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Chemical and Physical Determination of Gibberellic Acid Effects on Postharvest Quality of Sweet Cherry

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The effect of preharvest gibberellic acid treatments with the dose of 10, 20 and 30 ppm on Aksehir Napolyon sweet cherry were compared with control during 4 weeks storage. The most important problem of sweet cherry is decolouration of stem after storage. Different preharvest treatments can be effective to stop or slow down decolouration. In this research fruit firmness, titrable acidity, total soluble solids, stem colour (1-3 scale), weight losses and fruit decay were evaluated depend on different concentrations of gibberellic acid. The application of gibberellic acid decreased the loss of fruit firmness, delayed stem decolouration and maintained the brightness during storage compared with control and the other application rates.

Key Words: Gibberellic acid, Fruit quality, Storage, Fruit firmness, Stem browning.

INTRODUCTION

Sweet cherries for fresh consumption and export are important crop in Turkey. The production of sweet cherry increases rapidly with the cultivation areas increase every year. If the fruit has good quality, it has also perfect market value. But, sweet cherry fruits deteriorate rapidly after harvest, due to water loss,stem browning, surface pitting and fruit softening[1,2].

In sweet cherry fruit firmness is one of the important factors effect the fruit quality and postharvest life, due to firm fruits are desired for fresh eating, handling, marketing and shipping[3]. There are some differences in term of fruit firmness among species. However, it is reported that treatment with the gibberellic acid (GA_3) influences sweet cherry fruit quality and can reduce adverse effects of rain and premature picking[4,5]. There are some reported variable responses to GA_3. Sweet cherry fruits treated with GA_3 were significantly firmer than fruits not treated. There were no differences between single and multiple GA_3 treatments[6]. The use of GA_3 increase fruit firmness at harvest, decrease the rate of fruit softening and delayed fruit maturity in general.

The aim of this research is to establish the influence of different doses of gibberellic acid on the physical and chemical properties (stem colour, firmness of fruits, total soluble solids, acidity, pH, surface pitting) of sweet cherry cultivar, Aksehir Napolyon, that grown in Pozanti conditions. The authors also intend to investigate the possibility of improving the fruit firmness and reduce the surface pitting by the use of gibberellic acid and to find the most suitable application dose.

EXPERIMENTAL

The fruit trees of Aksehir Napolyon species that are located in the orchard at Pozanti were selected randomly and GA_3 was sprayed at a concentrations of 10, 20 and 30 ppm. Control trees were sprayed with water and were protected from spraying with GA_3. Cherry fruits were picked at commercial maturity on the basis of subjective estimation of fruit colour. Fruits were hydrocooled and transported to the Cukurova University Horticulture Department Postharvest Laboratory immediately after harvest. Sorted fruits were arranged acording to 3 replication for each treatment and packed into 500 g commercial plastic cups then stored for 4 weeks at 1ºC and 90-95 % relative humidity.

Measurements and analyses of trials were done weekly. Fruit firmness was measured by hand shoremeter from both side of the fruit. Fruits were squeezed through cheesecloth and juice analyzed for per cent soluble solid using a hand held refractometre (Atago, ATC1, Japan). The pH of the juice was measured with a pH meter (Schott, CG840, Germany) and the titrable acidity (TA) determined by titration of juice (5 mL) with 0.1 N sodium hydroxide with pH meter and the end point is found to be 8.10 (expressed as gram of citric acid per 100 mL juice). Weight loss was determined by weighing fruit at the start of experiment and at various intervals during storage and expressed as percentage (%). Surface pitting was observed visually, pitted fruit weighed and calculated as percentage of each replicate. All data were analyzed statistically using Anova statistic program.

RESULTS AND DISCUSSION

Fruit firmness: The means of firmness were higher for the cherries treated with GA_3 than untreated fruits, which is in agreement with several reports[6-8]. Spraying with GA_3 significantly increased the average fruit firmness (Table-1). Average fruit firmness decreased from 31.41 shore to 27.64 shore after 4 week storage. The highest firmness average was observed at 10 ppm GA_3 treatment with 30.29 (a) shore whereas control had the lowest average with 27.92 shore at the end of storage period.

TABLE-1
FRUIT FIRMNESS DURING STORAGE (SHORE)

Treatment	Storage period (d)					Average
	0	7	14	21	28	
Control	30.96	26.27	29.58	26.53	26.23	27.92b
10 ppm GA_3	32.51	28.61	30.63	30.11	29.58	30.29a
20 ppm GA_3	30.52	28.45	28.15	27.84	27.19	28.43b
30 ppm GA_3	31.33	27.18	29.08	29.63	27.58	29.02ab
Average	31.41a	27.62b	29.36b	28.53b	27.64b	–

$D_{\%5}$ storage period: 1.42, $D_{\%5}$ treatment : 1.27.

Firmness is one of the most important attributes in sweet cherry, thus it is often used for quality assessment[9]. There are considerably genotypic differences regarding the fruit firmness in sweet cherry[10]. On the other hand, it is known that GA_3 application, for those late cultivars, has a positive effect on fruit firmness of sweet cherry. This reseach showed that GA_3 treated sweet cherry fruits were significantly firmer than control at harvest time and this firmness maintained better than control after 28 d of storage.

Weight losses: Table-2 shows the average weight loss in relation to the different GA_3 treatment doses during storage. In all treatments, weight losses were observed during the whole storage period. The highest weight losses was 1.04 % (a) whereas, the lowest was 0.79 % (a). Weight losses increased during storage and average weight losses was 1.51 % (a) after 28 day of storage.

TABLE-2
WEIGHT LOSSES DURING STORAGE (%)

Treatment	Storage period (d)				Average
	7	14	21	28	
Control	0.58	0.56	1.25	1.41	0.95a
10 ppm GA_3	0.68	0.57	1.10	1.80	1.04a
20 ppm GA_3	0.30	0.38	0.89	1.61	0.79a
30 ppm GA_3	0.36	0.52	1.60	1.21	0.92a
Average	0.48b	0.51b	1.21a	1.51a	–

$D_{\%5}$ storage period : 0.27, $D_{\%5}$ treatment : N.S.

Different doses did not effect the weight losses significantly. However, present result showed that there were some differences among the treatments and control. Several factors may play role on weight losses. It is suggested that GA_3 influences cuticula thickness and dimensions of the epidermal cells but this effect differed according to the cultivar[11].

Total soluble solids: Total soluble solids (TSS) of sweet cherries affected by GA_3 treatment. Control had a higher TSS content than GA_3 treated fruits at harvest time (Table-3). Average TSS content that had the 16.51 % (a) value at the begining of storage period, slightly decreased to 16.36 % (a) after 4 week storage. 10 ppm GA_3 treatment had higher TSS content, 16.45 % (a), than others after the storage period.

TABLE-3
TOTAL SOLUBLE SOLIDS (TSS) (%)

Treatment	Storage period (d)					Average
	0	7	14	21	28	
Control	17.33	15.06	16.20	15.46	16.40	16.09ab
10 ppm GA_3	16.73	16.26	16.40	16.46	16.60	16.45a
20 ppm GA_3	15.80	16.46	16.46	15.73	16.40	16.17ab
30 ppm GA_3	16.20	15.00	16.00	15.40	16.06	15.73b
Average	16.51a	15.70c	16.26ab	15.71bc	16.36a	–

$D_{\%5}$ storage period : 0.38, $D_{\%5}$ treatment : 0.34.

Increased firmness is a more consistent response to GA_3 and there are not always chances in fruit weight and TSS[7]. Control had the highest average of TSS after harvest at 0 day whereas, 10 ppm GA_3 treated fruits had utmost average at the end of storage time and differences among treatments were significant.

Acidity and pH: Acidities of treatments were lower than control fruits (Table-4). Control had the highest acidity average on both 0 day and at the end point. GA_3 aplication lowered the acidity significantly. Treated fruits had, on average, less acidity than control at different research[12].

TABLE-4
ACIDITY DURING STORAGE (%)

Treatment	Storage period (d)					Average
	0	7	14	21	28	
Control	0.84	0.77	0.70	0.61	0.61	0.70a
10 ppm GA_3	0.75	0.67	0.57	0.54	0.55	0.61b
20 ppm GA_3	0.70	0.63	0.54	0.42	0.42	0.54c
30 ppm GA_3	0.74	0.60	0.59	0.50	0.50	0.58b
Average	0.75a	0.66b	0.60c	0.52d	0.52d	–

$D_{\%5}$ storage period : 0.035, $D_{\%5}$ treatment : 0.031.

pH of sweet cherry fruits was significantly affected by the treatment after storage (Table-5). The lowest average pH value measured at control and the rest had almost same pH values. pH increased during storage.

TABLE-5
pH DURING STORAGE

Treatment	Storage period (d)					Average
	0	7	14	21	28	
Control	3.49	3.59	3.67	3.76	3.85	3.67b
10 ppm GA_3	3.70	3.97	4.04	4.04	4.13	3.97a
20 ppm GA_3	3.64	3.89	3.98	4.19	4.12	3.96a
30 ppm GA_3	3.68	4.05	4.02	4.06	4.08	3.98a
Average	3.63c	3.87b	3.93b	4.01a	4.04a	–

$D_{\%5}$ storage period : 0.039, $D_{\%5}$ treatment : 0.035.

Surface pitting and stem browning: Treatment with GA_3 resulted in lower surface pitting percentage (Fig. 1). Surface pitting did not occured till 14 day of storage. However, 4.50 % of pitting average found at control fruits in 21 day of storage. Moreover, GA_3 treatment significantly decreased average persentage of pitted fruit during storage.

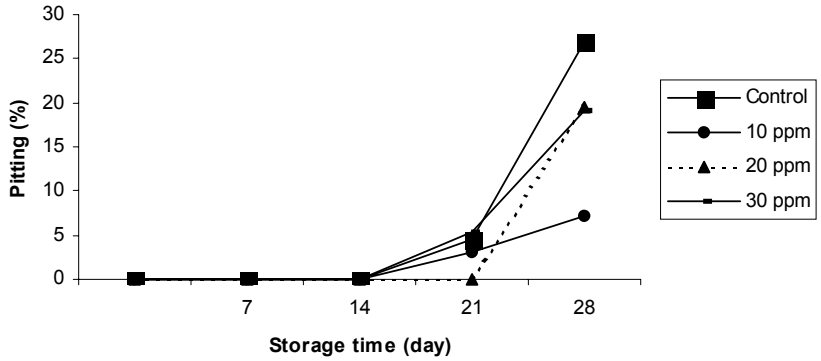

Fig. 1. Surface pitting (%)

Stem browning values (Table-6) were significantly different for GA_3 treated fruit at the end of storage. Visual assessment score of those GA_3 treated fruits were decreased during storage, especially after 21 days of storage.

TABLE-6
FRUIT STEM BROWNING (1-3 SCORE)

Treatment	Storage period (d)					Average
	0	7	14	21	28	
Control	3	3	3	1.66	1.00	2.33b
10 ppm GA_3	3	3	3	2.00	2.00	2.60a
20 ppm GA_3	3	3	3	2.33	1.66	2.60a
30 ppm GA_3	3	3	3	2.33	1.66	2.60a
Average	3a	3a	3a	2.08b	1.58c	–

$D_{\%5}$ storage period :0.22, $D_{\%5}$ treatment : 0.19.

The application of pre-harvest gibberellic acid treatment at different doses affect the postharvest quality of sweet cherry in positive ways. According to the trials results, GA_3 treated fruits maintained the firmness better than control and had lower acidity ratio whereas no effect on weight losses during 28 days of cold storage. The results confirm that, 10 ppm of GA_3 treatment had the best result comparing other doses and control. Thus pre-harvest dose of GA_3 mentioned above, can be use for commercial purposes to enhance the postharvest quality of Aksehir Napolyon sweet cherry cultivar.

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