J. Plant Production, Mansoura Univ., Vol. 5(11): 1795 - 1806, 2014

EFFECT OF ETHEPHON , ACETIC AND CITRIC ACID ON BERRY QUALITY AND STORAGE ABILITY OF FLAME SEEDLESS GRAPES.

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ABSTRACT

This study was conducted during two successive seasons of 2011 and 2012 on Flame Seedless grape cultivar in order to evaluate the effect of citric acid at 2.0g/l and acetic acid at 0.5 cm/l with ethephon at 250 and 500ppm on berry quality and storage ability under cold storage and through marketing at room temperature. Clusters were sprayed at version stage as a pre harvest treatments at the soluble solids content reached about 10 -12%**.** At full color, clusters were harvested when the soluble solids content in berry juice reached about 16-18 % and held at room temperature conditions or stored under cold storage conditions at 0c±1 and 90-95% relative humidity(R.H) to determine the physical and chemical characteristics of berries during storage period. The results reveal that spray clusters with citric or acetic acid combined with ethephon as pre harvest treatments reduced the total loss of cluster weight due to their effect on reducing decayed berries and berry shatter. Also, citric and acetic acid treatments presented a higher anthocyanin content in berry skins and gave an positive effect on increasing SSC in berry juice.

INTRODUCTION

Grapes (*vitis vinifera,L*) is one of the most important fruit crop grown in Egypt and in the world. Flame Seedless is an non-climacteric fruits with a relatively low rate of physiological activity, are exposed to serious water loss during storage and marketability, which result in stem drying and browning, berry shatter and shriveling or water loss. (Alobeed.,2009) .Storage of grapes under cold storage is to eliminate postharvest losses, berry shattering, stem browning and decay which reduces its post harvest quality.(Zutkhi,*et al.*).(2001) . Table grape is one of the moderate susceptible fruits to decay and subject to serious water loss during postharvest handling and rachis browning, which occurs as a consequence of water loss (Peacock and Smilanick,1998 and Crisosto *et al.,* 2001) . Gray mold (*Botrytis cinerea*) is the most postharvest diseases of table grapes especially late in the season. Ethephon can be used to accelerate berry color and enhance the time of harvest, yet can cause berry softening ,berry cracking or splitting and poor storage and shelf life . (jensen *et al.,* 1975). Because of the importance of fruit quality there is a need for additional tools to help improve

grape quality. Citric acid is known to have an antioxidant effect and has been found to decrease cellular pH consequently decreasing polyphenol oxidase (ppo) activity,(Michael,1991).Also Citric acid, which had lower degree of browning , also had relatively lower pH than the other treatments (Kanlayanarat,2003). Furthermore, AboEl.komsan etal.,(2003) mentioned that application of citric acid as an antioxidant can improve growth and productivity instead of using chemical toxins.

Acetic acid is generally recognized as safe (GRAS) compound. (Peter sholberg 2009).In this respect, Morsy *et al*.,(1999) obtained a complete inhibition using acetic acid solutions for controlling *B.cinerea and Rhizopus stolonifer.* Therefore , this study was under taken to evaluate the use of some natural compounds as citric acid and acetic acid with ethephon as a pre harvest treatment in controlling postharvest decay and keeping quality of berry and cluster of Flame Seedless grapes during cold storage and through marketing.

MATERIALS and METHODS

The present study was carried out during the two successive seasons of 2011 and 2012 on Flame Seedless table grape cultivar. in order to evaluate citric , acetic acid with combined ethephon as pre harvest treatments' to improve the fruit quality and storability of the grapes. Also the effect of these treatments on the behavior of clusters under cold storage and through marketing at room temperature were included.

The vines were four-years old grown in sandy soil under drip irrigation system, planted at 2 x 3 meters and trained to spur pruning under baron system at EL-khatatba district.

The applied treatments were carried out at version stage as a pre harvest application at the beginning of berry color and when the soluble solids content reached 10-12% as shown in table1.

Table 1 : The applied treatments.

N.O	Applied treatments
1	Control
2	Ethephon at 250ppm
3	Ethephon at 250 ppm + Citric acid at 2.0 g\ L
4	Ethephon at 250ppm+ acetic acid at 0.5cm\L
5	Ethephon at 500ppm
6	Ethephon at 500ppm+ Citric acid at 2.0 g\ L
7	Ethephon at 500ppm+ acetic acid at 0.5cm\L

Harvest date was determined when berries reached full color and the soluble solids content in berry juice reached about 16-18 % according to Badr and Ramming, (1999) and Samra 2001. In this respect, Clusters from each treatment were harvested and transported to the laboratory of Pomology Depart,Mansoura Univ.At the beginning of the experiment, samples of 3 clusters from each treatment were taken to determine the initial berry

characteristics .Clusters were sorted to remove any infected or damaged berries .From each treatment one box, containing 15 clusters and each cluster was packed using perforated bag according to (Morris et al.,1999).All bags were weighted and the samples of clusters were kept at room temperature conditions and examined every 3 days but under cold storage conditions at 0C+1 and 90-95% relative humidity, the samples were examined every 10 days to study the change in clusters and berry characteristics through marketing and under cold storage. since, the following determination was carried out. :

Loss in cluster weight percentage : Cluster bags were weighed and the percentage of weight loss for each cluster was calculated in relation to its initial weight. Cluster weight loss was calculated for each treatment according the following equation:

$$\text{Cluster weight loss \%} = \frac{\text{Initial weight – Sample weight}}{\text{Initial Cluster weight}} \times 100$$

Decayed berries percentage: It was determined by weighting the decayed berries with Botrytis cinerea or Penicillium sp. In each sample during storage and then estimated by using the initial weight of clusters.

$$\text{Berry decay \%} = \frac{\text{Weight of decayed berries}}{\text{Initial Cluster weight}} \times 100$$

Berry shatter percentage It was determined by weighting the lose berries per cluster after moderate shaking and then percent of berry shatter was estimated.

$$\text{Berry shatter \%} = \frac{\text{Weight of Berry shatter}}{\text{Initial Cluster weight}} \times 100$$

Total loss in cluster weight percentage: since It was calculated by adding the percentage of cluster weight loss, berry shatter and decayed berries.

Soluble solids content (SSC): It was determined by using a hand refract meter according to (Chen&Mellenthin,1981)

Titratable acidity: Ten ml of berry juice were titrated with 0.1 N sodium hydroxide solution using phenolphthalein as indicator. Total acidity was expressed as gram tartaric acid per /100 ml juice according to (A.O.A.C.,1980)

Soluble solid/ acid ratio: This ratio was calculated from the results recorded for juice SSC and titratable acidity .

Total anthocyanin content: Half gram of fresh skin berries was ground with 10ml. of acidified alcohol solution, centrifuged for 3 minutes and then filtered. The extract was measured at 535 nm using Spectra color meter according to (Ranganna,1979). .

Statistical analysis: All data of the study were statistically analyzed according to analysis of variance (ANOVA**)** for experiment in randomized complete block design according to **Gomez** & Gomez, (1984) and L.S.D at 5% used to compare the variances between the treatments.

RESULTS and DISCUSSION

Effect of ethephon, acetic and citric acid on total loss in clusters weight of Flame Seedless grape:

1-Cluster weight loss %:

The loss in cluster weight of Flame Seedless at room temperature and during cold storage are presented in table 2 .Data reveal that, the loss in cluster weight gradually increased as the period advanced at room temperature or at cold storage. Since, all treatments increased the loss in cluster weight than control.

Data disclose that cluster of Flame Seedless with ethephon treatment at 250 or 500 ppm alone gave a higher weight loss than the control. These results are agree with (Kelany, *et al*., 2011) they mentioned that spraying clusters with etherl at 500ppm significantly increased loss in berry weight %. Results also indicated a gradual increase in weight loss towards the end of the storage period (4 weeks). All concentrations of ethrel either than the control on cluster or as foliar application treatments increased significantly loss in berry weight percentage of "Flame seedless" grape cultivar.

Furthermore, spraying cluster of Flame Seedless with citric or acetic acid treatment combined with ethephon at 250ppm or 500ppm reduce cluster weight loss than spraying vines with ethephon alone.

Concerning, the effect on cluster weight loss at room temperature, data clearly showed that the cluster weight loss increased after 6 days at room temperature. So, cluster stored for 6 days at room temperature showed a higher loss in cluster weight than cluster stored for 30 days under cold storage.

In this respect, the cluster weight loss after harvest is a major problem cause in storage .Since, the losses is due to water loss, through transpiration, while some weight loss is due to loss of carbon in respiration but this is only a major part of the total loss. The high storage temperature causes a high respiration rate which lead to a cluster weight loss. The results of the present study and associated discussion are supported by the findings of (Hardenburg *et al.,*1990).

Table 2:Clusters weight loss percentage in "Flame Seedless" grapes at room temperature and under cold storage.

Treatments	Weight loss %						
	Days at room temperature			Days at cold storage			
	3	6	Mean	10	20	30	Mean
Control	4.58	6.57	5.57	1.98	3.38	3.92	3.09
Ethephon 250	6.67	9.08	7.87	4.35	5.18	6.31	5.49
Ethephon 250+Citric2.0g/l	5.11	7.25	6.18	2.57	4.05	4.53	3.72
Ethephon 250+ A.A0.5cm/l	6.38	8.81	7.59	3.99	5.48	6.09	5.19
Ethephon 500	8.47	10.64	9.56	5.77	6.95	8.43	7.05
Ethephon 500+Citric2.0g/l	7.26	9.65	8.45	5.07	6.06	7.28	6.14
Ethephon 500+ A.A0.5cm	7.11	9.85	8.48	5.18	6.67	7.22	6.36
Mean	6.51	8.84	---	4.13	5.49	6.25	---
L.S.D at 5%	Treatment (T) =0.771 Storage period(S) = 0.412 T x S =0.318			Treatment (T) = 0.373 Storage period(S) = 0.245 T x S =0.091			

(A.A) acetic acid

Berry decay percentage:

It's clear from table 3 that all treatments significantly increased the percent of decayed berries than the control. After 6 days at room temperature or at 30 days under cold storage. Furthermore , ethephon treatment at 250ppm or 500ppm with combined citric or acetic acid significantly reduced the percent of decayed berries than used ethephon a lone or the control treatment during the storage period.

In this respect (Venditti *et al*., 2008) reported that the spray of table grape with 5mL / 100 acetic acid decreased postharvest gray mold on 'Regina' and 'Taloppo' table grapes by 61 and 41%, respectively, after 8 weeks storage at 5 ◦C**.** Moreover, (Sholberg and Gaunce,. 1995) mentioned that Acetic acid (AA) as a vapor at low concentrations was effective in preventing fruit decay by postharvest fungi.

Furthermore, cluster sprayed with citric acid combined with ethephon gave a similar results on berry decay to those obtained by using acetic acid combined with ethephon ,but these treatments reduced the percent of decayed berries less than the control .Also, data from table 3 mention that the percent of decayed berries gradually increased through marketing at room temperature as storage period advanced but data showed that the percent of decayed berries under cold storage was almost lower than at room temperature.

Table 3:Decayed berries % in "Flame Seedless" grapes at room Temperature and under cold storage.

Treatments	Decay %						
	days at room temperature			days at cold storage period			
	3	6	Mean	10	20	30	Mean
Control	1.11	1.88	1.50	0.52	0.76	0.49	0.82
Ethephon 250	1.07	1.75	1.41	0.67	1.02	1.26	0.98
Ethephon 250+Citric2.0g/l	0.36	0.88	0.62	0.12	0.24	0.56	0.31
Ethephon 250+ A.A0.5cm/l	0.15	0.43	0.29	0.05	0.11	0.30	0.16
Ethephon 500	1.71	2.45	2.08	0.75	1.18	1.82	1.25
Ethephon 500+Citric2.0g/l	0.95	1.73	1.34	0.35	0.52	0.92	0.60
Ethephon 500+ A.A0.5cm/l	0.83	1.62	1.22	0.42	0.67	1.03	0.71
Mean	0.88	1.54	--------	0.41	0.64	1.01	------
LSD at 5%	Treatment (T) = 0.279 Storage period(S) = 0.149 T x S = 0.041			Treatment (T) =0.182 Storage period(S) = 0.119 T x S = 0.021			

Berry shatter percentage:

It obvious from table 4 that berry shatter percentage was lower than those obtained from loss in cluster weight for all treatments used. Since, the percent of berry shatter and decayed berries were lower than loss in cluster weight.

From these results, the data showed that clusters treated with citric or acetic acid combined with ethephon reduced the percent of berry shatter than those treated with ethephon treatment alone but almost higher than the control.

In addition, sprayed clusters with citric acid and ethephon gave a pronounced reduction in berry shatter than acetic acid with ethephon treatments during marketing at room temperature and cold storage.

The increment in berry shatter during shelf life ,has been suggested that the pedicel and stalk of cluster behave in a climacteric process ,showing respiration and ethylene peaks (Ge et al.,1997).In this respect (Sholberg *. et al* ,. 1996) reported that acetic acid fumigation controlled decayed berries caused by both Botrytis and Penicillium decay and reduced berry shatter.

Table 4:Berry shatter % in "Flame Seedless" grape at room temperature and under cold storage.

Treatment	Shatter %						
	days at room temperature			days at cold storage period			
	3	6	Mean	10	20	30	Mean
Control	0.43	1.88	1.15	0.29	0.91	1.16	0.79
Ethephon 250	2.25	3.09	2.67	1.87	2.27	2.52	2.22
Ethephon 250+Citric2.0g/l	1.03	2.23	1.63	0.64	1.25	1.57	1.16
Ethephon 250+ A.A0.5cm/l	2.01	3.00	2.51	1.76	2.05	2.56	2.13
Ethephon 500	3.39	3.90	3.65	2.66	2.79	3.01	2.82
Ethephon 500+Citric2.0g/l	2.72	3.55	3.14	2.43	2.68	2.92	2.68
Ethephon 500+ A.A0.5cm/l	2.72	3.67	3.19	2.39	2.59	3.10	2.69
Mean	2.08	3.05	----------	1.72	2.08	2.41	--------
LSD at 5%	**Treatment (T) = 0.407 Storage period(S) = 0.217 T x S = 0.088**			**Treatment (T) = 0.319 Storage period(S) = 0.208 T x S = 0.066**			

Total loss in cluster weight percentage:

Total loss in cluster weight are mainly due to the losses in berry weight, shatter and decayed berries, so our treatments gave a higher effect for reducing both berry shatter and decayed berries than losses in berry weight.

From table 5 it's clear that using citric or acetic acid with ethephon significantly reduced the total loss in cluster weight than the ethephon treatment alone. Data also, revealed that citric acid with ethephon treatment reduced the percent of total loss in cluster weight than acetic acid treatment.

Table 5: Berry total loss in "Flame Seedless" grape under cold storage and at room temperature.

Treatment	Total Loss %						
	days at room temperature			Days at cold storage period			
	3	6	Mean	10	20	30	Mean
Control	6.13	10.33	8.23	2.81	5.06	6.07	4.64
Ethephon 250	10.01	13.73	11.87	6.90	9.11	10.10	8.70
Ethephon 250+Citric2.0g/l	6.75	10.10	8.42	3.34	5.55	6.08	5.19
Ethephon 250+ A.A0.5cm/l	9.00	12.25	10.63	5.81	7.65	8.97	7.98
Ethephon 500	13.58	17.00	15.30	9.18	10.93	13.26	11.13
Ethephon 500+Citric2.0g/l	10.94	14.94	12.94	7.86	9.27	11.14	9.42
Ethephon 500+ A.A0.5cm/l	10.55	15.15	12.85	8.00	9.94	11.36	9.77
Mean	9.56	13.36	---------	6.27	8.22	9.65	------
LSD at 5%	Treatment (T) = 1.120 Storage period(S) = 0.598 T x S = 0.669			Treatment (T) = 0.581 Storage period(S) = 0.380 T x S = 0.220			

Regarding to the effect on total loss in cluster weight the results presented that total loss in cluster weight gradually increased under cold storage and through marketing at room temperature. Generally, the reduction total loss of cluster weight due to using acetic, or citric with ethephon treatments are mainly due to their effecting for reducing both berry shatter and decayed berries especially which occurred by botrytis cineraria and pencillum spp more than the effect on loss in clusters weight.(Crisosto *et al*.(2001) reported that table grapes subjected to serious water losses during postharvest handling .

Effect of ethephon, acetic and citric acid on S.S.C in berry juice of Flame Seedless grape:

Concerning to the effect on SSC, data from table 6 showed that soluble solid content in berry juice tended to fluctuate with various treatment at cold storage and during marketing under room temperature . Data also, presented that clusters treated with ethephon at 500 ppm with citric acid gave a higher value of SSC at harvest time compared with the other treatments or the control.

Regarding to the change of soluble solids content in berry juice during marketing at room temperature, data indicated that similar trend was obtained to those found during cold storage.

In this respect, soluble solids concentration was slightly increased by ethephon concentrations. The results of this investigation clearly showed that application of ethephon at version increasing berry weight, soluble solids content and coloration, and reducing titratable acidity .(Abdelaziz ,1997).

Table 6: S.S.C.% in berry juice of "Flame Seedless" grape at room temperature and under cold storage.

Treatment	S.S.C.in berry juice %							
	days at room temperature				days at cold storage period			
	0	3	6	Mean	10	20	30	Mean
Control	19.01	19.08	19.23	19.11	19.23	19.38	19.43	19.26
Ethephon 250	19.56	19.63	19.78	19.66	19.78	19.86	19.93	19.78
Ethephon 250+Citric 2.0g/l	20.00	20.08	20.24	20.11	20.24	20.45	20.48	20.29
Ethephon 250+ A.A0.5cm/l	19.28	19.36	19.51	19.38	19.51	19.60	19.63	19.50
Ethephon 500	20.18	20.28	20.58	20.35	20.58	20.71	20.86	20.58
Ethephon 500+Citric 2.0g/l	20.73	20.83	20.88	20.81	20.83	21.04	21.10	20.93
Ethephon 500+ A.A0.5cm/l	20.08	20.14	20.34	20.19	20.34	20.49	20.56	20.37
Mean	19.83	19.91	20.08	---------	20.07	20.22	20.28	-------
LSD at 5%	Treatment (T) = 0.311 Storage period(S) = 0.203 T x S =0.063				Treatment (T) = 0.261 Storage period(S) = 0.197 T x S =0.051			

Effect of ethephon, acetic and citric acid on total titratable acidity in berry juice of Flame Seedless grape:

Data from table 7 presented that total titratable acidity in berry juice gave a somewhat reduction as storage period advanced. Also, data showed that total acidity in berry juice tended to fluctuate During cold storage or through marketing. Thus, all treatments produced a lower acidity in berry juice compared with the control . In this respect, (Kelany, *et al*., (2011) mentioned that spraying table grape cluster by ethrel at 250 and 500 ppm increased berry titratable acidity as it recorded 1.23,1.00 % and 1.22,0.98 % at initial time of cold storage in 1" and 2nd seasons, respectively .On the other side, a decrease in berry titratable acidity percentage of "Flame seedless" table grapes was observed up to 4 weeks under cold storage conditions for all treatments used .The content of total acidity in berry juice was declined as storage period advanced from harvest till 30 days at cold storage or during storage at room temperature, which may be attributed to the use of acid as substrate for respiration. The values of total acidity in berry juice were almost lower during cold storage than those obtained at room temperature.

Table 7 :Total titratable acidity in berry juice of "Flame Seedless" grape at room temperature and under cold storage .

Treatment	Total acidity in berry juice %							
	Days at room temperature				Days at cold storage period			
	0	3	6	Mean	10	20	30	Mean
Control	0.603	0.598	0.594	0.598	0.594	0.591	0.591	0.594
Ethephon 250	0.591	0.588	0.584	0.588	0.584	0.581	0.581	0.584
Ethephon 250+Citric2.0g/l	0.588	0.584	0.581	0.584	0.581	0.578	0.574	0.580
Ethephon 250+ A.A0.5cm/l	0.600	0.596	0.593	0.596	0.593	0.590	0.590	0.593
Ethephon 500	0.581	0.578	0.573	0.577	0.573	0.570	0.570	0.573
Ethephon 500+Citric2.0g/l	0.579	0.576	0.573	0.576	0.573	0.569	0.566	0.572
Ethephon 500+ A.A0.5cm/l	0.586	0.583	0.580	0.583	0.580	0.576	0.576	0.580
Mean	0.590	0.586	0.582	-------	0.582	0.579	0.578	------
LSD at 5%	Treatment (T) = 0.011 Storage period(S) = 0.007 T x S = 0.001				Treatment (T) = 0.009 Storage period(S) =0.007 T x S = 0.001			

Effect of ethephon, acetic and citric acid on S.S.C/acid ratio in berry juice of Flame Seedless grape:

It's obvious from table 8 that SSC/acid ratio was gradually increased during storage period advanced from harvest till 30 days at cold storage or 6 days at room temperature.

The increment in SSC/acid ratio during the storage period mainly due to the increment of SSC content and the reduction in total acidity in berry juice with the advanced storage period. The data also, showed that sprayed vine with citric acid with ethephon gave a higher SSC/ acid ratio in berry juice than other treatments used during marketing at room temperature and at cold storage.

In this respect, (Omar,2000) presented that, sprayed table grape as foliar or cluster alone by ethrel at 500ppm recorded high berry SSC/acid ratio at harvest date and at the end of storage period.

Table 8 :SSC/acid ratio% in "Flame Seedless" grape at room temperature and under cold storage.

Treatment	S.S.C./ acid ratio in berry juice %							
	days at room temperature				days at cold storage period			
	0	3	6	Mean	10	20	30	Mean
Control	31.61	31.89	32.32	31.94	32.32	32.75	32.84	32.38
Ethephon 250	33.08	33.38	33.82	33.43	33.82	34.15	34.27	33.83
Ethephon 250+Citric 2.0g/l	34.00	34.34	34.82	34.38	34.82	35.35	35.62	34.95
Ethephon 250+ A.A0.5cm/l	32.14	32.45	32.96	32.52	32.89	33.21	33.27	32.88
Ethephon 500	34.70	35.07	35.90	35.23	35.90	36.34	36.61	35.89
Ethephon 500+Citric 2.0g/l	35.74	36.12	36.13	35.99	36.42	36.76	37.23	36.53
Ethephon 500+ A.A0.5cm/l	34.24	36.04	35.08	35.12	35.08	36.04	35.66	35.26
Mean	33.64	34.18	34.43	-------	34.46	34.951	35.07	--------
LSD at 5%	Treatment (T) = 1.042 Storage period(S) = 0.682 T x S = 0.710				Treatment (T) = 0.623 Storage period(S) = 0.471 T x S = 0.293			

Effect of ethephon, acetic and citric acid on Anthocyanin content of Flame Seedless grape:

It's clear from table 9 that total anthocyanin content in berry skin of Flame Seedless grape was gradually reduced as storage period advanced from harvest till30 days of cold storage. Data also reveal that the content of anthocyanin in berry skin was varied with the treatments used. So, citric acid with ethephon treatment produced significant a higher values of anthocyanin in berry skin than the control or other treatments during period storage.

In this respect Holcroft and Kader (1999) mentioned that anthocyanin concentrations were higher in the external tissues than in the internal tissues. Slight changes in PH have significant effect on the expression of anthocyanin since the acidity of the solution affects the ratio between the various forms of the pigments. Similar changes in anthocyanin concentration were observed in the internal tissues, with initial increase after 10 days at 5 C followed by a decrease in concentration. Also, it's clear the changes in total anthocyanin in berry skin through marketing, 6 days at room temperature were almost similar to those obtained at cold storage. Yet, the reduction in anthocyanin values was almost lower than under cold storage. Data also, disclose that citric or acetic acid with ethephon treatment keep the berry color during storage period compared than those treated with ethephon alone or than the control.

Table (9): Anthocyanin in "Flame Seedless" grape at room temperature and under cold storage.

Treatment	Anthocyanin content							
	days at room temperature				days at cold storage period			
	0	3	6	Mean	10	20	30	Mean
Control	19.76	19.66	19.40	19.61	19.58	19.44	19.34	19.53
Ethephon 250	22.54	22.48	22.37	22.46	22.39	22.29	22.23	22.36
Ethephon 250+Citric2.0g/l	23.46	23.46	23.43	23.45	23.38	23.35	23.35	23.39
Ethephon 250+ A.A0.5cm/l	21.27	21.24	21.18	21.23	21.16	21.10	21.08	21.15
Ethephon 500	25.88	25.82	25.72	25.81	25.74	23.60	23.54	24.69
Ethephon 500+Citric2.0g/l	27.06	27.06	27.03	27.05	26.98	26.95	26.95	26.99
Ethephon 500+ A.A0.5cm/l	24.93	24.80	24.73	24.82	24.72	24.65	24.80	24.78
Mean	23.56	23.51	23.41	------	23.42	23.05	23.04	-------
LSD at 5%	Treatment (T) = 0.562 Storage period(S) = 0.368 T x S = 0.206				Treatment (T) = 0.484 Storage period(S) =0.366 T x S = 0.177			

From the above mentioned results data presented that sprayed Flame seedless vine with citric and acetic acid with ethephon treatment reduced the total loss in cluster weight than sprayed ethephon alone or the untreated vine .Data also showed that these treatment increased both soluble solid content and SSC/acid ratio in berry juice, and improved berry coloring through to their on increasing the values of anthocyanin content.

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"تأثير الايثيفون وحمض الخليك وحمض االسيتريك على جودة الحبات والقدرة التخزينية لثمار العنب الفليم سيدليس"

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أجريت هذه الدراسة خلال موسمين متتاليين 2011,2012 على صنف عنب الفليم سيدلس استخدام حمض السيتريك بتركيز ٢ جم / لتر و حمض الخليك بتركيز٥سم/ لتر مع الرش بالايثيفون بتركيز ٢٥٠- ٥٠٠ جزء في المليون كمعاملات ما قبل الحصاد في التحكم في تلف الحبات وكذا تحسين التلوين والحفاظ على جوده الحبات والعناقيد للعنب الفليم وذلك خلال فتره التداول وخلال التخزين البارد. حيث تم الرش للمعاملات عند بداية التلوين وعندما تكون نسبه المواد الصلبة الذائبة الكلية لحوالي ١٠-١٢% . وعند وصول الحبات إلى تمام التلوين وكذا عندما وصلت نسبة المواد الصلبة الكلية في عصير الحبات ١٦-١٨% تم جمع العينات وإجراء معاملات التخزين في درجه حرارة الغرفة وكذا تحت ظروف التخزين المبرد (٠ ± ١ درجة مئوية و رطوبة نسبية ٩٠-٩٥٪) وذلك لتقدير التغيرات في الصفات الفيزيائية و الكيميائية المختلفة للثمار خلال فتره التخزين. وقد أشارت النتائج إلى ان الرش بمعاملات حمض السيتريك وكذا حمض الخليك مع الايثيفون كمعاملات ما قبل الحصاد أدى إلى تقليل الفقد الكلى في وزن العناقيد نتيجة تأثيره على تقليل فرط الحبات وكذا الحبات التالفة نتيجة الإصابة بالعفن الرمادي والبنسليوما مقارنة باستخدام الرش بالايثيفون بمفرده وكذا بالمقارنة بالعناقيد الغير معاملة. في حين أظهرت معاملات الرش بحمض السيتريك وكذا حمض الخليك ارتفاعا طفيفا في محتوى قشره الحبات من الانثوسيانين عن باقي المعاملات كما أنها تحافظ على العناقيد دون اثر على الحبات. أيضا أظهرت النتائج أن لهذه المعاملات تأثيرات ايجابية على زيادة نسبه المواد الصلبة الذائبة في عصير الحبات .