International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(5): 494-498

Received: 15-06-2020
Accepted: 19-08-2020

Rinkal F Baladha
Department of Horticulture, College of Agriculture, JAU, Junagadh, Gujarat, India

DK Varu
Department of Horticulture, College of Agriculture, JAU, Junagadh, Gujarat, India

SK Bhuva
Department of Horticulture, College of Agriculture, JAU, Junagadh, Gujarat, India

JS Parsana
Department of Horticulture, College of Agriculture, JAU, Junagadh, Gujarat, India

HR Pipaliya
Department of Horticulture, College of Agriculture, JAU, Junagadh, Gujarat, India

Corresponding Author:
Rinkal F Baladha
Department of Horticulture, College of Agriculture, JAU, Junagadh, Gujarat, India

Effect of drip fertigation schedule and different mulches on vegetative growth of gladiolus cv. Psittacinus Hybrid

Rinkal F Baladha, DK Varu, SK Bhuva, JS Parsana and HR Pipaliya

DOI: https://doi.org/10.22271/chemi.2020.v8.i5g.10347

Abstract
The field experiment was conducted at Department of Horticulture, Junagadh Agricultural University, Junagadh during the year October 2016 to April 2018. The experiment was laid out in Randomized Block Design with Factorial concept (FRBD) consisting three factors with three replications. The treatment comprised with three levels of drip fertigation *viz*., water soluble NPK @ 200:200:200 kg/ha (F1), water soluble NPK @ 300:225:225 kg/ha (F2) and water soluble NPK @ 400:250:250 kg/ha (F3); three levels of split application of fertilizer *viz*. 2 split i.e. 30 and 60 DAP (S1), 3 split i.e. 20, 40 and 60 DAP (S2) and 4 split i.e. 15, 30, 45 and 60 DAP (S3) and three different mulches *viz*. red mulch (M1), black mulch (M2) and silver mulch (M3). The effects of these treatments were noted on vegetative growth of gladiolus. Significantly maximum sprouting percentage, plant height (at 30, 60 and 90 DAP), number of leaves (at 30, 60 & 90 DAP), number of effective tillers/plant and number of total tillers/plant, while number of non effective tillers/plant was minimum with the application of drip fertigation of NPK @ 200:200:200 kg/ha (F1), 3 split application of fertilizer (S2) and use of red mulch (M1). For interaction effect, the result was found non significant for all parameters except number of effective tillers/plant was recorded in treatment combinations F1S2, S2M1, F1M1 and F1S2M1.

Keywords: Drip, fertigation, split, application, mulches, hybrids

1. Introduction
Floriculture has become one of the important high valued agricultural industries in many countries of the world. Due to globalization and its effect on income enhancement in different regions of the world, a growing per capita consumption of floricultural products is witnessed in most of the countries. The flowers like gladiolus, jasmine, marigold, chrysanthemum, tuberose and crossandra are the mainstay of India. The estimated area under flower growing in the country is about 3.07 lakh hectares with 18.05 lakh MT productions of loose flowers and 7.04 MT productions of cut flowers. The area under cultivation is maximum
(52.37 thousand hectares) in Karnataka with highest loose flower production (4.26 lakh tonnes) in Tamil Nadu, whereas cut flower production is maximum in West Bengal (2.03 lakh tonnes) (Anon. 2018) [1].
Gladiolus (from Latin, the diminutive of gladius, a sword) is a genus of perennial bulbous flowering plants in the iris family (Iridaceae). Sometimes called the sword lily, the most widely used English common name for these plants is simply gladiolus (plural gladioli, gladioluses or sometimes gladiolas). Gladiolus also known as ‘’Queen” of the bulbous flowers is one of the important ornamental flowering crops of the world. It is a popular cut flower owing to its versatile colours and varieties having larger keeping quality of flower.
Fertilizer management is the most important agro-technique, which controls development, yield and quality of a crop. Fertilizer use efficiency is only 50 per cent in conventional practice of soil application (Vinodh, 2012) [13]. Location specific fertilizer management practices are essential for increasing fertilizer use efficiency for optimizing the fertilizer input and maximizing the productivity.
Fertigation is one such technique of applying nutrients through micro irrigation systems directly at the site of active root zone. Though a new concept in India, it has potential for more accurate and timely crop nutrition leading to increased yields, enhanced quality and early crop maturity. Fertigation also helps in reducing the wastage of nutrients through enhanced

fertilizer use efficiency, besides providing flexibility in timing of fertilizer application in relation to crop demand based on physiological stages of growth (Papadopoulos, 1992) [9].
Mulching is the process or practice of covering the soil/ground to make more favourable conditions for plant growth, development and efficient crop production. Mulching maintains better environment of the soil by conserving soil moisture, increasing soil temperature and suppression of weed's growth. Mulches are of two types, natural mulches and synthetic mulches. When compared to other mulches, plastic mulches are completely impermeable to water; it therefore prevents direct evaporation of moisture from the soil and thus limits the water losses and soil erosion over the surface. In this manner, it plays a positive role in water conservation.

2. Materials and Methods
The present investigation was carried out during the year 2016-18 at Fruit Research Station, Madhadi Baug, College of Agriculture, Junagadh to study the effect of drip fertigation schedule and different mulches on vegetative growth of gladiolus. A field experiment comprised of three factors i.e. factor A, B and C. Factor A consist of 3 levels of drip fertigation of NPK kg/ha(F1 - 200:200:200, F2 - 300:225:225 and F3 - 400:250:250), factor B consist of 3 levels of split application of fertilizer (S1 – 2 split at 30 + 60 days, S2 – 3 split at 30 + 45 + 60 days and S3 – 4 split at 15 + 30 + 45 + 60 days) and factor C consist of 3 type of mulches (M1– Red mulch, M2 – Black mulch and M3 – Silver mulch) with twenty seven treatment combinations replicated thrice in a Factorial Randomized Block Design. The raised beds were prepared with the laying of drip lines and use of different mulches in 35.10 x 10.5 m2 area. Corms were treated with fungicide for healthy growth of plants and planted in lines at 40 cm x 20 cm spacing and 5 cm deep in the soil. Corms were then gently covered with the soil. Observations on growth parameters *viz*., sprouting percentage, plant height (at 30, 60 and 90 DAP), number of leaves (at 30, 60 & 90 DAP), number of effective tillers/plant and number of non effective tillers/plant and number of total tillers/plant. Collected data was statistacially analyzed as per the method given by Panse and Sukhatme (1985) [8]. The appropriate standard error of mean SE (m±) and the critical difference (CD) were calculated at 5% level of probability.

3. Results and Discussion
The data presented in table 1 revealed that, drip fertigation level, split application dose and different mulches had significant effect on growth parameters in gladiolus studied in this experiment.

3.1 Effect of drip fertigation
Significantly maximum sprouting percentage (82.71%), plant height (21.42 cm, 58.02 cm and 75.17 cm at 30, 60 and 90 DAP, respectively), number of leaves per plant (3.23, 6.38 and 8.03 at 30, 60 and 90 DAP, respectively), number of effective tillers per plant (2.07) and number of total tillers per plant (2.28), while minimum number of non effective tillers per plant (0.21) was recorded with the drip fertigation of NPK @ 200:200:200 kg/ha (F1) (Table 1). This might be due to under fertigation, uniform distribution of the nutrients, coupled with confinement in the root zone, might have increased the nutrient uptake thereby leading to higher synthesis of metabolites and their subsequent translocation resulting in enhanced vegetative growth. In case of lowest dose of NPK requirement of crop should be full field, additional dose of nitrogen fertilizer in higher dose was loss due to leaching and high pH in calcareous soil. Higher dose of Phosphorus was combine with Ca2+ and make insoluble calcium phosphate and unavailable to plant, while higher dose of potassium was not uptake by plant due to fix in clay mineral and some amount of leaching. Increased growth of plant is in agreement with the results obtained by Waly *et al*. (2001) [14] and Bashir *et al*. (2016) [3] in gladiolus.

3.2 Effect of split application
In case of split application, variation was also found significant for all growth parameter and highest sprouting percentage (81.06%), plant height (20.96, 56.65 & 71.87 cm at 30, 60
& 90 DAP, respectively), number of leaves (2.89, 6.15 & 7.87 at 30, 60 & 90 DAP, respectively), number of effective tillers per plant (1.80) and number of total tillers per plant (2.02), however number of non effective tillers per plant (0.23) were registered in application of water soluble fertilizer in 3 split i.e. 20, 40 and 60 DAP (S2) (Table 1). This might be due to stage based supply of nutrients in to the plants which resulted to improve nutrient use efficiency for better growth performance. The result was also supported by Kakamani (2013) [7], Sharma (2014) [11] in gladiolus.

3.3 Effect of different mulches
The variation due to different mulches were also found significant and maximum plant height (20.41, 57.07 & 71.46 cm at 30, 60 & 90 DAP, respectively), number of leaves (2.95, 6.14 7 7.93 at 30, 60 & 90 DAP, respectively), number of effective tillers per plant (1.79) and number of total tillers per plant (2.01), while minimum number of non effective tillers per plant (0.23) were obtained in use of red mulch (M1) (Table 1). The result might be due to plant responds to the high proportion of reflected far-red from the red mulch by growing taller and putting out more leaves. It is the colour of the mulch that changes the intensity of certain wave lengths of light that in turn has an impact on plant growth. Maintenance of appropriate soil temperature and higher moisture availability might have favoured better nutrient uptake resulting in better growth and development of plant which ultimately increased growth parameters.

3.4 Interaction effect
For interaction effect, the result was found non-significant for all parameters except number of effective tillers per plant due to due to drip fertigation and split application, split application and different mulches, drip fertigation and different mulches & drip fertigation, split application and different mulches.

3.5 Interaction effect between drip fertigation and split application
Significantly maximum number of effective tillers per plant (2.29) was recorded in treatment combination drip fertigation of NPK @ 200:200:200 kg/ha with 3 split application i.e. 20, 40 and 60 DAP (F1S2) (Table 2). Optimum dose of water soluble fertilizer with uniform distribution of the nutrients at proper time and stage through split by drip fertigation resulted to increase the nutrient uptake thereby leading to higher synthesis of metabolites and their subsequent translocation which might be the proper reason and enhanced effective tillers per plant. These results were supported by Quasim *et*

al. (2008) [10] in rose and Singh and Dilta (2015) [12] in alsroemeria.

3.6 Interaction effect between split application and different mulches

Number of effective tillers per plant (2.09) was found maximum in treatment combination 3 split application i.e. 20, 40 and 60 DAP with use of red mulch (S2M1) (Table 3). This might be due to positive correlation between timely application of fertilizer and red mulch, which maintained appropriate soil temperature. Stage based application of nutrients through split and red mulch might have also improved the soil physical and biological condition of soil resulted to increase the uptake of nutrients.

3.7 Interaction effect between drip fertigation and different mulches

Treatment combination drip fertigation of NPK @ 200:200:200 kg/ha with use of red mulch was observed significantly highest number of effective tillers per plant (2.34) (Table 4). Under drip fertigation, the optimum quantity of NPK coupled with confinement in the root zone and red mulch which, maintain appropriate soil physical and biological parameter might have favoured better nutrient uptake thereby leading to higher synthesis of metabolites and their subsequent translocation resulting in enhanced number of tillers per plant. Further more, these results were supported by Gavhane *et al*. (2004) [4] in marigold and Haidari (2009) [5] in chrysanthemum.

3.8 Interaction effect between drip fertigation, split application and different mulches

Significantly maximum number of effective tillers per plant (2.90) was reported in treatment combination drip fertigation of NPK @ 200:200:200 kg/ha with 3 split application i.e. 20, 40 and 60 DAP in red mulch (F1S2M1) (Table 5). It is true that favourable combination of drip fertigation i.e. optimum dose of water soluble fertilizer, its split application at proper time with use of red mulch which helped to improve the soil condition might be resulted to higher number of effective tillers per plant. The results were supported by Kabariel (2015) [6] in tuberose and Babu *et al*. (2018) [2] in marigold.

Table 1: Effect of drip fertigation, split application and different mulches on growth parameters of gladiolus cv. 'Psittacinus Hybrid'

Treatments	Sprouting percentage	Plant height (cm) (30 DAP)	Plant height (cm) (60 DAP)	Plant height (cm) (90 DAP)	No. of leaves/pl. (30 DAP)	No. of leaves/pl. (60 DAP)	No. of leaves/pl. (90 DAP)	No. of effective tillers/pl.	No. of non effective tillers/pl.	No. of total tillers/pl.
Factor A – Drip Fertigation (NPK @ kg/ha)										
F1	82.71	21.42	58.02	75.17	3.23	6.38	8.03	2.07	0.21	2.28
F2	78.19	20.40	55.08	69.28	2.68	5.76	7.50	1.61	0.24	1.85
F3	75.89	17.44	53.07	64.16	2.35	5.65	7.36	1.19	0.32	1.52
S.Em.±	0.850	0.330	0.852	0.909	0.044	0.084	0.112	0.026	0.005	0.030
C.D. at 5%	2.38	0.92	2.39	2.55	0.12	0.24	0.31	0.07	0.02	0.09
Factor B – Split application										
S1	79.62	19.47	55.51	70.21	2.58	5.95	7.73	1.68	0.25	1.93
S2	81.06	20.96	56.65	71.81	2.89	6.15	7.87	1.80	0.23	2.02
S3	76.11	18.73	54.01	66.60	2.79	5.70	7.29	1.44	0.31	1.72
S.Em.±	0.850	0.330	0.852	0.909	0.044	0.084	0.112	0.026	0.005	0.030
C.D. at 5%	2.38	0.92	2.39	2.55	0.12	0.24	0.31	0.07	0.02	0.09
Factor C – Mulches										
M1	81.00	20.41	57.07	71.46	2.95	6.14	7.93	1.79	0.23	2.01
M2	78.74	19.86	55.43	69.64	2.75	5.91	7.63	1.62	0.27	1.89
M3	77.05	18.99	53.67	67.51	2.58	5.74	7.33	1.47	0.28	1.74
S.Em.±	0.850	0.330	0.852	0.909	0.044	0.084	0.112	0.026	0.005	0.030
C.D. at 5%	2.38	0.92	2.39	2.55	0.12	0.24	0.31	0.07	0.02	0.09
C.V.%	7.91	12.27	11.30	9.61	11.79	10.43	10.80	11.82	10.17	11.89
F X S										
S.Em.±	1.472	0.571	1.475	1.575	0.077	0.146	0.194	0.045	0.009	0.053
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	0.13	NS	NS
S X M										
S.Em.±	1.472	0.571	1.475	1.575	0.077	0.146	0.194	0.045	0.009	0.053
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	0.13	NS	NS
F X M										
S.Em.±	1.472	0.571	1.475	1.575	0.077	0.146	0.194	0.045	0.009	0.053
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	0.13	NS	NS
F X S X M										
S.Em.±	2.549	0.989	2.555	2.727	0.133	0.253	0.336	0.078	0.006	0.091
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	0.22	NS	NS
Year										
S.Em.±	0.694	0.269	0.695	0.742	0.036	0.069	0.092	0.021	0.004	0.025
C.D. at 5%	NS	0.75	1.95	2.08	0.10	NS	0.26	NS	0.01	NS
Y X F X S X M										
S.Em.±	3.605	1.399	3.614	3.857	0.188	0.357	0.476	0.111	0.023	0.129
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Interaction effect of drip fertigation and split application on number of effective tillers per plant of gladiolus cv. 'Psittacinus Hybrid'

Treatments combination	Number of effective tillers per plant
F1S1	2.18
F1S2	2.29
F1S3	1.75
F2S1	1.59
F2S2	1.83
F2S3	1.41
F3S1	1.28
F3S2	1.23
F3S3	1.08
S.Em.±	0.045
C.D. at 5%	0.13

Table 3: Interaction effect of split application and different mulches on number of effective tillers per plant of gladiolus cv. 'Psittacinus Hybrid'

Treatments combination	Number of effective tillers per plant
S1M1	1.75
S1M2	1.68
S1M3	1.61
S2M1	2.09
S2M2	1.77
S2M3	1.48
S3M1	1.51
S3M2	1.42
S3M3	1.30
S.Em.±	0.045
C.D. at 5%	0.13

Table 4: Interaction effect of drip fertigation and different mulches on number of effective tillers per plant of gladiolus cv. 'Psittacinus Hybrid'

Treatments combination	Number of effective tillers per plant
F1M1	2.34
F1M2	2.03
F1M3	1.86
F2M1	1.73
F2M2	1.67
F2M3	1.42
F3M1	1.29
F3M2	1.18
F3M3	1.11
S.Em.±	0.045
C.D. at 5%	0.13

Table 5: Interaction effect of drip fertigation, split application and different mulches on number of effective tillers per plant of gladiolus cv. 'Psittacinus Hybrid'

Treatments combination	Number of effective tillers per plant
F1S1M1	2.24
F1S1M2	2.24
F1S1M3	2.07
F1S2M1	2.90
F1S2M2	2.10
F1S2M3	1.87
F1S3M1	1.9
F1S3M2	1.7
F1S3M3	1.6
F2S1M1	1.74
F2S1M2	1.51
F2S1M3	1.50
F2S2M1	1.99
F2S2M2	1.98
F2S2M3	1.51
F2S3M1	1.47
F2S3M2	1.50
F2S3M3	1.25
F3S1M1	1.29
F3S1M2	1.29
F3S1M3	1.27
F3S2M1	1.39
F3S2M2	1.22
F3S2M3	1.07
F3S3M1	1.20
F3S3M2	1.02
F3S3M3	1.00
S.Em.±	0.078
C.D. at 5%	0.22

4. References

1. Anonymous. The Indian Horticulture Database 2017-18. National Horticulture Board, Gurgaon. Available at http://nhb.gov.in/statistics/State_Level/2017-18 (1st%20Adv.%20Est).pdf accessed on 20 April, 2018.
2. Babu KR, Sumangala HP, Rupa TR, Sangama Nair SA. Effect of fertigation, irrigation and mulching on growth, flowering and yield parameters in African marigold. Int. J Microbial. App. Sci. 2018; 7(3):685-692.
3. Bashir M, Khan I, Qadri RWK, Ashraf U, Waqas MA, Ahif M. Optimization of NP and K to enhance the productivity and quality of *Gladiolus grandiflorus* cv. Essential under semi-arid conditions for Pakistan. Bangladesh J Bot. 2016; 45(2):389-395.
4. Gavhane PB, Kore VN, Dixit AJ, Gondhali. Effect of graded doses of fertilizers and polythene mulches on growth, flower quality and yield of marigold (*Tagetus erecta*) cv. Pusa Narangi Gainda. J Orrisa Hort. 2004; 32(1):35-37.
5. Haidari R. Effect of mulching and fertigation on growth, yield and quality of chrysanthemum var. Chandini. M.Sc. thesis submitted to University of Agricultural Sciences, Bangalore, 2009.
6. Kabariel J. Standardization of fertigation levels, irrigation regimes, micronutrients and growth promoter for improved growth, yield and quality and bulb production in tuberose (*Polianthes tuberose* L.) cv. Prajwal. Ph.D. thesis submitted to Tamilnadu Agricultural University, Coimbatore, 2015.
7. Kakamani C. Effect of graded level of nitrogen and phosphorus in gladiolus (*Gladiolus grandiflorus* L.) cv. White Prosperity. M.Sc. thesis submitted to Dr. Y. S. R. Horticultural University, Venkataramannagudem, West Godavari, 2013.
8. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR Pub., New Delhi, 1985, 327.
9. Papadopoulos I. Fertigation of vegetables in plastic houses: present situation and future prospects. Acta Hort. 1992; 323:151-174.

10. Quasim M, Iftikhar A, Tanveer A. Optimizing fertigation frequency for Rosa hybrida. Pakistan J Bot. 2008; 40(2):533-545.
11. Sharma UB. Effect of bio-fertilizer and zinc on gladiolus (*Gladiolus grandiflorus* L.). Ph.D. thesis submitted to Jiwaji University, Gwalior (M.P.), India, 2014.
12. Singh J, Dilta BS. Studies on effect of growing substrates and NPK doses on growth and flowering of alstromeria (*Alstromeria hybrid* L.). American Int. J Res. in Allied and Natural Sci. 2015; 12(1):01-04.
13. Vinodh S. Studies on optimization of fertigation schedule for Improved growth, yield and quality of Asiatic and oriental lilies (*Lilium* spp.). Ph.D. thesis submitted to Tamil Nadu Agricultural University, Coimbatore, India, 2012.
14. Waly AA, Ali MAM, Hassan MA, Sadek FO. Response of gladiolus plant to different complete fertilizer treatments under North Sinai conditions. Annals Agri. Sci. 2001; 39(3):1665-1680.