EFFECT OF PREHARVEST APPLICATION OF SEAWEED EXTRACT AND NAPHTHALENE ACETIC ACID ON THOMPSON SEEDLESS GRAPES DURING COLD STORAGE

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ABSTRACT

This work was conducted during two successive seasons, 2000 and 2001on five-year old Thompson seedless vineyards, that were head-trained and cane-pruned, planted in Kelin, Kafr El-Sheikh governorate.

Vineyards were sprayed with seaweed extract (Algifert K30) at 4 ml / liter either one spray on two weeks after full bloom or two sprays on two weeks after full bloom and at veraison. Naphthalene acetic acid (NAA) at 5 ppm or 10 ppm was sprayed eight weeks after full bloom. Clusters were stored at zero centigrade.

Seaweed extract increased SSC/Acid ratio and shattering during cold storage period.

NAA treatment maintained general appearance of cluster, reduced SSC / Acid ratio, prolonged shelf life and increased shattering during cold storage period.

Seaweed extract combined with 5 ppm NAA treatment maintained general appearance of cluster, reduced berries decay, increased fresh weight loss during storage period, and prolonged shelf life period.

Cold storage (0 ° C) for 8 weeks maintained general appearance of cluster, whereas prolonged storage period resulted in increase fresh weight loss, berries decay, shattering and reduce SSC/Acid ratio.

INTRODUCTION

Grapes are among the most important fruit crops in the Arab Republic of Egypt. They are the third largest fruit crop by area, 129,984 feddans, Thompson seedless grapes represents 61 % of this area, after citrus and dates and second in production, 10,009,563 tons, Thompson seedless grapes represents 62.4 % of this production, after citrus (Annon, 2001).

Many different beneficial effects have been recorded for crops treated with seaweed extracts, increased crop yields (Povolny, 1976, Blunden and Wildgoose, 1977 and Bentchikou *et al.*, 1992), increased uptake of inorganic constituents from the soil, and increased resistance of plants to fungal and insect attack (Abetz, 1980, Villiers *et al.*, 1983, and Jolivet *et al.*, 1991). Ripening of fruits on tree as well as at storage was retarded by seaweed extracts treatment (Povolny, 1972, El-Ansary, and El-Morsy 1997 a & b). The beneficial results from the use of seaweed extract may be due to it's cytokinin content (Featonby-Smith and Van Staden, 1984 and Tay *et al.*, 1985). The high concentration of cytokinin in the fruit may be necessary for the creation of strong physiological sink of competing with the remainder of the plant for nutrients (Luckwill, 1977).

Foliar application of NAA increased berry weight (Reynolds *et al.*, 1991) maximized yield, lowered cracking of berries, and induced fairly good quality (Ahmed, 1988) and reduce postharvest berry drop (Youme *et al.*, 1992).

The objective of the current study was to evaluate the effect of seaweed extract, as a natural product, and NAA on storage behavior of Thompson seedless grapes at low temperature.

MATERIALS AND METHODS

This work was carried out during two successive seasons, 2000 and 2001 on five-year old Thompson seedless vineyards at Kelin, Kafer El-Sheikh governorate where the soil was classified as loamy-clay.

Fifty-four vines were chosen as uniform as possible. The vines were head-trained and cane-pruned and the total number of eyes per vines was 48. Normal agriculture practices as recommended by the Ministry of Agriculture and Land Reclamation were used in this orchard. Nine spray treatments were conducted as follows:

1-Control (water sprayed vines).
2-Seaweed extract (Algifert k30) (4 ml / L) two weeks after full bloom.
3-Seaweed extract (Algifert k30) (4 ml / L) two weeks after full bloom + seaweed extract (4 ml / L) at veraison.
4- Seaweed extract (4 ml / L) two weeks after full bloom + 5 ppm NAA at eight weeks after full bloom.
5- Seaweed extract (4 ml / L) two weeks after full bloom + 10 ppm NAA at eight weeks after full bloom.

6- Seaweed extract (4 ml / L) two week after full bloom + seaweed extract (4 ml / L) at veraison + 5 ppm NAA at eight weeks after full bloom.
7- Seaweed extract (4 ml / L) two weeks after full bloom + seaweed extract (4 ml /L) at veraison +10 ppm NAA at eight weeks after full bloom .
8- NAA 5 ppm at eight weeks after full bloom.
9- NAA 10 ppm at eight weeks after full bloom.

Each treatment included three replicates, each of two vines, in randomized block design. Clusters were picked in both seasons, when the soluble solids content (SSC) reached 16.1 ± 0.1 % (Winkler *et al.*, 1974, and El-Ansary *et al.*, 1999). At harvest, clusters were picked early morning and transported, within 1 h., at ambient temperature to the laboratory of the Hort. Dpt., Faculty of Agr., Kafr El-Sheikh, Tanta University. Trimmed clusters were packed in plastic boxes (50 x 35 x 15 cm) with perforated polyethylene liners, and SO_2 slow-release pads were placed to control *Botrytis cinerea* Pers. Fr. (Abd Elal *et al.*, 1978 and Rauld *et al.*, 1991). All plastic boxes were stored at 0 ° C (Smilanick *et al.*, 1990 and Rauld *et al.*, 1991) and 92 -95 % RH.

At the beginning of the storage period (zero time storage) and after every two weeks of storage up to 8 weeks, samples (every treatment was represented by three pags x 2 kg replicates) were taken out to evaluate the storability of Thompson seedless grapes as affected by the treatments.

General appearance of clusters was evaluated according to Mansour *et al.*, (1981) and El-Ansary *et al.*, (1999) by applying five parameters and scores as follows: very good, good, fair, bad, and very bad. They were given numerical values of 5, 4, 3, 2, and 1 respectively. Fresh weight loss as a percentage was calculated. Shattering was determined by given two light shakes by hand for every cluster in the sample, and then weights the shattered berries per sample and expressed as percentage in relation to the sample's weight before the shaking. Decayed berries were separated, weighted and expressed as percentage in relation to each sample's weight. A sample of 100 berries from each replicate per every treatment was juiced and soluble solids content (SSC) was determined with a hand refractometer, and titratable acidity was determined as tartaric acid by NaOH 0.1 N according to Annon (1965). Soluble solids content / Acid ratio (SSC/Acid) was calculated.

Two clusters from each replicate per every treatment weighted and put in the ambient room temperature (28 ° C ± 1 & 75 ± 2 % RH) to determine the shelf life in days, when 50 % of clusters became unmarketable (treatment termination).

Results were statistically analyzed as randomized complete block design with factorial arrangement according to Snedecor and Cochran (1972) and means compared by Duncan's Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

Data in Table (1) indicated that, seaweed extract treatments had no significant effect in general appearance of cluster except two sprays of seaweed extract in the second season, which reduced it significantly. NAA treatments improved general appearance of cluster significantly, only in the second season, whereas it showed no different effects in the first one. General appearance of cluster was maintained by low temperature, but decreased by 0.09 and 0.05 degree per week in the two study seasons, respectively. The combination of 5 ppm NAA and one or two sprays seaweed extract treatment as well as control treatment showed satisfied general appearance of cluster compared to other treatments in the two seasons.

Results obtained from Table (2), indicated that there were positive correlations between shattering and seaweed treatments (r = 0.87 and 0.95) in the two study seasons, respectively. Shattering was increased by 0.12 % and 0.15 % per every application in the two study seasons, respectively. However the difference was not significant. Whereas NAA treatments reduced shattering in the two seasons, especially 5 ppm NAA treatment. The same trend was observed by Daulta *et al.* (1983) and Prakash *et al.* (1983). Shattering was increased during storage period by 0.01 % and 0.05 % per week in the two study seasons, respectively. Also, shattering was increased by the combination of seaweed extract and NAA treatments, whereas it was decreased by NAA treatments only, especially 5 ppm NAA treatment.

Two sprays of seaweed extract increased fresh weight loss % (FWL) significantly, whereas one spray seaweed extract treatment showed different effect in the two seasons (Table, 3). NAA treatments had no significant effect in FWL, except the 5 ppm treatment in the first season

Table (1) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on cluster general appearance of Thompson seedless grapes during cold storage at 0 ° C for 8 weeks.

(season 2000)

Seaweed(SW)	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage mean
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	
0 week	4.67 a	4.00 ab	5.00 a	4.56a	4.00 ab	4.33 ab	5.00 a	4.44a	4.67a	5.00 a	4.33 a	4.67 a	4.56 a
2 weeks	3.00 b	3.00 b	3.00 b	3.00c	4.33 a	5.00 a	4.67ab	4.67 a	4.67 a	3.00 b	3.00 b	3.56 b	3.74 bc
4 weeks	4.00 ab	4.67 a	3.67 b	4.11ab	4.33 a	3.00 c	3.67bc	3.67bc	4.33 ab	5.00 a	4.00 a	4.44 a	4.07 b
6 weeks	4.33a	3.00 b	3.33 b	4.56bc	3.00 b	3.33 bc	3.00c	3.11 c	3.00 c	4.33 a	3.67 b	3.67 b	3.44 c
8 weeks	5.00 a	3.67 ab	4.00 ab	4.22a	3.33 ab	4.33 ab	3.67bc	3.78 b	3.33 bc	4.00ab	3.00 b	3.44 b	3.81 bc
Mean	4.20A	3.67 B	3.80AB		3.80A	4.00 A	4.00 A		4.00AB	4.27 A	3.60 B		
SW-mean	3.92 A				3.93 A				3.96 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	4.00 A				3.98 A				3.80 A				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage mean
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	
0 week	3.00 b	4.00 ab	4.00 a	3.67 bc	4.00 a	5.00 a	4.67 a	4.56 a	3.67 a	4.33 a	4.00 a	4.00ab	4.07 b
2 weeks	5.00 a	4.33 a	4.00 a	4.44 a	4.00 a	5.00 a	5.00 a	4.67 a	3.67 a	5.00 a	4.00 a	4.22 a	4.44 a
4 weeks	4.00 ab	4.33 a	4.00 a	4.11 ab	3.00ab	3.637 b	4.33 a	3.67 b	3.00 a	4.00 a	3.67 a	3.56 b	3.78 b
6 weeks	3.00 b	4.00 ab	3.00 a	3.33 cd	2.33 b	4.00 ab	4.66 a	3.67 b	2.67 b	2.67 b	2.00 b	2.44 c	3.15 c
8 weeks	3.00 b	3.00 b	3.00 a	3.00 d	2.00 b	1.67 c	3.00 b	2.22 c	1.33 c	1.33 c	2.00 b	1.56 d	2.26 d
Mean	3.60 A	3.93 A	3.60 A		3.07 B	3.87 A	4.33 A		3.87 A	3.47 AB	3.13 B		
SW-mean	3.71 A				3.76 A				3.16 B				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	3.18 B				3.76 A				3.69 A				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT.

Table (2) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on shattering percentage of Thompson seedless grapes during cold storage at 0 ° C for 8 weeks.

(season 2000)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	1.06 b	0.84 a	0.89b	0.93 bc	2.03 ab	2.25 a	2.12 a	2.13 a	1.97 ab	1.75 a	1.78 ab	1.83 a	1.63 a
2 weeks	0.20 b	0.67 a	0.44b	0.44 c	0.92 b	2.33 a	1.00 ab	1.42 b	2.76 a	0.35 c	0.02 c	1.05 b	0.97 b
4 weeks	1.08 b	1.35 a	2.22a	1.55 ab	2.24 a	0.26 b	0.74 b	1.08 b	1.44 bc	0.61 bc	1.14 b	1.06 b	1.23 b
6 weeks	2.38 a	0.51 a	1.10b	1.33 ab	0.97 b	0.75 b	1.82 ab	1.18 b	0.70 c	0.39 c	1.58ab	0.88 b	1.13 b
8 weeks	2.72 a	0.94 a	1.44ab	1.70 a	1.91 ab	0.86 b	1.31 ab	1.36 b	1.44 bc	1.59 ab	2.34 a	1.79 a	1.62 a
Mean	1.49 A	0.86 B	1.22 AB		1.61 A	1.29 A	1.40 A		1.66 A	0.94 B	1.37 B		
SW-mean	1.19 A				1.43 A				1.43 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	1.56 A				1.03 B				1.33 A				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	1.82 a	1.00 a	0.59 b	1.14 ab	1.48 a	0.97 b	0.92 a	1.12 b	1.86 a	1.11 b	1.55 a	1.51 ab	1.26 b
2 weeks	0.45 b	0.53 a	0.80 b	0.59 b	0.83 a	0.44 b	0.52 a	0.60 b	1.42 a	0.80 b	0.91 a	1.04 b	0.74 cd
4 weeks	0.28 b	0.52 a	1.27 ab	0.69 b	1.03 a	0.46 b	0.68 a	0.72 b	1.02 a	0.93 b	0.72 a	0.89 b	0.77 d
6 weeks	1.63 a	0.60 a	1.38 ab	1.17 ab	0.93 a	1.19ab	1.21 a	1.11 b	0.94 a	1.54 ab	1.26 a	1.24 b	1.17 bc
8 weeks	1.56 a	0.75 a	2.29 a	1.54 a	1.49 a	2.10 a	1.67 a	1.79 a	1.71 a	2.32 a	1.75 a	1.93 a	1.75 a
Mean	1.15A	0.66 B	1.27 A		1.15 A	1.03 A	1.02 A		1.39 A	1.34 A	1.24 A		
SW-mean	1.02 A				1.08 A				1.32 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	1.23 A				1.01 A				1.17 A				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT.

which maintained FWL significantly. Fresh weight loss % was increased significantly by 0.20 % and 0.13 % per week in the two study seasons, respectively. Generally, FWL was reduced by the control treatment in the two seasons as well as the combined of one spray seaweed extract and 5 ppm NAA treatment in the second season compared with the other treatments (Table, 3).

Seaweed extract treatments showed different effects in berries decay expressed as percentage depending on number of applications in the two seasons (Table, 4). Generally, seaweed extract treatments increased berries decay by 0.21 % and 1.13 % in the two study seasons, respectively (Table, 4). NAA treatment, as a main effect, had no significant effect in this respect. Also, it was noticed that the berries decay percentage were increased by 0.83 % and 1.09 % during the storage period in the two study seasons, respectively. The combination between seaweed extract and NAA treatments showed beneficial effect in reduction of berries decay % in the two seasons.

Soluble solids content (SSC) was increased significantly by using two sprays seaweed extract treatment. Whereas it was not affected significantly by one spray seaweed extract treatment (Table, 5). It could be noticed that NAA treatments decreased SSC significantly especially in the second season. During cold storage, SSC had been maintained by low temperature storage especially in the first season, whereas it decreased slightly, 0.01 % per week, in the second one (Table, 5). This maintenance during low temperature storage may be due to reduction of the rate of respiration (Abd Elal *et al.*, 1978), the conversion of malice acid and probably tartaric acid to sugars (Hulme, 1971) and increase water loss (Pool *et al.*, 1972).

Data present in Table (6), showed that one spray seaweed extract treatment, as a main effect, had no significant effect in the titratable acidity compared to the control treatment, whereas two sprays seaweed treatment showed different effects in the two seasons. Titratable acidity was increased significantly by NAA treatments only in the second season. This increment of titratable acidity may be due to declining the respiration rate (Ranjit-Kumar *et al.*, 1987) and delay berry ripening by NAA treatment (Yakushiji *et al.*, 2001). Titratable acidity was correlated negatively with storage period (r =0.71 and 0.86) and had been decreased by 0.65 % and 0.01 % per week in the two study seasons, respectively. This decline of titratable acidity, during storage period, could be attributed to the

Table (3) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on fresh weight loss percentage of Thompson seedless grapes during cold storage at 0 o C for 8 weeks.

(season 2000)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	Mean
0 week	0.00 c	0.00 b	0.00 c	**0.00 c**	0.00 b	0.00 b	0.00 b	**0.00 b**	0.00 b	0.00 c	0.00 c	**0.00 c**	**0.00 c**
2 weeks	0.84 b	1.98 a	1.03 b	**1.28 b**	2.13 a	2.45 a	1.80 a	**2.06 a**	2.12 a	1.56 b	1.82 b	**1.84 b**	**1.74 b**
4 weeks	2.03 a	1.69 a	1.36 b	**1.69 ab**	2.40 a	1.98 a	2.12 a	**2.17 a**	1.51 a	2.56 a	2.53 ab	**2.20 ab**	**2.02 a**
6 weeks	0.86 b	2.21 a	1.20 b	**1.42 b**	1.64 a	2.54 a	1.96 a	**2.04 a**	1.86 a	2.51 a	2.65 a	**2.34 a**	**1.93 ab**
8 weeks	1.18 b	2.45 a	2.19 a	**1.94 a**	2.16 a	1.94 a	1.64 a	**1.92 a**	1.75 a	2.32 a	1.87 b	**1.98 ab**	**1.94 ab**
Mean	0.98 B	1.67 A	1.16 B		1.67 A	1.74 A	1.50 A		1.45 B	1.79 A	1.77 A		
SW-mean	1.27 B				1.64 A				1.67 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	1.63 B				1.73 A				1.48 B				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	Mean	mean
0 week	0.00 c	0.00 c	0.00 c	**0.00 c**	0.00 b	0.00 b	0.00 b	**0.00 b**	0.00 c	0.00 c	0.00 b	**0.00 c**	**0.00 c**
2 weeks	2.23 a	2.45 a	1.89 a	**2.19 a**	1.61 a	1.40 a	1.96 a	**1.66 a**	2.04 b	1.64 b	1.96 a	**1.88 b**	**1.91 a**
4 weeks	1.46 b	1.21 b	1.06 b	**1.24 b**	2.05 a	1.48 a	1.96 a	**1.86 a**	1.68 b	1.69 b	2.09 a	**1.95 b**	**1.68 b**
6 weeks	1.96 ab	1.85 a	1.72 a	**1.84 a**	2.12 a	1.68 a	1.90 a	**1.90 a**	2.00 b	2.00 b	2.02 a	**2.02 b**	**1.92 a**
8 weeks	1.81 ab	2.20 a	2.29 a	**2.10 a**	1.91 a	1.46 a	2.32 a	**1.89 a**	2.69 a	2.69 a	2.05 a	**2.37 a**	**3.12 a**
Mean	1.49 A	1.54 A	1.39 A		1.54 A	1.22 B	1.63 A		1.60 A	1.60 A	1.62 A		
SW-mean	1.48 B				1.46 B				1.64 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	1.58 A				1.46 A				1.55 A				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT.

Table (4) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on berries decay percentage of Thompson seedless grapes during cold storage at 0 ° C for 8 weeks.

(season 2000)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	0.46 b	3.65 c	3.44 b	2.51 c	2.82 c	0.71 c	2.64 d	2.06 d	2.93 c	2.23 c	3.23 b	2.82 c	2.46 d
2 weeks	2.56 a	4.77 bc	7.84 a	5.06 b	1.53 c	1.32 c	3.44 cd	2.09 d	3.20 c	3.30 c	1.42 b	2.64 c	3.26 c
4 weeks	3.05 a	4.45 bc	4.26 b	3.92 b	5.85 b	3.52 b	5.36 bc	4.91 c	6.44 b	2.34 c	2.87 b	4.22 b	4.34 b
6 weeks	4.09 a	3.37 b	4.78 b	5.08 b	14.84 a	8.86 a	6.97 b	10.22 a	11.06 a	5.82 b	8.94 a	8.60 a	7.97 a
8 weeks	4.39 a	10.80 a	8.75 a	7.98 a	7.25 b	9.70 a	9.43 a	8.79 b	9.67 a	7.96 a	7.47 a	8.37 a	8.38 a
Mean	2.91 B	6.01 A	5.81 A		6.46 A	4.82 B	5.57 AB		6.67 A	4.55 B	4.79 B		
SW-mean	4.91 B				5.62 A				5.33 AB				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	5.34 A				5.13 A				5.39 A				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	4.33 b	3.16 b	2.77 b	3.47 bc	3.94 b	1.49bc	1.87ab	2.43 cd	6.12 b	2.30 c	5.29 bc	4.57cd	3.47 c
2 weeks	0.39 b	1.45 b	0.59 b	0.81 c	2.14 b	0.68 c	0.83b	1.22 d	4.29 b	1.32 c	1.80 c	2.47 d	1.50 d
4 weeks	0.27 b	4.24 b	1.58 b	2.03 bc	8.98 a	2.21bc	3.69ab	4.96 bc	8.44 ab	5.84 bc	5.66 bc	6.65bc	4.55 c
6 weeks	4.00 b	3.89 b	5.81 ab	4.57 b	11.58 a	6.55 b	4.76ab	7.63ab	9.27 ab	8.08 b	10.37 ab	9.24 b	7.14 b
8 weeks	11.38 a	14.38 a	10.16 a	11.97 a	10.47 a	12.06a	6.98 a	9.84 a	12.33 a	15.06 a	11.53 a	12.98a	11.59 a
Mean	4.07 A	5.42 A	4.18 A		7.42 A	4.60 B	3.63 B		8.09 A	6.52 A	6.93 A		
SW-mean	4.56 B				5.21 B				7.18 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	6.53 A				5.51 A				4.91 A				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT.

Table (5) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on soluble solids content (SSC) percentage of Thompson seedless grapes during cold storage at 0 ° C for 8 weeks.

(season 2000)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage mean
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	
0 week	17.45 a	17.45 a	16.75 a	17.22 a	16.73 a	15.25 a	15.92 a	15.97 a	18.00 a	15.50 b	16.43 a	16.64 b	16.10 a
2 weeks	16.33ab	15.83 a	16.00 a	16.06 b	16.75 a	16.42 a	16.25 a	16.47 a	18.17 a	16.50 ab	16.50 a	17.06 ab	16.53 a
4 weeks	15.50 b	16.50 a	16.50 a	16.17 b	16.83 a	16.50 a	16.00 a	16.44 a	17.33 a	16.33 ab	16.17 a	16.16 b	16.41 a
6 weeks	17.17ab	15.75 a	16.00 a	16.31 ab	16.75 a	16.17 a	16.50 a	16.47 a	18.00 a	17.50 a	15.25 a	16.92 ab	16.56 a
8 weeks	16.00ab	16.00 a	16.08 a	16.03 b	16.33 a	15.67 a	15.50 a	15.83 a	18.83 a	17.42 a	17.00 a	17.75 a	16.54 a
mean	16.49A	16.31 A	16.27A		16.56A	16.00 A	16.03A		17.69A	16.77 B	16.20 B		
SW-mean	16.35 B				16.20 B				17.00 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	17.00 A				16.32 B				16.19 B				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	16.15 a	15.89 a	15.12 b	15.72b	16.80ab	15.68a	15.65a	16.04a	17.96ab	16.80a	15.87bc	16.88a	16.21b
2 weeks	16.62 a	16.50 a	16.47 a	16.53a	16.00b	16.37a	16.03a	16.13a	18.17a	15.37c	16.67ab	16.73ab	16.46a
4 weeks	16.63 a	16.07 a	15.47 b	16.05ab	17.17a	15.50a	16.03a	16.23a	17.13bc	15.62bc	16.00abc	16.25b	16.18b
6 weeks	16.27 a	16.03 a	15.87 ab	16.06ab	17.15a	16.10a	16.00a	16.42a	17.00bc	16.53ab	15.00c	16.34ab	16.27ab
8 weeks	16.07 a	16.00 a	16.49 ab	16.00ab	16.00b	16.00a	16.58a	16.19a	16.90c	15.17c	16.97a	16.34ab	16.18b
Mean	16.35 A	16.10 AB	15.77 B		16.62A	15.92B	16.06B		17.43A	15.90B	16.20B		
SW-mean	16.07 B				16.20 B				16.51A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	16.80 A				15.97 B				16.01B				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT.

Table (6) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on titratable acidity percentage of Thompson seedless grapes during cold storage at 0 ° C for 8 weeks.

(season 2000)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	0.66 a	0.71 a	0.69 a	0.69 a	0.72 a	0.77 a	0.67 a	0.72 a	0.74 a	0.58 a	0.72 a	0.68 a	0.70 a
2 weeks	0.60 ab	0.56 b	0.56 b	0.57 b	0.56 b	0.65 b	0.62 a	0.61 b	0.54 b	0.56a b	0.59 b	0.56 b	0.58 b
4 weeks	0.55 b	0.51 b	0.51 bc	0.52 c	0.54 bc	0.54 c	0.51 b	0.53 c	0.47 b	0.50 bc	0.50 c	0.49 c	0.52 c
6 weeks	0.57 b	0.54 b	0. 50 bc	0.54 bc	0.48 c	0.50 c	0.50 b	0.50 c	0.50 b	0.48 c	0.55 bc	0.51 c	0.51 c
8 weeks	0.57 b	0.55 b	0.47 c	0.53 bc	0.50 bc	0.53 c	0.51 b	0.51 c	0.55 b	0.47 c	0.53 bc	0.52bc	0.52 c
Mean	0.59 A	0.57 AB	0.54 B		0.56 B	0.60 A	0.56 B		0.56 A	0.52 B	0.58 A		
SW-mean	0.57 A				0.57 A				0.55 B				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	0.57 A				0.56 A				0.56 A				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	0.70 a	0.87 a	0.88 a	0.81 a	0.87 a	0.85 a	0.99 a	0.90 a	0.84 a	0.86 a	0.80 ab	0.83 a	0.85 a
2 weeks	0.79 a	0.77 a	0.75 a	0.77 a	0.79 ab	0.72 ab	0.83 bc	0.78 b	0.66 b	0.90 a	0.74 ab	0.76 ab	0.77 b
4 weeks	0.75 a	0.73 a	0.86 a	0.78 a	0.72 bc	0.63 b	0.87abc	0.76 bc	0.77 ab	0.81 ab	0.71 b	0.76 ab	0.77 b
6 weeks	0.77 a	0.78 a	0.77 a	0.77 a	0.65 bc	0.78 ab	0.97 ab	0.80 b	0.72 ab	0.71 b	0.87 a	0.76 ab	0.78 b
8 weeks	0.76 a	0.72 a	0.78 a	0.75 a	0.59 c	0.68 b	0.76 c	0.68 c	0.67 b	0.77 ab	0.70 b	0.71 b	0.71 c
Mean	0.75 A	0.77 A	0.81 A		0.72 B	0.74 B	0.88 A		0.73 B	0.81 A	0.76 AB		
SW-mean	0.78 A				0.77 A				0.78 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	0.73 C				0.77 B				0.82 A				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT.

conversion of malice acid and probably tartaric acid to sugars (Hulme, 1971). The lowest titratable acidity, 0.56 % and 0.72 %, was obtained by one single spray seaweed extract treatment in the two study seasons, respectively.

Results in Table (7), indicated that SSC / Acid was increased and correlated with seaweed extract treatments (r = 0.82 and 0.72) in the two study seasons, respectively. This increment in SSC /Acid ratio was pronounced in the two sprays seaweed extract treatment compared to the control treatment. Also, data show that SSC / Acid ratio was correlated negatively with NAA treatments (r = 0.96 and 0.99) and was decreased by 0.11 and 0.36 unit per ppm NAA in the two study seasons, respectively. Throughout the storage period, SSC / Acid ratio showed reduction, by 1.16 and 0.34 unit per week, and was correlated negatively (r = 0.90 and 0.87) with storage period in the two study seasons, respectively. The highest SSC / Acid ratio was recorded in the two sprays seaweed extract treatment only without any combination (33.08 and 23.99 unit) in the two study seasons, respectively

Shelf life period was prolonged by one spray seaweed extract treatment, whereas it did not affect significantly by two sprays seaweed treatment(Table, 8). Blunden *et al.*, (1978) have shown that immersed fruit in cytokinin solution exhibit increased shelf life. Such increase may be due to flesh firmness increasing by maintaining the total pectin and Ca contents at a higher concentration and increasing the number of flesh cell layers as it was suggested by Yang-YauShiang *et al.* (1997)). NAA treatment prolonged shelf life period compared to control treatment, especially in the second season. Shelf life period showed different trends, by prolonging storage period, in the two study seasons. Shelf life was prolonged by 0.10 day per week in the first season and shortened by rate of 0.02 day per week in the second one. The longest shelf life period was noticed in one spray seaweed extract combined with 5 ppm NAA treatment (8.53 and 4.67 day) in the two seasons, respectively.

The results of the experiment reveal that the combination between seaweed extract and NAA improved the storability of Thompson seedless grapes. Further investigation in this direction is being continued.

Table (7) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on soluble solids content/ titratable acidity ratio of Thompson seedless grapes during cold storage at 0 ° C for 8 weeks.

(season 2000)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	26.49a	28.55b	24.45c	25.16c	23.11c	19.77c	23.78c	22.22c	24.59b	26.76c	23.15b	24.83c	24.07c
2 weeks	27.45a	28.30ab	28.49bc	28.08b	28.80b	25.23b	26.71bc	26.91b	33.50a	29.74bc	28.19a	30.48b	28.60b
4 weeks	28.27a	32.41 a	32.46ab	31.05a	31.37ab	30.45a	31.51a	31.11a	36.63a	32.63ab	32.33a	33.68a	32.01a
6 weeks	30.02a	29.55a	32.22ab	30.60ab	39.59a	32.49a	32.79a	34.95a	45.71a	36.76a	27.57ab	36.96a	34.08a
8 weeks	28.08a	29.38a	34.49a	30.65ab	32.72ab	29.67ab	30.26ab	30.88a	41.86a	36.85a	32.18a	36.96a	32.83a
Mean	28.06B	28.84AB	30.42A		30.13A	27.52B	29.01AB		33.08A	32.56A	28.69B		
SW-mean	29.11 B				28.89 B				31.44 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	30.42 A				29.64 A				29.37 A				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	23.20 a	18.52 a	19.46 a	20.39a	19.48 b	18.64 b	15.81 b	17.98 c	21.78 a	19.55 ab	19.66 a	20.33 a	19.57 b
2 weeks	21.93 a	21.61 a	21.41 a	21.65a	20.33 b	23.29ab	19.44ab	21.02 bc	27.07 a	16.78 b	21.68 a	21.83 a	21.50 ab
4 weeks	22.99 a	22.59 a	17.73 a	21.10a	24.15ab	23.80ab	18.29ab	22.08 b	22.38 a	18.72 ab	21.19 a	20.76 a	21.32 ab
6 weeks	21.28 a	20.32 a	20.95 a	20.85a	26.67 a	21.74ab	15.76 b	21.39 b	23.78 a	23.66 a	17.53 a	21.66 a	21.30 ab
8 weeks	20.98 a	22.39 a	20.48 a	21.28a	28.77 a	25.08 a	22.09 a	25.32 a	24.98 a	19.75 ab	23.30 a	22.68 a	23.09 a
Mean	22.08 A	21.09 A	20.01A		23.88A	22.51A	18.28 B		23.99 A	19.69 B	20.67 B		
SW-mean	21.06 A				21.56 A				21.45 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	23.32 A				21.10 B				19.65 C				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT

Table (8) : Effect of seaweed (SW) extract (Algifert K30) and NAA treatments on shelf life period (in days) of Thompson seedless grapes during cold storage at 0 ° C for 8 weeks.

(season 2000)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	7.67 ab	6.00 a	6.00 b	6.56bc	8.67 ab	9.33 ab	7.33 a	8.44ab	4.00 c	5.33 c	3.67 c	4.33 d	6.44 bc
2 weeks	9.00 a	7.00 a	7.67 ab	7.89ab	8.33 ab	9.33 ab	8.00 a	8.56ab	8.00 a	8.33 ab	9.67 a	8.67 a	8.37a
4 weeks	7.00 ab	6.00 a	7.00 ab	6.67bc	8.00 ab	7.00 b	8.00 a	7.67 bc	7.00 ab	7.00 abc	7.00 ab	7.00bc	7.11 b
6 weeks	6.00 b	6.00 a	5.00 b	5.67 c	6.33 b	6.67 b	7.00 a	6.67 c	5.67abc	6.00 bc	6.67 b	6.11 c	6.15 c
8 weeks	8.00 ab	8.67 a	9.33 a	8.67a	9.33 a	10.33 a	8.33 a	9.33 a	5.00bc	9.00 a	9.33 ab	7.78ab	8.59 a
Mean	7.53 A	6.73 A	7.00 A		8.13 A	8.53 A	7.73 A		5.93 B	7.13 A	7.27 A		
SW-mean	7.09 B				8.13 A				6.78 B				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	7.20 A				7.47 A				7.33 A				

(season 2001)

Seaweed	Control				One spray (4 ml/L)				Two sprays (4 ml/L)				Storage
NAA(ppm)	0	5	10	mean	0	5	10	mean	0	5	10	mean	mean
0 week	3.67 ab	4.33 ab	5.33 a	4.44 ab	5.00 a	6.00 a	5.67 a	5.56 a	4.00 a	5.00 ab	4.33 a	4.44ab	4.81 a
2 weeks	4.67 ab	3.33 b	3.67 bc	3.89 b	3.33 bc	4.33 b	4.00 b	3.89 b	2.67 a	3.67 bc	3.67 ab	3.33 c	3.70 b
4 weeks	3.33 b	3.33 b	4.00abc	3.56 b	2.67 c	4.00 b	4.00 b	3.56 b	3.00 a	3.33 c	3.67 ab	3.33 c	3.48 b
6 weeks	3.67 ab	4.00 ab	3.00 c	3.56 b	3.00 bc	4.67 ab	4.67 ab	4.11 b	4.00 a	4.34abc	2.67 b	3.67bc	3.78 b
8 weeks	5.00 a	5.00 a	4.67 ab	4.89 a	4.33 ab	4.33 b	4.00 b	4.22 b	4.00 a	5.33 a	4.67 a	4.67 a	4.59 a
Mean	4.07 A	4.00 A	4.13 A		3.67 B	4.67 A	4.47 A		3.53 B	4.33 A	3.80 AB		
SW-mean	4.07 A				4.27 A				3.89 A				
NAA	0 ppm				5 ppm				10 ppm				
NAAmean	3.76 B				4.33 A				4.13 A				

Except SW-means, means followed by the same letter in the same column are not significantly different at 5% level according to DMRT.

In SW-means row or NAA-means rows, means followed by the same letter are not different at 5% level according to DMRT.

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الملخص العربى

تأثير استخدام مستخلص الأعشاب البحرية ونفثالين حامض الخليك على للعنب البناتى أثناء التخزين البرد

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تمت هذه الدراسة في عامي ٢٠٠٠ & ٢٠٠١ على كرمات عنب ذات عمر ٥ سنوات ومرباة تربية قصبية في مزرعة بمركز قلين بمحافظة كفر الشيخ .

تم رش الكرمات بكل من مستخلص الأعشاب البحرية(الجيفرت ك ٣٠) ٤ مل/لتر وكذلك نفثا لين حامض الخليك ٥ & ١٠ جزء في المليون.

تم تخزين العناقيد الثمرية للعنب البناتى تحت ظروف التخزين البارد (صفر ° م) .

أدت المعاملة بمستخلص الأعشاب البحرية إلى زيادة كل من نسبة محتوى المواد الصلبة الذائبة إلى الحموضة ونسبة الفرط وذلك أثناء فترة التخزين.

كما أدت المعاملة بنفثالين حامض الخليك إلى المحافظة على المظهر العام للعناقيد والى انخفاض نسبة محتوى المواد الصلبة الذائبة إلى الحموضة بينما أدت الى زيادة نسبة الفرط وذلك أثناء فترة التخزين كما أدت الى إطالة فترة حياة الرف.

أدت المعاملة بكل من مستخلص الأعشاب البحرية بصفة عامة بالإشتراك مع نفثالين حامض الخليك بتركيز ٥ جزء في المليون إلى المحافظة على المظهر العام للعناقيد وتقليل نسبة تلف الحبات وزيادة الفقد في الوزن الطازج وذلك أثناء فترة التخزين كما أدت الى إطالة فترة حياة الرف.

أدى التخزين في الجو البارد (صفر ه م) إلى المحافظة على المظهر العام للعناقيد إلا أنه مع زيادة فترة التخزين تزداد كل من نسبة الفقد في الوزن الطازج ونسبة تلف الحبات ونسبة الفرط بينما تنخفض نسبة المواد الصلبة الذائبة إلى الحموضة .