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THE EFFECT OF SOME POSTHARVEST TREATMENTS ON ZAGHLOUL DATE FRUITS DURING STORAGE

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ABSTRACT

Wrapping in polyethylene (0, 2, 5% perforation); pre-cooling for 1, 2 and 3 hours and using promote as a biological agent for fruit rot (at 1000, 2000 and 4000 ppm) were applied to increase the storability of Zaghloul date fruits and export opportunities. Fruits were stored at 0°C and 5°C for 4 weeks, then quality parameters: weight loss, a* & b* values, texture, rutab stage %, T.S.S. % and total acidity % were evaluated. All treatments were more successful than the control, either at 0°C or 5°C. The best and most significant result in the 4 weeks was obtained by fruits wrapped in polyethylene, which kept good qualities such as low weight loss percentage, texture, glossy red colour and low percentage of rutab fruits. The least results were obtained by promote 4000 ppm and pre-cooling for 3 hours. Fruit texture was an accurate and reliable indicator for recognizing the differences between treatments in connection with keeping quality and marketability. All treatments, except the sealing treatment, attained a higher rutab percentage at 0°C than at 5°C.

INTRODUCTION

Dates are fruits of the palm, *Phoenix dactylzfera* L., which has been cultivated in the Middle East and North Africa for thousands of years. For many Arab peoples the date is the stable carbohydrate food. Susceptibility to physiological darkening, mould damage and mite infestation is determined by post-harvest handling practices and, in particular, by the moisture content of the dates (Snowdon, 1990)

Many chemicals have been used for the control of such damages. However, many of those chemicals have been reported to be dangerous for human health. Therefore, many countries issued some laws for excluding some chemicals that used in pest management. Egypt, recently, issued by MOA a list of the chemicals, i.e. fungicides and pesticides that should not be used for controlling plant pests. Nowadays, biological control of plant pathogens is worldwide practice (Sabry, 1998).

The main objective of the present work was to investigate the effect of some physiological treatments such as pre-cooling treatment, biological control, wrapping with polyethylene and cold storage temperature on keeping quality and storability of Zaghloul date fruits.

MATERIALS AND METHODS

This investigation has been carried out during the seasons of 1997-1998. Zaghloul date fruits were harvested from an orchard in Giza Governorate. Ten treatments of mature fruits were carried out, each

treatment was replicated three times and a single replicate consisted of thirty fruits, then stored at 0°C and 5°C with RH 90%. Fruits were rejected when the percentage of rutab stage, shrinking fruit and rotted ones exceeded 50%. The treatments applied were as follows:

1, 2 and 3 modified atmosphere by sealed fruits in polyethylene (low density 30 micron). 0, 2 & 5% perforation (the unit's dimensions were 20 x 25 cm., and consisted of 20 fruits).

4, 5 and 6 pre-cooling treatment (at 5°C) for 1, 2, 3 hour.

7, 8 and 9 treated with promote (two colons of trichoderma) at 1000, 2000 and 4000 ppm for 2 minutes.

10 control fruits (untreated fruits)

Weekly samples (for 4 weeks) were taken for various physical and chemical analysis as follows:

Physical Properties:

Percentage of weight loss: Fruits were periodically weighed and the percentage of weight loss was calculated.

Peel Colour Measurement: was determined by using a Hunter colorimeter type (DP-9000) for the estimation of a* (green-red) and b* (blue-yellow) values.

Pulp Texture: was recorded by a lfra texture analyzer instrument, using a penetrating cylinder of 1 mm of diameter, to a constant distance 3mm inside the fruit and by a constant speed, 2mm/sec, and the results were expressed per gram.

Rutab stage: calculated when fruits reached ripe stage or full browning.

Chemical Properties:

Titratable Acidity %: Titratable acidity was determined in terms of anhydrous malic acid percentage after titration against 0.1 N. Sodium hydroxide using phenolaphthaline as indicator (A.O.A.C.,1990).

Total Soluble Solids %: Abbé refractometer was used to determine the percentage of total soluble solids in fruit juice (A.O.A.C.,1990).

Statistical Analysis: The statistical analysis of the obtained data was carried out according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Physical Properties:

Weight Loss:

It is clear from table 1 that differences between treatments at 0°C indicated that sealed fruits attained the lowest rate of weight loss (especially 0% perforation). It was also obvious that promote treatment and 3-hours pre-cooling treatment attained a higher rate during both seasons. The 3 hours pre-cooling fruits attained the highest result in the 1st season (6.25%) and also the promote fruits, while promote fruits attained the highest result in the 2nd season (6.87%).

A: Storage temperature.
B: Period per week.
C: Treatments.

At 5°C, sealed fruits, especially not perforated, attained the lowest rate with significant differences during both seasons. However, the highest weight loss percentage was attained by 4000 promote fruits (9.09) in the 1st season, and the 3-hours pre-cooling fruits (7.44) in the 2nd season.

Table (1) : Effect of postharvest treatments on weight loss (%) of Zaghloul dates fruits stored under cold storage temperature during seasons 1997and1998.

Season (1997)												
Treatments		**Modified atmosphere By sealing**			**Precooling (per hour)**			**Promot**			**Cont**	**M**
Storage temperature	Period per week	Perfortion 0%	2%	5%	1h.	2h	3h	1000 pppm	2000 ppm	4000 ppm		
0 ° C	**0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
	1	0.15	0.51	0.76	0.74	0.39	0.63	0.90	0.58	1.40	0.86	**0.692**
	2	0.22	1.06	1.62	1.52	1.39	2.83	2.29	1.72	1.72	2.45	**1.682**
	3	0.37	1.52	2.06	4.56	3.17	5.38	4.10	2.82	2.65	3.93	**3.056**
	4	0.54	2.05	2.54	4.67	4.17	6.25	5.74	4.89	4.10	4.93	**3.988**
	M	**0.256**	**1.028**	**1.396**	**2.298**	**1.824**	**3.018**	**1.988**	**2.002**	**2.592**	**2.434**	**1.884**
5 ° C	**0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
	1	0.23	0.53	0.76	1.71	1.09	1.21	3.90	1.64	3.03	1.69	**1.579**
	2	0.39	1.08	1.88	3.00	2.77	3.02	4.10	2.87	4.32	5.51	**2.894**
	3	0.52	1.62	2.76	4.85	3.73	5.66	5.45	4.31	6.49	5.59	**4.098**
	4	0.78	2.32	3.26	6.32	5.01	6.88	6.54	6.67	9.09	5.65	**5.252**
	M	**0.384**	**1.110**	**1.732**	**3.176**	**2.520**	**3.354**	**3.998**	**3.098**	**4.586**	**3.688**	**2.765**
A.V		**0.320**	**1.069**	**1.564**	**2.737**	**2.172**	**3.186**	**2.993**	**2.550**	**3.589**	**3.061**	**2.324**
Season (1998)												
0 ° C	**0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
	1	0.00	0.18	0.59	1.75	1.40	1.06	1.36	0.98	0.81	0.51	**0.864**
	2	0.12	0.73	1.02	3.21	2.00	3.19	3.30	2.85	3.42	2.05	**2.189**
	3	0.16	1.10	1.84	4.93	3.33	5.31	4.10	3.57	5.61	3.07	**3.302**
	4	0.16	2.21	2.86	5.56	5.31	6.25	6.31	6.42	6.87	5.64	**4.759**
	M	**0.088**	**0.844**	**1.262**	**3.090**	**2.408**	**3.162**	**3.014**	**2.764**	**3.342**	**2.254**	**2.223**
5 ° C	**0**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
	1	0.00	0.19	0.61	1.85	1.54	1.59	1.72	1.42	1.02	1.60	**1.154**
	2	0.16	1.57	1.62	3.70	3.10	3.85	3.42	3.33	3.57	3.57	**2.789**
	3	0.32	1.97	2.59	5.19	4.82	5.07	5.46	5.52	5.69	5.02	**4.165**
	4	0.64	2.36	3.36	6.79	5.33	7.44	6.84	6.64	7.14	5.72	**5.226**
	M	**0.224**	**1.218**	**1.636**	**3.506**	**2.958**	**3.590**	**3.488**	**3.382**	**3.484**	**3.182**	**2.667**
A.V		**0.156**	**1.031**	**1.449**	**3.298**	**2.683**	**3.376**	**3.251**	**3.073**	**3.413**	**2.718**	**2.447**

L.S.D at 5%	**1997**	**1998**
A	0.0045	0.0039
B	0.0070	0.0064
A×B	0.0097	0.0089
C	0.0097	0.0089

L.S.D at 5%	**1997**	**1998**
A×C	0.0136	0.0125
B×C	0.0217	0.0201
A×B×C	0.0306	0.0281

A: Storage temperature.
B: Period per week.
C: Treatments.

Table (2): Effect of postharvest treatments on color (A* value) of Zaghloul dates fruits stored under cold storage temperature during seasons 1997and1998.

Season (1997)													
Treatments		Modified atmosphere By sealing			PRECOOLING (per hour)			PROMOT			Cont	M
Storage Temperature	Period per week	Perfortion			1h.	2h.	3h.	1000 p.p.m	2000 p.p.m	4000 p.p.m		
		0%	2%	5%								
0 ° C	0	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79
	1	25.14	25.18	25.22	24.81	24.92	24.92	24.89	24.85	24.83	24.75	24.95
	2	24.49	24.62	24.55	24.05	24.04	24.10	23.95	23.81	23.89	23.78	24.12
	3	23.80	23.85	24.02	23.19	23.17	23.22	23.06	22.82	22.93	22.86	23.29
	4	23.20	23.38	23.51	22.31	22.29	22.37	22.15	21.83	21.95	21.79	22.47
	M	24.48	24.56	24.61	24.03	24.04	24.08	23.96	23.82	23.87	23.79	24.12
5 ° C	0	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79	25.79
	1	25.10	25.14	25.18	25.08	25.06	25.08	25.05	25.01	25.02	25.01	24.64
	2	24.39	24.49	24.56	24.39	24.35	24.38	24.28	24.24	24.27	24.24	24.35
	3	23.62	23.84	23.94	23.65	23.64	23.68	23.53	23.44	23.48	23.46	23.62
	4	22.98	23.22	23.30	22.98	22.92	22.99	22.78	22.66	22.74	22.68	22.92
	M	24.37	23.62	24.55	24.37	24.35	24.38	24.28	24.22	24.26	24.23	24.26
A.V		24.43	24.09	24.58	24.20	24.19	24.23	24.12	24.02	24.06	24.01	24.23
Season (1998)												
0 ° C	0	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99
	1	26.34	26.38	26.43	26.12	26.10	26.15	26.08	26.07	26.19	26.23	26.20
	2	25.65	25.77	25.87	25.25	25.23	25.42	25.18	25.16	25.42	25.48	25.44
	3	25.01	25.21	25.25	24.40	24.37	24.63	24.27	24.24	24.62	24.70	24.67
	4	24.35	24.56	24.72	23.53	23.49	23.81	23.36	23.32	23.82	23.95	23.89
	M	25.66	25.78	25.85	25.25	25.23	25.40	25.17	25.15	25.40	25.47	25.44
5 ° C	0	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99	26.99
	1	26.33	26.40	26.30	26.27	26.24	26.26	26.23	26.22	26.21	26.01	26.24
	2	25.68	25.64	25.58	25.54	25.49	25.51	25.49	25.44	25.46	25.08	25.49
	3	25.04	24.94	24.87	24.81	24.72	25.74	24.74	24.66	24.69	24.03	24.82
	4	24.39	24.25	24.17	24.07	23.98	24.02	23.98	23.87	23.94	23.04	23.97
	M	25.68	25.64	25.58	25.53	25.48	25.70	25.48	25.43	25.45	25.03	25.50
A.V		25.67	25.71	25.71	25.39	25.36	25.55	25.23	25.29	25.43	25.25	25.46

L.S.D at 5%	1997	1998
A	0.1708	0.0017
B	0.2699	0.0025
A×B	0.3816	0.0036
C	0.3816	0.0036

L.S.D at 5%	1997	1998
A×C	0.5396	0.0053
B×C	0.8532	0.0081
A×B×C	1.2067	0.0117

This means that the higher concentration of promote fruits and 3-hours pre-cooling fruits attained the highest rate of weight loss during both season at 0°C & 5°C.

With regard to polyethylene effect, the data clearly indicated that wrapping the fruits with polyethylene reduced weight loss. This may be due to that both polyethylene wrapping created a modified atmosphere surrounding the fruits. Consequently, wrapped fruits in polyethylene film reduced fruit weight loss by evaporatranspiration and slowed down fruit respiration. These results were in line with those obtained by Attia *et al.* (1997), who noted that sealing Zaghloul fruits stored at 0°C reduced weight loss significantly compared with control fruits. Miller and Risse (1988) also stated that film wrapping of fresh produce in Florida including broccoli,

cucumbers, lettuce, sweet potatoes, tomatoes, blueberries, mangoes, grapefruits, lemons and oranges reduced moisture loss, retarded softening, and maintained characteristic freshness with reduced colour development during extended periods of storage and marketing.

A Value:

A gradual decrease of A value towards the end of storage period was recorded (table 2). The highest decrease of A value was recorded at 0°C by control fruits (25.79-21.79). However, the lowest decrease was recorded by sealed fruits especially 5% ventilation (23.51 at 0°C and 23.30 at 5°C in the first season).

Almost the same trend was detected in the second season. The least decrease was attained by sealed fruits with 5% perforation at 0°C (24.72) and with 0% perforation at 5°C (34.39). The highest decrease rate was recorded by 2000 promote fruits (26.99 – 32.32) and control fruit at 5°C (23.04). These results indicated that all treatments kept better qualities of red colour than control fruits. It was also noticeable that the best treatment was fruits wrapped with polyethylene, which attained less decrease of red colour.

B Value:

Table 3 indicated that a slight decrease occurred in all treatments towards the end of 4 weeks storage period. In general, data showed that the development of colour darkening (decreasing of b* value) which was associated with rutab stage progress was observed in all treatments. During the 1st season the least decrease was recorded at 0°C by fruits sealed in polyethylene especially without perforation (10.47 – 9.58). During the 2nd season, control fruits attained the highest decrease rate (8.65).

Texture:

It appeared in the present study (table 4) that fruit texture was an important feature of storability as well as a reliable index to recognize keeping quality and marketability of Zaghloul date fruits. The effect of sealing on keeping fruits' quality appeared clearly. Sealed fruits recorded the best result during both seasons, especially without perforation whose texture decreased from 130g to 123.2g at 0°C and 122.7g at 5°C, whereas control fruits recorded the highest decrease at 0°C (82.0g) and so did promote fruits at 5°C (87.4g). During the second season texture of sealed fruits with 0% perforated decreased from 149 – 126g at 0°C and 131.2g at 5°C. The highest texture decrease was recorded by 4000 ppm promote, as it was 93.6g at 0°C and 108.0g at 5°C. It was also clear in most of storage periods that rate of texture decrease was higher at 0°C than at 5°C in all treatments.
It was also observable that texture value of all promote treatments decreased compared to other treatments at 0°C & at 5°C during both seasons, but control fruits did not attain any observable decrease at 0°C.

Table (3): Effect of postharvest treatments on color (b*value)of Zaghloul dates fruits stored under cold storage temperature during seasons 1997and1998.

Season (1997)												
Treatments		**Modified atmosphere By sealing**			**PRECOOLING (per hour)**			**PROMOT**			**Cont**	**M**
Storage Temper-ature	Period per week	Perfortion 0%	2%	5%	1h.	2h.	3h.	1000 p.p.m	2000 p.p.m	4000 p.p.m		
0 ° C	0	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47
	1	10.24	10.22	10.19	10.06	10.09	10.89	10.04	10.04	9.99	10.01	10.17
	2	10.02	09.95	9.92	9.65	9.72	9.69	9.59	9.61	9.52	9.57	9.724
	3	09.81	09.70	9.64	9.23	9.33	9.30	9.15	9.19	9.05	9.11	9.351
	4	09.58	09.44	9.35	8.82	8.95	8.91	8.72	8.75	8.57	8.65	8.974
	M	10.02	9.956	9.914	9.646	9.712	9.852	9.594	9.612	9.520	9.562	9.739
5 ° C	0	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47	10.47
	1	10.22	10.20	10.17	10.13	10.15	10.14	10.09	10.11	10.08	10.09	10.13
	2	9.98	9.93	9.88	9.78	9.84	9.81	9.71	9.75	9.69	9.72	9.809
	3	9.73	9.67	9.58	9.44	9.52	9.48	9.34	9.39	9.31	9.34	9.480
	4	9.47	9.39	9.28	9.09	9.19	9.16	9.97	9.03	8.90	8.94	9.242
	M	9.974	9.932	9.876	9.782	9.834	9.812	9.916	9.750	9.690	9.712	9.828
A.V		9.999	9.944	9.895	9.714	9.773	9.832	9.755	9.681	9.605	9.637	9.775
Season (1998)												
0 ° C	0	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39
	1	9.16	9.13	9.11	9.06	9.01	8.99	9.04	9.04	9.00	9.02	9.05
	2	8.94	8.86	8.84	8.74	8.62	8.61	8.69	8.71	8.63	8.66	8.73
	3	8.71	8.59	8.56	8.42	8.28	8.21	8.34	8.36	8.24	8.29	8.40
	4	8.47	8.34	8.28	8.09	7.84	7.81	7.99	8.01	7.86	7.92	8.06
	M	8.934	8.862	8.836	8.740	8.628	8.602	8.690	8.702	8.624	8.656	8.727
5 ° C	0	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39	9.39
	1	9.14	9.12	9.10	9.05	9.07	9.06	9.02	9.02	8.99	8.91	9.04
	2	8.89	8.86	8.81	8.87	8.75	8.73	8.64	8.66	8.60	8.43	8.72
	3	8.64	8.59	8.52	8.37	8.43	8.40	8.26	8.30	8.21	7.95	8.36
	4	8.40	8.32	8.23	8.03	8.11	8.07	7.88	7.93	7.83	7.47	8.02
	M	8.892	8.856	8.810	8.742	8.750	8.730	8.638	8.660	8.604	8.430	8.711
A.V		8.913	8.859	8.823	8.741	8.689	8.666	8.664	8.681	8.614	8.543	8.719

L.S.D at 5%	1997	1998
A	0.0019	0.0028
B	0.0031	0.0042
A×B	0.0042	0.0061
C	0.0042	0.0061

L.S.D at 5%	1997	1998
A×C	0.0058	0.0084
B×C	0.0095	0.0134
A×B×C	0.0134	0.0189

A: Storage temperature.
B: Period per week.
C: Treatments.

These results agreed with those obtained by Kader (1986), who reported that control atmosphere delayed fruit ripening and softening. In addition, many workers stated that fruits stored in the modified or controlled atmosphere retained rind firmness than fruits stored in air (Kader, 1986; Miller and Risse, 1988 and Zhamba, 1988). In general, results relevant to the effect of promote in fruit texture go in line with those reviewed by Sabry (1998) who stated that the promote treatment on apple fruits decreased firmness more than other treatments.

Table (4) : Effect of postharvest treatments on texture (3mm) of Zaghloul dates fruits stored under cold storage temperature during seasons 1997and1998.

Season (1997)												
Treatments		Modified atmosphere By sealing			PRECOOLING (per hour)			PROMOT			Cont	M
Storage Temper-ature	Period per week	Perfortion 0%	2%	5%	1h.	2h.	3h.	1000 p.p.m	2000 p.p.m	4000 p.p.m		
0 ° C	0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
	1	130.0	129.0	130.0	122.0	128.0	120.0	113.0	115.0	120.0	122.0	122.9
	2	127.8	125.6	128.3	116.2	125.4	118.5	105.6	110.6	118.2	110.8	118.7
	3	125.4	122.3	123.0	105.0	117.3	112.4	99.2	101.0	97.6	98.7	110.1
	4	123.2	120.6	118.5	89.8	106.4	96.2	83.3	87.4	85.5	82.0	99.29
	M	127.2	125.5	125.9	112.6	121.4	115.4	106.2	108.8	110.2	108.7	116.2
5 ° C	0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0
	1	128.1	125.0	127.5	125.0	130.0	125.0	125.0	120.0	123.0	125.0	125.3
	2	126.3	123.4	123.2	120.1	126.2	122.7	119.2	117.3	118.0	117.5	121.3
	3	125.1	121.7	118.4	105.3	120.4	115.6	100.5	102.2	97.4	99.4	110.6
	4	122.7	119.5	108.2	97.2	115.0	106.2	92.0	96.4	87.4	90.0	103.4
	M	126.4	123.9	121.4	115.5	124.3	119.9	113.3	113.1	111.1	112.3	118.1
A.V		126.8	124.7	123.7	114.0	122.8	117.6	109.7	110.9	110.7	110.5	117.1
Season (1998)												
0 ° C	0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
	1	142.0	125.6	133.0	124.3	132.7	126.6	117.8	124.0	111.3	113.0	125.0
	2	131.2	123.0	117.0	115.0	125.0	123.0	110.0	111.0	107.0	109.5	117.1
	3	129.8	111.5	111.0	104.2	108.4	104.6	103.0	103.3	98.5	103.0	107.7
	4	126.0	109.0	110.4	100.0	103.8	102.0	96.8	98.2	93.6	96.3	103.6
	M	135.6	123.6	124.0	118.5	123.7	121.0	115.3	117.1	111.8	114.1	120.5
5 ° C	0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0	149.0
	1	146.0	133.0	127.2	142.5	148.0	143.2	140.0	141.0	133.7	134.7	138.9
	2	135.5	129.0	126.4	130.2	138.6	135.2	123.0	130.2	120.0	122.8	129.0
	3	133.0	125.1	122.0	120.0	123.0	125.0	118.2	119.0	112.8	117.6	121.5
	4	131.2	124.8	119.6	117.2	119.3	118.8	109.1	115.8	108.0	109.0	117.2
	M	138.9	132.1	128.8	131.7	135.5	134.2	127.8	131.0	124.7	126.6	131.1
A.V		137.2	127.9	126.4	125.1	129.6	127.6	121.5	124.0	118.2	120.3	125.8

L.S.D at 5%	1997	1998
A	0.0535	0.0457
B	0.0847	0.0721
A×B	0.1198	0.1020
C	0.1198	0.1020

L.S.D at 5%	1997	1998
A×C	0.1694	0.1443
B×C	0.2677	0.2281
A×B×C	0.3788	0.3226

A: Storage temperature.
B: Period per week.
C: Treatments.

Rutab Stage %: Table (5) clearly showed the importance of treatments which increased longevity of date fruits before rutab stage. The best treatment at 0°C was sealing treatment, 0 % perforation (27.5% in the 1st season and 25.5% in the 2nd season respectively). However, at 5°C the least

rutab stage percentage was obtained by sealed fruits (5% perforation); it ranged between 30% in the 1st season and 28.9% in the 2nd season. The highest rutab percentage was obtained by the control, it ranged between 43.3 – 48.55% and between 42.5 and 46.3% at 5°C. It was also noticeable that rutab percentage increased according to the increasing concentration of promote. It was also obvious that the longer the pre-cooling period was, the higher the percentage of rutab obtained. From the fore-cited results, one can conclude that, low concentration of promote or pre-cooling (for 1 hour) is recommended.

Table (5) : Effect of postharvest treatments on Rutab stage (%) of Zaghloul dates fruits stored under cold storage temperature after 4 weeks during seasons 1997and1998.

Storage		Modified atmosphere By sealing			PRECOOLING (per hour)			PROMOT			Cont	M
Seasons	Temp.	Perfortion			1h.	2h.	3h.	1000 p.p.m	2000 p.p.m	4000 p.p.m		
		0%	2%	5%								
1997	0˚c	27.50	28.50	30.00	35.70	37.60	43.10	34.20	36.10	39.00	43.20	35.49
	5˚c	35.00	34.50	30.00	32.00	37.10	39.70	32.70	35.10	40.90	42.50	35.95
	M	31.25	31.50	30.00	33.85	37.35	41.40	33.45	35.60	39.95	42.85	35.72
1998	0˚c	25.50	27.00	27.50	33.70	34.20	39.60	36.60	37.90	39.90	48.55	35.04
	5˚c	33.00	37.00	28.90	31.70	31.70	23.80	36.10	31.60	44.90	46.30	34.50
	M	29.25	32.00	28.20	32.70	32.95	31.70	36.35	34.75	42.40	47.42	34.77

L.S.D at 5%	1997	1998
A	0.0586	0.0423
B	0.1308	0.0943
A×B	0.1851	0.1334

A: Storage temperature.
B: Treatments.

Concerning the effect of storage temperature, it was notable that all fruits except the sealed fruits attained a higher rutab percentage at 0°C than at 5°C. Similar results were obtained by Attia *et al* (1997), who pointed out that polyethylene treatment had lower fruit rutab percentages when compared with untreated ones.

Chemical Properties:

Total acidity%:

It is clear from table (6) that total acidity decreased gradually towards the end of storage period. It was also noticeable that pre-cooling, promote and control treatments recorded a more decrease of total acidity than sealed fruits. This might have been due to the effect of sealing or retarding fruit sensecence and extended fruit shelf life. In this connection El-Morshdy *et al.* (1992) and Attia *et al.* (1997) pointed out that fruit juice acidity of Zaghloul dates gradually decreased with increasing the storage period.

It seemed quite clear that polyethylene types reduced the rate of reduction in the total acidity of several fruits. Maintaining higher titratable acidity in peaches (Brecht *et al.*, 1982) and oranges (Zhamba, 1988) was observed under modified atmosphere conditions.

Table (6): Effect of postharvest treatments on total acidity (%) of Zaghloul dates fruits stored under cold storage temperature during seasons 1997and1998.

Season (1997)												
Treatments		Modified atmosphere By sealing			PRECOOLING (per hour)			PROMOT			Cont	M
Storage Temper-ature	Period per week	Perfortion 0%	2%	5%	1h.	2h.	3h.	1000 p.p.m	2000 p.p.m	4000 p.p.m		
0 ° C	0	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174
	1	0.139	0.174	0.104	0.104	0.104	0.139	0.139	0.104	0.104	0.121	0.123
	2	0.139	0.121	0.104	0.087	0.104	0.121	0.104	0.104	0.087	0.121	0.109
	3	0.104	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.087	0.104	0.090
	4	0.104	0.087	0.087	0.069	0.087	0.069	0.087	0.087	0.087	0.104	0.087
	M	0.132	0.129	0.111	0.104	0.111	0.118	0.118	0.111	0.108	0.125	0.117
5 ° C	0	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174
	1	0.139	0.139	0.139	0.139	0.139	0.156	0.139	0.174	0.121	0.139	0.142
	2	0.121	0.139	0.139	0.104	0.121	0.104	0.104	0.121	0.121	0.121	0.119
	3	0.121	0.121	0.139	0.104	0.104	0.104	0.104	0.104	0.104	0.104	0.111
	4	0.104	0.121	0.121	0.087	0.087	0.069	0.087	0.087	0.087	0.087	0.094
	M	0.132	0.139	0.142	0.122	0.125	0.121	0.122	0.132	0.121	0.125	0.128
A.V		0.132	0.134	0.127	0.113	0.118	0.120	0.120	0.122	0.115	0.125	0.122

Season (1998)												
0 ° C	0	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123
	1	0.123	0.123	0.098	0.098	0.123	0.123	0.123	0.123	0.123	0.123	0.118
	2	0.098	0.123	0.098	0.098	0.123	0.098	0.098	0.123	0.098	0.123	0.108
	3	0.098	0.098	0.086	0.098	0.098	0.098	0.098	0.098	0.098	0.074	0.094
	4	0.086	0.098	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.078
	M	0.106	0.113	0.096	0.098	0.108	0.103	0.103	0.108	0.102	0.103	0.104
5 ° C	0	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123	0.123
	1	0.123	0.123	0.123	0.123	0.123	0.098	0.123	0.123	0.098	0.098	0.116
	2	0.123	0.123	0.098	0.098	0.123	0.098	0.123	0.098	0.098	0.098	0.108
	3	0.098	0.098	0.098	0.074	0.098	0.098	0.098	0.074	0.074	0.074	0.088
	4	0.086	0.074	0.098	0.074	0.074	0.098	0.074	0.074	0.074	0.074	0.080
	M	0.111	0.108	0.108	0.098	0.108	0.103	0.108	0.098	0.093	0.093	0.103
A.V		0.108	0.111	0.102	0.098	0.108	0.103	0.106	0.103	0.098	0.098	0.104

L.S.D at 5%	1997	1998
A	0.0008	0.0003
B	0.0011	0.0006
A×B	0.0017	0.0008
C	0.0017	0.0008

L.S.D at 5%	1997	1998
A×C	0.0025	0.0011
B×C	0.0039	0.0017
A×B×C	0.0056	0.0025

A: Storage temperature. **B: Period per week.** **C: Treatments.**

T.S.S. %:

Concentration of T.S.S. increased towards the end of storage period in all treatments.

Data in table (7) showed that T.S.S. concentration in 4000 ppm promote fruits was higher than the other treatments at 0°C in both seasons. At 5°C, in the two seasons, control fruits followed by 4000 ppm promote fruits was higher than the other treatments. On the other hand, the least accumulation of T.S.S. was recorded by sealed fruits (especially 0% perforation & 2% perforation).

Regarding the effect of storage temperature, it was noticeable that the T.S.S. concentration was higher in fruits stored at 5°C compared to those stored at 0°C at the end of storage period in most treatments.

This increase of T.S.S% may be interpreted as the degradation of complex insoluble compounds (protopectins) to simple molecules throughout the period of storage.

These results confirmed the previous results obtained by El-Morshedy *et al.* (1992) and Attia *et al.* (1997), who found that total soluble solids of Zaghloul date fruits increased during storage the fruits at 0°C.

Table (7) : Effect of postharvest treatments on T.S.S (%) of Zaghloul dates fruits stored under cold storage temperature during seasons 1997and1998.

Season (1997)												
Treatments		**Modified atmosphere By sealing**			**PRECOOLING (per hour)**			**PROMOT**			**Cont**	**M**
Storage Temper-ature	**Period per week**	**Perfortion**			**1h.**	**2h.**	**3h.**	**1000 p.p.m**	**2000 p.p.m**	**4000 p.p.m**		
		0%	**2%**	**5%**								
0 ° C	0	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.40
	1	17.6	17.6	17.9	17.6	17.6	17.6	17.8	17.8	17.9	17.8	17.72
	2	17.8	17.8	18.2	18.0	17.9	18.0	18.1	18.1	18.2	18.1	18.02
	3	18.0	18.0	18.5	18.3	18.2	18.3	18.5	18.4	18.5	18.6	18.33
	4	18.2	18.2	17.7	18.6	18.5	18.7	18.7	18.6	18.8	19.0	18.60
	M	17.8	17.8	18.1	17.9	17.9	18.0	18.1	18.0	18.1	18.1	18.01
5 ° C	0	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.40
	1	17.6	17.6	17.6	17.6	17.6	17.6	17.7	17.7	17.8	18.1	17.69
	2	17.9	17.9	18.0	18.0	17.9	18.0	18.1	18.1	18.2	18.5	18.06
	3	18.2	18.2	18.4	18.4	18.2	18.6	18.6	18.5	18.6	18.9	18.46
	4	18.5	18.5	18.8	18.7	18.6	18.8	18.9	18.8	19.0	19.3	18.79
	M	17.9	17.9	18.0	18.0	17.9	18.0	18.1	18.1	18.2	18.4	18.08
A.V		17.8	17.8	18.0	18.0	17.9	18.0	18.1	18.0	18.1	18.3	18.04
Season (1998)												
0 ° C	0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.00
	1	17.2	17.2	17.2	17.2	17.2	17.2	17.3	17.3	17.4	17.3	17.25
	2	17.4	17.4	17.5	17.5	17.5	17.6	17.6	17.6	17.7	17.6	17.54
	3	17.6	17.6	17.8	17.8	17.8	17.9	17.9	17.9	18.0	17.9	17.82
	4	17.8	17.8	18.1	18.1	18.2	18.3	18.2	18.1	18.3	18.2	18.11
	M	17.4	17.4	17.5	17.5	17.5	17.6	17.6	17.5	17.6	17.6	17.54
5 ° C	0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.00
	1	17.2	17.2	17.2	17.2	17.2	17.2	17.3	17.3	17.4	17.3	17.25
	2	17.5	17.5	17.6	17.6	17.5	17.6	17.7	17.7	17.8	17.8	17.63
	3	17.8	17.8	17.8	18.0	17.9	18.0	18.1	18.1	18.2	18.3	18.00
	4	18.1	18.1	18.4	18.3	18.2	18.4	18.5	18.4	18.6	18.9	18.39
	M	17.5	17.5	17.6	17.6	17.5	17.6	17.7	17.7	17.8	17.8	17.65
A.V		17.4	17.4	17.5	17.5	17.5	17.6	17.6	17.6	17.7	17.7	17.59

L.S.D at 5%	1997	1998
A	0.0097	0.0095
B	0.0156	0.0150
A×B	0.0220	0.0212
C	0.0220	0.0212

L.S.D at 5%	1997	1998
A×C	0.0309	0.0298
B×C	0.0490	0.0474
A×B×C	0.0694	0.0669

A: Storage temperature. **B: Period per week.** **C: Treatments.**

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تأثير بعض معاملات ما بعد الحصاد علي ثمار البلح الزغلول أثناء التخزين

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طبقت عدة معاملات وهى التغليف بالبولى ايثيلين صفر، ٢، ٥% تثقيب، وإجراء عملية التبريد المبدئى لمدة ١ساعة، ٢، ٣ ساعات ، واستخدام مادة حيوية تدعى البروموت بتركيز ١٠٠٠، ٢٠٠٠، ٤٠٠٠ جزء فى المليون. ثم خزنت الثمار على درجة صفر°م أو ٥°م لمدة ٤ أسابيع قيمت الثمار من ناحية طول فترة التخزين، الفقد فى الوزن، قيمة L, a, b ، القوام،نسبة الترطيب، نسبة المواد الصلبة الذائبة الكلية، نسبة الحموضة الكلية وذلك لزيادة القدرة التخزينية لثمار البلح الزغلول وبالتالى زيادة فرص التصدير.

وأثبتت النتائج أن كل المعاملات تفوقت عن معاملة المقارنة (الكونترول) والتى خزنت على درجة صفر أو ٥°م. وكانت أحسن هذه المعاملات من حيث قلة الفقد فى الوزن، صلابة الثمار، الاحتفاظ باللون الأحمر الزاهى، ونسبة الترطيب هي الثمار المعبأة فى أكياس البولى إيثيلين. وكانت أقل المعاملات هى معاملة بروموت ٤٠٠٠ جزء فى المليون والتبريد المبدئى لمدة ٣ ساعات.

يمكن استخدام صفة القوام كمؤشر جيد ، دقيق، وحقيقى لإظهار الفروق بين المعاملات.كل المعاملات ماعدا معاملة التغليف كانت نسبة الترطيب فيها على درجة الصفر المئوى أعلى من درجة ٥°م.