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(Original Article)

Effect of some Pre and Post-harvest Treatments on White Banaty (Thompson Seedless) Grapes during Cold Storage

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Abstract

This study was carried out during 2020 and 2021 seasons on White Banaty grapevines grown in the Experimental Orchard of Pomology Department, Faculty of Agriculture, Assiut University. This investigation aimed to examine the effect of some pre and post-harvest treatments on physical and chemical characteristics of white Banaty berries during cold storage. The obtained results showed that all treatments reduced the decay % and fruit weight loss under cold storage for five weeks compared with control treatment. The combined treatment of ascorbic acid as pre-harvest + GA_3 at 50 ppm as post-harvest treatment was more effective in storage of white Banaty grapes for the longest period with high berries quality.

Keywords: *White Banaty, Pre and post-harvest, Cold storage, Berries quality.*

Introduction

Grapes are one of the most important fruit crops in the world. In Europe as well as other parts of the world, it is widely grown. In Egypt, it ranks third behind citrus and mango in terms of the size of the cultivated area and the magnitude of the fruit yield. Endogenous metabolites, dietary glutathione, vitamins, phenols, flavonoids, anthocyanins, and other antioxidants are considered to be key sources of it. Grapes therefore significantly contribute to their health benefits (Anastasiadi *et al*., 2010).

The majority of grape cultivars grown in Egypt are table grapes, which are the most popular types in Egyptian vineyards for both domestic and international trade. About 1472418 tonnes of fruits were produced in Egypt's 184410 fedden of grapevine cultivation (MALR, 2021). Thompson Seedless grapevines are a popular grape grown in Egypt. It is a sweet, refreshing, and natural source of minerals and vitamins (B1, B2, and C). Increasing demand of grape production requires a new strategy. However, there are many pathogenic fungi on the surfaces of grapes that directly lead to grape spoilage (Martins *et al*., 2014). Numerous physiological and biochemical processes in the fresh grape, including as nutrient intake, increased respiration, and water loss, cause the grape quality to decline during storage (Sabir and Sabir, 2013 and Champa *et al*., 2015). In light of this, the exogenous administration of several plant hormones at distinct developmental stages. Endogenous levels have underlined the significance of fruits for fruit

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development and quality traits (Srivastava and Handa, 2005). Gibberellic acid and ethylene have a significant impact on the maturation and ripening of fruit (Rizk-Alla and Meshrake, 2006; Elfving *et al*., 2009 and Lurie, 2010). In grapes, their roles in postponing maturation and ripening have been proven (Ponce *et al*., 2002) by reducing softening (Mirdehghan *et al*., 2006). Additionally, they were said to boost the fruit set and production of many fruit species (Biasi *et al*, 1991; Crisosto, 1992). To overcome the cluster tightness, gibberellic acid (GA_3) is administered to the clusters before full bloom in order to lengthen the main cluster stem (Omer and El Morsey, 2000, Omer and Girgis, 2005 and Mohamed *et al*., 2019). But there are some risks, such as a decline in fertility and a delay in maturation (Jawanda *et al*., 1974) Gibberellins actively contribute to cell elongation and division. Additionally, when used after flowering, plant growth regulators efficiently improve fruit weight (Gao *et al*., 2020). The GA_3 treatment dramatically reduced ethylene production, weight loss, stem browning, fungal rot, and fruit ripening, while increasing anthocyanin content, firmness, and acidity (Gholami *et al*., 2010). Auxins and other compounds have recently been replaced with certain antioxidants in order to improve the growth, development, and fruiting of diverse fruit trees (El Sayed *et al*., 2000). Ascorbic acid, a naturally occurring organic antioxidant, has been proven to play a significant effect in boosting the growth and productivity of fruits (Farag, 1996). Ascorbic acid application has a variety of stimulating impacts on the development and physiological functions of different plants (Dewick, 2000, Ismail, 2008 and Abdou *et al*., 2015). Ascorbic acid and citric acid, two antioxidants, work in concert with auxins to promote fruit and blossom development in fruit trees. Recently, antioxidants have been utilized in place of auxins to promote fruit tree growth, development, and fruiting (El Sayed *et al*., 2000 and Maksoud *et al*., 2009). Citric and ascorbic acids could enhance the Ruby seedless grapevine's physical and chemical characteristics (Abdel-Salam, 2016). Blokhina *et al*. (2003) Ascorbic acid has been regarded as a regulator of cell division and differentiation and is one of the most readily available antioxidants that protect plant cells. It is also used in a variety of crucial processes, including photo protection, regulation of photosynthesis, and growth. Ascorbic acid is involved in a variety of processes, such as photosynthesis, cell wall development, cell lengthening, resistance to environmental stressors, and the manufacture of ethylene, gibberellins, anthocyanins, and proline pigments (Galal *et al*., 2000 and Blokhina *et al*. 2003).

The purpose of this study was to shed more light on the benefit of pre-harvest gibberellic acid (GA_3) and ascorbic acid (AA) foliar application on berry quality and postharvest life of Thompson Seedless grapes during cold storage conditions.

Materials and Methods

This study was conducted during two successive seasons of 2020 and 2021 on White Banaty grapevines grown in the Experimental Orchard of Pomology Department, Faculty of Agriculture, Assiut University. The experiment was conducted on eighteen years old. Vines were cultivated at 2×2 m apart. in a clay soil. The vines were trained according to the head training system by leaving the total bud load of 79 buds/vine (15 fruiting spurs × 5 buds + 2 replacement spurs × 2 buds/vine). Fifteen healthy vines selected and divided into three groups, five vines each. The vines received the same agriculture management with an exception of the study treatments. The experiment was arranged in randomized completely block design in split plot design.

Pre harvest treatments

The cluster of selected vines was sprayed with the following solutions:

1-water sprayed (control).

2- GA_3 sprayed 4 times on the same vine (at 10 ppm at the beginning of flowering, 15ppm at full bloom, at 30ppm when fruit reached 5 mm and at 50 ppm one month later).

3- Ascorbic acid sprayed two times (at 500 ppm when fruit reached 5mm and at 1000ppm one month later). At the harvest date clusters were collected and selected for uniformity of size and shape and absence of visible defects and were directly transferred to the laboratory of the Pomology Department, Faculty of Agriculture, Assiut University.

Post harvest treatments

The collected clusters from each treatment were divided into two groups. Each group (consisted of 30 clusters) was subjected to one of the following treatments:

1-Control (water only).

2-Control in the orchard and GA_3 at 50 ppm in the laboratory.

3-GA_3 in the orchard only.

4-GA_3 in the orchard and GA_3 at 50 ppm in the laboratory.

5-Ascorbic in the orchard.

6-Ascorbic in the orchard and GA_3 at 50 ppm in the laboratory.

The clusters of all treatments were dipped for 60 seconds in the solution of each treatment, and air dried and were stored at 5-7 °C and 90-85 R.H.

Two clusters were taken randomly from each replicate to determine the clusters and berries' physical and chemical properties during cold storage.

The parameters of storage grape cluster were determined periodically at a weekly interval as follow:

- Berries Weight loss percentage

The initial weight of Thompson Seedless cluster was recorded for each treatment at weekly interval, and then berries weight loss % was calculated by weighing the same fruits at each interval until the end of cold storage period Using the following formula:

$$\text{Berries weight loss \%} = \frac{\text{Initial weight} - \text{weight at specific interval}}{\text{Initial weight}} \times 100$$

- Berries Decay Percentage (%):

The number of decayed berries from each treatment were discarded and the number of such discarded berries related to the initial number of berries per each treatment was estimated and decay percentage was calculated.

- Changes in 50 berries weight during storage period.
- Changes in juice weight of 50 berries during storage period.

Chemical properties:

- Total soluble solids (T.S.S %):

Total soluble solids (TSS%) of berries juice were measured using a hand refract meter. The total soluble solids were expressed as a percent.

Total Acidity%:

Berries total acidity (grams of tartaric acid per 100ml of juice) were determined by using 5 ml juice were titrated 0.1N sodium hydroxide using phenol naphthalene as an indicator according to A.O.A.C. (1990).

Reducing sugar %

Reducing sugars % were determined according to Lane and Eynon method as outlined in A.O.A.C. (1990).

Statistical analysis

The obtained data were tabulated and subjected to the proper statistical analysis of variance according to the split plot design using L.S.D test for recognizing the significant differences among the various treatment means (Snedecor and Cochran,1989).

Results

The percentages of weight loss and decay

The effect of gibberellic acid, ascorbic acid as pre-harvest treatments and GA3 as post- harvest treatment on weight loss % and decay % of white Banaty grapes during cold storage, are shown in tables (1 and 2) concerning the weight loss % and decay %, the obtained results approximately took the same treated during the two studies seasons. It can be noticed that the weight loss % and decay % significantly increased with the progression of storage period during 2020 and 2021seasons. The highest values of Weight loss % and decay % were recorded at the end of the storage period.

Data also showed that the using of GA_3 as post-harvest or ascorbic acid pre and GA_3 post-harvest treatments decreased weight loss % and decay % compared to the water sprayed (control). The best treatment concerned weight loss % was using GA_3 as pre and post-harvest treatment which gave the lowest values of (17.96 & 16.58)% followed by ascorbic acid + GA_3 which gave (18.64 & 17.55)% at the end of the storage period during 2020 and 2021season respectivel .

Moreover, the decay% reached (27.64 & 33.26)% in the Control treatments after three and four weeks of storage during the two studied seasons respectively.

The combined treatment (Ascorbic + GA_3) gave the lowest decay% values after five weeks (18.93 & 20.48)% followed by (GA_3 + GA_3) which gave (19.69 & 22.80)% during 2020 and 2021 Seasons respectively.

In general view, the obtained results cleared that, the storage period during 2020 season was three weeks for the control, four weeks for control + Gibberellic acid and five weeks for other treatments, during 2021season the storage duration was four weeks for the Untreated grapes (Control), while the storage period was extended to five weeks for the grapes treated with GA_3 as post-harvest treatment

Table 1. The effect of Pre and Post-harvest treatments on weight loss % of 2021 season.

Treatments / Period	Week of cold storage in season 2020					
	0	1	2	3	4	5
Control	0.00	4.25	11.24	16.13	-	-
Control + gibberellic (post)	0.00	4.07	10.79	14.57	17.34	-
Gibberellic (pre)	0.00	3.29	9.84	13.71	15.82	18.24
Gibberellic (pre) + gibberellic (post)	0.00	3.38	9.93	12.86	15.52	17.96
Ascorbic (pre)	0.00	3.69	10.44	13.78	15.88	18.95
Ascorbic (pre) + gibberellic (post)	0.00	3.73	10.69	13.73	15.97	18.64
Mean (week)	0.00	3.73	10.48	14.13	16.10	18.44
LSD 5%	Treatments = 0.021					
	Period = 0.24					
	Treatments* period = 0.052					
Treatments / Period	Week of cold storage in season 2021					
	0	1	2	3	4	5
Control	0.00	3.44	10.52	15.81	17.29	-
Control + gibberellic (post)	0.00	2.98	9.77	13.77	15.96	18.90
Gibberellic (pre)	0.00	2.57	8.51	11.59	14.30	17.33
Gibberellic (pre) + gibberellic (post)	0.00	2.58	8.42	11.39	13.92	16.58
Ascorbic (pre)	0.00	2.96	8.88	11.87	14.17	18.05
Ascorbic (pre)+ gibberellic (post)	0.00	2.90	8.59	11.54	13.95	17.55
Mean (week)	0.00	2.90	9.11	12.55	14.93	17.68
LSD 5%	Treatments = 0.014					
	Period = 0.27					
	Treatments* period = 0.033					

Table 2. The effect of Pre and Post-harvest treatments on Decay percentage % of White Banaty (Thompson seedless) grapes during cold storage in 2020 and 2021 season.

Treatments / Period	Week of cold storage in season 2020					
	0	1	2	3	4	5
Control	0.00	60.84	14.72	27.64	-	-
Control + gibberellic (post)	0.00	4.55	10.96	21.80	29.18	-
Gibberellic (pre)	0.00	3.19	8.31	15.29	20.92	28.57
Gibberellic (pre) + gibberellic (post)	0.00	2.60	6.48	12.56	16.70	19.69
Ascorbic (pre)	0.00	2.82	7.82	14.11	18.98	22.17
Ascorbic (pre) + gibberellic (post)	0.00	2.24	4.71	9.47	13.88	18.93
Mean (week)	0.00	3.70	8.83	16.81	19.93	22.34
LSD 5%	Treatments = 0.024					
	Period = 0.025					
	Treatments* period = 0.059					
Treatments / Period	Week of cold storage in season 2021					
	0	1	2	3	4	5
Control	0.00	8.15	15.97	29.18	33.26	-
Control + gibberellic (post)	0.00	5.19	10.72	23.32	30.37	35.17
Gibberellic (pre)	0.00	4.81	7.72	15.60	22.18	27.91
Gibberellic (pre) + gibberellic (post)	0.00	3.00	6.19	13.94	17.90	22.80
Ascorbic (pre)	0.00	4.18	7.21	15.22	19.51	24.68
Ascorbic (pre)+ gibberellic (post)	0.00	2.78	5.55	11.18	14.66	20.48
Mean (week)	0.00	4.68	8.89	18.07	22.98	26.20
LSD 5%	Treatments = 0.018					
	Period = 0.24					
	Treatments* period = 0.043					

Changes in 50 berries weight (g) and their Juice weight(g)

During cold storage in response to pre and post-harvest treatments throughout seasons 2020 and 2021 were illustrated in tables (3 and 4). Data in previously tables cleared that (50) berries weight (g) and juice weight (g) had a similar tendency. Data showed that berries weight (g) and Juice weight (g) were decreased with advanced of cold storage period. Concerning the berries weight (g) the recorded values were (54.00 & 48.00) g due to control after three and four weeks, while berries white reached (54.47 & 47.00) g due to (control + GA_3) after four and five weeks during 2020 and 2021 seasons respectively, While berries weight(g) values were (62.70 & 59.00) g, (65.00 & 61.00) g, (54.38 & 46.00) g and (64.48 & 53.00) g due to GA_3, (GA_3 + GA_3), Ascorbic and (Ascorbic + GA_3) during the two studied seasons respectively. Data indicates that the weight reduction % of fifty berries were (23.94 & 26.15) % due to untreated berries after three and four weeks during 2020 and 2021 seasons respectively. The lowest reduction percentage were recorded in berries treated with (ascorbic as pre-harvest treatment + GA_3 as post-harvest treatment), (14.03 & 17.00) % followed by (GA_3 + GA_3), (23.53 & 25.60) % after five weeks during the two studied seasons respectively. Concerning the juice weight date cleared that juice weight gradually decreased for the control and all treatments juice weigh (g) reached (32.00 &

28.00) g with reduction % (39.62 & 39.13)% due to untreated berries after (3) and (4) weeks during 2020 and 2021 seasons respectively. It could be noticed that combined treatment (Ascorbic+ GA_3) had the lowest juice weight reduction percentage (27.95 & 28.34) % followed by (GA_3 + GA_3) treatments (29.74 & 31. 94) % after five weeks during the two studied seasons respectively.

Table 3. The effect of Pre Post-harvest treatments on weight (g) of fifty berries of White Banaty (Thompson seedless) grapes during cold storage in 2020 and 2021 season

Treatments / Period	Week of cold storage in season 2020					
	0	1	2	3	4	5
Control	71.00	69.00	64.00	54.00	-	-
Control + gibberellic (post)	72.00	70.00	68.50	55.36	54.47	-
Gibberellic (pre)	86.00	75.26	72.80	66.96	64.89	62.70
Gibberellic (pre) + gibberellic (post)	85.00	81.66	77.94	68.88	66.69	65.00
Ascorbic (pre)	74.00	72.33	68.00	59.00	55.68	54.38
Ascorbic (pre) + gibberellic (post)	75.00	73.00	69.18	66.90	65.14	64.48
Mean (week)	77.16	73.54	70.07	61.85	61.42	61.64
LSD 5%	Treatments = 0.013					
	Period = 0.1					
	Treatments* period = 0.033					
Treatments / Period	Week of cold storage in season 2021					
	0	1	2	3	4	5
Control	65.00	61.00	59.00	50.33	48.00	-
Control + gibberellic (post)	67.00	65.00	63.33	63.33	51.00	47.00
Gibberellic (pre)	82.00	75.00	73.00	63.90	62.00	59.00
Gibberellic (pre) + gibberellic (post)	82.00	78.00	76.00	66.00	65.00	61.00
Ascorbic (pre)	64.00	63.00	58.00	52.00	50.00	46.00
Ascorbic (pre)+ gibberellic (post)	64.00	64.00	62.00	57.00	56.00	53.00
Mean (week)	70.66	67.66	65.22	58.76	55.33	53.20
LSD 5%	Treatments = 0.008					
	Period = 0.11					
	Treatments* period = 0.020					

Table 4. The effect of Pre and Post-harvest treatments on fifty berries juice weight (g) of White Banaty (Thompson seedless) grapes during cold storage in 2020 and 2021 season.

Treatments / Period	Week of cold storage in season 2020					
	0	1	2	3	4	5
Control	53.00	49.00	44.00	32.00	-	-
Control + gibberellic (post)	50.00	43.00	42.00	36.00	34.00	-
Gibberellic (pre)	65.00	62.00	53.33	46.33	45.00	42.00
Gibberellic (pre) + gibberellic (post)	65.00	64.00	55.67	48.67	47.00	45.67
Ascorbic (pre)	50.00	43.00	42.00	36.00	34.00	31.66
Ascorbic (pre) + gibberellic (post)	53.89	48.70	46.00	43.00	40.34	38.83
Mean (week)	56.14	51.61	47.16	40.33	40.06	39.54
LSD 5%	Treatments = 0.14					
	Period = 0.27					
	Treatments* period = 0.33					

Treatments / Period	Week of cold storage in season 2021					
	0	1	2	3	4	5
Control	46.00	44.80	41.00	30.00	28.00	-
Control + gibberellic (post)	46.00	45.00	42.19	32.00	29.00	27.96
Gibberellic (pre)	59.96	56.00	51.00	42.00	39.00	38.00
Gibberellic (pre) + gibberellic (post)	60.18	57.80	54.00	48.00	42.67	40.96
Ascorbic (pre)	46.00	41.00	40.00	33.11	31.00	30.00
Ascorbic (pre)+ gibberellic (post)	46.00	44.70	43.10	39.00	36.00	32.96
Mean (week)	50.69	48.21	45.21	37.35	34.27	33.97
LSD 5%	Treatments = 0.01					
	Period = 0.13					
	Treatments* period = 0.023					

Changes in chemical properties: -

Total soluble solids% (TSS) and reducing sugar %

Data presented in table (5&6) showed, the effect of pre and post- harvest treatments on chemical properties i.e. TSS% and reducing sugar during cold storage in 2020 and 2021 seasons. The obtained results indicated that total soluble solids and reducing sugar were increased and gradually with advanced of storage period.

In response of pre and post-harvest treatments, data showed that all treatments decreased the TSS under cold storage. Compared with control which recorded (18.80 &19.00) % after three and four weeks during the two studied seasons. Concerning the pre and post-harvest treatments, at the end of storage period, the treatment (Ascorbic) was the best treatment which gave the highest TSS values (19.60 &19.40) % while the compiled treatment (Ascorbic + GA_3) which recorded (19.00 & 18.50) % during while the combined treatment(GA_3 + GA_3) had the Lowest TSS % values (17.50 &17.20) % after five weeks during the two studied seasons respectively.

Also, the recorded reducing sugars% values were (15.56 &16.11) % due to untreated berries after three and four weeks during 2020 and 2021 seasons. Concerning the used treatments, the highest reducing sugars%. Values were obtained from berries treated with ascorbic acid as pre-harvest treatment (16.36 &16.75) % followed by the combined treatment (Ascorbic+GA_3) (15.86 &16.22) %, while the combined treatment (GA_3+GA_3), gave the lowest reducing Sugars% values (13.84 &14.10) % after five weeks under cold storage during 2020 and 2021 seasons respectively.

Table 5. The effect of Pre and Post-harvest treatments on total soluble solids (TSS%) of White Banaty (Thompson seedless) grapes during cold storage in 2020 and 2021 season.

Period Treatments	Week of cold storage in season 2020					
	0	1	2	3	4	5
Control	16.50	17.90	18.30	18.80	-	-
Control + gibberellic (post)	16.00	16.50	17.20	17.40	17.60	-
Gibberellic (pre)	15.30	16.20	17.00	17.30	17.50	18.20
Gibberellic (pre) + gibberellic (post)	15.30	16.00	16.60	16.80	16.80	17.50
Ascorbic (pre)	16.80	17.70	17.80	18.00	18.90	19.60
Ascorbic (pre) + gibberellic (post)	16.80	17.40	17.40	17.80	18.00	19.00
Mean (week)	16.11	16.95	17.38	17.68	17.76	18.57
LSD 5%	Treatments = 0.021					
	Period = 0.19					
	Treatments* period = 0.052					
Period Treatments	Week of cold storage in season 2021					
	0	1	2	3	4	5
Control	16.40	17.40	18.00	18.30	19.00	-
Control + gibberellic (post)	16.40	17.00	17.20	17.50	17.80	18.40
Gibberellic (pre)	15.00	16.00	16.80	17.00	17.40	18.00
Gibberellic (pre) + gibberellic (post)	15.00	15.60	16.00	16.50	16.80	17.20
Ascorbic (pre)	16.50	17.00	17.20	17.80	18.80	19.40
Ascorbic (pre)+ gibberellic (post)	16.00	16.40	17.00	17.50	18.00	18.50
Mean (week)	15.88	16.56	17.03	17.43	17.96	18.30
LSD 5%	Treatments = 0.013					
	Period = 0.20					
	Treatments* period = 0.033					

Table 6. The effect of Pre and Post-harvest treatments on reducing sugar % of White Banaty (Thompson seedless) grapes during cold storage in 2020 and 2021 season.

Treatments / Period	Week of cold storage in season 2020					
	0	1	2	3	4	5
Control	13.49	14.22	14.81	15.56	-	-
Control + gibberellic (post)	12.88	13.66	14.60	15.90	15.54	-
Gibberellic (pre)	11.95	12.75	13.66	14.82	14.86	15.24
Gibberellic (pre) + gibberellic (post)	11.60	12.30	12.85	12.99	13.56	13.84
Ascorbic (pre)	13.62	14.64	14.79	15.66	16.00	16.36
Ascorbic (pre) + gibberellic (post)	13.13	13.64	14.19	14.24	15.63	15.86
Mean (week)	12.77	13.53	14.15	14.86	15.11	15.32
LSD 5%	Treatments = 0.022					
	Period = 0.21					
	Treatments* period = 0.051					
Treatments / Period	**Week of cold storage in season 2021**					
	0	1	2	3	4	5
Control	13.38	14.43	15.10	15.25	16.11	-
Control + gibberellic (post)	13.20	13.41	13.95	14.30	15.22	15.38
Gibberellic (pre)	12.48	13.20	13.37	13.83	14.49	14.82
Gibberellic (pre) + gibberellic (post)	12.20	12.90	12.98	13.15	13.75	14.10
Ascorbic (pre)	14.43	14.60	15.23	15.50	16.55	16.75
Ascorbic (pre)+ gibberellic (post)	12.95	14.38	15.08	15.15	15.85	16.22
Mean (week)	13.10	13.82	14.40	14.53	15.32	14.65
LSD 5%	Treatments = 0.014					
	Period = 0.22					
	Treatments* period = 0.033					

Moreover, data in table (7) showed the effect of pre and post-harvest treatments on white Banaty berries juice total acidity % under cold storage during 2020 and 2021 seasons.

The obtained results indicated that total acidity% (TA%) gradually decreased for all, treatments and then it increased at the end of storage period during the two studied seasons.

At the end of storage period, the combined treatment (GA_3 + GA_3) Caused the highest values of (TA%) (0.78 &0.83) % while the lowest (TA%) values were measured in the berries treated with Ascorbic acid as pre harvest treatment (0.68 &0.70) % at during the two investigated season, respectively.

Table 7. The effect of Pre and Post-harvest treatments on total acidity % of White Banaty (Thompson seedless) grapes during cold storage in 2020 and 2021 season.

Treatments / Period	Week of cold storage in season 2020					
	0	1	2	3	4	5
Control	0.75	0.60	0.60	0.60	-	-
Control + gibberellic (post)	0.75	0.63	0.63	0.60	0.70	-
Gibberellic (pre)	0.97	0.75	0.75	0.68	0.53	0.73
Gibberellic (pre) + gibberellic (post)	0.97	0.90	0.78	0.75	0.60	0.78
Ascorbic (pre)	0.83	0.83	0.60	0.53	0.52	0.68
Ascorbic (pre) + gibberellic (post)	0.83	0.68	0.73	0.53	0.47	0.73
Mean (week)	0.85	0.73	0.68	0.61	0.56	0.73
LSD 5%	Treatments = 0.006					
	Period = 0.011					
	Treatments* period = 0.015					
Treatments / Period	Week of cold storage in season 2021					
	0	1	2	3	4	5
Control	0.75	0.68	0.53	0.45	0.63	-
Control + gibberellic (post)	0.70	0.68	0.60	0.53	0.53	0.75
Gibberellic (pre)	0.83	0.75	0.56	0.48	0.68	0.75
Gibberellic (pre) + gibberellic (post)	0.83	0.78	0.60	0.60	0.75	0.83
Ascorbic (pre)	0.68	0.60	0.53	0.45	0.60	0.70
Ascorbic (pre)+ gibberellic (post)	0.68	0.60	0.53	0.43	0.58	0.73
Mean (week)	0.74	0.68	0.55	0.49	0.62	0.75
LSD 5%	Treatments = 0.001					
	Period = 0.01					
	Treatments* period = 0.002					

Discussion

Grapes consider one of the most significant crops in the world. Thompson seedless grape is a popular grape grown in Egypt. This cultic is attracting huge interest for its better. Eating quality and higher returns to the grower but it has smaller in berry size and lower cluster traits which might cause a trouble for marketing. The grape quality is reduced. During storage due to many physiological and biochemical reactions in the fresh grape, including consumption of nutrients, enhancement of respiration and water loss (Champ *et al*. 2015). GA_3 has many positive effects on Seedless grape cultivars. The application of GA_3 Promotes the increase of berries mass, rachis, mass and berry diameter (Guerios *et al*., 2016). GA_3 increased the productivity of seedless grape cultivars, promoting growth (Ferrara *et al*., 2014). The acquired results demonstrated an increase in fruit weight (g) and berry juice weight (g) when GA_3 was used as a pre-harvest treatment. This might be as a result of GA_3 actively contributing to cell elongation, division, and berry set reduction. As opposed to untreated grapes, GA_3 treatment delayed fruit ripening and reduced ethylene synthesis, which resulted in a decrease in TSS and reduced sugars while enhancing acidity (Gao *et al*., 2020). These results are in harmony with these obtained by (Abada *et al*., 2015), (Gouda-Fatma El-zahraa 2016), (sembok *et al*., 2016) and (Kaplon *et al*., 2017) who reported that this GA_3 reduced shoot berries, TSS and reducing sugars while improved yields cluster and berry weight and total acidity. Due to the existence of bigger berries, GA_3 application should detect a decrease in sugar accumulation (Crupi *et al*., 2016).

Recently, antioxidants like ascorbic acid have replaced auxins as a method of promoting the growth, development, and fruiting of a variety of fruit trees (EL-Sayed *et al*., 2000). Ascorbic acid can enhance the physical and chemical characteristics of seedless grape cultivars and has a synergistic effect and auxin action on the flowering and fruiting of fruit trees The results cleared that Ascorbic acid as pre-harvest treatment improve fruit quality in terms of increasing TSS and reducing sugars this may due to Ascorbic acid has main function in plant as antioxidant. It participates in a variety of presses such as photosynthesis, resistance to environmental stresses and synthesis of ethylene, metabolism and translocation of carbohydrates (Smirnoff, 1996; Elham and shahin 2006 and Maksoud *et al*., 2009).

Data cleared that fruit decay and weight loos% were increased by extending storage period. While berries weight and berries juice weight were decreased. Whereas TSS, and reducing sugars were increased as prolong the storage period, this increase may be due to solubilization of compounds other than carbohydrate to sugars. On the other hand, results. showed a decrease in acidity which caused by the use of acids in fruits as a source of energy and the conversion of organic acids to form of sugars (wills *et al*., 1998). Our results showed that using Ascorbic acid as pre-harvest plus GA_3 as post- harvest was effective on elongation storage period where decreasing weight loss%, decay% and keeping berries quality internes of TSS and reducing sugars, this could be due to use GA_3 delayed fruit ripening, decreased ethylene production, flesh softening, weight loss and fungal rot. These results are in agreement with those obtained by (Gao *et al*., 2020, Gholami *et al*., 2010 and Ibrahim *et al*.,2021).

Conclusion

On the light of obtained results of this study, all treatments reduced decayed percentage as well as weight loss percentage under cold storage conditions for a period of five weeks compared to the control treatment. At the end of the storage period, the fruits treated with gibberellic acid or ascorbic acid contained a higher percentage of reducing sugars compared to the untreated fruits (control). The highest values were found in the fruits treated with ascorbic acid, followed by the fruits treated with gibberellic acid, during the two study seasons. It may be concluded that the using mixture of ascorbic acid as a pre-harvest and gibberellic acid as a post-harvest was more effective for storing Thompson seedless grapes for the longest period while maintaining the highest quality of berries.

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تأثير بعض معاملات ما قبل وبعد الحصاد على ثمار العنب البناتي تحت ظروف التخزين البارد

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الملخص

أجريت هذه الدراسة خلال عامي2020 ،2021 على صنف العنب البناتي (الطومسون سيدلس) المنزرعة بمزرعة أبحاث كلية الزراعة جامعة اسيوط. وكانت هذه الدراسة تهدف إلى دراسة تأثير بعض معاملات ما قبل وبعد الحصاد على الصفات الطبيعية والكيمائية وجوده ثمار العنب البناتي خلال التخزين البارد، وكانت تصميم التجربة هو القطاعات كاملة العشوائية في توزيع القطع المنشقة مرة واحدة (split plot design).

أظهرت النتائج المتحصل عليها أن جميع المعاملات قللت نسبة التلف وكذلك نسبه الفقد في الوزن تحت ظروف التخزين البارد لمدة خمسة اسابيع مقارنه بمعاملة الكنترول.

في نهاية فترة التخزين احتوت الثمار المعاملة بالجبريلليك او الاسكوربيك على نسبة أعلي من السكريات المختزلة مقارنة بالثمار الغير معاملة (الكنترول) ووجدت أعلي القيم في الثمار المعاملة بالاسكوربيك تلتها الثمار المعاملة بالجبريلليك وذلك خلال موسمي الدراسة.

كانت المعاملة الخليط من حمض الاسكوربيك كمعاملة قبل الحصاد وحمض الجبريلليك كمعامله بعد الحصاد أكثر تأثيراً لتخزين العنب البناتي لأطول فتره مع الاحتفاظ بأعلى جوده للحبات.