Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(2): 719-724
Received: 21-01-2020
Accepted: 24-02-2020

AM Rajesh
College of Horticulture, Tamaka, Kolar, Karnataka, India

KV Jayaprasad
Department of Horticulture, University of Agricultural Sciences, Bangalore, Karnataka, India

HA Yathindra
College of Horticulture, Banavasi Road, Sirsi, Uttara Kannada, Karnataka, India

M Harshavardhan
College of Horticulture, Hunsur Road, Yelwala Yelachenahalli farm, Mysore, Karnataka, India

P Vinaya Kumar Reddy
College of Horticulture, Venkataramannagudem, West Godavari, Andhra Pradesh, India

Corresponding Author:
AM Rajesh
College of Horticulture, Tamaka, Kolar, Karnataka, India

Quality of Dutch rose cultivars influenced by different levels of fertigation, growth regulators and their interaction effects under polyhouse condition

AM Rajesh, KV Jayaprasad, HA Yathindra, M Harshavardhan and P Vinaya Kumar Reddy

Abstract
Increased concentration of gibberellic acid combined with 120 percent of recommended dose of fertilizers as fertigation significantly increased neck diameter, neck length, flower stalk length, stalk diameter and diameter of opened flower respectively. Though all the varieties positively responded for the treatments but variety Grand gala produced significantly superior quality of flower when plants were treated with 120 per cent of fertigation in combination with 300 ppm of GA_3.

Keywords: Fertigation, ppm

Introduction
Floriculture is increasingly regarded as a viable diversification from the traditional field crops due to increased returns per unit and the increasing habit of “saying it with flowers” during all occasions. With the advent of Government of India’s liberalization policies and floriculture development initiatives, several corporate houses have entered to set up 100 per cent export oriented units, since the implementation of the new policies during 1991. These 100 per cent export oriented units are supported with technology and marketing tie up with the collaborators from Netherland and Israel. These were setup in and around Bangalore, Pune, Hyderabad and Delhi, mainly for rose, carnation and anthurium. The area under environment controlled greenhouse is estimated to be around 500 ha. Of this, many have received very encouraging results in terms of acceptance of the quality in the major international markets.
In International floriculture trade, India ranks 198 in flower export. In India, area under floriculture is estimated at nearly 3, 24,000 ha. The total production of flowers in India is 1962 lakh MT of loose flowers and 823 lakh of cut flowers. The total export value of flowers in 2018-19 in India is 42967 lakhs. Among the flowers, rose alone contributes 51 per cent share in the world flower trade. Area under rose cultivation in India is more than 6000 ha. Karnataka is a leading state in rose production. In spite of long tradition of agriculture and floriculture, India’s share in the International market for cut flowers is hardly 0.04 per cent of global trade. The most important cut flower traded in the market is rose.
Although, breeders have developed several rose cultivars having desirable characters, but all the characters could not be incorporated into a single variety. Hence, there is a great need to improve the quality of rose flowers to emulate the flowers of international standard. There are various ways by which quality of flowers can be improved and use of growth regulators combined with fertigation have played a vital role in retarding the senescence, improving quality and prolonging the vase life of flowers. Hence, studies were conducted to know the “Effect of different levels of fertigation and growth regulators on growth, yield and quality of rose cultivars under polyhouse condition”.

Materials and Methods
Two years old healthy budded plants were pruned. The cut ends were treated with blitox (copper oxychloride) at the rate of 2 per cent. Channels were opened at the centre of each bed. They were filled with well decomposed FYM at the rate of 50 kg per bed (bed length 24 m). The beds were irrigated thoroughly to maintain the optimum soil moisture condition. Major nutrients (N, P & K) as per the recommendations were supplied by fertigation in the morning hours. Micronutrients (Multiplex) were supplied as foliar spray at 0.2 per cent at monthly intervals. The nutrients were given in splits at weekly intervals as per treatment.

Growth regulators at required concentrations were prepared. To prepare 200 ppm GA_3, 200 mg of GA_3 was dissolved in 1ml 0.1 N NaOH and volume was increased up to one liter using distilled water. Whereas, humic acid was directly dissolved in water and then applied to plants as foliar spray. The experiment was carried out in two seasons.

Results and Discussion

Higher mean girth of cut flower stalk was noticed in Grand gala (0.69cm & 0.93cm), plants treated with 300 ppm GA_3 (0.71cm & 0.89cm) and in 120 percent fertigation schedule (0.72cm & 1.00cm) in both the seasons respectively. The maximum shoot girth was observed in the interactions between 300 ppm GA_3 x 120 percent fertigation (0.82cm & 1.03cm) and Grand gala x 120 percent fertigation (0.79cm & 1.20cm). However the other interaction Grand gala x 300 ppm GA_3 (0.78cm) produced thicker shoots only in one season.

It was observed that flower stalks of variety Grand gala (62.03cm & 61.27cm), flowers harvested from 300 ppm GA_3 treated plants (59.85cm & 54.06cm) and 120 percent fertigation schedule (59.76cm & 55.60cm) were found to be significantly larger as compared to rest of the treatments in both the seasons respectively. The same trend was continued even in all their interactions.

Application of 120 per cent (59.76cm, 55.60cm and 0.72cm, 1.00cm) of recommended dose as fertigation and GA_3 300 ppm (59.76cm, 55.60cm and 0.71cm, 0.89cm) resulted in longer length and girth of cut flower stalk was depicted in significantly higher values obtained in var. Grand Gala (62.03cm, 61.27cm and 0.69cm, 0.93cm). The same results were reflected in the interaction between var. Grand Gala and 120 per cent fertigation and between GA_3 300 ppm and 120 per cent fertigation. Many workers recorded an increase in the length of cut flower stalk (Johanson, 1978) [6]; Mikio *et al* (1996) [8], Uma and Gowda, (1987) [14] in roses and Pimple *et al*. (2006) [11] in Gerbera with increase in the dosage of fertilizers.

Increase in stalk length and girth due to application of GA confirmed the finding of Sarhan and Sayed (1993) in *Antirrhinum*, Venkatesh Reddy and Nagarajaiah (1986) [15] and Arun *et al.*, (1999) [1] in roses. The role of GA in increasing the plant height during early stage may be acceleration in mitotic activity and subsequent cell division and cell elongation resulting in stem extension. These findings are in line with those of Prabhat Kumar *et al*. (2003) [12] in China, Aster and Jyothi *et al*. (1995) [7] in Chrysanthemum, Dhekney *et al*. (2000) [4] in carnation, Hashemabadi and Zarchini, 2010 [5] in rose.

Neck diameter was maximum in flowers of variety Grand gala (0.24cm & 0.26cm), 300 ppm GA_3 treated plants (0.24cm & 0.29cm) and in plants when exposed to 120 percent fertigation (0.26cm & 0.31cm) in their respective seasons. When interactions were compared it was found that Grand gala x 120 percent fertigation (0.30cm & 0.34cm) and 300 ppm GA_3 x 120 percent fertigation (0.30cm & 0.37cm) significantly superior in both the seasons respectively.

Neck length was maximum in flowers of First Red variety (9.01cm), among the treatments 300 ppm GA_3 (8.57cm) and 120 percent fertigation (8.83cm) significantly increased neck length. Whereas, interaction between First Red x 120 percent fertigation (8.88cm) and 300 ppm GA_3 x 120 percent fertigation (8.86cm) were on par with each other and differed significantly for the character neck length.

These are the varietal characters and will have very slow response to the external factors. However, it was found that var. Grand Gala produced flowers of lengthy neck and having thicker diameter. Same results were noticed with 120 per cent fertigation and 300 ppm gibberellic acid. The results of the present investigation confirmed the earlier result of Nanjan and Muthuswamy (1978), Banker and Mukhopadhyay (1982) [2] and Dhekney *et al*. (2000) [4] who have also reported increased neck length due to GA spray.

It was observed that Grand gala variety (8.14cm & 8.08cm) and 300 ppm GA_3 treated plants (7.74cm & 7.47cm) produced flowers of larger diameter as compared to rest of the treatments in both the seasons respectively. Among the fertigation treatments 120 percent fertigation (7.86cm & 7.73cm) induced maximum flower diameter. The interaction between Grand gala x 120 percent fertigation (8.27cm & 8.37cm) recorded maximum diameter of flower in both the seasons respectively. In another interaction, combination between Grand gala x 300 ppm GA_3 (8.23cm) was significantly superior for the character flower diameter in their respective seasons.

The above results were in accordance with the findings of Arun *et al*. (1999) [1], Sadanand *et al*. (2000) [13] and Nagaraju *et al*. (2003) [9], observed higher bud length in gerbera and rose, respectively grown under low cost polyhouse. These results are also comparable with the findings of Dhekney *et al*. (2000) [4], Chakradhar *et al*. (2003) [3] where they observed the highest bud conditions which were attributed to the genetic response of the cultivars to the treatments.

Table 1: Neck length and Neck diameter of flower stalk as influenced by varieties, growth regulators and levels of fertigation

Particulars	Mean neck length (cm)		Mean neck diameter (cm)	
Varieties	**Season 1**	**Season 2**	**Season 1**	**Season 2**
V_1-First Red	4.91	9.01	0.18	0.22
V_2-Noblesse	4.80	8.15	0.20	0.22
V_3-Gold Strike	3.97	7.69	0.17	0.21
V_4- Grand Gala	6.60	8.65	0.24	0.26
F-test	NS	*	*	*
SEm ±	0.94	0.04	0.005	0.004
CD at 5%	-	0.15	0.020	0.014
Growth regulators		*		
G_1-200 ppm GA_3	5.11	8.38	0.20	0.23
G_2-300 ppm GA_3	5.37	8.57	0.24	0.29
G_3-0.2% Humic acid	4.87	8.23	0.16	0.19
G_4-0.4% Humic acid	4.93	8.32	0.18	0.21
F-test	NS	*	*	*
SEm ±	0.27	0.12	0.004	0.005
CD at 5 %	-	0.44	0.01	0.018
Fertigation				
F_0-100% RDF Soil application	4.83	8.05	0.15	0.15
F_1-80% Fertigation	4.95	8.25	0.18	0.23
F_2-120% Fertigation	5.43	8.83	0.26	0.31
F-test	NS	*	*	*
SEm ±	2.01	0.02	0.02	0.01
CD at 5 %	-	0.10	0.07	0.06

Table 2: Neck length and Neck diameter of flower stalk as influenced by interaction between variety and growth regulators and variety and fertigation

Particulars	Mean neck length (cm)		Mean neck diameter (cm)	
V X G	**Season 1**	**Season 2**	**Season 1**	**Season 2**
V_1G_1	4.98	9.00	0.18	0.23
V_1G_2	5.18	9.28	0.21	0.27
V_1G_3	4.71	8.85	0.15	0.18
V_1G_4	3.58	6.68	0.12	0.14
V_2G_1	4.86	8.16	0.21	0.24
V_2G_2	5.21	8.39	0.26	0.28
V_2G_3	4.51	8.00	0.16	0.18
V_2G_4	4.62	8.06	0.17	0.19
V_3G_1	4.91	8.00	0.20	0.21
V_3G_2	4.35	7.86	0.21	0.26
V_3G_3	3.76	7.54	0.14	0.19
V_3G_4	2.83	5.75	0.11	0.16
V_4G_1	6.68	8.66	0.27	0.30
V_4G_2	6.75	8.77	0.30	0.33
V_4G_3	4.89	6.39	0.15	0.16
V_4G_4	4.92	6.48	0.17	0.17
F-test	NS	NS	NS	NS
SEm ±	0.55	0.05	0.009	0.01
CD at 5 %	-	-	-	-
V X F				
V_1F_0	4.70	8.72	0.13	0.12
V_1F_1	4.88	8.91	0.19	0.23
V_1F_2	5.15	9.39	0.22	0.30
V_2F_0	4.28	7.88	0.15	0.15
V_2F_1	4.7	8.02	0.17	0.20
V_2F_2	5.41	8.57	0.28	0.32
V_3F_0	3.97	7.35	0.12	0.16
V_3F_1	3.72	7.55	0.13	0.22
V_3F_2	4.21	8.18	0.24	0.26
V_4F_0	6.36	8.25	0.19	0.19
V_4F_1	6.50	8.51	0.24	0.25
V_4F_2	6.95	9.18	0.30	0.34
F-test	NS	NS	*	*
SEm ±	1.00	0.06	0.01	0.009
CD at 5 %	-	-	0.03	0.030

Table 3: Neck length and Neck diameter of flower stalk as influenced by interaction between fertigation and growth regulators

Particulars	Mean neck length (cm)		Mean neck diameter (cm)	
G X F	**Season 1**	**Season 2**	**Season 1**	**Season 2**
G_1F_0	4.78	8.01	0.15	0.15
G_1F_1	5.04	8.26	0.19	0.23
G_1F_2	5.49	8.88	0.28	0.31
G_2F_0	5.14	8.19	0.17	0.18
G_2F_1	5.19	8.39	0.22	0.30
G_2F_2	5.76	8.86	0.30	0.37
G_3F_0	4.65	7.98	0.12	0.14
G_3F_1	4.78	8.13	0.16	0.19
G_3F_2	5.19	8.59	0.20	0.25
G_4F_0	4.74	8.03	0.15	0.15
G_4F_1	4.80	8.22	0.17	0.18
G_4F_2	5.25	8.71	0.22	0.29
F-test	NS	*	*	*
SEm ±	0.47	0.05	0.007	0.009
CD at 5 %	-	0.17	0.02	0.031

Table 4: Shoot girth as influenced by varieties, growth regulators and levels of fertigation

Particulars	Mean shoot girth (cm)	
Varieties	**Season 1**	**Season 2**
V_1-First Red	0.64	0.78
V_2-Noblesse	0.69	0.77
V_3-Gold Strike	0.52	0.70
V_4-Grand Gala	0.69	0.93
F-test	*	*
SEm ±	0.003	0.01
CD at 5 %	0.011	0.05
Growth regulators		
G_1-200 ppm GA_3	0.60	0.77
G_2-300 ppm GA_3	0.71	0.89
G_3-0.2 % Humic acid	0.56	0.75
G_4-0.4 % Humic acid	0.66	0.78
F-test	*	*
SEm ±	0.004	0.01
CD at 5 %	0.014	0.04
Fertigation		
F_0-100 % RDF Soil application	0.57	0.62
F_1-80 % Fertigation	0.61	0.77
F_2-120 % Fertigation	0.72	1.00
F-test	*	*
SEm ±	0.01	0.05
CD at 5 %	0.05	0.18

Table 5: Shoot girth as influenced by interaction between variety and growth regulators and variety and fertigation

Particulars	Mean shoot girth (cm)	
V X G	**Season 1**	**Season 2**
V_1G_1	0.60	0.72
V_1G_2	0.74	0.88
V_1G_3	0.55	0.76
V_1G_4	0.50	0.57
V_2G_1	0.66	0.69
V_2G_2	0.75	0.69
V_2G_3	0.64	0.64
V_2G_4	0.70	0.69
V_3G_1	0.55	0.83
V_3G_2	0.58	0.86
V_3G_3	0.46	0.72
V_3G_4	0.41	0.57
V_4G_1	0.75	0.96
V_4G_2	0.78	1.01
V_4G_3	0.45	0.66
V_4G_4	0.55	0.68
F-test	*	NS
SEm ±	0.008	0.02
CD at 5 %	0.029	-
V X F		
V_1F_0	0.58	0.76
V_1F_1	0.62	0.64
V_1F_2	0.72	0.94
V_2F_0	0.63	0.65
V_2F_1	0.64	0.61
V_2F_2	0.79	0.86
V_3F_0	0.47	0.59
V_3F_1	0.51	0.74
V_3F_2	0.58	0.99
V_4F_0	0.60	0.94
V_4F_1	0.67	0.65
V_4F_2	0.79	1.20
F-test	*	*
SEm ±	0.007	0.02
CD at 5 %	0.025	0.09

Table 6: Shoot girth as influenced by interaction between fertigation and growth regulators

Particulars	Mean shoot girth (cm)	
G X F	Season 1	Season 2
G_1F_0	0.57	0.77
G_1F_1	0.59	0.62
G_1F_2	0.63	0.93
G_2F_0	0.61	0.84
G_2F_1	0.68	0.66
G_2F_2	0.82	1.03
G_3F_0	0.54	0.60
G_3F_1	0.55	0.73
G_3F_2	0.60	0.91
G_4F_0	0.57	0.75
G_4F_1	0.62	0.61
G_4F_2	0.80	0.98
F-test	*	*
SEm ±	0.007	0.021
CD at 5 %	0.020	0.074

Table 7: Flower shoot length and mean diameter of opened flower as influenced by varieties, growth regulators and levels of fertigation

Particulars	Mean flower shoot length (cm)		Mean diameter of opened flower (cm)	
Varieties	Season 1	Season 1	Season 1	Season 2
V_1-First Red	51.80	7.34	7.34	7.10
V_2-Noblesse	48.79	7.69	7.69	6.95
V_3-Gold Strike	60.20	7.40	7.40	7.14
V_4- Grand Gala	62.03	8.14	8.14	8.08
F-test	*	*	*	*
SEm ±	0.24	0.01	0.01	0.05
CD at 5%	0.85	0.03	0.03	0.18
Growth regulators				
G_1-200 ppm GA_3	57.61	7.67	7.67	7.33
G_2-300 ppm GA_3	59.85	7.74	7.74	7.47
G_3-0.2% Humic acid	53.13	7.56	7.56	7.17
G_4 - 0.4% Humic acid	52.21	7.58	7.58	7.27
F-test	*	*	*	*
SEm ±	0.23	0.01	0.01	0.03
CD at 5 %	0.82	0.04	0.04	0.10
Fertigation				
F_0-100% RDF Soil application	51.95	7.46	7.46	6.85
F_1-80% Fertigation	55.40	7.61	7.61	7.37
F_2-120% Fertigation	59.76	7.86	7.86	7.73
F-test	*	*	*	*
SEm ±	1.04	0.05	0.05	0.15
CD at 5 %	3.60	0.19	0.19	0.53

Table 8: Flower shoot length and mean diameter of opened flower as influenced by interaction between variety and growth regulators and variety and fertigation

Particulars	Mean flower shoot length (cm)		Mean diameter of opened flower (cm)	
V X G	Season 1	Season 2	Season 1	Season 2
V_1G_1	54.46	52.45	7.40	7.09
V_1G_2	57.97	54.33	7.50	7.22
V_1G_3	47.91	49.14	7.20	6.99
V_1G_4	35.15	35.46	5.44	5.33
V_2G_1	50.12	49.91	7.72	6.97
V_2G_2	52.57	51.41	7.77	7.15
V_2G_3	46.72	46.61	7.64	6.79
V_2G_4	45.74	46.07	7.63	6.88
V_3G_1	61.43	51.08	7.68	7.51
V_3G_2	62.60	46.53	7.47	7.30
V_3G_3	58.78	41.54	7.36	6.99
V_3G_4	43.50	30.59	5.50	5.31
V_4G_1	65.36	63.53	8.18	8.11
V_4G_2	66.26	63.98	8.23	8.22
V_4G_3	44.35	44.98	6.04	5.94
V_4G_4	43.70	43.92	6.09	6.05
F-test	*	NS	*	NS
SEm ±	0.47	0.44	0.02	0.06

CD at 5 %	1.64	-	0.08	-
V_1F_0	47.44	44.89	7.18	7.20
V_1F_1	51.59	51.89	7.22	6.70
V_1F_2	56.36	55.63	7.61	7.39
V_2F_0	45.20	44.28	7.40	7.08
V_2F_1	46.29	46.50	7.73	6.37
V_2F_2	54.88	54.72	7.94	7.38
V_3F_0	56.00	40.51	7.27	7.07
V_3F_1	61.91	42.65	7.32	6.57
V_3F_2	62.68	46.96	7.60	7.77
V_4F_0	59.16	56.80	7.98	8.12
V_4F_1	61.83	61.94	8.16	7.74
V_4F_2	65.10	65.08	8.27	8.37
F-test	*	NS	*	*
SEm ±	0.52	0.54	0.02	0.07
CD at 5 %	1.80	-	0.09	0.26

Table 9: Flower shoot length and Mean diameter of opened flower as influenced by interaction between fertigation and growth regulators

Particulars	**Mean flower shoot length (cm)**		**Mean diameter of opened flower (cm)**	
G X F	**Season 1**	**Season 2**	**Season 1**	**Season 2**
G_1F_0	54.38	47.73	7.43	6.87
G_1F_1	56.54	51.86	7.62	7.38
G_1F_2	61.92	57.60	7.93	7.74
G_2F_0	56.63	48.39	7.52	7.05
G_2F_1	58.25	52.94	7.64	7.47
G_2F_2	62.84	58.33	7.95	7.60
G_3F_0	48.69	45.61	7.41	6.64
G_3F_1	53.88	49.60	7.57	7.28
G_3F_2	56.84	52.74	7.70	7.60
G_4F_0	48.10	44.75	7.44	6.80
G_4F_1	52.95	48.58	7.60	7.35
G_4F_2	55.60	51.20	7.71	7.68
F-test	*	*	*	NS
SEm ±	0.41	0.38	0.02	0.05
CD at 5 %	1.42	1.31	0.07	-

References

1. Arun DS, Ashok AD, Rengasamy P. Effect of different growth regulators on nutrient and pigment composition of First Red rose grown under protected conditions. South Indian Hort. 1999; 1-6:119-124.
2. Banker GJ, Mukhopadhya A. Gibberellic acid influences growth and flowering of rose cv. Queen Elizabeth. Indian J Hort. 1982; 39:130-133.
3. Chakradhar M, Khirtkar SD, Rosh K. Effect of growth regulators on flower quality and vase life of rose cv. Gladiator. J Soil and Crops. 2003; 13(2):374-377.
4. Dhekney SA, Ashok AD, Rengaswamy P. Effect of some growth regulating chemicals on growth and flowering of rose cv. First Red under greenhouse conditions. J Ornamental Hort. New Series. 2000; 3(1):51-53.
5. Hashemabadi D, Zarchini M. Yield and quality management of rose (*Rosa hybrida* cv. Poison) with plant growth regulators. Plant Omics. 2010; 3(6):167-171.
6. Johanson J. Effects of nutrient levels on growth, flowering and leaf nutrient content of greenhouse roses. Acta Agriculture Scandinavica. 1978; 28(4):363-386.
7. Jyothi PD, Seemanthuni R, Abdul K. Effect of growth regulators on flower production in chrysanthemum. Prog. Hort. 1995; 27(3-4):205-2080.
8. Mikio N, Hitoshi Y, Mituharau K. The influence of porous ceramic particle size and fertigation quantity on the yield and quality of roses grown in soilless culture. J Japan Soc. Hort. Sci. 1996; 70(5):650-655.
9. Nagaraju CG, Reddy JV, Madaiah D. Effect of N, K and multiplex on growth, production and quality at harvest of field grown roses cv. Gladiator. J Ornamental Hort. 2003; 6(4):287-293.
10. Nanjan K, Muthuswamy S. Growth and flowering responses of Edward rose (*Rosa bourboniana*) to certain growth regulant sprays. South Indian Hort. 1975; 23:94-99.
11. Pimple AG, Dalals SR, Nanadre SM. Yield and quality of Gerbera influenced by nitrogen and phosphorous level under polyhouse cultivation. International J Agric. Sci. 2006; 2(2):320-321.
12. Prabhat Kumar, Raghava SPS, Mishra RL, Krishna P Singh. Effect of GA_3 on growth and yield of China aster. J Ornamental Hort. 2003; 6(2):110-112.
13. Sadanand DA, Ashok AD, Rangaswamy P. Effect of some growth regulating chemicals on growth and flowering of rose cv. First Red under greenhouse conditions. J Ornamental Horticulture, New Series. 2000; 3(1):51-53.
14. Uma S, Gowda JV. Studies on effect of pruning, nutrients and their interaction on growth and flowering or rose cv. ‘Super Star’. Mysore J Agric. Sci. 1987; 21(4):455-460.
15. Venkatesh RT, Nagarajaiah C. Quality of ‘Queen Elizabeth’ cut roses as influenced by gibberellic acid. Mysore J Agric. Sci. 1986; 20:292-295.