

The Effect of Different Concentrations of the Thinner Globaryll100 on Chemical Characteristics of Gala Apples

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Abstract

Apple (*Malus domestica*) is a plant in the form of short shrub or tree with branches lacking thorns and simple oval obular leaves and small and short head. Apple buds include vegetative or simple buds producing branches and its fertile buds are plain mixed generative buds and produce five flowers and 7-8 leaves when waking up. Apple is of great importance in the world so that in 2011, 75.5 million tons of apples were produced and consumed in the world according to the FAO. It has a lot of properties such as maintaining healthy skin, preventing cancer, and so on. The thinner Globaryll100 at concentrations of 150, 250 and 350 mg were used in the Gala apple varieties with the aim of resolving the problem of alternate fruiting and making coarse and high quality fruits and then traits such as pH, acidity, dry matter content, sugar content, total soluble solids were measured. Globaryll was used when the fruit was 10 mm. Globaryll at a concentration of 350 mg per liter has achieved the first place of Duncan in terms of sugar content, soluble solids, pH, and percentage of dry matter. The results showed that the effect of treatments on all traits was significant except acidity, and also high concentration of both hormones could reduce fruiting percentage compared to the control.

Keywords: Globaryll100, thinner, Galaapple

Introduction

One of the most abundant fruits in the world is apple. Fertility a fruit tree can be divided into 3 categories: (Mclaughlin, 1984) The number of flowers in fruit tree, (Meberg, 2000) The number of flowers becoming fruit, (Mostafavi, 1970) The quality of the fruit during the harvest. So it can be said that, appropriate flower production is of great economic importance for optimal yield (Johnson et al., 1996). One important point about apples is its shelf-time compared to other tree fruits that can be stored for months while still maintaining its nutritional value. Apple tree is usually propagated through grafting; as well different varieties of apple demand for gentle summer with rainfall of 700 to 900 mm. Most apple trees can grow in any fertile soil and apple likes sand and clay; because the fruiting life of the tree will be longer in this soil. Fertility age varies in different varieties and normally ranges from 4 to 15 years. We can harvest up to 50 tons of product in one hectare of apple orchard. This amount can be totaled over 100 tons in the dwarf gardens (Mclaughlin, 1984 ; Meberg, 2000; Mostafavi, 1970).

Apple varieties take better form and size in hot weather conditions with cold nights rather than warm days and nights.

Apple has the highest consumption as fresh fruit and can be found in all seasons of the year. A fruit which is available in all seasons has to provide quality characteristics such as size, shape, color, taste, aroma and flavor to the consumers (Murneek, 1954; Norman, 1986).

Iran can have high quality apple with a variety of weather conditions. Production of high quality and market-friendly apples improves the export of this product and it will bring currencies for the country. So research on chemical thinning is necessary (Osborne,1989 ; Sensory, 2005 ; Ramirez,1984; Rucculi,2004).

One of the most important problems of gardeners is small fruits with asymmetric shape that has little economic value and plant growth regulators are suggested to deal with this problem. In general, plant growth regulators are used in fruit trees for vegetative growth, flowering, fruiting, ripening, improving the quality and so on.

Another important objective of thinning fruit trees in addition to high performance and access to larger fruit with good size and good quality is getting appropriate annual product, improving fruit quality, preventing branches from breaking. Fruit growth is measured using the three factors increased volume, wet weight and dry weight. Having sufficient information about the fruit growth and seasonal changes, as well as factors affecting growth help us to predict fruit size and level of thinning using fertilizers, pruning and plant growth regulators.

Thinning is a common method to enhance the value of product whether in terms of quantity or quality characteristics. In fact, it is a commercial operation to raise the size, quantity, color, shape, quality, and increase flowering, growth and maintenance of its structure (Rocha, 2004).

Materials and Methods

The research was carried out in Imam Khomeini Higher Education Center in Karaj. Gala apple varieties is grafted on M9 rootstock and the tree is 7 years old. The type of block design is completely random including four treatments and four repetitions. Experimental treatments include cytokinin, 6-Benzyl Adenine from commercial material Globaryl100 containing 100 grams per liter of active ingredient in:

1-concentration of 0 ml (control), 2- concentration of 150 ml, 3- concentration of 250 ml, 4-concentration of 350 ml.

Before the implementation of the pilot project, four blocks including four experimental units in each there were four identical trees in terms of vegetative growth are considered. In each experimental unit, the two middle trees are considered as sample trees and the two side trees are accounted as the removal of side effects. So, there are four experimental units in each block, and 4 trees in each experimental unit, and each block contains 16 trees and the total number of trees used in this research is 64. Also, spraying has been made in early May, when fruits are nutlets (between 10 -12 mm).

Table 1: Design of the method

R4	R3	R2	R1
x**x G350	x**x G250	x**x G0	x**x G150
x**x G0	x**x G150	x**x G250	x**x G350
x**x G250	x**x G350	x**x G150	x**x G0
x**x G150	x**x G0	x**x G350	x**x G250

*: Trees sampled

x: trees in margin

Number of repetitions: 4

Number of treatments: 4

Number of trees per experimental unit: 4 Number of sample trees per experimental unit: 2

Number of marginal trees per experimental unit: 2 Number of sample trees per experimental repetition: 8

Number of trees per experimental repetition: 8 Number of trees per experimental repetition: 16

Number of trees sampled: 32 Number of trees in margin: 32

Total number of trees in the experiment: 64

Type of design: a completely randomized block design

The traits are investigated on the data from sampling, and variance analysis is carried out based on completely randomized block design model. After f-test, the results of the variance analysis, the comparison of mean properties was made by Duncan method at 1% level.

Results and Analysis

Data analysis of Table 2 shows that the effect of repetition is not significant on any of the traits, but the effect of treatment is not significant at 1% on TSS, 5% on pH, and at the studied levels (5% 1%) on AT.

Table 2: Analysis of variance of TSS, pH and TA

Variable	DF	Mean		
		TSS	PH	TA
Block	2	0.039	0.004	0.009
Treatment	5	4.224	0.225	0.005
Error	10	0.355	0.062	0.004
Variation factor		4.9	5.5	15.4

It can be concluded that the concentration levels of Globaryll100 at 350ppm has significantly increased the TSS compared to the control, but other concentrations studied did not show significant differences with the control. Globaryll100 at a concentration of 350ppm has the highest level of TSS in the first category and other hormone levels studied as well as control group were placed in the last category of Duncan.

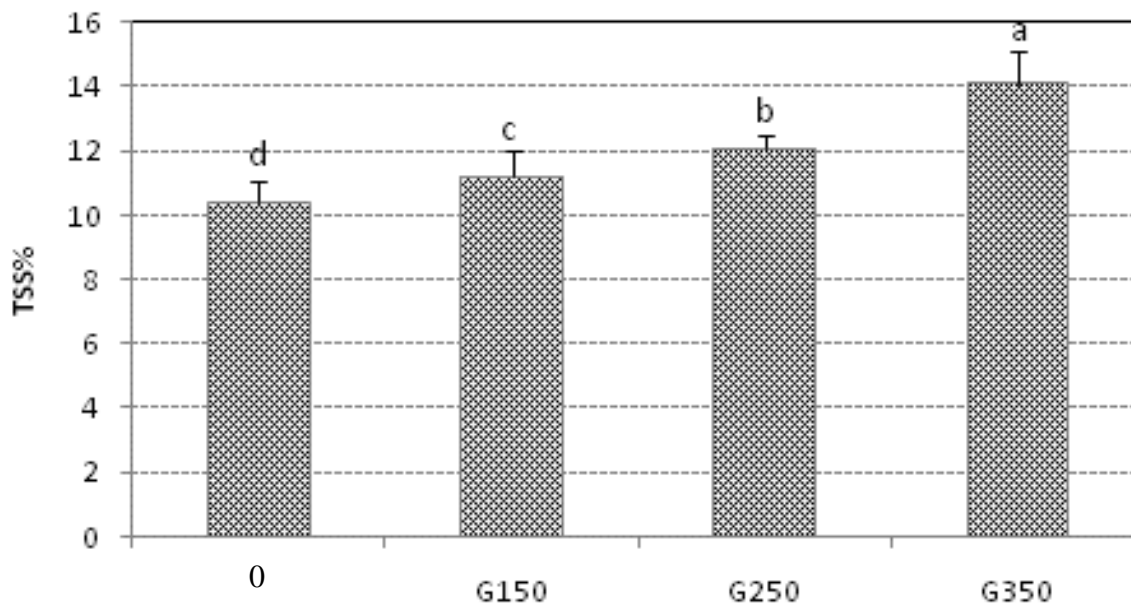


Figure 1: Comparison of the mean effects of Globaryll100 on TSS

Based on the comparison of the means (Table 2) concluded that, except for treatment with Globaryll100 at a concentration of 350ppm that significantly enhanced pH levels compared to the control, the other levels of hormones studied did not show any significant difference.

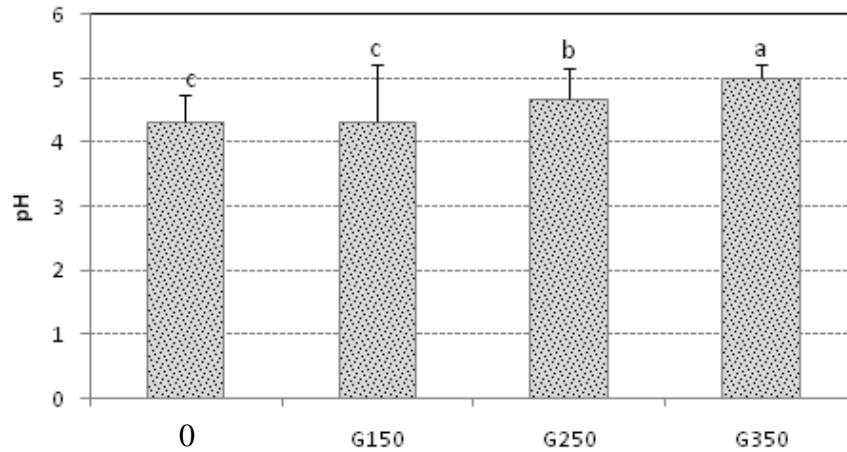


Figure 2: Comparison of the mean effects of Globaryll100 on PH

As the analysis of variance table (Table 2) shows, the effect of treatment was not significant on TA, hence there was no significant difference between concentrations including the control group.

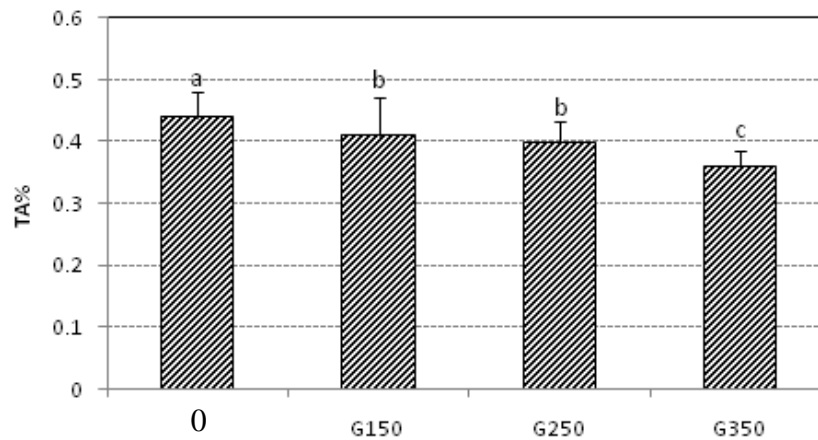


Figure 3: Comparison of the mean effects of Globaryll100 on TA

Data analysis showed that the effect of repetition is not significant on none of the traits listed in the table, but the effect of treatment on the percentage of dry matter is significant at the level of 5% and on sugar content and firmness at 1%.

Table 3: Analysis of variance of percentage of dry matter, sugar content and firmness

Variable	DF	Mean		
		Dry material	Go locos	Stiffness
Block	2	1.478	0.722	1.260
Treatment	5	2.362	3.698	35.535
Error	10	0.671	0.362	6.068
Variation factor		8.3	5.1	3.8

Figure 4 shows that the dry matter content increased by increasing the concentration. In the meantime, the increase in the treatment with Globaryll100 at a concentration of 300ppm was significant. There was no significant difference between other levels of the hormones studied and also the control group.

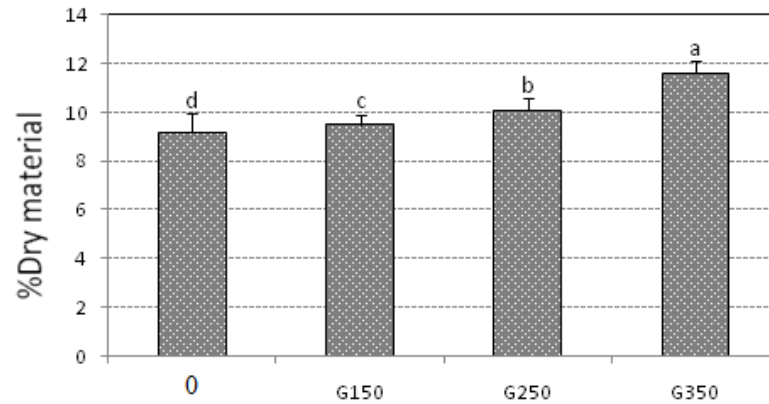


Figure 4: Comparison of the mean effects of Globaryll100 on dry matter content

The comparison showed that the treatments with Globaryll 100 at a concentration of 250ppm have significantly increased the sugar content compared to the control, but other levels studied did not show a significant difference compared to control. Globaryll 100 at a concentration of 350 ppm was alone in first place of Duncan significantly increased compared to the other groups studied.

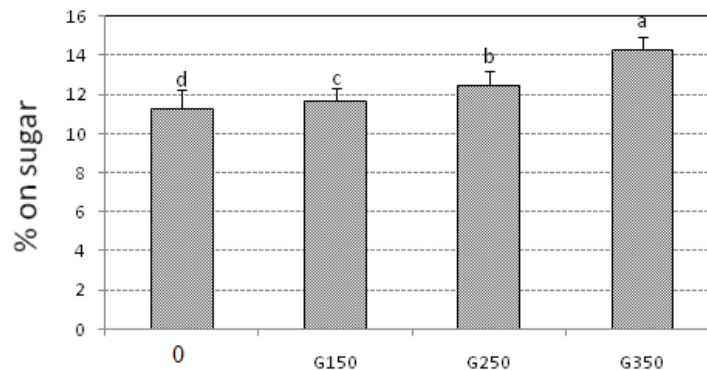


Figure 5: Comparison of the mean effects of Globaryll100 on sugar content

It can be concluded according to the figure that Globaryll 100 at concentrations of 350 and 250ppm showed significant increase compared to the control in terms of firmness, but other levels studied did not show a significant difference compared to the control.

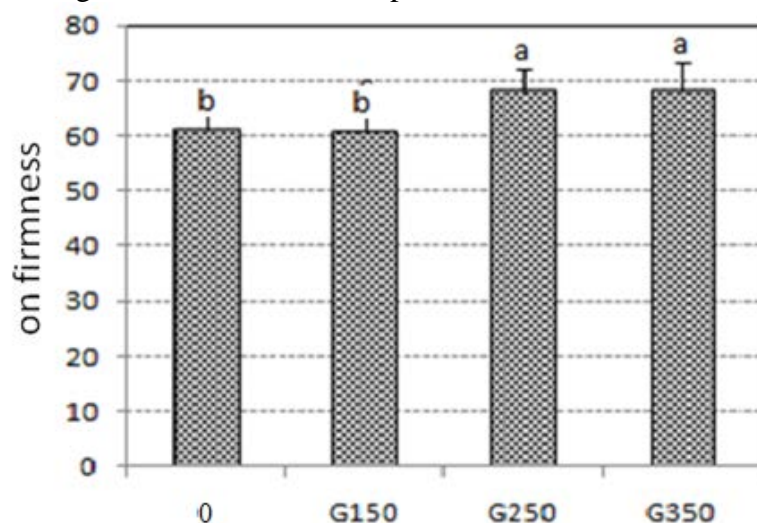


Figure 6: Comparison of the mean effects of Globaryll100 on firmness

Data Analysis

Increased ratio of leaf to fruit by thinning will give more nutrition to the remaining fruits. Hence, the total acidity and sugar will be higher, although there are complex relationships in these structures and thinning fruit may be one of the reasons which is in consistent with the findings (Stern, 2004).

If we assume that the weight of the fruit is directly related to the soluble solid content, it can be concluded that the hormone Globaryll100 at a concentration of 350 mg per liter, which has the highest weight, is in the first place in terms of soluble solid content and has significant difference from the controls.

The soluble solids increase because the polymeric carbohydrates break down into smaller molecules dissolved in water (Stover, 1996).

Dry matter is the sum of organic and mineral matter in fruits that constitute total moisture and weight of the fruit. The highest percentage of dry matter among experimental treatments belongs to the treatment with Globaryll 100 at a concentration of 350ppm. Therefore, it can be concluded that thinning would remove competition between the fruit, increase the size of the cells and accumulate matters assemblage in the cell wall. As a result, the percentage of dry matter increases. The higher dry matter content will cause more firmness. Main part of the dry matter in apple is carbohydrate, so the key process to increase the fruit dry matter include an increase in supply of carbohydrates in the relationship of Sink and Source (Struckmeyer, 1950).

Generally, the factors affecting the size of fruit and causing an increase in the ratio of length to diameter include climatic factors, strong bases, high thinning, position of flower on the cluster and treatment with growth regulators.

Conclusion

The effect of the thinner hormone Globaryll100 to Gala apples showed that a different concentration of this hormone was significant on all traits except acidity. High concentrations of this hormone could significantly increase the percentage of the early abscission compared to the control. On the other hand, it reduces the percentage of pre-harvest fruit drop and fruiting rate compared to the control.

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