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EFFECT OF GIBBERELLIC ACID ON GROWTH AND FRUIT YIELD OF GRAPE CULTIVAR 'FLAME SEEDLESS'

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ABSTRACT

Gibberellic acid (GA_3), a plant growth regulator is commonly used for berry enlargement in grapes. Flame seedless grapes vines, grown at NARC, Islamabad, were sprayed at bloom and fruit set (just after berry shatter) with GA_3, at the concentration of 15ppm, 20pp and 25ppm. For each treatment, GA_3 was applied twice with the first spray at 80% blooming and second spray a week later just at fruit set. Water was sprayed to serve as a control. Average cluster and berry weight of sprayed vines increased significantly over the non-sprayed vines and the largest cluster weight depicted as fruit yield per vine (344.22g) was found in the treatment with highest concentration of GA_3 (25ppm). Maximum berry weight, width, length and TSS i.e. 2.82g, 1.79cm, 1.85cm and 19.00% respectively, were recorded at 25ppm. Statistical differences were observed for cluster weight, berry weight, berry width, length and TSS with GA_3 at 15ppm and 20ppm. Based on this research, 25ppm of GA_3 is recommended for spray on the flame seedless grape cultivar for obtaining higher yield and better quality.

Key Words: Gibberellic acid, spray, grape, berry yield and T.S.S.

INTRODUCTION

Grape (*Vitis* vinifera L.) is one of the earliest fruits grown by man. Among the fruits, grape occupies first position in the world with respect to area and production. Total area of cultivation is 61,300 ha and the total world production was 46, 97,000 MT (FAO, 2003). Grape cultivar, flame seedless is a complex hybrid, where parents include Sultania, Malaga and Muscatd, Alexander, and was developed in the early 1960, by John Weinberger in California. In Pakistan, during 2007-08, total area under grape cultivation was 15,000 ha and the production was 75.3 thousand tones (Government of Pakistan, 2007-08).

Gibberellic acid is specially used in viticulture. It affects grape berry by means of different ways. Some of these effects include formation of flower cluster, berry set, berry enlargement, cluster length, berry thinning in cluster and prevention of berry cracking (Korkutal *et al*., 2008). GA_3 proved most effective in increasing bunch size, bunch weight. And fruit yield while the quality of grapes in terms of T.S.S., acidity, T.S.S/ acid ratio and reducing sugar were significantly improved. During storage, at room temperature, minimum physiological loss in weight (PLW) was observed with girdling plus 40 ppm GA, thus extending shelf life up to three days (Ahmed *et al*., 2005). Gibberellins are known to increase the parthenocarpic fruit production like Auxins and even they are some times more efficient (Bora and Sarma, 2006). Avenant and Avenant (2006) reported that the combination of GA_3 and CPPU delayed sugar accumulation (ripening), but improved berry firmness.

Dokoozlian *et al*., (2000) applied one gram of GA_3 per acre and found that 80% to 90% bloom reduces fruit set and increases berry length and berry weight. GA_3 has also proved to be useful for stimulating early and even ripening seedless grapes. Panwar *et al*. (1994) illustrated that the application GA_3 made in the periods of inflorescence and small grape berries reaching (10 day later than full bloom), make important effects on grape berry hardness and the elasticity of the skin. Brown *et al*. (1997) explained some techniques such as, the Gibberellic acid application and girdling to Improve berry set. It supports branching after fallen grape grains after inadequate granulation and it takes part in fruit efficiency. The above findings clearly indicate that the use of GA_3 is beneficial for enhancing yield and grape quality. Main objective of the present study was to check the positive effect of GA_3 on grape cv. Flame seedless, which is being popularized in humid and rainy climate of Islamabad due to early ripening before the onset of rains.

MATERIALS AND METHODS

A study was conducted to examine the response of table grapes cv. Flame seedless, to foliar GA_3 spray in 2009 on twenty years old table grape vineyard at NARC. Grape vines were planted at row to row and plant to plant 3 x 1.5m. The plants were grown on a single wire trellis system at experimental vineyard.

The experiment was of a randomized complete block design, in triplicate fashion. each replicate having 3 vines. The numbers of clusters /vine were not adjusted but the average 24 clusters/ vine were adjusted. The spray material

was applied in full coverage with a hand sprayer. Different concentrations of GA_3 (15ppm, 20ppm and 25ppm) were applied. Bloom treatments were applied in 2009, in two splits. The first spray was at 70-80% bloom (on 3rd April) followed by second spray after the post bloom treatments, were applied just after fruit setting (on 7th May). Three vines were used for each treatment.

After the fruits were fully mature, three clusters were randomly harvested from each vine to determine the cluster fruit weight, berry weight, 100 berry weight, berry width, berry length and total soluble salts (determined by hand refractometer).

The data obtained was analyzed statistically by computer using "Statistics 8.1" package and the means were compared using least significance difference (LSD) test at 0.05% significant level using "Statistics 8.1" (Steel and Torri, 1984). All data presented here is on the basis of fresh weight.

RESULTS AND DISCUSSION

Results regarding all seven characteristics showed significant difference among the treatments (Table 1). The largest cluster numbers resulted when the plants were sprayed with GA_3 at 25ppm (Fig. 1). This increase may be due to the increase in both in the number of berries and the size of cluster. This characteristic was significant at 15 and 25ppm GA_3 spray.

Table 1. Effect of GA_3 on the yield and quality traits in grape cv. 'Flame seedless'

Treatments	No. of Clusters / vine)	No. of berries / cluster	Average Berry Wt.(g)	100 berry wt. (g)	Berry Length (cm)	Berry Width (cm)	Fruit Yield / vine (g)	T.S.S. (Brix %)
Control	**16.33 c**	**72.33 d**	**1.66 c**	**166.66 c**	**1.60 c**	**1.49 b**	**261.82 c**	**17.25 b**
15 ppm	**26.00 b**	**88.33 c**	**2.24 b**	**224.63 b**	**1.66 bc**	**1.58 b**	**305.22 bc**	**17.81 b**
20 ppm	**22.00 bc**	**101.00 b**	**2.13 b**	**213.63 b**	**1.70 b**	**1.76 a**	**298.33 b**	**18.05 ab**
25 ppm	**34.00 a**	**118.66 a**	**2.82 a**	**282.22 a**	**1.85 a**	**1.79 a**	**344.22 a**	**19.00 a**
LSD value (0.05 %)	**6.7506**	**9.8498**	**0.3536**	**35.808**	**0.0859**	**0.126**	**37.309**	**1.0922**

Data regarding number of berries/cluster, the vines treated with GA_3 in 15ppm or higher concentration produced large number of berries per cluster than control (Table 1) while no statistical differences were found among the GA_3 treatments. Gaser *et al*. (1998) found that GA_3 concentration at 05, 15 and 40 ppm have no effect on berries per cluster.

Appreciable increase in berry weight (2.82g) was observed with 25ppm GA_3 (Fig. 2). Reynolds *et al*. (2006) also observed similar results, while working on Sovereign coronation table grapes in which he however, applied 20mg/L at bloom and 40-100mg/L post bloom. Applications of GA_3 or basal leaf removal, gibberellic acid increased yield and berry weight.

Results regarding 100 berry weight (Fig. 3), the number and average berry weight. 100 berries were collected at random from different parts of the clusters. GA_3 treated vines also produced significantly higher 100 berry weight than the control. There was a tendency that higher the GA applied, higher the 100 berry weight produced. The largest berry weight (282.22g) was found in 25ppm and was 69% higher than control. (Pires *et al.*, 2000) found that, girdling + 40ppm GA_3 proved most effective in increasing bunch size, bunch weight and yield.

Data regarding berry length (1.85cm) given in Fig.4 and berry width (1.79cm) in Fig.5, the largest berry length and width was also observed in 25ppm treatment. This may be due to increase in both number of berries and size of berries. More over, the results from cv "Flame seed less" indicate that berry length and width is also significant between GA_3 treatments. This can be attributed to the genetic make up CV "Flame seed less". These results are also in line with earlier researcher. Ikeda et al. (2004) however observed that at 10-12 days after full bloom, application of 25 or 50ppm GA_3 and 10ppm CPPU, by dipping the clusters, promote berry size. Dokoozlian et al. (2000) used 1 gram of GA_3 per acre, applied at 80-90% bloom reduces, fruit set and approximately increases berry length and width.

Data concerning Fruit yield per vine indicate that the vines treated with GA_3 in 25ppm produced largest cluster weight than the control (Table 1 and Fig. 7), while no statistics difference was found between 15ppm, 20ppm in cluster weight. The largest fruit yield was (344.22 g) produced in 25ppm GA_3 concentration and it was (31.47%) higher than control. This may be due to thinning effect of GA_3. Reynolds et al. (2004) applied 15ppm at bloom and 40ppm GA_3 and found that girdling increase cluster weight and berry weight.

Data regarding TSS (Brix %), a positive response was recorded for this trait. Highest brix% (19.00%) was obtained from 25ppm GA_3 spray treatment. Moreover high Brix percentages were observed with GA_3 spray of 15ppm, 20ppm and 25ppm, which may result from GA_3 spray activities (Fig.8). Patil *et al*. (2006) found that with 50mg GA_3 treatment induced significantly highest percentage of reducing sugars in grapes cv. Vitis viniferafera L. Further more, application treatments improved the quality of grapes in terms of total soluble salts.

CONCLUSION

Positive response of GA_3 was found when 25ppm was sprayed at 80% bloom and fruit set. Very little effect was found when the GA_3 concentrations were reduced to 15ppm. The average berry weight, berry width and berry length, 100 berry weight and fruit yield of the sprayed vines increased significantly and the largest berries were found in the treatment of 25ppm. Based on this study, 25 ppm GA_3 at 80% bloom and fruit setting is recommended for spraying on the grapes cv. "Flame-seedless".

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