was recorded in treatment T₁ (30 x 20 cm +single row + mulching) followed by T₂. While minimum number of spikes was recorded in treatment T₈ (40 x 20 x 80 cm +paired row + no mulching).

During *Kharif*-2007 treatments differed significantly. The maximum number of spikes per plot (59.00) was recorded in treatment T₁ (30 x 20 cm +single row + mulching). While minimum (27.12) number of spikes was recorded in treatment T₇ and T₈, respectively. Similarly during *Rabi* the treatments differed significantly. The maximum number of spikes per plot (107.15) was recorded in treatment T₁ (30 x 20 cm +single row + mulching) followed by T₁ (103.50), while minimum (38.84) was recorded in treatment T₈ (40 x 20 x 80 cm +paired row + no mulching) followed by T₇ (42.24).

During *Kharif*-2007 treatments differed significantly. The maximum number of spikes per hectare (200600) was recorded in treatment T₁ (30 x 20 cm +single row + mulching), while minimum (90400) number of spikes was recorded in treatment T₇ and T₈, respectively. Similarly during *Rabi* the treatments differed significantly. The maximum number of spikes per hectare (365500) was recorded in treatment T₁ (30 x 20 cm +single row + mulching) followed by T₂. However, the minimum (132800) was recorded in

Table 4 : Effect of spacing, planting methods and plastic mulching on duration of spikes and Fresh weight of spike in gladiolus cv. AMERICAN BEAUTY

Treatments	Duration of spikes (Days)			Fresh weight of spike (g)		
	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean
T ₁ : 30 x 20 cm +single row + mulching	8.97	9.23	9.10	48.40	50.50	49.45
T ₂ : 30 x 20 cm +single row + no mulching	7.67	8.66	8.17	45.03	49.70	47.37
T ₃ : 40 x 20 cm +single row + mulching	8.67	9.00	8.84	49.33	52.33	50.83
T ₄ : 40 x 20 cm +single row + no mulching	7.67	8.66	8.17	36.93	40.26	38.60
T ₅ : 30 x 20 x 60 cm + paired row + mulching	8.67	9.00	8.84	43.26	49.76	46.51
T ₆ : 30 x 20 x 60 cm + paired row + no mulching	7.67	8.67	8.17	39.36	42.36	40.86
T ₇ : 40 x 20 x 80 cm +paired row + mulching	8.00	9.00	8.50	52.30	58.83	55.57
T ₈ : 40 x 20 x 80 cm +paired row + no mulching	7.83	9.33	8.58	45.33	49.50	47.42
S.E.±	0.38	0.26	-	0.07	0.41	-
C.D. (P=0.05)	1.66	0.78	-	0.21	1.22	-
F test	*	*	-	*	*	-

treatment T₈ (40x20x80 cm +paired row + no mulching).

Cormal parameters:

Number of corms per plant, per plot and per hectare:

The data on number of corms per plant, per plot and per hectare as influenced by plant density, planting method and mulching during *Kharif* and *Rabi* season are presented in Table 6.

During *Kharif-2007* the number of corms produced per plant as influenced by different spacing, planting methods mulching significantly differed among the treatments. The maximum number of corms per plant (1.56) was recorded in treatments T₁ (30 x 20 cm +single row + mulching), while minimum (1.30) number of corms produced was recorded in treatment T₆ (30 x 20x60 cm + paired row + no mulching). Similarly during *Rabi-2008* the maximum number of corms per plant (1.85) was recorded in treatment T₁ (30 x 20 cm + single row + mulching), while minimum (1.42) was recorded in treatment T₆ (30 x 20x60 cm + paired row + no mulching).

During *Kharif-2007* the treatments differed

significantly, the maximum number of corms produced (78.00) per plot was recorded in treatments T₁ (30 x 20 cm + single row + mulching). While minimum (32.40) was recorded in treatment T₈ (40 x 20 x 80 cm + paired row + no mulching). Similarly during *Rabi-2008* the maximum number of corms per plot (92.50) was recorded in treatment T₁ (30 x 20 cm +single row + mulching). While minimum (35.28) was recorded in T₈ (40 x 20 x 80 cm + paired row + no mulching).

During *Kharif-2007* the treatments differed significantly, the maximum number of corms produced (265200) per hectare was recorded in treatments T₁ (30 x 20 cm + single row + mulching) followed by T₂. While minimum (108000) was recorded in treatment T₈ (40 x 20 x 80 cm + paired row + no mulching). Similarly during *Rabi-2008* the maximum number of corms per hectare (314500) was recorded in treatment T₁ (30 x 20 cm + single row + mulching), while minimum (117600) was recorded in treatment T₈ (40 x 20 x 80 cm + paired row + no mulching).

Table 5: Effect of spacing, planting methods and plastic mulching on number of spikes in gladiolus cv. AMERICAN BEAUTY

Treatments	Number of spikes								
	Per plant			Per plot			Per hectare		
	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean
T ₁ : 30 x 20 cm +single row + mulching	1.18	2.15	1.67	59.00	107.15	83.08	200600	365500	283050
T ₂ : 30 x 20 cm +single row + no mulching	1.10	2.07	1.59	55.00	103.50	79.25	187000	351900	269450
T ₃ : 40 x 20 cm +single row + mulching	1.13	1.95	1.54	42.94	74.10	58.52	147233	253500	200367
T ₄ : 40 x 20 cm +single row + no mulching	1.12	1.87	1.50	42.56	71.06	56.81	145600	246100	195850
T ₅ : 30 x 20 x 60 cm + paired row + mulching	1.13	2.10	1.62	37.29	69.30	53.30	124300	231000	177650
T ₆ : 30x20 x 60 cm + paired row + no mulching	1.12	1.91	1.52	36.96	63.03	50.00	123233	210100	166667
T ₇ : 40 x 20 x 80 cm +paired row + mulching	1.13	1.76	1.45	27.12	42.24	34.68	90400	140800	115600
T ₈ : 40x20 x 80 cm +paired row + no mulching	1.13	1.66	1.40	27.12	38.84	32.98	90400	132800	111600
S.E.±	0.01	0.05	-	1.84	0.44	-	1.07	0.67	-
C.D. (P=0.05)	0.04	0.16	-	5.57	1.34	-	3.23	2.02	-
F Test	*	*	-	*	*	-	*	*	-

Table 6 : Effect of spacing, planting methods and plastic mulching on number of corms in gladiolus cv. AMERICAN BEAUTY

Treatments	Number of corms								
	Per plant			Per plot			Per hectare		
	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean
T ₁ : 30 x 20 cm +single row + mulching	1.56	1.85	1.71	78.00	92.50	85.25	265200	314500	289850
T ₂ : 30 x 20 cm +single row + no mulching	1.31	1.50	1.41	60.00	70.00	65.00	205700	238000	221850
T ₃ : 40 x 20 cm +single row + mulching	1.50	1.75	1.63	57.00	66.50	61.75	195000	227500	211250
T ₄ : 40 x 20 cm +single row + no mulching	1.35	1.55	1.45	51.30	58.90	55.10	175500	201500	188500
T ₅ : 30 x 20 x 60 cm + paired row + mulching	1.45	1.66	1.56	47.85	54.78	51.32	159500	182600	171050
T ₆ : 30 x 20 x 60 cm + paired row + no mulching	1.30	1.42	1.36	42.90	46.86	44.88	143000	156200	149600
T ₇ : 40 x 20 x 80 cm +paired row + mulching	1.40	1.56	1.48	33.60	37.44	35.52	112000	126133	119067
T ₈ : 40 x 20 x 80 cm +paired row + no mulching	1.35	1.47	1.41	32.40	35.28	33.84	108000	117600	112800
S.E.±	0.05	0.06	-	5.35	2.18	-	0.48	4.50	-
C.D. (P=0.05)	0.16	0.19	-	16.21	6.63	-	1.45	13.65	-
F Test	*	*	-	*	*	-	*	*	-

Table 7 : Effect of spacing, planting methods and plastic mulching on weight of corms, number of cormels and cormel weight per plant of gladiolus cv. AMERICAN BEAUTY

Treatments	Weight of corms per plant (g)			No. of cormels per plant			Cormel weight per plant (g)		
	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean	<i>Kharif</i>	<i>Rabi</i>	Mean
T ₁ : 30 x 20 cm +single row + mulching	47.45	65.45	56.45	40.22	51.86	46.04	17.67	20.33	19.00
T ₂ : 30 x 20 cm +single row + no mulching	44.82	58.82	51.82	36.47	46.80	41.64	11.01	21.00	16.01
T ₃ : 40 x 20 cm +single row + mulching	48.17	66.83	57.50	37.60	44.93	41.27	18.80	23.60	21.20
T ₄ : 40 x 20 cm +single row + no mulching	41.70	65.78	53.74	30.27	42.93	36.60	10.11	20.11	15.11
T ₅ : 30 x 20 x 60 cm + paired row + mulching	46.17	66.87	56.52	36.80	45.80	41.30	17.59	29.40	23.50
T ₆ : 30 x 20 x 60 cm + paired row + no mulching	40.75	67.08	53.92	32.60	37.93	35.27	14.69	25.36	20.03
T ₇ : 40 x 20 x 80 cm +paired row + mulching	50.17	67.85	59.01	34.80	38.80	36.80	19.05	21.38	20.22
T ₈ : 40 x 20 x 80 cm +paired row + no mulching	43.72	67.39	55.56	37.47	39.13	38.30	11.49	20.15	15.82
S.E.±	-	6.40	-	-	2.21	-	-	0.89	-
C.D. (P=0.05)	-	19.56	-	-	6.70	-	-	2.70	-
F test	NS	*	-	NS	*	-	NS	*	-

NS=Non-significant

Weight of corms per plant, no. of cormels per plant and cormel weight per plant:

The data on weight of corms per plant, no. of cormels per plant and cormel weight per plant (g) as influenced by plant density, planting method and mulching during both *Kharif* and *Rabi* season are presented in Table 7.

During *Kharif*-2007 the treatments did not differ significantly. The maximum weight of corms (50.17) was recorded in treatment T₇ (40 x 20 x 80 cm + paired row + mulching). While minimum (40.75) was recorded in treatment T₄: (40x20 cm +single row + no mulching). Similarly during *Rabi*-2008 the treatments differed significantly, the maximum weight of corms per plot (67.85) was recorded in treatment T₇: (40 x 20 x 80 cm + paired row + mulching).

During *Kharif* the treatments did not differ significantly. The maximum number of cormels per plant was recorded in treatment T₁ (30 x 20 cm + single row + mulching). While minimum (30.27) was recorded in treatment T₄ (40x20 cm + single row + no mulching). Similarly during *Rabi*-2008 the maximum number of cormels per plant (51.86) was recorded in treatment T₁ (30 x 20 cm + single row + mulching), while minimum was (37.93) recorded in T₆ (30 x 20x60 cm + paired row + no mulching).

During *Kharif*-2007, treatments did not differ significantly. The maximum cormel weight per plant (19.05g) was recorded in treatment T₇ (40 x 20 x 80 cm +paired row + mulching). While minimum (10.11g) was recorded in treatment T₄ (40x20 cm +single row + no mulching). Similarly during *Rabi*-2008 the treatments differed significantly. The maximum cormel weight per plant (29.40g) was recorded T₅ (30 x 20x60 cm + paired row + mulching). While minimum cormel weight (20.11) was recorded in treatment T₄ (40x20 cm +single row + no mulching).

The mulched plants like T₁, T₃, T₅ and T₇ with single row and paired row treatments showed significantly more number of corms, weight of corms, cormel number and cormel weight in mulched plots in both *Kharif* and *Rabi* seasons, respectively. Where as the minimum number of corms, cormel number and cormel weight was noticed in non mulched treatments T₂, T₄, T₆ and T₈. These finding are at par with the findings of Barman *et al.* (2005) in gladiolus, Benkenstein *et al.* (1976) in tulips and gladiolus.

REFERENCES

- Barman, D., Rajni, K., Ram Pal and Upadhyaya, R.C. (2005). Effect of mulching on cut flower production and corm multiplication in gladiolus. *J. Orna. Hort.*, **8** (2): 152-154.
- Benkenstein, H., Hellwing, J. and Buder, A. (1976). Investigation on the effect of black polyethylene mulch on growth and yield of tulip and gladiolus. *Archiv-fur-Gartenbau*, **24** (4): 251-258.
- Huh, K.Y., Kim, K.S. and Yamaguchi, T. (1994). Effect of reflective film mulching on the growth, productivity and quality of cut spray chrysanthemum flowers in green house cultivation. *RDA J. Agric. Sci. Hort.*, **36** (1): 422-429.
- Klasman, R., Molinari, J. and Benedetto, A. (1995). Green house cultivation of cut gladiolus at four planting densities. *Hort. Argentina*, **14** (36): 65-68.
- Kwack, B.H., Kim, H.K. and Lee, K.M. (1990). The effect of polyethylene film mulching in early spring on growth and flowering of field planted *Canna hybrida* L. *J. Korean Soc. Hort. Sci.*, **31**(2):162-168.
- Nilimesh, R. and Roychowdhury, N. (1989). Effect of plant spacing and growth regulators on growth and flower yield of gladiolus grown under polyethylene tunnel. *Acta Hort.*, **246**: 259-263.
- Pawlowski, H.E. (1966). The effect of different N:K ratios in the nutrition solutions of petunias, chrysanthemum and Begonias. *Z. Pfl. Enshr. Dung.*, **115** : 100-113.

Sanjib, S., Talukdar, Sharma, S., Misra, R.L. and Sanyat, M. (2002). Effect of time, spacing, and depth of planting on gladiolus. *Flori. Res. Trend India*, **7**: 243-245.

Sharma, K.C. (2001). Responses of fertility and spacing to seed production of Chinese cabbage under North West Himalayas. *Indian J. Agric. Sci.*, **71** (9): 608-611.

Sharma, R.K. and Mohammad, S. (2004). Influence of grad levels of nitrogen and sulphur on growth, flowering and essential oils content in in tuberos cultivar Mexican Single. *J. Orna. Hort.*, **7** (1): 52-57.

Shiraz, Anwar and Maurya, K.R. (2005). Effect of spacing and corm size on growth, flowering and corm production in gladiolus. *Indian*

J. Hort., **62** (4): 419-421.

Singh, A.K. and Bijimol, G. (1999). Growth, flowering and corm production in gladiolus cultivar Oscar as influenced by nitrogen and spacing in acidic soil of Nagaland. *Indian J. Hill Farming*, **14** (1): 128-131.

Sundaraj, N., Nagaraju, S.C.S, Venkataramu, M.N. and Jaganath, M.K. (1972). *Design and analysis of field experiment*, University of Agricultural Sciences, Technical Series, Bangalore (KARNATAKA) INDIA.

Wadsworth, C.A. and Butters, R.C. (1972). The nutrition of AYR Chrysanthemum in loam less media. pp. 83-84.

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