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EFFECT OF ANTITRANSPIRANT TREATMENTS ON STORAGE ABILITY OF SOME CANTALOUPE VARIETIES

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ABSTRACT

This study was conducted on eight netted cantaloupe varieties (Primal, Ideal, Rafigal, Vicar, Galor, Croso, and Total) to investigate the effect of variety and antitranspirant (calcium lactate) treatments during cold storage.

All physical properties, i.e. weight loss %, decay % and firmness, and chemical composition, i.e. TSS, total sugars, and vit. C of fruits were tested.

Stored fruits showed great losses in weight percent, which coincided with high incidence of decay percent during storage. The period of storage had a pronounced effect, since the loss were increased as the storage period was prolonged. On the other hand, the flesh fruits after harvested had the highest firmness values, which significantly reduce as storage period proceeded. Moreover, Total and Croso vrs. lost higher proportion weight and decay percent but less firm than the other varieties under test during storage. Fruits treated with calcium lactate as antitranspirant exhibited not only lower in weight loss and decay percent but also higher firmness compared with untreated.

All chemical composition in fruits were significantly decreased with prolongation of storage period. Vicar and Ideal vrs. generally appeared to be higher in TSS, total sugars and vitamin C content than the other varieties.

Maximum TSS and total sugars values were observed, generally, in treated fruits in all varieties. Whereas, there were no significant effect on ascorbic acid content in treated or untreated fruits in all varieties under test.

INTRODUCTION

To lengthen shelf life of cantaloupe fruits we must reduce the rate of respiration, and decay development, as stated by Ryall and Lipton (1979) on melon. Antitranspirant does not improve the quality of any inferior fruits but it can be beneficial to good handling, as stated by Kasmire (1981). Antitranspirant reduce moisture loss and thus retards shriveling, Ezzat (1991) on cantaloupe. Some climacteric fruits as cantaloupes show the climacteric before the fruits normally were harvested, therefore, the senescence of fruits occurs during marketing, Wills *et al.*, (1982) on melon. It is well known that the respiration rate at climacteric was very high. Thus, sugar loss took place through respiration and/or the conversion of sugars to other forms of carbohydrate compounds, Abd El-Khalek (1996) on melon. Ascorbic acid being decreased during storage due to the rate of oxidation and using then in respiration with proceeding the storage period, Soliman (1980) on melon.

The changes in physical and chemical composition of fruits during storage were investigated by Ezzat (1991) and Abd El-Khalek (1996) concerning physical properties on melon, Soliman (1980) regarding TSS, Vaulex and Aubert (1977) on melon respecting sugar loss and Kuar *et al.* (1975) on melon concerning ascorbic acid.

Varietal differences in physical and chemical composition were reported by Ryall and Lipton (1979), Hassan *et al.* (1984), Ezzat (1991) and Abd El-Khalek (1996).

Therefore, the aim of this study was to investigate the effect of antitranspirant treatments on physical and chemical composition of fruits and their storageability.

MATERIALS AND METHODS

Two successive field trials were carried out at El-Roda Farm (Nubaria) during the winter seasons of 1998/1999 and 1999/2000 to study the effect of antitranspirant (calcium lactate) treatments on the storageability of some cantaloupe varieties.

The resulted treatments combination between the studied factors were tested in a split-plot design with four replicates. Main and sub-plots of this design were assigned for varieties x chemical treatments, respectively. The seeds were sown on December 28th in both seasons under polyethylene tunnels. All the cultivation aspects were practiced as usual according to the recommendation of the Ministry of Agriculture.

The studied factors were 8 varieties (Primal, Ideal, Regal, Rafigal, Vicar, Galor, Croso and Total) and 2 chemical treatments (control and calcium lactate 1.5%). Thus, this experiment included 16 treatments.

The studied fruits of 8 varieties were picked at the maturity stage, then discarded the misshaped, washed, dried, then treated with calcium actate (1.5%). The treated fruits were kept in carton boxes linning with craft paper and stored as it is under cold conditions (2.5°C + 95% RH).

Data recorded:

The changes in fruit physical and chemical composition were determined at 7 days intervals during storage period starting at the beginning of storage period.

The estimated physical properties were as follows:-

1. **Weight loss**: according to the equation.

$$\text{Percent loss in weight} = \frac{\text{Initial weight - Weight of fruits at sampling dates}}{\text{Initial weight of fruit}} \times 100$$

2. **Decay percent**: Any fruit showing decay incidence was counted and related to the number of total fruits.

$$\text{Decay percentage} = \frac{\text{Number of decayed fruits}}{\text{Total number}}$$

Firmness: Firmness of the fruits were measured in pounds per square / inch using the pressure tester (Model Magness Tailur equipped with 6/17 inch

plunger and calibrated to measure the number of pounds per square inch required to force the plunger into the fruit).

The estimated chemical composition were as follows:-

1. **Total soluble solids content:** TSS was recorded using hand refractometer on sections taken from the central axis of the fruit (Wills *et al.*, 1982).
2. **Total sugar contents**: Total sugars in the flesh, a sample of 15 gram equally taken from both ends and middle of the fruit. The modified method of Shaffer and Hartman (1921) was adapted.
3. **Vitamin C**: Ascorbic acid was determined in the juice by the titration method using 2, 6 dichlorophenol endophenol (A.O.A.C., 1960).

All data were subjected to statistical analysis according to the methods described by Snedecor (1962).

RESULTS AND DISCUSSION

A. Keeping quality:

1. Change during storage:

Data in Table (1) and Fig. (1a) show that stored fruits showed great losses in weight percent, which coincided with high incidence of decay percent during cold storage. The period of storage had a pronounced effect, since the losses were increased as the storage period was prolonged.

Table 1: Effect of storage period, variety and antitranspirant treatment on physical characters of cantaloupe fruits during storage.

Treatment	1998 / 1999			1999 / 2000		
	Weight loss (%)	Decay (%)	Firmness (Pound / inch^2)	Weight Loss (%)	Decay (%)	Firmness (Pound / inch^2)
	Effect of storage period / day					
0	--	--	21.24	--	--	21.84
7	2.83	4.52	20.17	3.43	5.12	20.77
14	5.61	5.94	18.66	6.21	6.54	19.18
21	10.28	7.83	16.85	10.88	8.43	17.45
30	13.46	12.63	14.64	14.06	13.22	15.04
LSD at 0.05	0.24	--	0.36	0.26	--	0.34
	Effect of variety					
Primal	5.91	5.99	20.85	6.51	6.59	21.55
Ideal	2.22	3.90	24.33	2.82	4.50	24.93
Regal	7.81	8.05	19.15	8.41	8.65	19.75
Rafigal	8.99	8.53	18.06	9.69	9.13	18.66
Vicar	3.28	4.93	23.08	3.88	5.53	23.68
Galor	10.80	9.10	16.12	11.40	9.70	16.72
Croso	12.06	11.14	13.41	12.66	11.74	14.01
Total	13.28	13.54	11.45	13.88	14.14	12.05
LSD at 0.05	0.16	--	0.28	0.18	--	0.30
	Effect of antitranspirant treatment					
Control	9.59	9.32	17.49	10.19	9.92	18.09
Ca lactate	6.48	6.97	19.02	7.08	7.57	19.59
LSD at 0.05	0.21	--	0.33	0.23	--	0.36

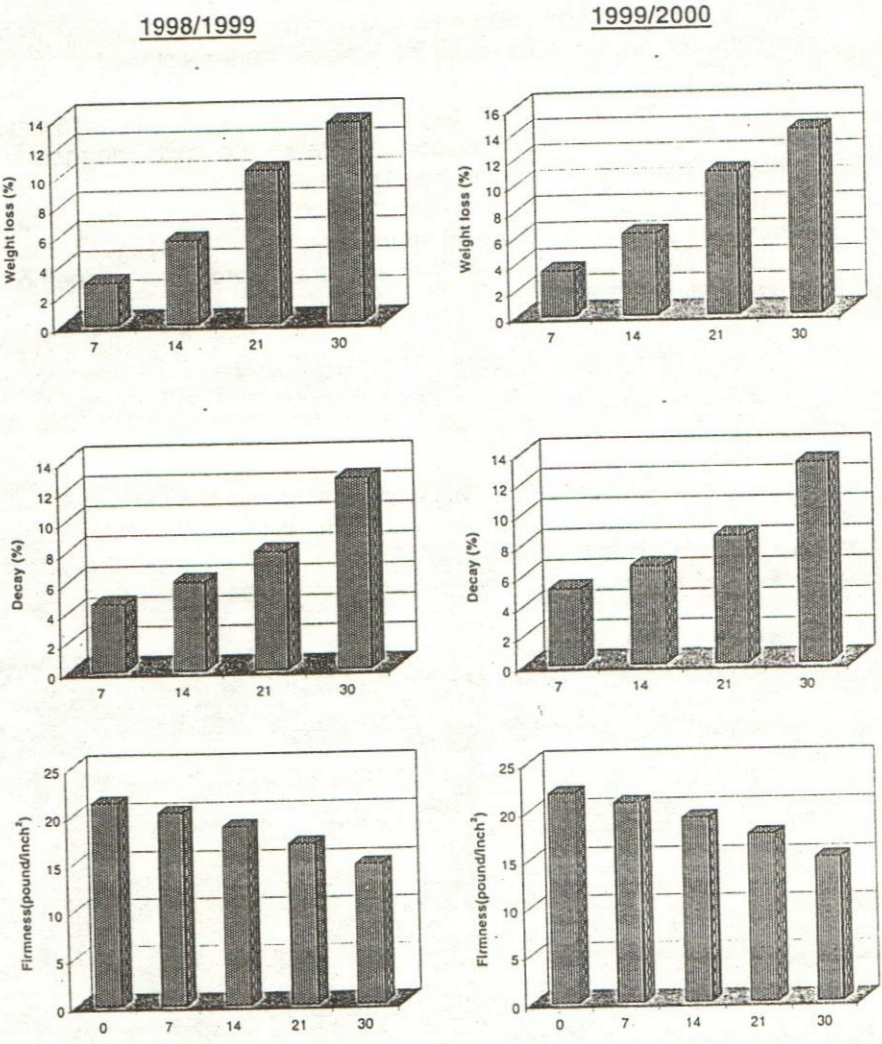

Fig.1. (a): Effect of storage period/days on physical properties of cantaloupe fruits during storage.

This decrement in weigh might be due to the losses in moisture and dry matter through respiration.

Similar results were be attributed to both evaporation and respiration as reported by Evensen (1983) and Cohen and Hicks (1986) on muskmelon.

The increase in decay percentage (Table 1, and Fig., 1a) at the later period of storage might be attributed to that the biological activity in fruits become low and this, in turn, facilitates infection of fruits by microorganisms.

These results are in accordance with those reported by Ezzat (1991) and Abd El-Khalek (1996) on cantaloupe.

Regarding the firmness, data presented in Table (1) and Fig. (1a) indicated that the flesh fruits after harvested had the highest firmness values, which significantly reduced as storage period proceeded.

Increasing the storage period may result in increasing the duration through which the pectin esterase perform and this may lead to increase the soluble form of pectin substances as stated by Wills *et al.* (1982).

It is assuring that Soliman (1980). Ezzat (1991) and Abd El-Khalek (1996) on melon, came to the similar results.

2. Effect of variety:

Data in Table (1) and Fig. (1b) reflected that Total and Croso varieties Lost higher proportion weight than the other varieties under test during storage. The data show also that the same varieties was higher in decay percentage and less firmness.

Soliman (1980), Evensen (1983), Ezzat (1991) and Abd El-Khalek (1996) on melon, attributed similar results to varietal differences.

The differences between varieties in weight loss, decay and firmness might be attributed to the genetic differences, which lead to differences in physical properties of the fruits as lenticels, cork cells and thickness and nature of protective waxy wall.

3. Effect of antitranspirant:

Results presented in Table (1) and Fig. (1c) indicated that fruits treated with calcium lactate as antitranspirant exhibited not only lower in weight loss and decay percent, but also higher firmness compared with control (untreated).

These results might be attributed to that using calcium lactate as antitranspirant decrease the water loss through evaporation. Moreover, disinfectant prevent the micro-organism from attacking the fruits and inhibit spore germination and affect conidia formation. On the other hand, calcium lactate decrease exchangeable gas and subsequently reduce respiration and enzymes activity and in turn conversion of protopectin to soluble pectin.

These results agreed with those obtained by Abd El-Rahman (1990) on sweet pepper, Ezzat (1991) on melon and Emam (1993) on cucumber.

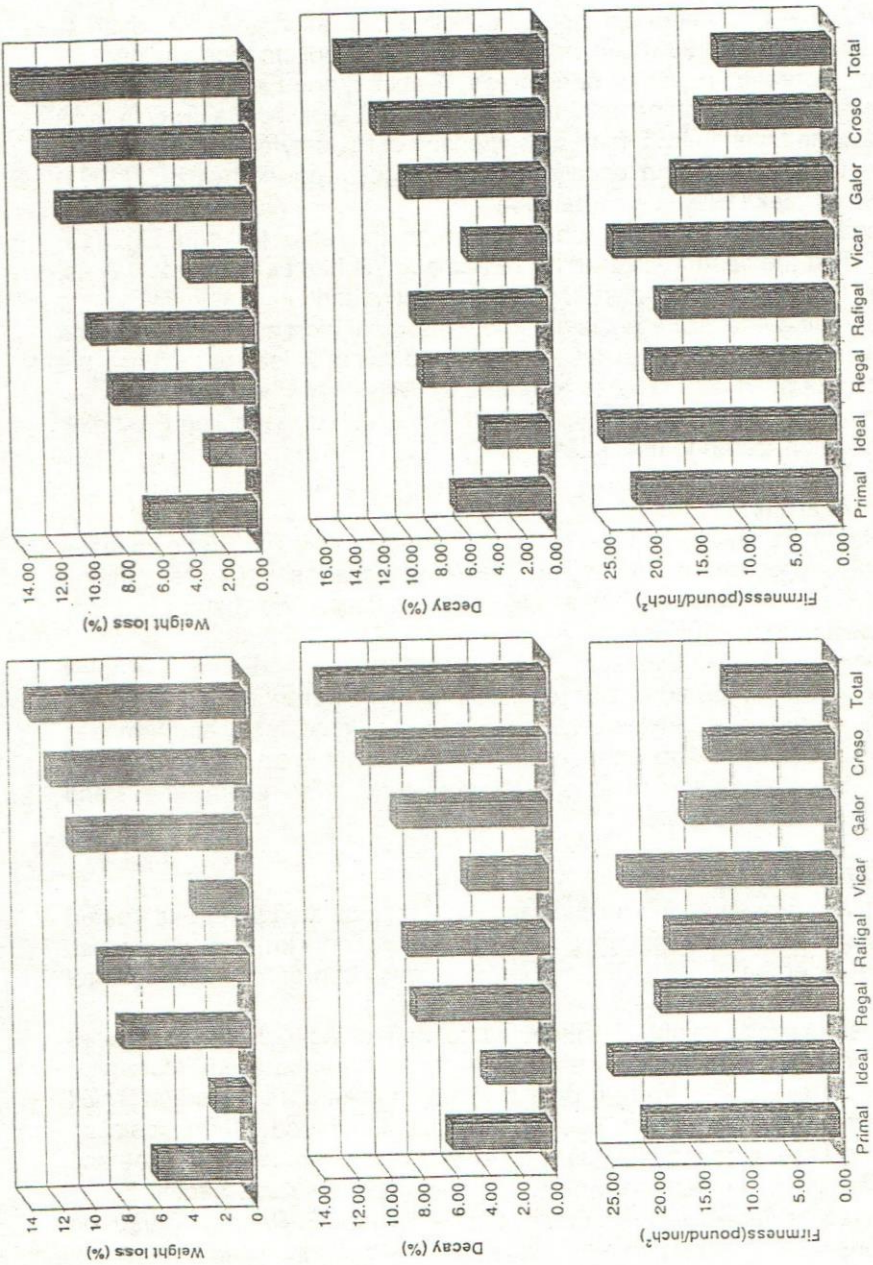

Fig.1. (b): Effect of variety on physical properties of cantaloupe fruits during storage.

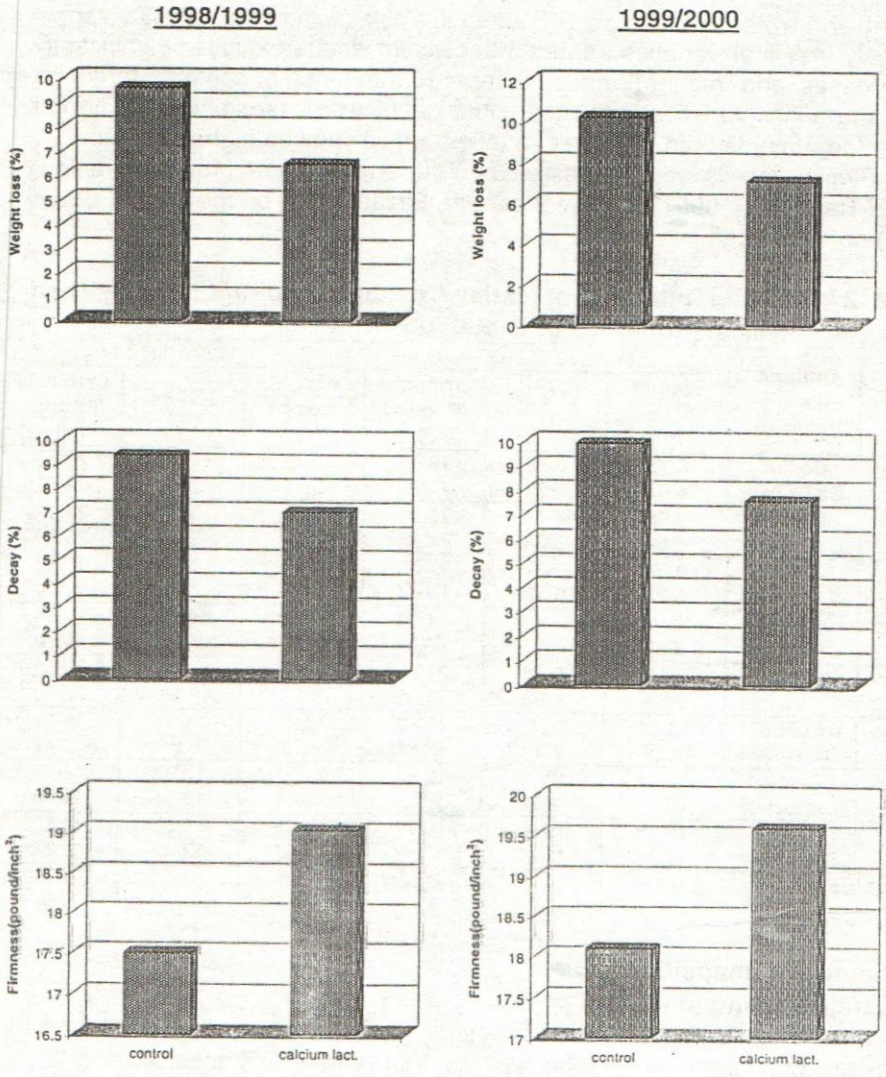

Fig.1 (c): Effect of antitranspirant treatment on physical properties of cantaloupe fruits during storage.

4. Effect of interaction (variety x antitranspirant):

Regarding the effect of interaction on weight loss percent, decay percent and firmness, data are presented in Table (2) and Fig. (2). Data show obviously that in all varieties treated with calcium lactate exhibited significantly lower losses and higher firmness compared with those of control. Moreover, Ideal and Vicar varieties exhibited significant lower losses and more firm at different treatments than the other varieties, which showed higher values.

Similar results were obtained by Hardenburg *et al.* (1986) on melon, Abd El-Rahman (1990) on sweet pepper, Ezzat (1991) on melon and Eman (1993) on cucumber.

Table 2. Effect of interaction (variety x antitranspirant treatment) on physical properties of cantaloupe fruits.

Variety	Antitrans-pirant treatment	1998 / 1999			1999 / 2000		
		Weight loss (%)	Decay (%)	Firmness (Pound / inch^2)	Weight loss (%)	Decay (%)	Firmness (Pound / inch^2)
Primal	Control	6.75	6.76	19.95	7.35	7.36	20.55
	Ca. lactate	5.07	5.22	21.95	5.67	5.82	22.55
Ideal	Control	2.85	4.47	23.54	3.45	5.07	24.14
	Ca. lactate	1.59	3.34	24.98	2.19	3.94	25.58
Regal	Control	9.39	9.27	17.85	9.99	9.87	18.45
	Ca. lactate	6.22	6.83	19.64	6.82	7.43	20.04
Rafigal	Control	11.16	9.88	17.08	11.76	10.48	17.68
	Ca. lactate	6.82	7.17	19.04	7.42	7.77	19.64
Vicar	Control	4.02	5.78	22.76	4.62	6.38	23.36
	Ca. lactate	2.53	4.08	23.39	3.13	4.68	23.99
Galor	Control	13.01	10.79	15.42	13.61	11.39	16.02
	Ca. lactate	8.59	7.41	16.82	9.19	8.01	17.42
Croso	Control	14.11	12.37	12.63	14.71	12.97	13.23
	Ca. lactate	10.01	9.91	14.18	10.61	10.51	14.78
Total	Control	15.48	15.26	10.72	16.08	15.86	11.32
	Ca. lactate	11.07	11.82	12.18	11.67	12.42	12.78
LSD at 0.05		0.16	--	0.32	0.18	--	0.34

B. Chemical composition:

1. Changes during storage:

Presented data in Table (3) and Fig. (3a) showed clearly that all the chemical compositions in fruits, i.e. TSS, total sugars and ascorbic acid (Vit. C.) were significantly decreased consistently with the prolongation of storage period. These results hold true at the two growing seasons.

The decrement in TSS during the storage period might be due to the relatively higher rates of sugar loss through respiration. These results agree with those obtained by Ezzat (1991) and Abd El-Khalek (1996) on melon.

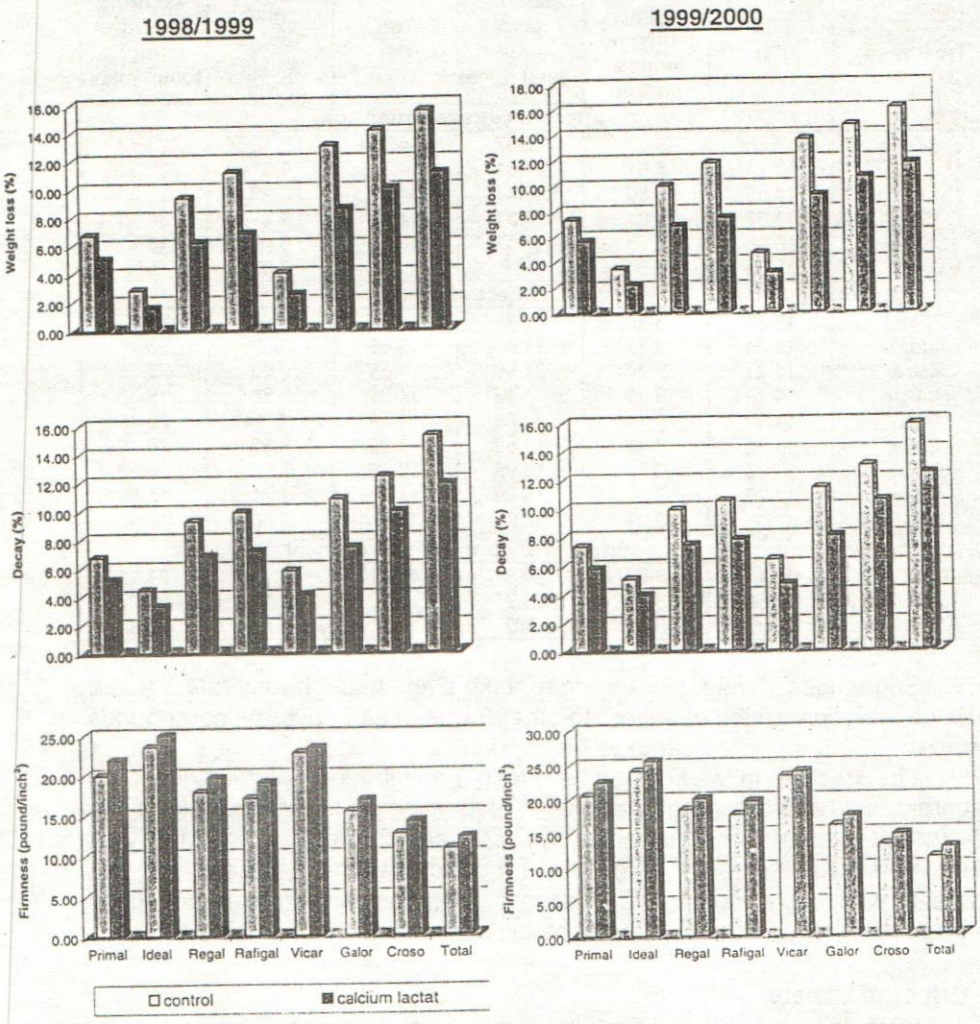

Fig.2. : Effect of interaction (variety x antitranspirant treatment) on physical properties of cantaloupe fruits.

Table 3: Effect of storage period, variety and antitranspirant treatment on chemical composition of cantaloupe fruits during storage.

Treatment	1998 / 1999			1999 / 2000		
	TSS (%)	Total sugar (gm/ 100gm edible portion	Ascorbic acid (mg/ 100ml juice)	TSS (%)	Total sugar (gm/ 100gm edible portion	Ascorbic acid (mg/ 100ml juice)
	Effect of storage period / day					
0	13.85	9.00	22.87	14.45	9.40	23.47
7	13.71	8.91	21.61	14.31	9.31	22.21
14	13.55	8.80	20.41	14.15	9.20	21.01
21	13.56	8.81	19.51	14.16	9.21	20.11
30	13.16	8.55	17.51	13.76	8.45	18.11
LSD at 0.05	0.12	0.04	0.18	0.11	0.03	0.16
	Effect of variety					
Primal	13.68	8.89	22.88	14.28	9.29	23.48
Ideal	15.26	9.91	24.84	15.88	10.31	25.44
Regal	14.23	9.24	21.66	14.83	9.64	22.38
Rafigal	14.29	9.28	17.72	14.89	9.68	18.32
Vicar	14.99	9.74	24.89	15.59	10.14	25.49
Galor	13.00	8.45	19.89	13.60	8.85	20.49
Croso	11.59	7.53	15.99	12.19	7.93	16.59
Total	11.26	7.31	15.09	11.86	7.71	15.69
LSD at 0.05	0.22	0.07	0.16	0.19	0.06	0.18
	Effect of antitranspirant treatment					
Control	13.41	8.58	20.51	14.01	8.98	21.11
Ca lactate	13.66	8.87	20.37	14.27	9.27	20.97
LSD at 0.05	0.06	0.05	NS	0.08	0.06	NS

Sugar loss during storage may take place through respiration and/or through the conversion of sugars to other forms of carbohydrate compounds. Soliman (1980) on melon came to similar results.

The decline in Vit. C might be due to the higher rate of the oxidation of ascorbic acid and other organic acids in respiration process with prolongation of storage period. Similar conclusions, concerning the loss of Vit. C were obtained by Kaur *et al.* (1975), who reported that the decrease in Vit. C content was highly due to its susceptibility to oxidation either directly or through the agency of an enzyme ascorbic acid oxidase.

2. Effect of variety:

Data in Table (3) and Fig. (3b) reflected the variety in TSS, total sugar contents and ascorbic acid as affected by varieties. Vicar and Ideal var., generally appeared to be higher in TSS, total sugar and vitamin C contents.

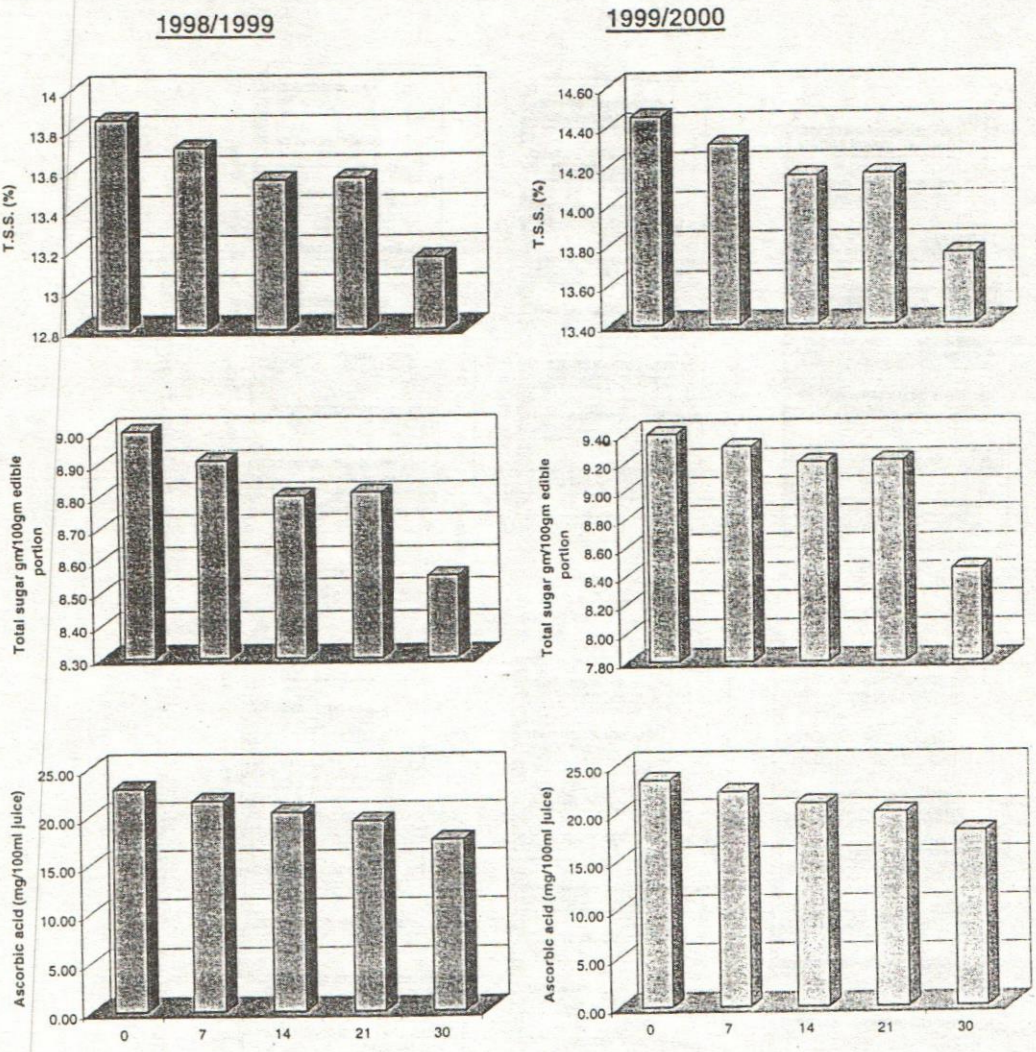

Fig.3. (a): Effect of storage period on chemical composition of cantaloupe fruits during storage.

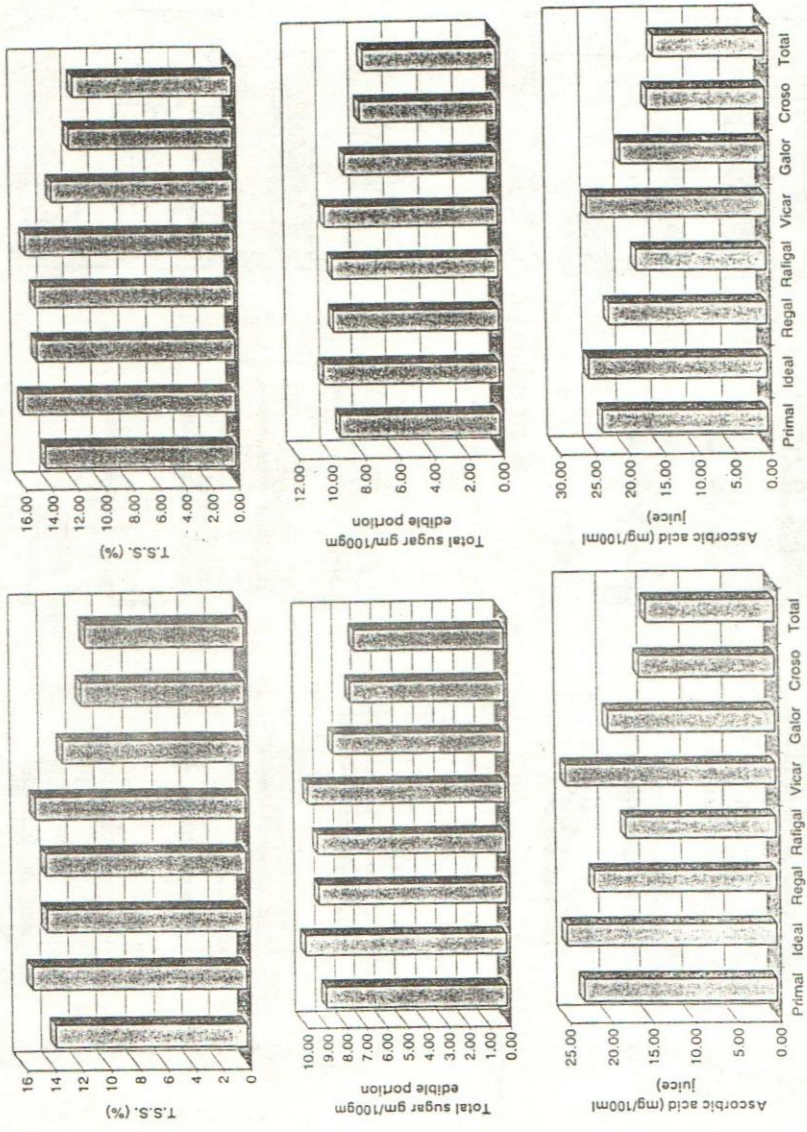

Fig.3. (b): Effect of variety on chemical composition of cantaloupe fruits during storage.

Similar results being concerned with variety differences in TSS of melon were reported by El-Deweny (1978) on sweet melon and muskmelon and Cohen and Hicks (1980) on muskmelon as they stated the increment in TSS resulted in a linear increase in quality, they added that TSS in the juice of cantaloupe varieties is the single most reliable index to their quality.

Concerning the varietal differences in total sugar content of melon, similar findings were obtained by El-Deweny (1978), Ezzat (1991), as they mentioned that soluble sugar concentrations on both fresh or dry weight basis are important to sensory quality evaluation.

The ascorbic acid content in vegetables and fruits appear to be highly sensitive nutritive constituent to storage conditions, and therefore, commonly used as indicator for detecting the freshness of most horticultural commodities, as stated by Ryall and Lipton (1979) and Wills *et al.* (1982). In addition, ascorbic acid varies considerably according to variety, maturity stage and post-harvest conditions.

The differences between the eight varieties in TSS sugars and Vit. C might be due mainly to the genetic differences between varieties.

3. Effect of antitranspirant:

The results presented in Table (3) and Fig. (3c) indicated that fruits treated with calcium lactate as antitranspirant or untreated (control) showed slight differences in TSS, total sugars and Vit. C under cold storage.

These findings is agreed by those obtained by Hassan *et al.* (1984) on melon, Abd El-Rahman (1990) on sweet pepper, Ezzat (1991) on melon and Emam (1993) on cucumber.

4. Effect of interaction (variety x antitranspirant):

Data in Table (4) and Fig. (4) showed obviously that treated or untreated fruits of the eight varieties exhibited significant differences in all chemical properties, i.e. TSS, total sugar and ascorbic acid. However, Vicar and Ideal variety at different treatments showed significantly higher values in these chemical properties compared to other varieties under test kept under cold storage.

5. Effect of interaction (variety x storage period):

Stored cantaloupe fruits showed losses in weight, which coincided with high incidence of decay percent during storage. Ideal and Vicar cvs were outstanding in keeping quality compared with other hybrids (Tables 5&6 and Fig. 5 a&b). In general, fruits Ideal and Vicar appeared to have higher TSS, total sugar and ascorbic acid than the other hybrids (Tables 5&6). Therefore, these hybrids are considered to be of high quality fruits and have relatively higher nutritive value.

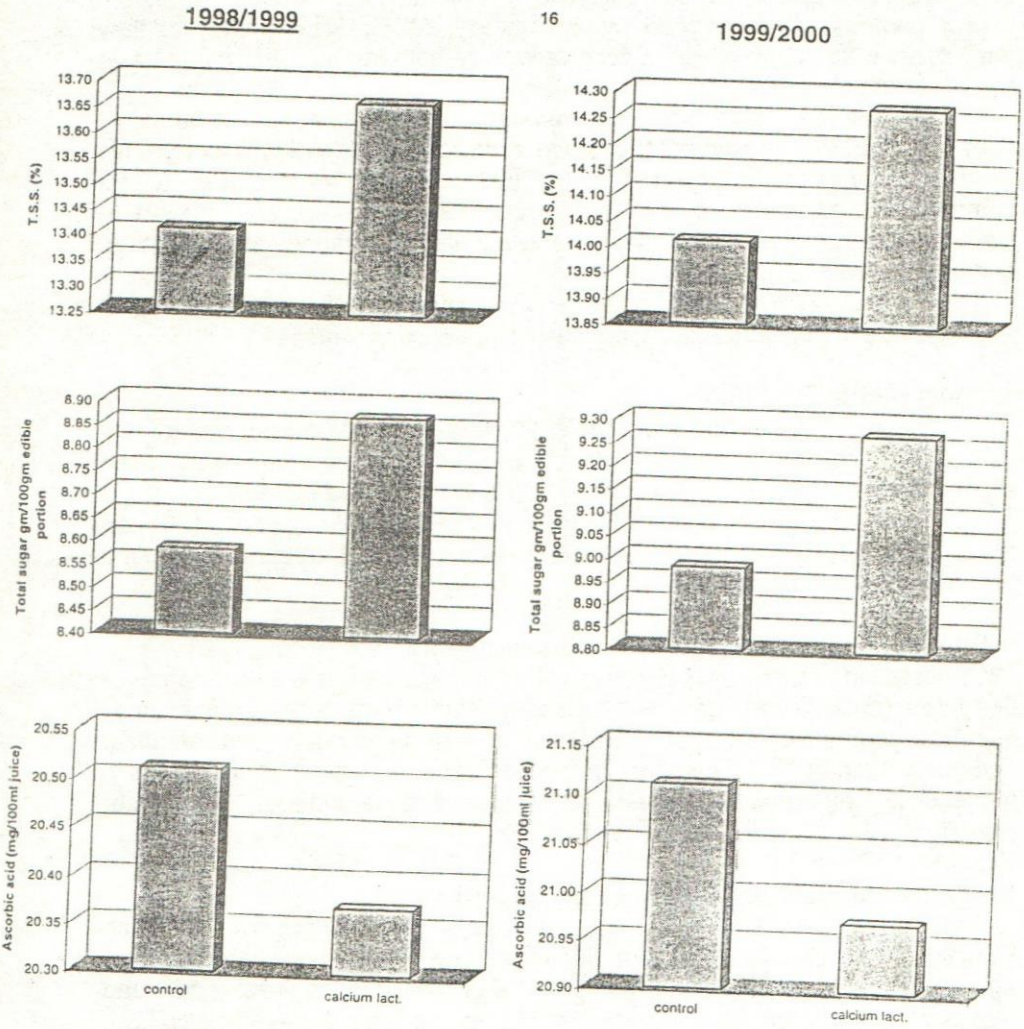

Fig.3. (c): Effect of antitranspirant treatment on chemical composition of cantaloupe fruits during storage.

Table 4: Effect of interaction (variety x antitranspirant treatment) on chemical composition of cantaloupe fruits.

Variety	Antitrans-pirant treatment	1998 / 1999			1999 / 2000		
		TSS (%)	Total sugar (gm/ 100gm edible portion	Ascorbic acid (mg/ 100ml juice)	TSS (%)	Total sugar (gm/ 100gm edible portion	Ascorbic acid (mg/ 100ml juice)
Primal	Control	13.76	8.94	22.96	14.36	9.34	23.56
	Ca. lactate	14.00	9.10	22.80	14.60	9.50	23.40
Ideal	Control	15.16	8.85	24.88	15.76	9.25	25.48
	Ca. lactate	15.36	9.98	24.80	15.96	10.38	25.40
Regal	Control	14.08	9.15	21.98	14.68	9.55	22.58
	Ca. lactate	14.35	9.32	21.66	14.95	9.61	22.26
Rafigal	Control	14.18	9.21	17.88	14.78	9.76	18.48
	Ca. lactate	14.40	9.36	17.76	15.00	0.61	18.36
Vicar	Control	14.68	9.54	24.92	15.28	9.94	25.52
	Ca. lactate	14.90	9.68	24.86	15.50	10.08	25.46
Galor	Control	12.68	8.24	19.94	13.28	8.64	20.54
	Ca. lactate	13.32	8.65	19.84	13.92	9.05	20.44
Croso	Control	11.52	7.48	16.20	12.12	7.88	16.80
	Ca. lactate	11.66	7.57	16.06	12.26	7.97	16.66
Total	Control	11.18	7.26	15.34	11.76	7.66	15.94
	Ca. lactate	11.34	7.37	15.24	11.94	7.77	15.84
LSD at 0.05		0.11	0.04	0.26	0.12	0.06	0.28

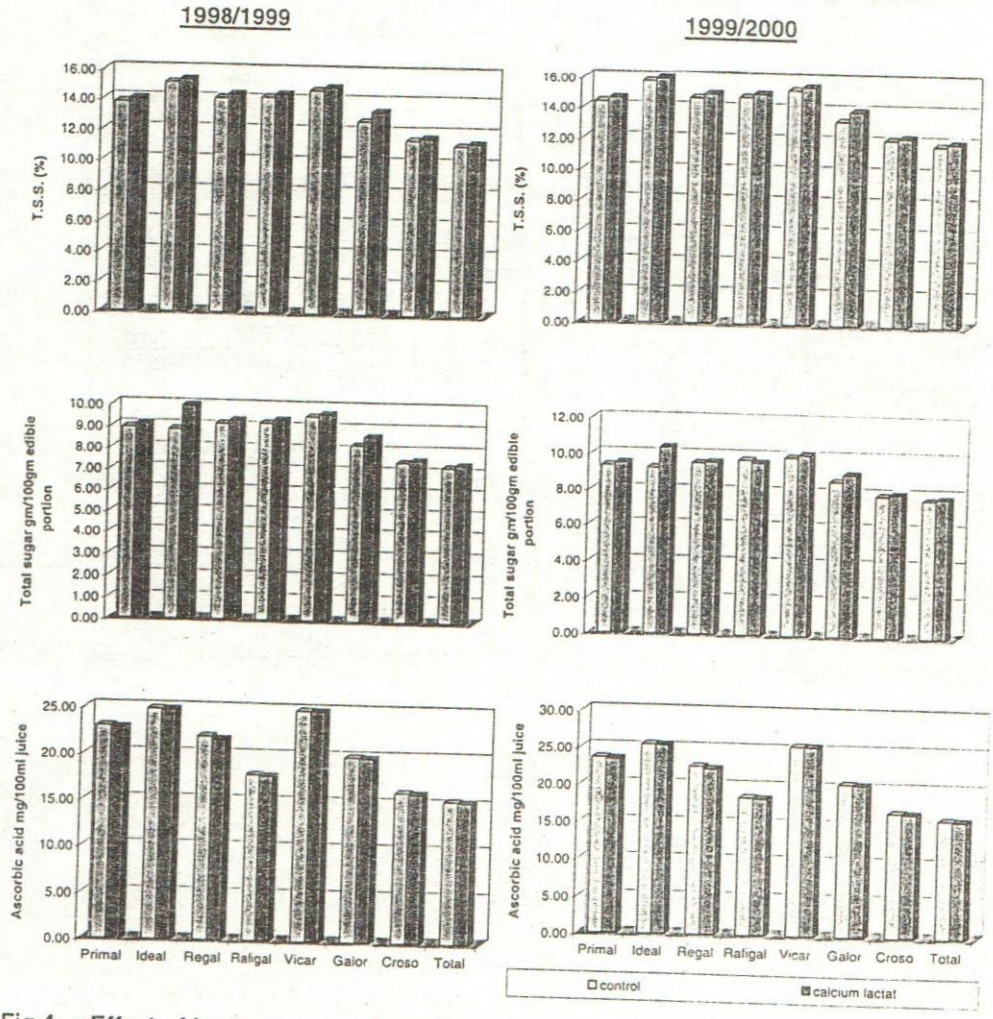

Fig.4. : Effect of interaction (variety x antitranspirant treatment) on chemical composition of cantaloupe fruits.

Table 5: Effect of interaction between variety and storage period on keeping quality and chemical composition of cantaloupe fruits during 1998/1999 season.

Variety	Storage period (days)	1998 / 1999					
		Weight loss (%)	Decay (%)	Firmness (Pound / inch^2)	TSS (%)	Total sugar (gm/ 100gm edible portion	Ascorbic acid (mg/ 100ml juice)
Primal	0	--	--	23.25	14.30	9.30	25.10
	7	1.84	--	22.00	14.15	9.19	23.90
	14	3.21	4.00	20.95	13.90	9.03	23.20
	21	7.84	5.18	20.65	13.70	8.90	22.05
	30	10.76	8.79	17.95	13.35	8.67	20.20
Ideal	0	--	--	26.30	15.50	10.08	26.90
	7	0.25	--	25.63	15.38	9.99	26.05
	14	0.68	2.10	25.05	15.30	9.94	25.10
	21	2.82	2.83	23.60	15.15	9.84	24.05
	30	5.13	6.78	21.05	14.98	9.73	22.05
Regal	0	--	--	21.35	14.50	9.43	23.80
	7	2.12	--	22.23	14.37	9.34	23.05
	14	4.79	5.38	19.35	14.25	9.26	21.45
	21	10.51	7.15	17.45	14.20	9.23	21.05
	30	13.81	11.63	15.35	13.85	9.00	19.55
Rafigal	0	--	--	20.90	14.60	9.49	20.50
	7	2.62	--	19.45	14.48	9.41	19.20
	14	6.45	5.93	18.35	14.33	9.31	18.05
	21	11.88	7.41	17.00	14.15	9.19	16.80
	30	15.02	12.25	14.60	13.90	9.03	14.05
Vicar	0	--	--	25.20	15.10	9.82	27.10
	7	0.65	--	24.95	14.95	9.71	26.05
	14	1.08	2.65	23.83	14.80	9.62	25.10
	21	4.20	4.22	21.75	15.65	10.17	24.00
	30	7.19	7.93	19.65	14.45	9.39	22.20
Galor	0	--	--	19.50	13.20	8.58	22.10
	7	4.16	--	18.05	13.05	8.48	21.05
	14	8.22	6.30	16.75	12.88	8.37	20.00
	21	13.78	7.92	14.15	13.13	8.53	19.20
	30	17.05	13.08	12.15	12.75	8.28	17.10
Croso	0	--	-	17.30	12.00	7.80	19.00
	7	5.06	3.60	15.53	11.85	7.70	17.10
	14	9.45	9.62	13.80	11.60	7.54	16.05
	21	15.07	12.90	11.25	11.40	7.41	14.90
	30	18.66	18.44	9.15	11.10	7.21	12.90
Total	0	--	--	16.10	11.60	7.54	18.50
	7	5.94	5.44	13.55	11.45	7.44	16.45
	14	10.97	11.57	11.20	11.30	7.34	14.35
	21	16.11	15.05	9.15	11.10	7.21	14.10
	30	20.08	22.10	7.25	10.85	7.05	12.05
LSD at 0.05		0.12	--	0.19	0.14	0.02	0.16

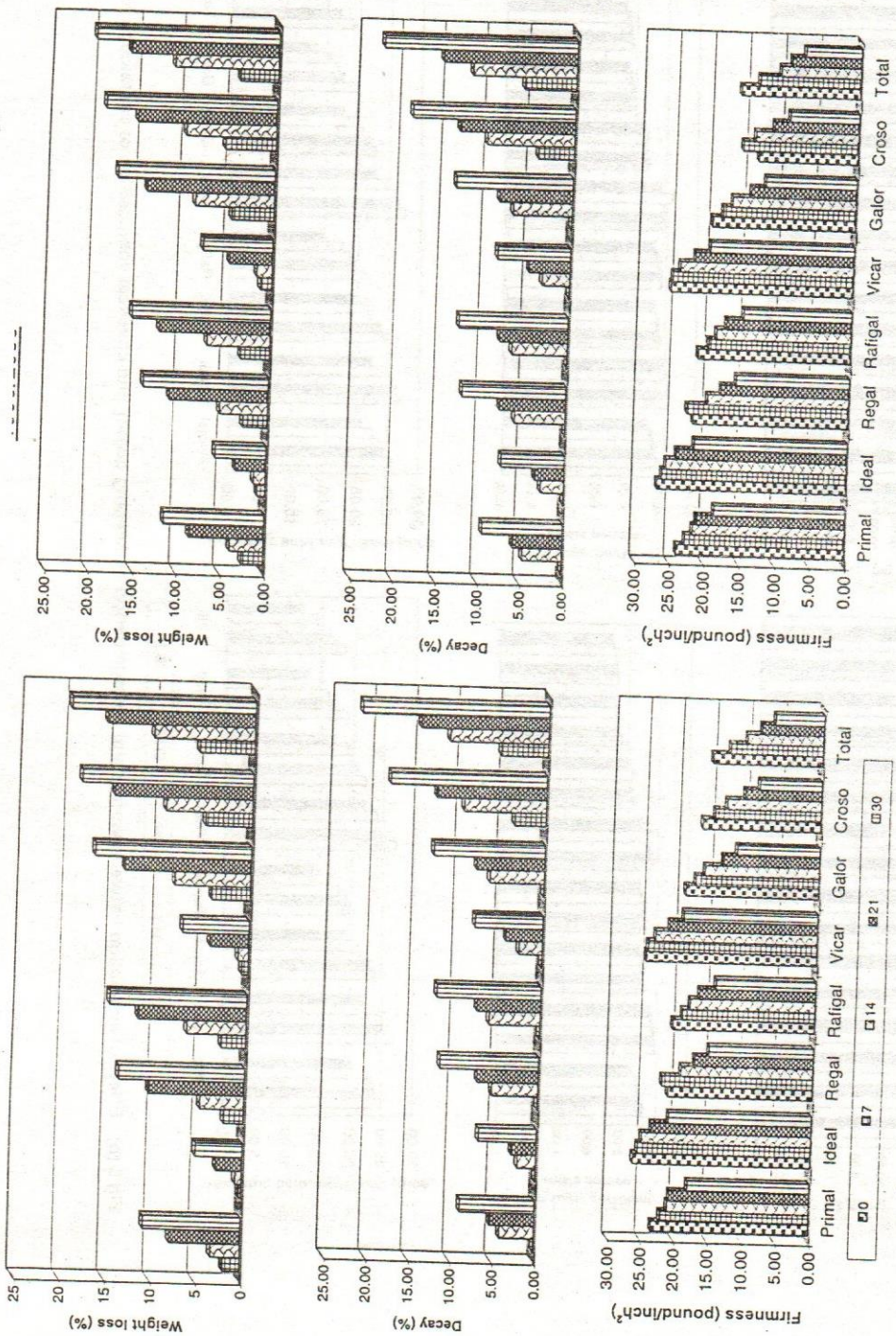

Fig.5 (a) : Effect of interaction between variety and storage period on keeping quality of cantaloupe fruits.

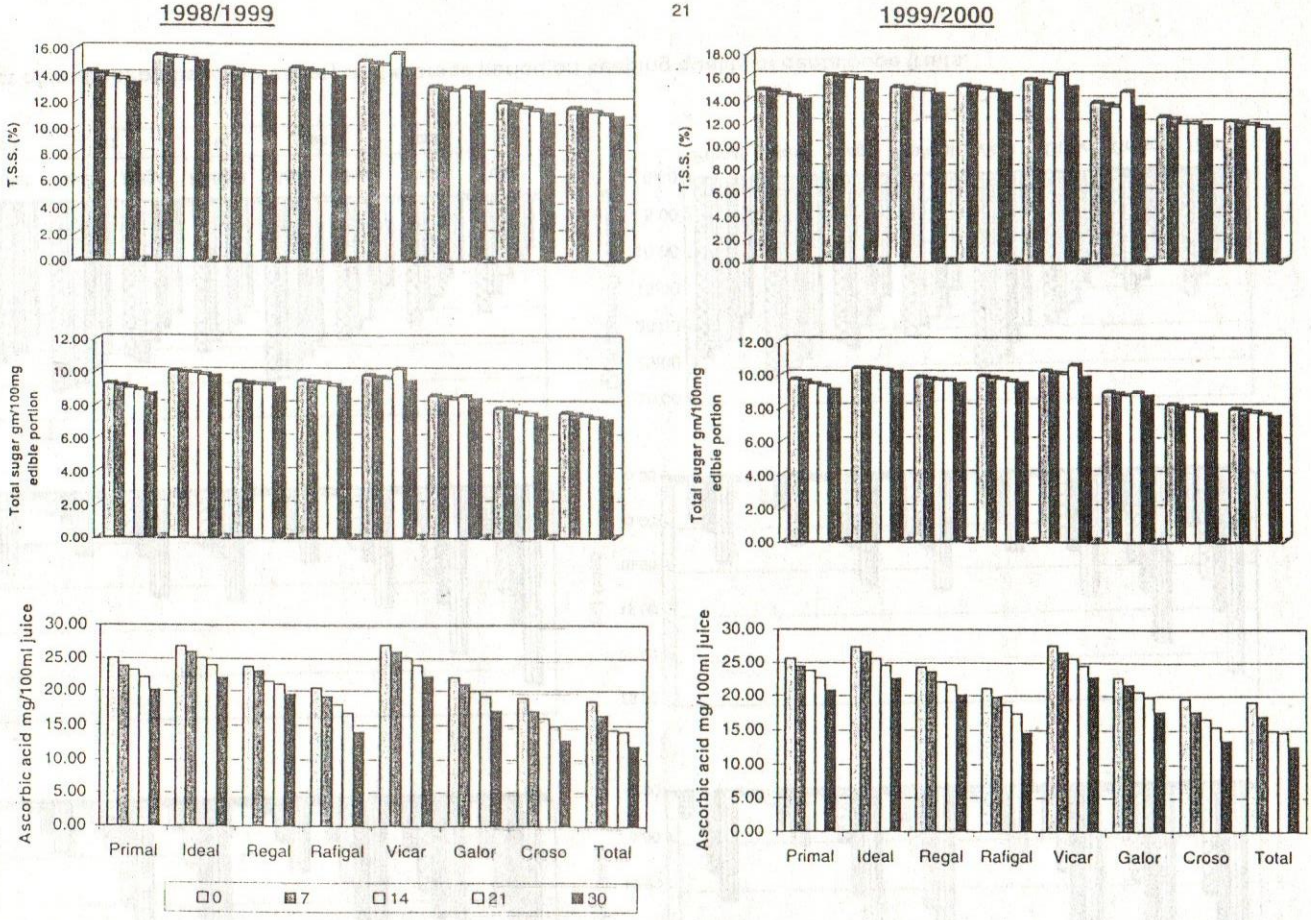

Fig.5 (b) : Effect of interaction between variety and storage period on keeping quality and chemical composition of cantaloupe fruits.

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تأثير المواد المثبطة للنتح على القدرة التخزينية لثمار بعض أصناف الكنتالوب

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أجريت هذه الدراسة على ٨ أصناف من الكنتالوب (بريمال – ايديال – ريجال – رافيجال – فيكار – جالور – كروزو – توتال) لدراسة تأثير الصنف ومعاملة الثمار ببعض المواد المثبطة للنتح (لكتات الكالسيوم) مقارنة بالمنترول على القدرة التخزينية للثمار.

ولقد إختبرت الصفات الطبيعية مثل فقد الوزن والتالف والصلابة والصفات الكيماوية مثل المواد الصلبة الذائبة الكلية ، والسكريات الكلية والمحتوى من فيتامين ج .

ولقد أوضحت النتائج إزدياد فقد الوزن والتالف فى الثمار بإطالة مدة التخزين بينما تناقصت الصلابة معنويا.

ولقد كان صنفى توتال وكروزو بصفة عامة أعلى قيمة فى فقد الوزن والتالف وأقل صلابة بالمقارنة بالأصناف الأخرى.

ومن جهة أخرى أوضحت النتائج أن ثمار الأصناف المعاملة بمثبطات النتح كانت أقل فى فقد الوزن والتالف وأعلى قيمة فى الصلابة عن ثمار الأصناف الغير معاملة.

وبالإشارة إلى نتائج المكونات الكيماوية فى الثمار أوضحت أنها تتناقص معنويا بإطالة مدة التخزين. وكان صنفى فيكار وايديال ، بصفة عامة ، أعلى المواد الصلبة الذائبة الكلية والسكريات الكلية وفيتامين ج بالمقارنة بالأصناف الأخرى.

وبصفة عامة فقد لوحظ أن أعلى قيم للمواد الصلبة الكلية والسكريات الكلية كانت فى الثمار المعاملة فى كل الأصناف. بينما المحتوى من الفيتامين ج كانت ليس لها تأثير معنوى على كل من المعاملة أو الغير معاملة تحت الإختبار لكل الأصناف.