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Study of flowering behaviour and vase life by the action of various plant growth regulators in *Rosa hybrida* L. cv gladiator

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Abstract
A field experiment on the influence of plant growth regulators on flowering behavior and vase life of rose (*Rosa hybrid* L,) cv, "Gladiator" was conducted at Floriculture Research Scheme, Regional Horticulture Research Station, ASPEE College of Horticulture and Forestry, Gujarat Agricultural University, Navsari during 2002-2003. Four different concentrations of GA_3 (100, 150, 200 and 250 mg/l), BA (50, 100, 150 and 200 mg/l) and ethrel (200, 300, 400 and 500 mg/l) was compated with control. Thirteen treatments along with control were laid out in a Randomized Block Design (RBD) with and three replications. The highest weight of single flower (26.3 g) was obtained with GA_3 250 mg/l. The maximum number and weight of petals per flower were recorded in GA_3 250 mg/l. Number of flowers per plant was obtained highest with GA_3 250 mg/l which was at par with GA_3 200 mg/l and number of flowers per hectare was increased with an application GA_3 250 mg/l. Highest shelf life and vase life of cut rose flower was obtained with GA_3 250 mg/l.

Keywords: GA_3, BA, ethrel, flowering behaviour, vase life, rose

Introduction
In our country the flowers are used for worship in home, temple, mosque and tomb by making garlands and bouquets. The flowers are used in all occasion of festivals, religious or social functions. In this way, flowers are among the loveliest object on this earth of ours and among them the rose in the most common. In todays modern world rose is the highest demanded flower in cut flower production and its market and it ranks first in international flower trade. The annual consumption of rose as cut flower in the world is worth 1.5 billion US dollars (Reddy, 1999) [10].

The *Rosa hybrida* L. is a vigorous shrub with mild fragrance, foliage soft gray-green, the leaflets oval, usually three to five leaf. Branches very prickly with hooked. Flower are of large size, bleaming red colour of cv. Gladiator. The growth, yield and quality of flowers were influenced by various viz., varieties, cultivation practices, use of plant growth substances and plant protection. Among them plant growth substances are important factors which improves flowering, yield and quality of flowers, Keeping this view in mind a the present investigation to study the floral characters and keeping quality of flower influenced by plant growth regulators was undertaken in agroclimatic conditions of south Gujarat

Materials and Methods
The present investigation to study the "Influence of plant growth regulators on flowering and quality of rose (*Rosa hybrida* L.) cv. "Gladiator" was carried out at the Floriculture Research Scheme, Regional Horticulture Research Station in Block-E, ASPEE College of Horticulture and Forestry, Gujarat Agricultural University, Navsari during the year 2002-2003.The soil of experimental field was deep black rich in organic matter and potash, having good water holding capacity with fairly good drainage. The climate of this region is tropical characterized by fairly hot summer. Moderately cold winter and most humid and warm monsoon. The monsoon sets during the second fortnight of June and ends by the second fortnight of September. Two year old rose plant (*Rosa hybrida* L.) cv. "Gladiator" which are well established at experimental Farm of Floriculture Research Scheme, Regional Horticulture Research Station, Gujarat Agricultural University, Navsari were selected for present study.

Two year old rose plant (*Rosa hybrida* L.) cv. "Gladiator" which are well established at experimental Farm of Floriculture Research Scheme, Navsari were selected for present study. Pruning was done in the first week of November. Farmyard manure @ 15t/ha and NPK @ 150-150-150 kg/ha was given to this crop. FYM, half dose of nitrogen and full dose of phosphorus and potash were applied as a basal dose i.e. after pruning and remaining half dose

of nitrogen was applied after one month of first application. Irrigation was given immediately after fertilization of the crop. The irrigation was given at an interval of 15 days and 8-10 days during winter and summer, respectively. Weeding and hoeing were done as and when required and crop kept free from weeds. The experiment was laid out in Randomized Block Design (RBD) with 13 treatments replicated thrice with Ist spray one month after pruning and II nd spray one month after first spray.

Gibberellic acid 100, 150, 200 and 250 mg was measured individually and dissolved in a little quantity of 95 percent absolute alcohol in different beakers and final volume was made one litre with distilled water. Benzyl adenine 50, 100, 150 and 200 mg was measured individually and dissolved in a little quantity of 0.1 N NaOH in different beakers and final volume was made one liter by adding distilled water. Ethrel 0.5, 0.75, 1 and 1.25 ml was measured individually and final volume was made one litre by adding distilled water. Ethrel used was of 40 per cent aqueous solution. Both the surface of the leaves and apical meristem were fully moistened. Tipol was added as a sticky agent. Spraying was done in the morning by means of Ganesh hand sprayer.

Three plants in each plot were selected at random from the net plot of each treatment and tagged for recording the observations. Fresh weight of 5 flowers at each harvest was recorded from tagged plants and later on the average weight of single flower in grams was worked out. Size of five flowers from each plot was measured in centimeter by using vernier caliper and average value was worked out. Petals from tagged flowers were separated from each flower and counting of petals on precision balance. Later on average number of petals per flower was worked out. The number of flowers per plant was recorded at a time of each harvesting. Finally total number of flowers per plant was calculated on the basis of three selected plants. At the time of every picking flowers were counted by summarizing them all total number of flowers per plot was calculated. The observation was recorded by counting the days from the date of flower bud opening till the flower were no longer remained fit for selling in market from the five tagged flower of the net plot area.

Three fully opened flowers were plucked from each treatment and their cut ends were immediately immersed in distilled water. In the laboratory, flower stalks were cut so as to maintain their uniform stem length. Then the cut ends were kept in a beaker containing distilled water treatment wise. Distilled water was added whenever necessary to maintain the original level and the stem end was cut about half inch every alternate day. The vase life was expressed as the number of days from harvest until the flower were no longer remained fit as a cut flower.

Result and Discussion

Effect on Flowering Behaviour

a) Weight of flower

Data shown in the Table 1 indicates that the gibberellic acid increases the weight of flower. The increase in flower weight may be due to the increased flower size. A similar trend was also reported by Bhattacharjee (1985) [5] in *Jasminum arhorescences.* It is apparent from the table-1 that all the levels of ethrel significantly increased the weight of flower. Bhattacharjee and Divakar (1985) [5] also observed similar trend in jasmine.

b) Weight of petals

The perusal of data from Table-1 indicated that 250 mg/l treatment of GA_3 and weight of petals per flower significantly increased number. The maximum number (77.6) and weight (16.6 g) of petals were obtained with GA_3 250 mg/1. Increase in number and weight of petals of rose was also reported by Gowda (1988) [9] and Bhattacharjee (1993) [4] in rose. It is apparent from table 1 that ethrel at 400 mg/l significantly increased the number and weight of petals per flower in rose. Similar trend was also recorded by Anonymous (1992) in rose.

c) Number of flower

It was observed from the Table-1 that the number of flowers per plant was increased significantly with the increasing levels of gibberellic acid. GA_3 through alpha-amylase activity, auxin stimulating effect and cell wall loosing, increased cell elongation along with cell enlargement. All this causes effect on increased leaf area, thereby causing increased photosynthetic area. Thus, this caused increase in carbohydrates food material. Similar trends were in consonance with Bankar and Mukhopadhay (1982) [2], Gowda (1985 and 1988) [8, 9], Bhattacharjee (1993) [5] and Dhekney *el at.* (2000a) [6] on rose. Likewise, the number of flowers per plant was also increased with an application of BA. Similar results were also recorded by Dhekney *et al.* (2000) [6] in rose. It is revealed from the table that number of flowers per plant was significantly increased with all the concentrations of ethrel. Increased number of flowers per plant caused by ethrel application in the present study is in agreement with the results observed in rose by Farooqi and Sharma (1988) [7] in rose. The reasons for increasing number of flowers per plant are due to increasing the number of branches in ethrel treated plant.

Effect on shelf life

The data presented in Table-1 reveals that cut flowers obtained from plants which were treated with GA_3 shows the maximum vase life (11.4 days) as compared to other treatments as well as control. This might be due to higher stalk length as well as more number of petals content. GA_3 increased flower size and number of branches, which increased stored food material in the tissue, which caused increase in vase life of flowers indirectly. The positive effects of GA_3 on extending the vase life observed in the present study are in consonance with the findings of Dhekney *et al.* (2000) [6]. Likewise vase life also increased with an application of BA might be due to checks the loss of dry weight of maturing flower and also maintained cell integrity. Similar trend was also observed by Dhekney *el al.* (2000) [6]. Further, ethrel also increase vase life of rose as compared to control. Similar observation was also recorded by Singh and Bhattacharjee (1998) [5] in Raktagandha roses.

Table 1: Effect of various plant growth regulators on flowering behavior and vase life of Rose

Treatments	Weight of single flower (gm)	Flower size (cm)	Number of peals/ flower	Weight of petals/ flower (gm)	Number of flowers/ plant	Number of flowers/ha	Shelf life	Vase life
GA_3 100 mg/l	24.5	12.0	75.5	14.9	102.4	1006681.2	17.5	8.4
GA_3 150 mg/l	24.7	12.2	76.4	15.1	104.3	1080681.2	18.6	9.0
GA_3 200 mg/l	25.3	13.9	76.9	15.3	108.2	1108243.7	19.4	10.7

GA_3 250 mg/l	26.3	14.4	77.6	16.6	120.1	1197812.5	20.9	11.4
BA 50 mg/l	22.0	10.4	65.8	13.2	93.5	939202.0	16.2	7.5
BA 100 mg/l	22.6	10.7	67.0	13.4	97.2	990268.7	18.7	8.0
BA 150 mg/l	23.5	12.4	62.6	13.6	100.3	1007110.4	20.6	8.5
BA 200 mg/l	24.2	11.8	70.0	14.0	98.8	996343.7	16.1	8.7
Ethrel 200 mg/l	20.7	10.2	60.3	12.0	84.7	803797.9	14.5	7.3
Ethrel 300 mg/l	21.7	10.4	61.4	12.1	87.7	818739.5	14.7	6.8
Ethrel 400 mg/l	22.3	11.1	62.3	12.2	90.1	859002.0	15.0	6.4
Ethrel 500 mg/l	22.6	9.2	60.8	12.1	91.6	868106.2	13.0	6.5
Control	17.7	7.4	56.5	11.3	79.8	619629.1	9.9	5.9
CD 5%	4.2	2.0	12.0	2.0	18.1	109689.4	3.3	0.7
CV %	10.9	10.7	10.6	9.1	11.1	13.0	11.9	5.4

Conclusion

The maximum weight of single flower (26.3 g) was recorded with spraying of GA_3 250 mg/I, while minimum was recorded with control (17.7 g). The number of petals per flower was significantly influence by GA_3 250 mg/l being 77.6, whereas lowest number (56.5) of petals per flower was obtained with control. The maximum weight of petals per flower was recorded with GA_3 250 mg/l (16.6 g), while minimum (11.3 g) with control. Among the various treatments, an application of GA_3 250 mg/l produced longest shelf life (20.9) of flowers of rose cv. "Gladiator" while from untreated plant exhibited minimum shelf life (9.9) days. The maximum number of flower (120.1) per plant was recorded with an application of GA_3 250 mg/I whereas minimum (79.8) was obtained with control. Longest vase life was recorded with treatment GA_3 250 mg/l (11.4), while minimum with control (5.9) days. Application of GA_3 250 mg/l recorded maximum number of flowers per hectare (1157812.5) while minimum with control (719629.0).

Based on these experimental results, it can be concluded that an application of GA_3 250 mg/l found to be the most effective treatment for increasing weight and number of petals, shelf life and vase life with respect to rest.

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