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EFFECTS OF GIBBERELLIC ACID ON GROWTH, YIELD AND QUALITY OF GRAPE CV. PERLET

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ABSTRACT

Different concentrations of GA_3 (15ppm, 20ppm and 25ppm) were applied to grape CV. Perlet as Bloom treatments in 2011, in two splits doses. The first spray was applied at 70-80% bloom (on 4th April) and followed by second spray as the post bloom treatment, just after fruit setting (on 8th May). Three vines were used for each treatment. After the fruits were fully mature, five clusters were randomly harvested from each vine to determine the cluster and berry eight, number of berries per cluster, berry length and width, 100 berry weight, fruit weight and fruit extract content was measured using hand refractometer and determining the percentage content of extract in the juice solution, squeezing the out of 20 representative berries from each plant. Average cluster and berry weight of sprayed vines increased significantly over the non-sprayed vines and the largest cluster weight depicted as fruit yield as per vine (10.7kg) was found in the treatment with highest concentration of GA_3 (25ppm). Maximum berry weight, length berry width and TSS were 2.83 g, 1.86 cm, 1.81 g and 19.22%, respectively recorded at 25pp. More over Statistical differences were observed for cluster weight, berry width, length and total soluble salts with GA_3 at 15ppm and 20ppm.GA_3 at 25ppm may be recommended for spray on the perlet grape cultivar for obtaining higher yield and better quality/fruits.

Key words: Gibberellic acid, spray, grape, berry weight, fruit yield and Total soluble salts

INTRODUCTION

Grape (*Vitis vinifera* L.) is one of the earliest domesticated and widely grown fruit crop in the world which can be eaten raw and also used for making Juice, Wine, Jam and raisins. In Pakistan, grape is one of the earliest fruits grown by man. Among the fruits, the grape occupies first position in the world in respect of area and production. In Pakistan, grape is an important being one of the cash crops. In 2009-2010, total area under grapes was 15300 ha with total production 64700 t and national yield of 4.2 t ha^{-1} (Government of Pakistan, 2009-10).

Production According to the historical records, the cultivation of grapevine, *Vitis vinifera* subsp. Vinifera (which was evolved from its wild relative, *Vitis-vinifera* subsp. Sylvestris) The great benefits of spraying gibberllic acid was used as oxidant on improving growth and productivity of different grape vines and it is specially used in viticulture. It affects grape berry in different ways. GA_3 effects the formation of flower cluster, berry set, berry enlargement, cluster length, berry thinning in cluster and also prevention of berry cracking (Korkutal *et al*., 2008). Similar results were noticed by Oller (2006). GA_3 proved most effective in increasing bunch size, bunch weight and fruit yield while the quality of grapes in terms of Total soluble salts, acidity, Total soluble salts/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_3, 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 sometimes more efficient Bora and Sharma, (2006). (Avenant and Avenant, 2006) reported that the combination of GA_3 and CPPU delayed sugar accumulation (ripening), but improved berry firmness. Berry size is affected by both endogenous factors (nutrients and hormonal substances) and exogenous factors (temperature, light and water availability), (Ojeda *et al*., 2001; Ollat *et al*., 2002). Endogenous growth stimulators are related to seeds May (2000), whose number is closely correlated with the concentration with this type of compounds Gokturk and Harmankaya (2005).

Berry seeds contain high concentrations of gibberellins in the fruit. These high concentrations persist for at least three weeks after bloom, and then they drop to a low level, only to increase again two weeks later; subsequently their concentration decreases and remains at low level until the ripening period Perez *et al*., (2000). To increase the size of berries and clusters as well as their compactness, gibberellic acid has been used for many years in wine-producing countries: Brazil (Pommer, 1995; Formolo *et al*., 2010) Spain, (Casanova *et al*., 2009), Poland (Kalplan, 2009) and Jordan (Abu-Zahra, 2010).

In spite of many experiences and studies, still there are no clear guidelines as to rates and the number of applications of these gibberellins. According to Mysliwiec (2009). Einset Seedless or perlet are best among all the

seedless verities known in the world that are recommended for soil cultivation, mainly on account of their productivity, frost hardness and fruit quality. It supports branching after fallen grape grains after inadequate granulation and it takes part in fruit efficiency. The use of GA_3 is beneficial for enhancing yield and grape quality. The main objective of the present study was to evaluate the method of application of gibberellic acid (GA_3) on growth, fruit yield and quality of Perlet grapes, which is becoming popular in humid and rainy climate of Islamabad due to early ripening before the onset of rains.

MATERIALS AND METHODS

The field experiment was conducted during 2011 in the Vineyard Garden of National Agricultural Research Center Islamabad. The experimental material comprised grape vines of the table variety CV. Perlet, Gibberellic acid (GA_3) was applied in the form of growth regulator and was sprayed in 2011 on eighteen years old table grape vineyard at NARC. Grapes were planted at row to row and plant to plant 3 x 1.5m.The grape vines were grown on a single trellis system at experimental vineyard and they were composed of posts and four metal wires stretched between the posts at the heights of 70, 100, 140, 180 cm. the plants were trained in single Guyota style, with the trunk 38 cm in height, one cane with a length of about 0.8 m, and one to two-bud spur. The experiment was set up in a randomized block design, in triplicate fashion. Each replicate having 3 plants grew. Gibberellic acid is a plant growth regulator used for the berry enlargement in grapes. The grapes were sprayed at bloom and fruit set (just after berry shatter), Improvement was observed in terms of leaf area, can thickness and pruning weight were increased due to spraying containing of GA_3 at the concentrations of 15ppm, 20ppm and 25ppm. For each treatment GA_3 were applied twice with the first spray at 80% blooming and second spray a week later just at fruit set. The numbers of clusters/vine were adjusted and average 25 clusters/vine were adjusted. Spay material was applied in full coverage with hand sprayer. After the fruits were fully mature, twenty five clusters were randomly harvested from each vine to determine the cluster fruit weight, 100 berry weight, berry weight, berry length, berry width, fruit yield and total soluble salts (determined by hand refractometer).

Statistical Analysis

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

RESULTS AND DISCUSSIONS

Results regarding all nine characteristics showed significant differences among the treatments except total soluble salts, where non-significant differences was observed (Table 1) and (Table 2). The cluster weight, cluster number, number of berries/cluster, 100 berry weight. Water was sprayed to serve as control. There was remarkable promotion on fruit yield, either expressed as weight or clusters per vine. The largest cluster number and weight was depicted as fruit yield (1.700 kg/vine) with the application of gibberellic acid at @ 25ppm. Maximum berry weight, width, length and Total soluble salts i.e. 2.88g, 1.92cm and 20.76 %, respectively, were recorded with 25ppm.

The foliar application of Gibberellic acid improved significantly cluster weight of grape cv. Perlet (Table 1). Increasing concentration of GA_3 resulted in more pronounced effect on cluster weight. The vines whose inflorescence had been sprayed with the Gibberellic acid at 15ppm or higher concentration produced larger cluster weight. Maximum cluster weight was recorded with the application of 25ppm spray (278.50g) followed by 15ppm spray application (264g), while in control treatment least cluster weight was observed (135.70g). Reynolds +de Savigny (2004) found that, with the application of 15ppm at bloom and 40ppm GA_3 and girdling increased cluster weight.

Data regarding number of berries /cluster, the vines treated with GA_3 in 15ppm or higher concentration produced large number of berries per cluster as compared to control (Table 1). Significant differences were found among the GA_3 treatments. Maximum numbers of berries were found with the application of 25ppm GA_3 treatment (118.40), while statistical differences were observed in 15ppm and 20ppm treatments. Minimum berries were noticed in control treatment (60.70). Ferree *et al*. (2004) studied the beneficial effects of growth regulators on the number of fruits and fruit development in grapes.

The applied growth regulator showed beneficial effect on 100- berry weight (Table 1). There was a tendency that higher concentration of GA3 applied, higher the 100 berry weight produced. Significant differences were observed among the treatments. Maximum 100 berry weight (338.62g) was found with the application of GA_3 @ 25ppm concentration and it was followed by 20ppm concentration (274.75g). Least weight of 100 berry weight

(134.08g) was observed in control treatment. (Pires *et al*., 2000) found that, girdling + 40ppm GA_3 proved most effective in increasing bunch size, bunch weight and fruit yield.

Appreciable Increase in berry weight (2.83g) was observed with application of 25ppm GA_3 (Table 1). Spraying GA_3 was very effective for growth and berry development in grapes. (Reynolds et al., 2004) also observed similar results, while working on Sovereign coronation table grapes in which however, he applied GA_3 @ 20mg/L at bloom and 40-100mg/L at post bloom. Application of GA_3 increased yield and berry weight.

The grape vines treated with 25ppm GA_3 treatment showed significantly higher clusters of grape/vine (38.43) and it was followed by 20ppm GA_3 treatment (32.29). There has been significant difference among the treatments. Minimum numbers of clusters were observed in control treatment (18.50).Our results are in line with (Hyunggook *et al*., 2008).They found the positive role of gibberellins on growth and cluster numbers.

Table 1. Effect of GA_3 on the yield and quality traits in grape cv. Perlet.

Treatments	Cluster wt(g)	No. of berries/cluster	100 berry wt (g)	Berry wt (g)
Control	135.70 d	60.70 c	134.08d	2.22 d
15 ppm	235.60 c	97.97 b	250.98 c	2.62 c
20 ppm	264.80 b	99.20 b	274.75 b	2.77 b
25 pmm	278.50 a	118.40 a	338.62 a	2.83 a
Lsd value (0.05 %)	6.157	4.448	3.849	0.051

Table 2. Effect of GA_3 on the yield and quality traits in grape cv. Perlet.

Treatments	Cluster Number/vine	Berry length (cm)	Berry width(cm)	Fruit yield (kg)	T.S.S. (Brix %)
Control	18.497	1.60d	1.51c	2.49d	17.22a
15 ppm	28.013c	1.68b	1.59b	6.597c	17.95a
20 ppm	32.287b	1.71c	1.77a	8.55 b	17.78a
25 pmm	38.430a	1.86a	1.81a	10.70a	19.22a
Lsd value (0.05 %)	4.702	0.030	0.051	0.169	2.221

Data regarding berry length and width, beneficial effects of GA_3 applications were recorded. Maximum berry length (1.86cm) and berry width (1.81cm), (Table 2) Fig.6 and 7, the largest berry length and berry width was also observed in 25ppm treatment. This may be due to increase in both number of berries and size of berries. Moreover, the results from CV. "Perlet"indicated that berry length and width is also significant between GA_3 treatments. This may be attributed due to the genetic makeup of CV. "Perlet". These results are also in line with earlier researcher. Ikeda *et al*. (2004), however they 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. Moreover another earlier researcher Dokoozlian *et al*., (2000) found that 1gram of GA_3 per acre, applied at 80-90% bloom reduces, fruit set and approximately increases berry length and berry width.

In the present study, the applied growth regulator beneficially influenced fruit yield. Maximum fruit yield was observed in 25ppm GA_3 treatment (10.7kg), (Table 2) it was followed by 20ppm (8.65kg) and 15ppm (6.80kg) treatments. Our results are in line with Renolds + de Savigny (2004), however they observed that 15ppm and 40ppm of GA_3, and found that girdling increased berry weight and finally cluster weight depicted as fruit yield.

Data regarding TSS (Brix %), non significant differences were observed GA_3 treatments in grape CV.perlet. However highest brix% (19.22) was observed from 25ppm GA_3 spray treatment, while no difference was found between control to 20ppm treatment in (Brix%). Patil *et al*. (2006), found that with 50mg GA_3 treatment induced significantly higher percentage of reducing sugars in grapes cv. *Vitis vinifera* L. Furthermore, GA_3 application treatments improved the quality of grapes in terms of total soluble salts.

CONCLUSION

Application of GA_3 on grape had beneficial effect on berry and cluster weight as well as on the number of berries per cluster in cv. Perlet grape. Moreover, positive response to GA_3 was observed when 25ppm GA_3 was sprayed at 80% bloom and fruit set. The average cluster weight, berry weight, berry length, 100berry weight and fruit yield of the sprayed vines increased significantly and the largest berries were found in the treatment with 25 ppm GA_3. Based on this study, 25ppm GA_3 at 80% bloom and fruit setting may be recommended for spraying on the grapes cv. Perlet.

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