

PHYSICAL AND CHEMICAL CHANGES IN FRUITS OF SOME CANTALOUPE VARIETIES DURING MATURITY

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ABSTRACT

This study was carried out during the fall season of 1998 and 1999. Four cantaloupe varieties. were used in this study i.e. Primal, Total, Ideal and Vicar. The fruits were picked up at 3 maturity stages, i.e. at 35,40and 45- days after anthesis. The physical and chemical properties of fruits were tested. All varieties showed significantly higher fruit weight and flesh thickness. Whereas the superior varieties regarding firmness were Ideal, Primal, Vicar and Total, respectively. Ideal var. exhibited the higher values of TSS, total sugars, total acidity and Vit. C.

The fruits picked at 45- days stage exhibited significantly higher fruit weight, flesh thickness, TSS, as well as total sugars. Whereas firmness and Vit. C decreased toward the full maturity stage .

Moreover, the standard variety i.e. Ideal followed primal in earliness as the physical and chemical properties reached maturity stage after 40- days of anthesis while Primal reached these characters after 35- days. On the other hand Total and Vicar were later in maturity stage by 45-days from anthesis.

INTRODUCTION

It is well known that the fruits of netted varieties can be easily determine their suitable picking stage for marketing or consumption (Full slip yellow-stage) . Whereas, it is too defect to determine the half-slip green stage for export in the some varieties, since if it was picked at pre – maturity stage it would not ripe. The changes in physical and chemical properties can be used for determining the suitable picking stage for such varieties .

The changes in physical and chemical properties of melon fruits during maturity were studied by many investigators, i.e. El-Deweny (1978) , Soliman (1980), and Ezzat (1991) .

Accordingly, this study was conducted to determine the suitable picking stage for some netted cantaloupe varieties, through studying the changes in physical characters and chemical composition of fruits at different maturity stages.

MATERIALS AND METHODS

Two experiments were carried out at Isna (Qena-Governorate) during the two fall seasons of 1998 and 1999 to determine the suitable picking stage of some cantaloupe varieties.

Each experiment included 12 treatments, which were the combinations of four varieties and three maturity stages.

Varieties used:

1. Primal
2. Total
3. Vicar
4. Ideal

Harvesting stages:

The fruits were picked at 35,40 and 45-days after anthesis to determine the physical and chemical properties of the tested fruits.

A split-plot design with four replicates was used. The varieties were in main plots while the harvesting stages were in sub-plots. Cantaloupe seeds were sown on September 28th 1998 and 1999 seasons. Normal cultural practices were followed whenever needed according to the recommendation of the Ministry of Agriculture. The flowers were labeled at fruit set stage. The fruits were picked at the dates mentioned before, discarded the misshaped, washed with tap water, dried and determination of physical and chemical properties were done.

1. Fruit weight: (g).
2. Firmness: (in pounds per square inch, using the pressure tester) as stated by Wills *et al.* (1982).
3. Flesh thickness: (cm) using Adama as stated by Wills *et al.* (1982).
4. Total soluble solids (TSS.): (%) using hand refractometer (Wills *et al.* 1982).
5. Total sugar contents in the flesh: The modified method of Shaffer and Hartman (1921) was adapted.
6. Titratable acidity: (A. O. A. C., 1960).
7. Vitamin C: The titration method using 2,6 dichlorophenol endophenol (A. O. A. C., 1960).

All data were subjected to statistical analysis according to (Snedecor, 1962).

RESULTS AND DISCUSSION

A. Physical characters :

1. Differences among varieties:

Results in Table (1) and Fig. (1a) indicated that there were significances between the four studied varieties in all physical characters, i.e. fruit weight, flesh thickness and firmness. Results showed significantly higher fruit weight and flesh thickness for Total variety than those of other varieties. Whereas, the superior var. regarding firmness were Ideal, Primal, Vicar and Total, respectively.

Varietal differences could be attributed to the genetically differences, as stated by Ezzat (1991) and Abd El-Khalek (1996) concerning fruit weight, El-Deweny (1978) regarding flesh thickness and Kasmire (1981) respecting fruit firmness.

Another explanation concerning fruit softening was attributed to the higher amount of soluble pectic substances in some varieties as compare to others as stated by Wills *et al.* (1982).

Obtained results are in agreement with those of El-Deweny(1978), Mc Collum *et al.* (1987) and Ezzat (1991) regarding fruit weight; Ezzat (1991) concerning flesh thickness and Evenson (1983) and Abd El-Khalek, (1996) respecting firmness, all on melon .

Table 1: Effect of varieties and maturity stages on physical characters of some cantaloupe varieties during the fall season of 1998 and 1999.

Treatment	1998			1999		
	Fruit weight (gm)	Flesh Thickness (cm)	Firmness (Pound / inch ²)	Fruit weight (gm)	Flesh thickness (cm)	Firmness (Pound / inch ²)
	Effect of variety					
Primal	1020.33	2.73	19.10	989.33	2.69	20.36
Total	1313.66	3.23	17.20	1193.33	3.28	18.17
Ideal	1195.33	3.02	24.30	1096.00	3.04	25.37
Vicar	1062.00	2.94	18.95	1064.33	2.97	20.38
LSD at 0.05	32.01	0.08	0.19	25.02	0.06	0.22
	Effect of maturity stage					
35	1117.50	2.84	21.35	1031.25	2.86	22.48
40	1156.50	3.00	20.02	1097.50	2.99	21.05
45	1169.50	3.09	18.30	1128.75	3.14	19.68
LSD at 0.05	9.30	0.03	0.20	10.02	0.04	0.19

2. Effect of maturity stage :

At is quite clear from data reported in Table (1) and Fig.1.(b) that, fruits picked at 45-days stage exhibited significantly higher fruit weight and flesh thickness values compared with the other maturity stages. On the other hand, data of firmness values revealed steady and continuous decrease towards the full maturity stage i. e. 45-days.

Obtained results may be attributed to fruit weight and flesh thickness achieved almost their maximum values at 45-days stage of maturity, as stated by Ezzat (1991).

These results agreed with those obtained by Mc Collum *et al.* (1987-1988) on melon.

The high value of firmness may be due to the higher amount of insoluble pectin substances coincided with low respiration rate during the earlier stages of maturity. Whereas, at full maturity stage respiration rate and ethylene product increased which lead to enhancing of ripening and fruit softening, as stated by Ryall and Lipton (1979) and Wills *et al.* (1982).

Obtained results on firmness are coincided with those of Niculescu and Kasmire (1980) on melon.

3. Effect of interaction (Variety X maturity stage):

The effect of interaction on fruit weight, flesh thickness and firmness are shown in Table (2) and Fig.2.

Regarding fruit weight, the results show that primal Variety reached almost maximum fruit weight at 35-days after anthesis, while the Ideal variety reached at 40-days stage. Moreover, Total and Vicar varieties reached almost maximum fruit weight at 45-days stage.

Concerning flesh thickness, data indicated that there were significant differences between varieties in flesh thickness with prolongation of maturity. However, Total variety exhibited the highest flesh thickness followed by Ideal, Vicar and Primal at 45-days stage.

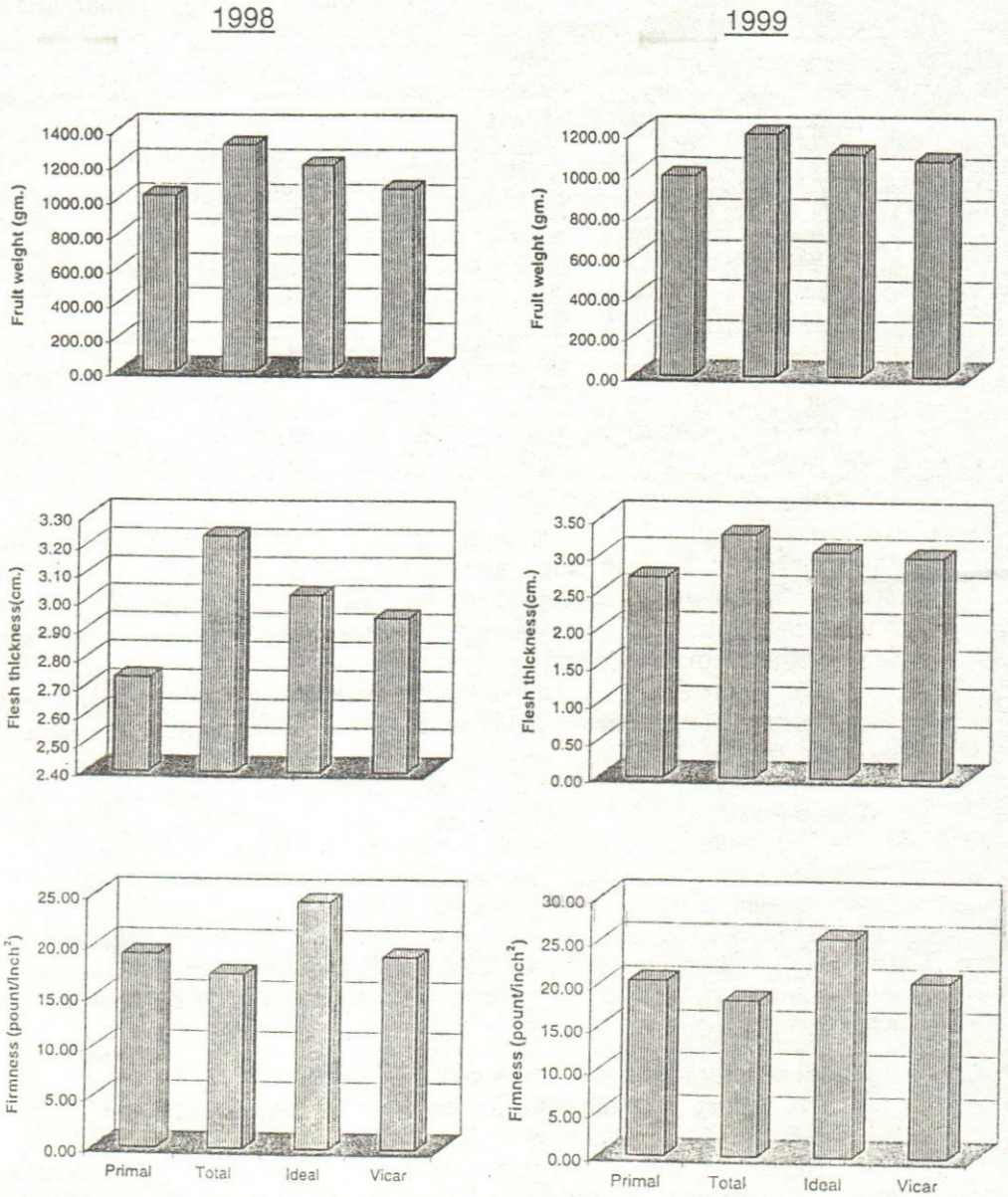


Fig.1.(a) Effect of variety on physical characters of some cantaloupe varieties during the fall season of 1998 and 1999.



Fig.1.(b) : Effect of maturity stage on physical characters of some cantaloupe varieties during the fall season of 1998 and 1999.

Table 2. Effect of interaction (variety x maturity stage) on physical characters of some cantaloupe varieties during the fall season on 1998 and 1999.

Variety	Maturity stage days	1998			1999		
		Fruit weight (gm)	Flesh thickness (cm)	Firmness (Pound / inch ²)	Fruit weight (gm)	Flesh thickness (cm)	Firmness (Pound / inch ²)
Primal	35	1004	2.70	21.24	962	2.65	22.62
	40	1022	2.72	19.07	984	2.70	20.13
	45	1035	2.76	17.00	1022	2.72	18.34
Galia	35	1132	3.10	18.32	1132	3.20	19.52
	40	1213	3.23	17.57	1213	3.25	18.34
	45	1235	3.35	15.70	1235	3.39	16.65
Ideal	35	1157	2.82	25.50	1042	2.90	26.67
	40	1263	3.11	24.30	1127	3.03	25.29
	45	1166	3.13	23.10	1119	3.19	24.14
Rafigal	35	1061	2.73	20.32	989	2.70	21.11
	40	1023	2.94	19.14	1066	2.96	20.43
	45	1102	3.16	17.40	1139	3.25	19.59
LSD at 0.05		36.12	0.08	0.42	28.16	0.14	0.63

It is also clear from Table (2) and Fig.2.that, there were significant differences and gradual decrease in fruit firmness values with the progress of maturity stages. However, Ideal variety exhibited the highest firmness value followed by Primal, Vicar and Total at 45-days stage.

The earliest variety was Primal between the four tested varieties as it reached its maturity stage earlier. The standard variety i. e. Ideal followed Primal in earliness as the physical properties reached maturity stage after 40 days of anthesis while Primal var. reached these characters after 35-days. On the other hand Total and Vicar were later in maturity by 45-days from anthesis.

B. Chemical composition :

1. Differences among varieties:

Concerning the total soluble solids and total sugar content, all varieties were significantly different in this respect as shown in Table (3) and Fig.3 (a). Results showed significantly higher values for Ideal and Vicar. The other two varieties exhibited lower values. These results are in agreement with those obtained by El-Deweny (1979) and Ryall and Lipton (1979) on melon, who stated that since soluble solids are mostly sugars, therefore melons with high concentration are likely to be sweet.

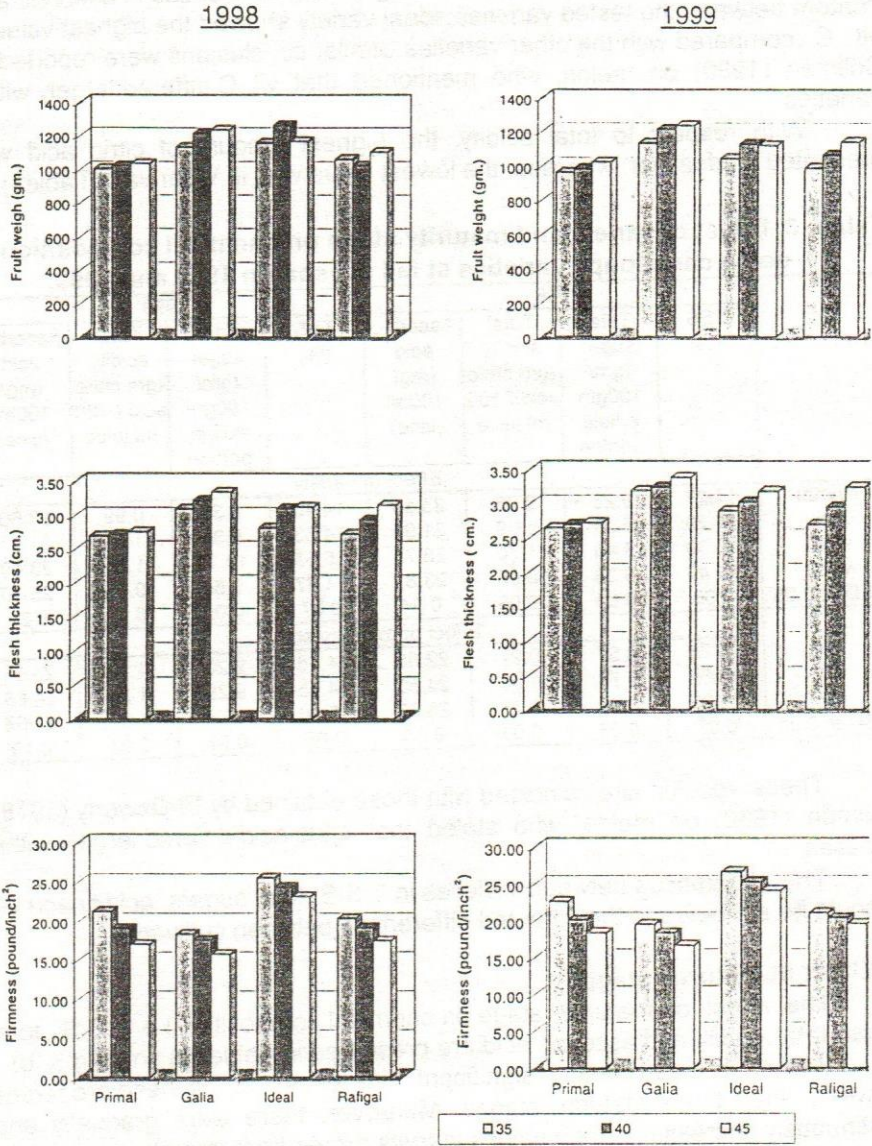


Fig. 2. Effect of interaction (maturity stage x variety) on physical characteristics of cantaloupe varieties at winter season of 1998 and 1999.

Regarding the effect of variety on ascorbic acid content, results in Table (3) and Fig.3. (a) reflected that there were significant differences in ascorbic acid content between the tested varieties. Ideal variety showed the highest value of vit. C compared with the other varieties. Similar conclusions were reported by Soliman (1980) on melon, who mentioned that vit. C differed largely within varieties.

With respect to total acidity, the highest amount of citric acid was presented in Ideal var. whereas, the lowest value was in Vicar var. (Table3).

Table 3. Effect of variety and maturity stage on chemical composition of some cantaloupe varieties at fall season on 1998 and 1999.

Treatment	1998				1999			
	TSS (%)	Total sugar (gm/100gm edible portion)	Total acidity (gm citric acid / 100 ml juice)	Ascorbic acid (mg/100ml juice)	TSS (%)	Total sugar (gm/100gm edible portion)	Total acidity (gm citric acid / 100 ml juice)	Ascorbic acid (mg/100ml juice)
Effect of variety								
Primal	14.27	9.28	0.98	23.53	14.43	8.39	0.99	23.60
Total	14.20	9.23	1.06	21.90	14.33	9.32	1.38	21.57
Ideal	15.30	9.46	1.70	28.77	15.63	10.16	1.77	28.40
Vicar	14.43	9.38	0.98	23.87	14.67	9.54	0.95	25.10
LSD at 0.05	0.06	0.04	0.06	0.24	0.07	0.05	0.05	0.21
Effect of maturity stage								
35	13.75	8.57	0.97	22.88	14.15	9.20	1.16	23.03
40	14.65	9.53	1.30	24.85	14.85	9.29	1.35	24.68
45	15.25	9.92	1.27	25.83	15.30	9.58	1.31	25.68
LSD at 0.05	0.07	0.06	0.03	0.36	0.08	0.07	0.03	0.19

These results are coincided with those obtained by El-Deweny (1978), Soliman (1980) on melon, who stated that citric acid differed largely within varieties.

The differences between varieties in T.S.S. total sugars, acidity and vit. C could be attributed to the inherited differences between cultivars.

2. Effect of maturity stage:

The effect of maturity stage on chemical composition i.e. T.S.S., total sugar, total acidity and ascorbic acid are presented in Table (3) and Fig.3.(b).

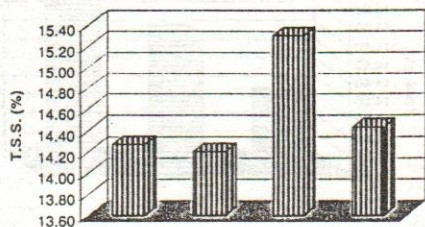
Results showed clearly significant differences in all these properties between the three maturity stages. Moreover, there were gradually and continuously increase in their values in fruits turned from immature to mature or ripe stage.

The highest values in these respects were at 45-days stage, while the lowest values were at 35-days stage.

These differences came to the fact that, leaving fruits to ripen on the vine resulted in an increase in chemical composition of melon fruits as reported by Cohen and Hicks (1986) and Ezzat (1991).

Obtained results are in agreement with those obtained on melon by Soliman (1980) and Ezzat (1991).

1998



1999

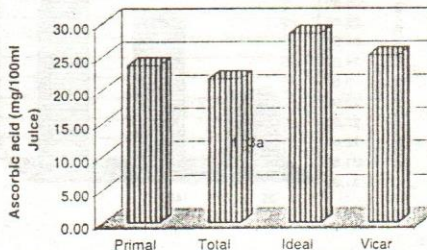
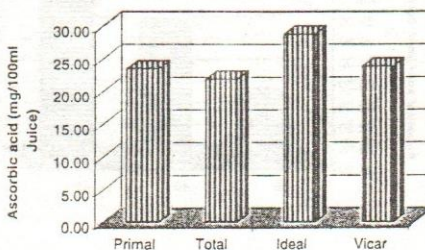
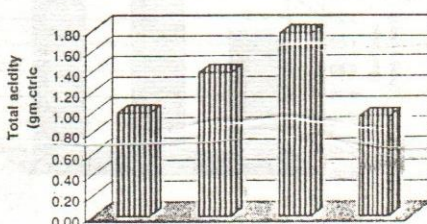
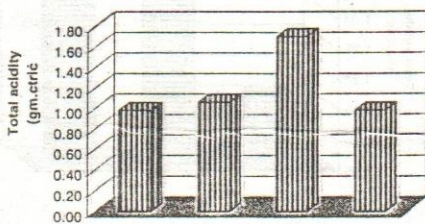
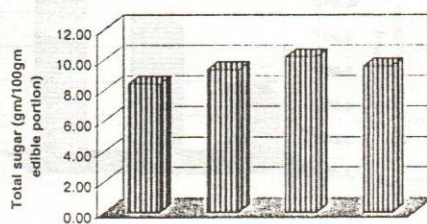
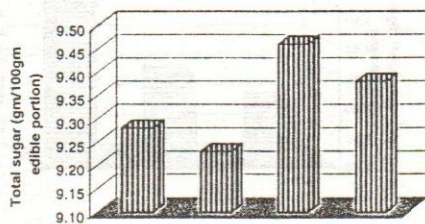
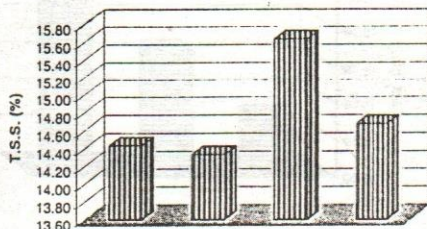


Fig.3.(a) Effect of variety on chemical composition of some cantaloupe varieties at fall season of 1998 and 1999.

1998

1999

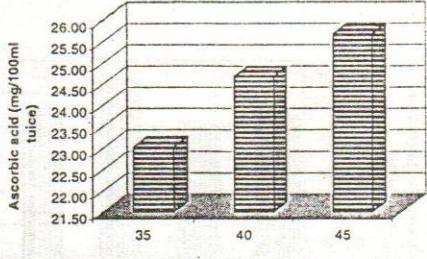
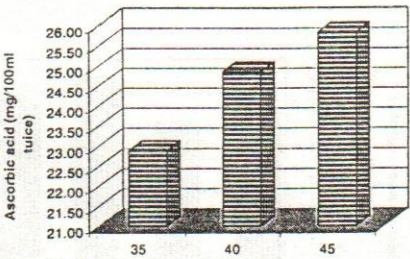
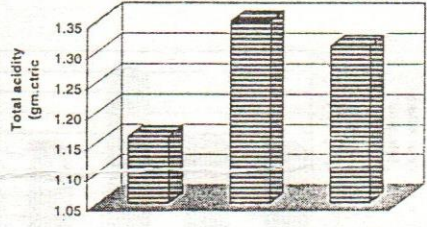
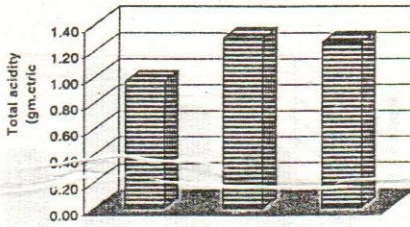
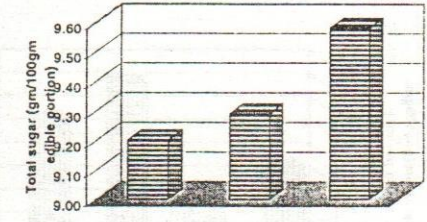
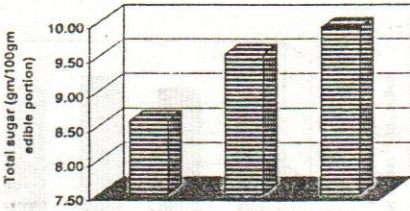
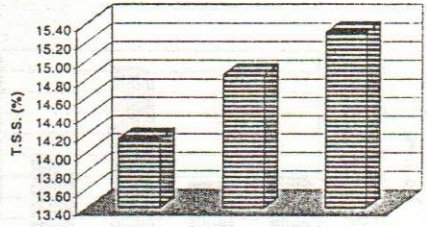
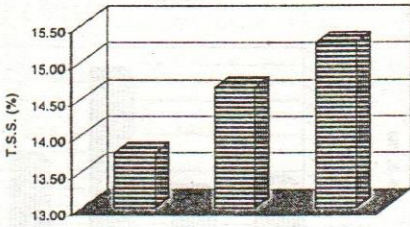


Fig.3.(b) Effect of maturity stage on chemical composition of some cantaloupe varieties at fall season of 1998 and 1999.

3. Effect of interaction (variety x maturity stage):

Data in Table (4) and Fig.4. show clearly that, there were significant differences and gradual increase in T.S.S. and total sugars values with the progress of maturity for all tested varieties. However, Ideal var. exhibited the highest values at 45-days stage, except with Vit. C which was maximum in Total and Vicar. Moreover, Primal and Ideal showed maximum Vit. C at 35-days and 40-days after anthesis, respectively.

Table 4. Effect of interaction (variety x maturity stage) on chemical composition of some cantaloupe varieties at fall season on 1998 and 1999.

Variety	Maturity stage days	1998				1999			
		TSS (%)	Total sugar (gm/100gm edible portion)	Total acidity (gm citric acid / 100 ml juice)	Ascorbic acid (mg/100ml juice)	TSS (%)	Total sugar (gm/100gm edible portion)	Total acidity (gm citric acid / 100 ml juice)	Ascorbic acid (mg/100ml juice)
Primal	35	14.00	9.10	0.83	25.3	14.30	0.29	0.82	25.5
	40	14.30	9.30	1.14	23.1	14.50	7.94	1.12	23.3
	45	14.50	9.43	0.98	22.2	14.50	7.95	1.04	22.0
Total	35	13.00	8.45	0.86	19.1	13.30	8.65	1.60	19.5
	40	14.50	9.43	1.18	22.3	14.50	9.43	1.33	21.1
	45	15.10	9.82	1.14	24.3	15.20	9.88	1.21	24.1
Ideal	35	14.50	14.50	7.95	1.40	26.7	15.00	9.75	1.42
	40	15.50	15.50	10.08	1.78	30.1	15.90	10.34	1.90
	45	15.90	15.90	10.34	1.92	29.5	16.00	10.40	2.00
Victor	35	13.50	8.78	0.80	20.4	14.00	9.10	0.80	20.8
	40	14.30	9.30	1.10	23.9	14.50	9.43	1.05	24.4
	45	15.50	10.07	1.04	27.3	15.50	10.08	1.00	27.6
LSD at 0.05		0.15	0.11	0.06	0.28	0.12	0.05	0.09	0.29

The effect of interaction on the total acidity, Ideal variety exhibited the highest acidity followed by Total, Vicar and Primal at 45-days stage, respectively.

With respect to ascorbic acid content, it was noticed from data in Table (4) and Fig.4. that there were significant differences and gradual increase in Vit.C. with the progress of maturity stage for all tested varieties except Primal var. which was maximum at 30-days stage and gradual decrease with the progress of maturity stage. However, Ideal var. showed the highest ascorbic acid followed by Vicar, Primal and Total at 45-days stage, respectively.

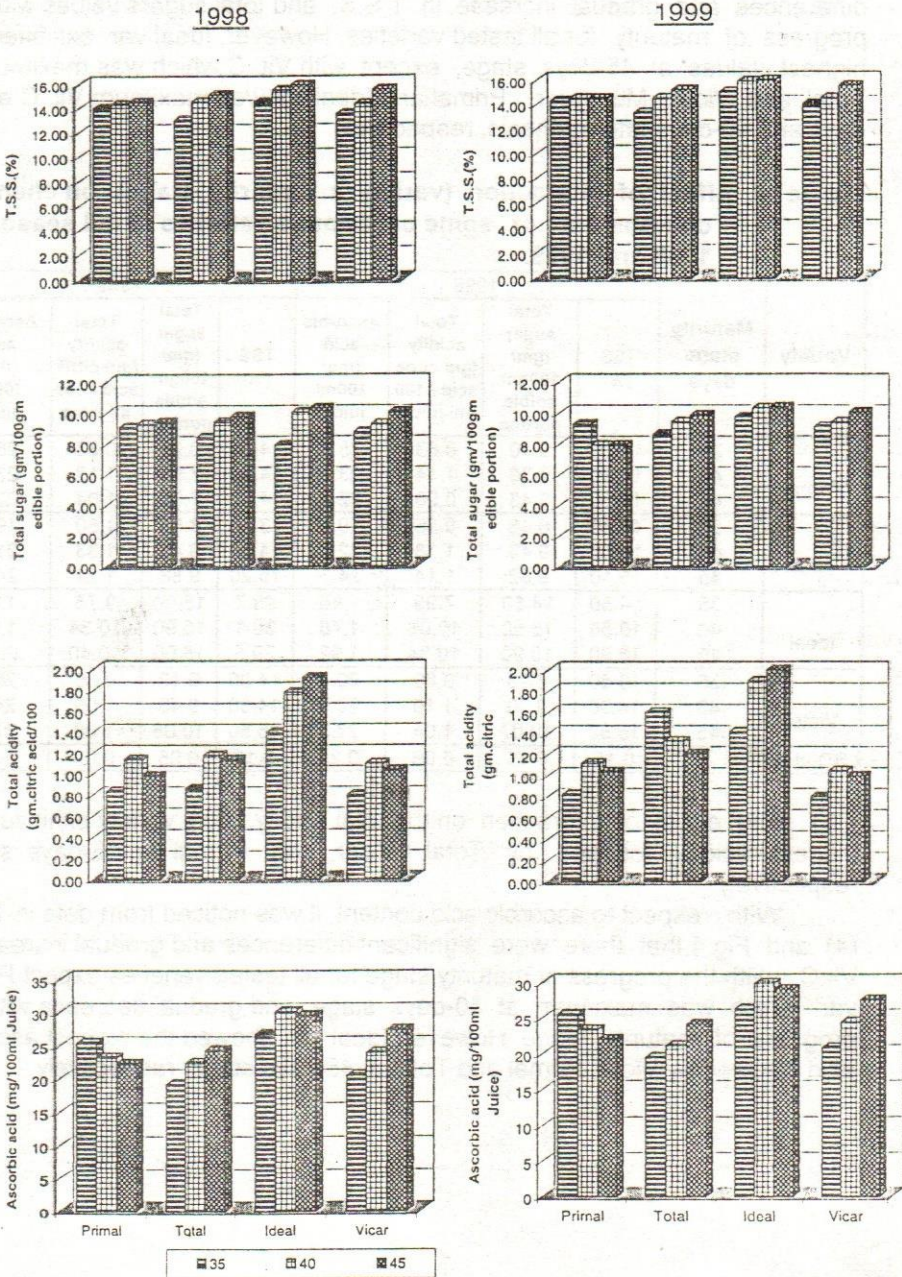


Fig. 4. Effect of interaction (maturity stage x variety) on chemical composition of some cantaloupe varieties at fall season of 1998 and 1999.

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التغيرات الطبيعية والكيميائية التي تحدث في ثمار بعض أصناف الكنتالوب أثناء نضجها

محسن عبد المقصود عزت

معهد بحوث البساتين ، مركز البحوث الزراعية

- أجريت هذه الدراسة خلال موسمي ١٩٩٨/ ١٩٩٩ على أربع أصناف من الكنتالوب هي بريمال ، توتال، ايدبال وفيكار . تم قطف الثمار على ٣ مراحل من النضج وهي بعد ٣٥ ، ٤٠ ، ٤٥ يوم من العقد حيث درست الصفات الطبيعية والكيميائية لثمار هذه الأصناف في هذه المراحل وأظهرت النتائج ما يلي:
- كانت أعلى الأصناف في وزن الثمار، وسمك اللحم هي صنف توتال .
 - كانت أعلى الأصناف في صلابة الثمار صنف ايدبال يليه صنف بريمال، فيكار ثم توتال على الترتيب .
 - كانت أعلى الأصناف في كل من المواد الصلبة الذائبة والسكريات الكلية والحموضة الكلية لفيتامين ج هو صنف ايدبال .
 - أظهرت الثمار التي قطفت بعد ٤٥ يوم من العقد تفوقاً معنوياً في وزن الثمار، سمك اللحم ، والمواد الصلبة الذائبة الكلية، والسكريات الكلية بينما تناقصت صلابة الثمار والحموضة الكلية وأيضاً فيتامين ج كلما تقدمت الثمار في مراحل النضج.
 - حققت ثمار صنف بريمال ويليه ايدبال التبكير في النضج وأعطت أقصى قيم لها في كلا من الصفات الطبيعية المدروسة عدا صفة الصلابة وفي كل الصفات الكيميائية عدا فيتامين ج بعد ٣٥ يوم من العقد لصنف بريمال ، ٤٠ يوم لصنف ايدبال بينما حقق صنف توتال وفيكار أقصى قيم بعد ٤٥ يوم من العقد.