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Impact of Fertigation and Mulching on Vegetative, Flowering, Yield and Nutrient Status of Gladiolus cv. Pusa Jyotsna

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ABSTRACT: Fertilizers are the main limiting factors affecting the agricultural production. Providing timely fertigation along with mulching in gladiolus is highly essential at critical stages as it indirectly affects root growth, spike and corm yield. However, literature on studies on optimizing fertigation schedule and mulching in gladiolus were found meagre. Hence trials were carried out to study the growth, flowering, yield and nutrient status of gladiolus cv. Pusa Jyotsna under different levels of drip fertigation and mulching during 2019-20 & 2020-21 at CPCT, IARI, New Delhi, involving 4 fertigation levels (100%, 80%, 60% and 120% RDF), 3 mulch levels (control, Silver/black and Yellow/black) set up in a Factorial Randomized Block Design. Fertigation with 80% RDF and Silver/Black mulch recorded earliest days to corms sprouting, highest leaf chlorophyll, least days to flowering, highest spike length, most florets/spike, longer duration of flowering, highest spikes/ha, highest corms/ha, higher available N, P and K (kg/ha) in soil. This study concluded that combination of drip fertigation at 80% RDF and Silver/Black mulch was effective in boosting yield and producing high-quality flowers.

Keywords: Gladiolus, Fertigation, Mulching, Growth, Yield, Nutrient status.

INTRODUCTION

Floriculture is a fast-growing agriculture sector undergoing a revolution consisting production and marketing of high value crops which has led it to 100 percent export-oriented industry. Consumption of flowers has been a part of our daily life owing to their aesthetic value and in fact no social or religious function is complete without the use of flowers. Gladiolus (*Gladiolus* × *hybridus* Hort.), the queen of bulbous ornamentals is a leading geophyte grown worldwide for cut flower and garden display. The genus *Gladiolus* is a member of family *Iridaceae* and sub-family *ixioideae* (Goldblatt, 1991). Gladiolus grows well in soils with a pH of 7.5 to 8.5 and is considered a highly lucrative crop for small and marginal farmers. It requires sufficient water and optimum nutrients to obtain high yield and flower quality under different soil types. Gladiolus varieties and hybrids imported from western countries are heavy feeders of nutrients and consume more water thereby enhance the cost of cultivation and reduce the profit margin to the farmers (Sudhir *et al*., 2007). Fertilizers applied through a drip irrigation system improve nutrient use efficiency, saves labour and increase flexibility in scheduling of its applications to fit crop needs (Rolston, 1979). Thompson *et al*. (2003) reported fertigation events can be planned as often as irrigation at different intervals in a week, a fortnight, or a month. Fertilizer requirement can be reduced by 15-25 per cent with fertigation through drip without affecting the yield (Hongal and Nooli 2007). Adoption of mulching with drip system moderate the soil temperature, increase soil air CO_2 content which ultimately improves the nutrient availability, control weeds up to 90 per cent and minimize evaporation loss of water from soil surface (Savani *et al*., 2017). In addition, mulching conserve soil moisture thus reducing the irrigation requirements, act as insulation layer, increasing root development, promoting faster crop development, and inducing earlier harvest of crop (Mahajan *et al*., 2007). In view of benefits of the above precision technologies, various authors have investigated the impact of drip fertigation (Prasad *et al*., 2022) and plastic mulching (Gantait, 2015; Kumar *et al*., 2020) either alone or in combination of both (Salma *et al*., 2016) towards enhancing gladiolus production and productivity in recent studies. There is a scope of increasing flower yield and quality using drip fertigation and plastic mulch considering economic potential of the crop. In this direction, only few works have evaluated the effect of drip fertigation coupled with coloured plastic mulch on growth and production of gladiolus. Hence, there is an urgent need to standardize the fertigation schedule and plastic mulching so as to guide the farmers towards achieving high flower and corm yield in gladiolus. Keeping in view the study was carried out to assess the response of drip fertigation and polythene mulching on growth, flowering and yield and nutrient status of gladiolus cv. Pusa Jyotsna.

MATERIALS AND METHODS

Gladiolus were grown in the open field at the Central Protected Cultivation of Technology (CPCT), IARI, New Delhi, during the period of two consecutive winter seasons in 2019–20 and 2020–21. The experiment was set up in a Factorial Randomised Block Design (FRBD) replicated three times with four fertigation levels (100% RDF-F_0, 80% RDF-F_1, 60% RDF-F_2 and 120% RDF-F_3) and three levels of mulches (Silver/Black mulch-M_1, Yellow/Black mulch (M_2) and No mulch (M_0).In this experiment, the recommended fertiliser dosage was 200:100:100 NPK kg/ha. The following parameters were measured throughout the entire growth period: vegetative (days to 50% corms sprouting, corms sprouting %, plant height, leaf length, leaf width, leaf chlorophyll), flowering (days to spike initiation, days to first floret opening, days to 50% flowering, spike length, rachis length, duration of flowering), and yield (number of florets/spike, number of spikes/plot, number of spikes/ha, number of corms/plant, number of corms/plot, number of corms/ha, corm diameter) and nutrient status(Available N, P, K (kg/ha) in soil after harvest, leaf N, P, K % at spike initiation and at harvest time of spikes). The data of two years were and pooled to obtain mean and such mean values were subjected to analysis using R Software (version 4.2.0). By using the Duncan's Multiple Range Test (DMRT) test at p 0.05, the statistical means of various sources of variation were distinguished. The significant main effects of fertigation dose, mulching and interactions between fertigation dose × mulch type were interpreted and presented accordingly.

RESULTS AND DISCUSSION

Vegetative growth

The effect of fertigation, mulch type, and their interactions on vegetative growth of gladiolus cv. Pusa Jyotsna as illustrated, in Table 1. Among the different fertigation doses, the application of 80% RDF significantly achieved the least days to 50% corm sprouting (13.94 days), broader leaves (2.77cm), and higher leaf chlorophyll (66.53) against the application of 100% RDF. Application of 120% RDF significantly increased the plant height (102.66cm) of Pusa Jyotsna. An adequate supply of fertilizers via drip irrigation at weekly intervals may have increased the availability of nutrients in the root zone, thereby increasing nutrient uptake and further influencing the vegetative growth of plants. The results conform with the findings reported by Kabariel and Kannan (2015) in tuberose, Sujatha *et al*. (2002) in gerbera and Ahmad *et al*. (2015) in Rose. The continual availability of moisture at the root zone and improved nutrient uptake by the plant may be responsible for the increased growth of plants, which resulted in higher cell elongation and division. The results are supported with the findings of Naik *et al*. (2021). Corms of gladioli mulched with Silver/Black polythene significantly reduced the number of days to 50% corm sprouting (13.79 days), higher corm sprouting % (97.92), highest plant height (101.98 cm), longer leaves (42.68cm), broader leaves (2.70 cm) and higher chlorophyll content (69.77) as compared to non-mulched plots. Vegetative growth in plants is encouraged by soil temperature. The differences in soil temperature beneath polythene mulch could be related to a wide range of heating and heat transfer processes in the soil that led to heat accumulation during the day and loss at night. These results are in agreement with the work of Kumari *et al*. (2021) in capsicum. The interaction effect of fertigation dose × mulch type significantly enhanced the growth of gladiolus except for the character days to 50% corm sprouting and leaf width. The treatment combination of 80% RDF + Silver/Black mulch recorded highest corm sprouting % (98.48), highest leaf length (44.27) and higher chlorophyll in leaves (80.70), and it was significantly at par with F_0M_1. However, the treatment combination of 120% RDF + Silver/Black mulch (109.46 cm) showed the highest plant height compared to other treatments. A higher application of fertilizers during vegetative growth might have increased the plant's height. According to Lazano *et al*. (2016), fertigation combined with mulching significantly improved strawberry production.

Flowering attributes. There were significant differences among the different fertigation doses, mulch types, and their interactions with flowering attributes, as presented in Table 2. Employing recommended fertilizers via drip irrigation exhibited a significant difference on floral characters except for the characters days to spike initiation, days to first floret opening and rachis length. Application of 80% RDF recorded least days to 50% flowering (101.89 days), maximum spike length (55.89 cm), most florets/spike (18.17), and longer duration of flowering (17.78 days) against F_0. These results supported earlier findings of Vijaykumar *et al*. (2010); Thamara *et al*. (2010) in China aster. The potassium nutrient promotes growth and photosynthetic pigment, which increases the absorption of CO_2 led to a significant effect on spike initiation (Salama, 1987). Corms mulched with Silver/Black mulch recorded a marked performance on the expression of least days to flower spike initiation (82.33 days), least days to first floret opening (94.83 days), least days to 50% flowering (101.50 days), maximum spike length (55.02 cm), highest rachis length (52, 54cm), most florets/spike (18.08) and duration of flowering (18.79 days) over other mulches. This could be due to increased soil moisture, maintained soil temperature, uptake of nutrients, and weed management during the entire crop growth stage under polythene mulch, which may have improved the plant's reproductive growth. The results obtained in the present study are in accordance with the Kumar and Kumar (2020). The interaction effect of fertigation × mulching on flowering attributes found significant except for the characters rachis length and number of florets/spikes (Fig. 1a & b). The treatment combination of 80% RDF + Silver/Black mulch achieved least days to spike initiation (80.67 days), least days to first floret opening (93 days), least days to 50% flowering (101.33 days), highest spike length (57.55 cm) and longer duration of flowering (19.83 days). The treatment combination 100% RDF + No mulch (F_0M_0) recorded least corm sprouting % (95.38) and plant height (90.22cm) and treatment combination of 100% RDF + Yellow/Black (F_0M_2) mulch showed lowest leaf length (37.69cm) and least chlorophyll content (54.30) in leaves. The emergence of a spike might have depended upon the food reserve in the plant that could be related to the plant growth regulating the accumulation of carbohydrates for slipping (Kumar and Yadav 2005).

Yield attributes. The data recorded for the influence of fertilizer doses and mulch type on yield characters were significant as illustrated in Table 3. Application of the application of 80% RDF (F_1) achieved highest spikes/plot (48.72), highest spikes/ha (165 thousand), highest corms/plot (81.94) and highest corms/ha (273.18 thousand) followed by 60% RDF (F_2) compared to other fertigation doses. Potassium nutrition strongly influences yield, quality of corms, and spikes. These results are in line with the findings of Rajhansa *et al*. (2013). Plants mulched with Silver/black polythene (M_1) produced maximum spikes/plot (48.33), maximum spikes/ha (160.97 thousand), maximum corms/plot (86.63), highest corms/ha (288.75 thousand) and larger corms (5.16) over other mulches. According to Ham *et al*. (1991), plants grown under polythene mulch commenced flowering 9 days earlier than plants grown in soil without mulch. The interaction effect of fertigation × mulching had significantly influenced on number of corms/plot and number of corms/ha (Fig. 2a). The treatment combination of 80% RDF + Silver/Black mulch (F_1M_1) obtained highest corms/plot (90) as well as highest corms/ha (300 thousand), which was statistically at par with 60% RDF + Silver/black mulch (F_2M_1). The treatment combination 120% RDF + Yellow/Black mulch (F_3M_2) produced least corms/plot (58.17) and corms/ha (193.89 thousand).The intensity of light and spectral balance reaching plants depends on the surface colour of the plastic mulch, which can alter plant growth and yield. However, plastic mulches frequently increased the soil's temperature and blocked the weeds, which caused flowers to bloom earlier than usual. These results are in conformity with the findings of Paul *et al*. (2013) in capsicum.

Nutrient status. The effect of fertigation, mulching, and their interactions significantly influenced on nutrient status of gladiolus cv. Pusa Jyotsna (Table 4). Among different levels of fertilizer doses, recommended dose of 80% RDF increased available N (232.91kg/ha), P (23.75kg/ha), and K (262.06kg/ha) in the soil after the harvest of gladiolus whereas lower available N (153.53 kg/ha), P (18.14 kg/ha) and K (168.45kg/ha) was recorded with the application of 60% RDF(F2). Application of 120% RDF significantly increased leaf NPK (3.64%, 0.21%, 2.76%) at spike initiation and NPK (2.52%, 0.20%, 2.53%) at harvest of spikes. However, lower leaf NPK (3.23%, 0.15%, 2.21%) at spike initiation and lower NPK (2.08%, 0.14%, 1.97%) at harvest of gladiolus spikes obtained in the treatment 60% RDF(F2). The highest value of nitrogen, phosphorous, and potassium in the leaves might be due to the application of balanced N, P and K doses of fertilizer via drip fertigation system near to the root zone (Singandhupe *et al*., 2005). Plants mulched with Silver/Black mulch significantly increased available NPK (202.54, 25.17, 252.98Kg/ha) in soil and highest NPK (3.59%, 0.18%, 2.55%) in leaves at spike initiation after harvest of gladiolus spike compared to control (M_0). Crop mulched with Yellow/Black mulch had higher leaf NPK (2.40%, 0.19%, 2.32%) at harvest of gladiolus spikes, while lowest NPK (2.06%, 0.15%, 2.12%) in leaves were found in the control (M_0). Polyethylene mulching has increased leaf tissues concentration of NPK in vegetable crops compared to those grown over bare soil (Hassan *et al*., 1995). The interaction effect of treatment combination 80% RDF + Silver/Black mulch recorded higher available N (261.48kg/ha) and K (289.80 kg/ha) in soil, while the treatment combination 60% RDF + Yellow/Black mulch (F_2M_2) recorded lower available N (144.05 kg/ha) and K (149.89 kg/ha) in soil after harvest. Application of treatment combination 120% RDF + Silver/Black mulch achieved higher leaf N (3.67%), P (0.21%) and K (2.84%), whereas treatment combination of 120% RDF + Yellow/Black mulch recorded higher N (2.60%), P(0.22%) and K (2.68%) at harvest of spikes compared to F_2M_2. These results are in line with those of Bhan (2002) in potato and Bhalla *et al*. (2007) in carnation.

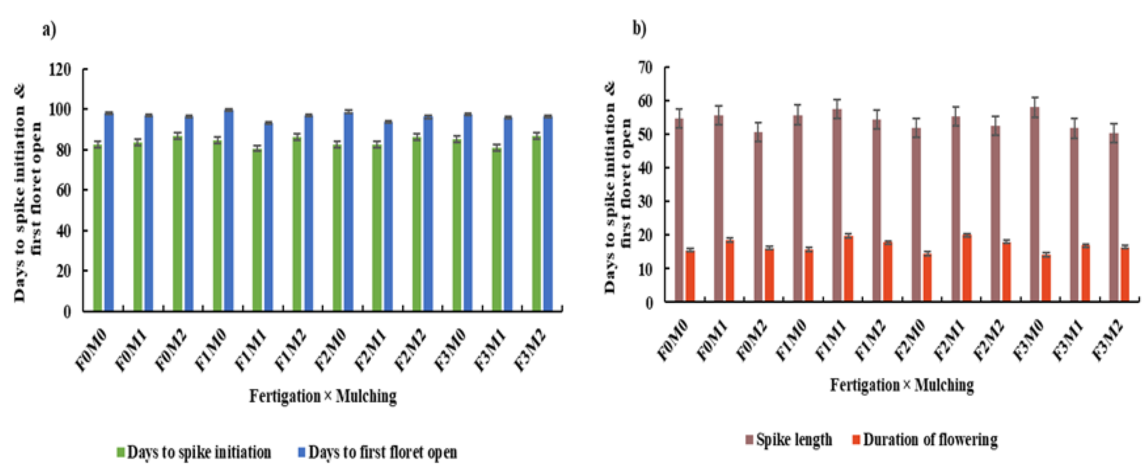

Fig. 1. Interaction effect of fertigation × mulching on flowering attributes of gladiolus. Vertical bars in figure represent SE ±.

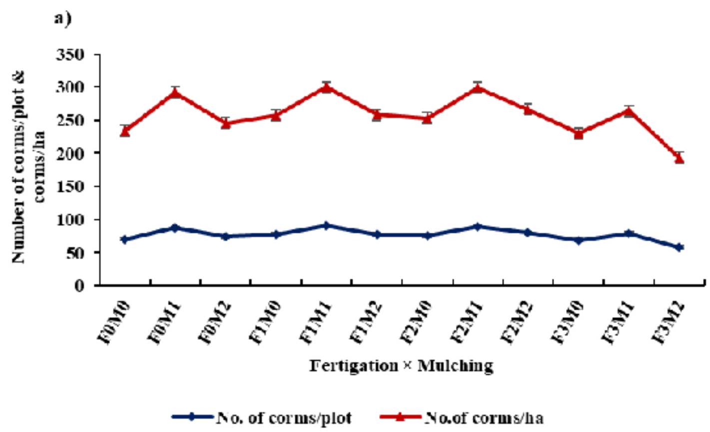

Fig. 2. Interaction effect of fertigation × mulching on flowering attributes of gladiolus. Vertical bars in figure represent SE ±.

Table 1: Effect of fertigation and mulching and their interactions on vegetative growth of gladiolus cv. Pusa Jyotsna.

Treatments	Days to 50% corms sprouting	Corm sprouting %	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Chlorophyll
Fertigation						
100% RDF (F_0)	14.83^{b}	96.69^{a}	96.16^{b}	40.48^{b}	2.70^{ab}	58.74^{b}
80%RDF (F_1)	13.94^{c}	97.21^{a}	94.85^{b}	42.08^{ab}	2.77^{a}	66.53^{a}
60% RDF (F_2)	15.78^{a}	96.87^{a}	95.60^{b}	42.39^{a}	2.67^{ab}	62.27^{b}
120% RDF (F_3)	16.17^{a}	96.98^{a}	102.66^{a}	40.57^{b}	2.51^{b}	60.02^{b}
SEm±	0.23	0.21	1.3	0.59	0.07	1.27
LSD	0.67	0.62	3.82	1.73	0.2	3.74
Mulches						
No mulch (M_0)	15.83^{a}	96.93^{b}	90.72^{b}	40.45^{b}	2.43^{b}	56.50^{b}
Silver/Black (M_1)	13.79^{b}	97.92^{a}	101.98^{a}	42.68^{a}	2.70^{a}	69.77^{a}
Yellow/Black (M_2)	15.92^{a}	95.96^{c}	99.25^{a}	41.01^{b}	2.86^{a}	59.40^{b}
SEm±	0.19	0.18	1.12	0.51	0.06	1.1
LSD	0.58	0.54	3.31	1.5	0.17	3.24
Interaction						
F_0M_0	15.50^{bcd}	95.38^{e}	90.22^{cd}	41.16^{bcd}	2.95^{ab}	57.77^{de}
F_0M_1	13.17^{fg}	98.52^{a}	100.42^{b}	42.58^{abc}	2.77^{abc}	60.62^{cde}
F_0M_2	15.83^{bc}	96.17^{cde}	97.83^{b}	37.69^{e}	2.37^{de}	54.30^{e}
F_1M_0	15.33^{bcd}	96.17^{cde}	84.58	39.50^{de}	3.07^{a}	64.49^{c}
F_1M_1	12.33^{g}	98.48^{a}	97.54^{b}	44.27^{a}	2.76^{abc}	80.79^{a}
F_1M_2	14.17^{ef}	96.97^{bcd}	102.42^{b}	42.47^{abcd}	2.48^{cde}	57.84^{de}
F_2M_0	16.33^{ab}	97.65^{ab}	90.33^{cd}	40.05^{bcde}	2.77^{abc}	55.62^{e}
F_2M_1	14.67^{de}	97.45^{ab}	100.50^{b}	44.27^{a}	2.72^{abcd}	73.69^{b}
F_2M_2	16.33^{ab}	95.52^{e}	95.98^{bc}	42.86^{ab}	2.53^{cde}	57.51^{e}
F_3M_0	16.17^{b}	97.73^{ab}	97.73^{b}	41.08^{bcd}	2.64^{bcde}	59.74^{cde}
F_3M_1	15.00^{cde}	97.25^{bc}	109.46^{a}	39.61^{cde}	2.56^{cde}	63.99^{cd}
F_3M_2	17.33^{a}	95.96^{de}	100.79^{b}	41.03^{bcd}	2.33^{e}	56.33^{e}
SEm±	0.39	0.37	2.25	1.02	0.12	2.21
LSD	1.16	1.09	6.65	3	0.35	6.48

Note: Means within the column followed by the same letter(s) are not significantly different at 5% level of significance by DMRT. SEm = Standard Error of Mean, LSD = Least Significant Difference. Significant at $P < 0.05$.

Table 2: Effect of fertigation and mulching on flowering attributes of gladiolus cv. Pusa Jyotsna.

Treatments	Days to spike initiation	Days to first floret open	Days to 50% flowering	Spike length (cm)	Rachis length (cm)	Number of florets /Spike	Duration of flowering (days)
Fertigation							
100% RDF (F_0)	84.33^{a}	97.17^{a}	103.44^{a}	53.62^{b}	49.68^{a}	16.67^{b}	16.72^{bc}
80%RDF (F_1)	84.55^{a}	96.56^{ab}	101.89^{b}	55.89^{a}	50.71^{a}	18.17^{a}	17.78^{a}
60% RDF (F_2)	83.16^{a}	96.22^{b}	103.39^{a}	53.21^{b}	47.37^{a}	17.33^{b}	17.50^{ab}
120% RDF (F_3)	84.38^{a}	96.67^{ab}	103.83^{a}	53.35^{b}	48.36^{a}	16.83^{b}	15.83^{c}
SEm±	0.90	0.32	0.29	0.56	1.75	0.25	0.31
LSD (p=0.05)	2.66NS	0.94NS	0.85	1.66	5.14NS	0.73	0.91
Mulches							
No mulch (M_0)	83.33^{b}	98.54^{a}	105.08^{a}	55.05^{a}	49.57^{a}	16.96^{b}	14.96^{c}
Silver/Black (M_1)	82.33^{b}	94.83^{c}	101.50^{c}	55.02^{a}	52.54^{a}	18.08^{a}	18.79^{a}
Yellow/Black (M_2)	86.67^{a}	96.58^{b}	102.83^{b}	51.98^{b}	44.98^{b}	16.71^{b}	17.13^{b}
SEm±	0.78	0.27	0.25	0.49	1.50	0.21	0.27
LSD (p=0.05)	2.3	0.81	0.74	1.44	4.45	0.63	0.79

Note: Means within the column followed by the same letter(s) are not significantly different at 5% level of significance by DMRT. SEm = Standard Error of Mean, LSD = Least Significant Difference. Significant at $P < 0.05$.

Table 3: Effect of fertigation and mulching and their interactions on yield attributes of gladiolus cv. Pusa Jyotsna.

Treatments	Number of spikes/plots	Number of spikes/ha	Number of corms/plots	Number of corms/ha	Corm diameter(cm)
Fertigation					
100% RDF (F_0)	45.39^{b}	151.30^{b}	77.11^{b}	257.04^{b}	4.84^{a}
80%RDF (F_1)	48.72^{a}	165.00^{a}	81.94^{a}	273.15^{a}	4.83^{a}
60% RDF (F_2)	49.50^{a}	161.67^{a}	81.50^{a}	271.67^{a}	4.96^{a}
120% RDF (F_3)	44.78^{b}	149.26^{b}	68.83^{c}	229.44^{c}	4.94^{a}
SEm±	0.59	2.00	1.40	4.74	0.13
LSD (p=0.05)	1.73	5.80	4.17	13.90	0.38NS
Mulches					
No mulch (M_0)	45.75^{b}	152.08^{b}	73.08^{b}	243.61^{b}	4.64^{b}
Silver/Black (M_1)	48.33^{a}	160.97^{a}	86.63^{a}	288.75^{a}	5.16^{a}
Yellow/Black (M_2)	47.21^{ab}	157.36^{a}	72.33^{b}	241.11^{b}	4.88^{ab}
SEm±	0.51	1.73	1.20	4.10	0.11
LSD (p=0.05)	1.5	5.09	3.67	12.03	0.33

Note: Means within the column followed by the same letter(s) are not significantly different at 5% level of significance by DMRT. SEm = Standard Error of Mean, LSD = Least Significant Difference. Significant at $P < 0.05$.

Table 4: Effect of fertigation and mulching and their interactions on nutrient status of gladiolus cv. Pusa Jyotsna.

Treatments	Available soil N(kg/ha) after harvest	Available soil P(kg/ha) after harvest	Available soil K (kg/ha) after harvest	Leaf N at Spike initiation (%)	Leaf P at Spike initiation (%)	Leaf K at Spike initiation (%)	Leaf N at harvest (%)	Leaf K at harvest (%)	Leaf K at harvest (%)
Fertigation									
100% RDF (F_0)	196.52^{b}	22.19^{b}	233.60^{b}	3.39^{b}	0.18^{b}	2.62^{b}	2.31^{b}	0.18^{b}	2.28^{b}
80%RDF (F_1)	232.91^{a}	23.75^{a}	262.06^{a}	3.38^{b}	0.16^{c}	2.34^{c}	2.21^{c}	0.14^{c}	2.11^{c}
60% RDF (F_2)	153.53^{d}	18.14^{d}	168.45^{d}	3.23^{c}	0.15^{d}	2.21^{d}	2.08^{d}	0.14^{c}	1.97^{d}
120% RDF (F_3)	176.55^{c}	21.04^{c}	205.39^{c}	3.64^{a}	0.21^{a}	2.76^{a}	2.52^{a}	0.20^{a}	2.53^{a}
SEm±	2.83	0.30	1.81	0.03	0.00	0.03	0.02	0.00	0.03
LSD	8.3	0.90	5.30	0.09	0.01	0.08	0.07	0.01	0.08
Mulches									
No mulch (M_0)	177.42^{c}	18.19^{c}	171.19^{c}	3.18^{c}	0.16^{c}	2.42^{c}	2.06^{b}	0.15^{c}	2.12^{c}
Silver/Black (M_1)	202.54^{a}	25.17^{a}	252.98^{a}	3.59^{a}	0.18^{a}	2.55^{a}	2.38^{a}	0.16^{b}	2.23^{b}
Yellow/Black (M_2)	189.68^{b}	20.47^{b}	227.96^{b}	3.46^{b}	0.18^{b}	2.48^{b}	2.40^{a}	0.19^{a}	2.32^{a}
SEm±	2.45	0.26	1.56	0.02	0.00	0.02	0.02	0.00	0.02
LSD	7.19	0.78	4.59	0.08	0.01	0.07	0.06	0.00	0.07
Interaction									
F_0M_0	200.70^{cd}	21.75^{de}	276.74^{b}	3.13^{c}	0.19^{b}	2.64^{b}	2.02^{f}	0.18^{de}	2.33^{c}
F_0M_1	213.25^{bc}	19.09^{fg}	176.21^{g}	3.51^{ab}	0.15^{d}	2.49^{c}	2.50^{ab}	0.16^{fg}	2.47^{b}
F_0M_2	175.61^{e}	25.71^{b}	247.84^{c}	3.52^{ab}	0.19^{b}	2.72^{ab}	2.41^{bc}	0.19^{c}	2.03^{ef}
F_1M_0	219.52^{b}	23.40^{c}	192.35^{f}	3.10^{c}	0.16^{c}	2.27^{d}	2.06^{f}	0.13^{h}	2.23^{cd}
F_1M_1	261.48^{a}	27.53^{a}	289.80^{a}	3.58^{ab}	0.15^{d}	2.29^{d}	2.27^{de}	0.12^{h}	2.12^{de}
F_1M_2	217.74^{b}	20.32^{ef}	271.04^{b}	3.45^{b}	0.17^{c}	2.48^{c}	2.31^{cde}	0.17^{ef}	1.98^{f}
F_2M_0	144.05^{g}	16.19^{h}	149.81^{i}	2.90^{d}	0.13^{e}	2.19^{d}	1.78^{g}	0.10^{i}	1.75^{g}
F_2M_1	163.07^{ef}	15.23^{h}	173.86^{gh}	3.59^{ab}	0.17^{c}	2.17^{d}	2.19^{e}	0.16^{g}	2.04^{ef}
F_2M_2	153.47^{fg}	23.01^{cd}	181.68^{g}	3.21^{c}	0.15^{d}	2.26^{d}	2.26^{e}	0.16^{fg}	2.14^{de}
F_3M_0	194.43^{d}	20.54^{ef}	238.51^{d}	3.59^{ab}	0.22^{a}	2.71^{ab}	2.38^{bcd}	0.19^{cd}	2.60^{ab}
F_3M_1	172.35^{e}	18.13^{g}	166.40^{h}	3.67^{a}	0.21^{a}	2.84^{a}	2.57^{a}	0.20^{b}	2.32^{c}
F_3M_2	162.86^{ef}	24.44^{bc}	211.27^{e}	3.66^{a}	0.20^{b}	2.74^{ab}	2.60^{a}	0.22^{a}	2.68^{a}
SEm±	4.9	0.53	3.13	0.05	0.004	0.046	0.042	0.003	0.047
LSD	14.38	1.56NS	9.19	0.16	0.011	0.13	0.122	2.07	0.137

Note: Means within the column followed by the same letter(s) are not significantly different at 5% level of significance by DMRT. SEm = Standard Error of Mean, LSD = Least Significant Difference. Significant at $P < 0.05$

CONCLUSION

According to the findings of the study, the combination of drip fertigation at 80% RDF and silver/black mulch significantly increased the majority of the characters viz vegetative, flowering, and NPK content in soil as well as leaves of the gladiolus cv. Pusa Jyotsna as compared to other treatments. Additionally, using 80% RDF + Silver/Black Mulch helps to properly utilise fertilisers by lowering cost by up to 20%, saving labour costs, and having a significant impact on crop yields, quality, growth, and water and nutrient conservation when compared to other conventional irrigation and fertilisation methods.

FUTURE SCOPE

Fertigation and mulching provide a viable option for sustainable crop production and quality produce of gladiolus crop. Farmers may get benefited from this study to precisely use of fertigation and mulch, saving labor and energy cost during production. Further, there is a need of fertigation and mulching studies on high valued flower crops from the present investigation.

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