

MATURITY AND COLD STORAGE OF THREE NEW CULTIVARS OF GRAPEFRUITS

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ABSTRACT

This research has been carried out over two seasons (2000 , 2001) in order to determine fruit quality, storage life, and marketability of three new cultivars of grapefruits, Star Ruby, Red Blush And Rio Red.

The fruits were obtained from private orchard at south Tahrir area and the effect of an edible coating as a pre-storage treatment on fruit quality during storage at 10°C was examined. Fruit weight, peel and pulp color, peel thickness, diameter, juice percentage, total soluble solids, acidity and total soluble solids/acidity were determined for the three cultivars. Moreover weight loss and physiological disorder were studied during storage.

Results revealed that RioRed cultivar reached maturity later than StarRuby and RedBlush. According to shape index RioRed is roundish, while the other two cultivares were slightly flattened. Juice color (a value) illustrated that StarRuby and RioRed are redder than RedBlush.

Storage life for the three cultivars were 90 days at 10 °C plus one week at ambient temperature (18 –20 °C) as a marketing period, while treated fruits by edible coating extended its storage life to 120 days plus 7 days as marketing period.

INTRODUCTION

Star Ruby, RedBlush and RioRed are new cultivars of grapefruit recently grown in Egypt. These cultivars are consumed as fresh fruit and also as processed products.

(1) Fruit quality and maturity :

Star Ruby, a new cultivar of red grapefruit was found to have an excellent color both in the flesh and in the juice even at late season. The internal quality of the Star-Ruby grapefruit show that the soluble solid content are around 8° Brix throughout the season. The titratable acidity decreased as the season advanced. The juice yield average about 48% for the season (Ting et al., 1980).

Star Ruby fruit is similar in size to RedBlush fruit but the flesh colour is redder more than three times and later in maturity (Grierson et al., 1986). Lycopene is the major color pigments with lesser amounts of B-carotene as determined by Hplc-a value, which is a good indication for pigmentation in red grapefruit juice (Ruby Red,- Rio Red, Star Ruby, Ray Ruby, Flame and March Red), Lee, (2000).

Generally grapefruit reaches maturity when the minimum soluble solids/acid ratio is 5.5 : 1 or 6 : 1 and 2/3 of fruit surface show yellow color (Kader, 1983).

(2) Pre-storage treatment :

During the last ten years or so orange of formulations of edible sucrose ester coatings have been developed and used in the fruit and vegetable industries. Most formulation have been based on one or more esters, a carrier, Sodium Carboxy, Methyl Cellulose, and an antiforament preparation of mono and diglycerides of fatty acids. The liquid dries as an invisible odorless, tasteless, non toxic coating which envelopes the subject as a differentially permeable membrane (Curtis, 1988).

Clemenules mandarins were treated either with a composite edible coatings or a commercial polyethylene resin based water wax, the fruit was then stored at 5°C up to 49 days and addition of one week at 20 °C simulating marketing conditions.

Both edible and wax coatings delayed loss of firmness, weight loss and reduced acidity, Brix and Chilling injury (Martinz et al., 1998).

(3) Transit of storage temperature :

Washed grapefruit without waxing or degreening, developed a yellow to yellow orange rind color as the acceptable color for marketing, during the 3 weeks transit period at 50° and 60°F (Chace, et al., 1966). Florida grapefruit is susceptible to chilling injury early in the harvest season (October to January) and it is better to be transported at 59 °C (Pantastico, 1975). In early season grapefruit stored at 50 °F (10 °C) were practically free of rind break down, which included pitting and aging. The maximum storage period ranged from 1 to 2 months as the fruit remained in good condition.

Total acidity decreased and T. S. S/acid ratio increased during storage at different storage temperatures (Salem and Khoreiby 1991) (Ismail et al., 1997).

1. The aim of this study is to evaluate fruit quality and to determine the maturity stage of the three new cultivars.
2. Studying effect of pre-storage treatments of edible coatings on fruit quality, storage life and marketability of the three cultivars of grapefruit after transit or cold storage at 10 °C.

MATERIAL AND METHODS

This experiment has been carried out during two seasons 2000-2001 on three new cultivars of grapefruit : Star Ruby, Red Blush and Rio Red. The trees are about 12 years old, grafted on Volkamariana and planted in private orchard at Tahrir area, Behera Governorate.

Sampling started after 215 days from full bloom. Three samples were picked at 10 days intervals to determine fruit maturity for each cultivar. Some physical and chemical characteristics were studied. Physical characteristics included fruit weight, peel and flesh color, fruit dimensions, peel thickness and juice percentage.

Chemical characteristics of the juice included total soluble solids, acidity and total soluble solids /acid ratio. Moreover, weight loss and physiological disorders, were studied during storage and marketing periods.

Cold storage studies :

Adequate number of fruits of each cultivar were picked when reached maturity according to previous studies and transported immediately to the laboratory. The fruits from each cultivar were divided into two groups. The first group was packed in one layer inside carton boxes (5 Kilo), four boxes of each cultivar were packed. The second group was dipped in edible coating 92% water, 5% polyphynileacetate, 2% methyl cellulose, 1% Sodium benzowic, few of glyside .

All boxes were stored at 10 °C and Rh 85% fruits were examined every 2 weeks until the end of the storage period (4 months).

Peel thickness and fruit dimensions were measured by a Vernier Calipar and Shape index was calculated. Juice percentage was coculated

by weight. T. S. S was determined by Abbe-digital-refractometer. The titratable acidity as citric acid was determined according to A. O. A. C (1990).

Peel and flesh color was quantified at tristimulus colorimeter date using Hunter colorimeter medle DP 9000 the hunter (a, value : green – red) (b, value : blue – Yellow) , were determined and the calculated Hunter a/b values were estimated according to Mc Gjuire, 1992.

Data obtained were statistically analyzed according to (Scedecor and Cohran, 1972).

RESULTS AND DISCUSSION

1. Fruit maturation :

1.1. Physical characters:

- 1.1.1. Fruit weight : Results presented in Table (1 a) revealed that fruit weight of the three cultivars increased gradually till the age of 235 days. Significant increase was observed between the age of 215 and 235 days. Red Blush fruits were heavier than fruits of the other two cultivars. The same trend was observed in the second season.
- 1.1.2. Fruit shape. No statistical differences were detected regarding fruit shape index during maturation time. Data in Table (1 b) revealed that RioRed was roundish than the other two cultivars Star Ruby is similar in size to RedBlush during the two seasons 2000 and 2001. Similar results were noticed by (Grierson, 1986).
- 1.1.3. Peel thickness : Results presented in Table (1 c) show that peel thicknes decreased significantly and gradually from 215 till 235 days. On the other hand the peel thicknes of Rio Red was thicker than the other two cultivars. These data was observed in both two seasons.
- 1.1.4. Peel and Pulp color : Peel and pulp color as measured by (a) value and a/b ratio illustrated that Rio Red cultivar at maturity time more developed more color of the peel and was redder in pulp color than the other two cultivars a/b ratio for peel recorded – 0.02 – 0.04 , 0.17 and for pulp, the value (a) recorded 8.5 , 21.5 and 23.6 for Red Blush, Star Ruby and Rio Red, respectively in the first season, the same trend was found in the second season Table (2). The results

Table (1) Physical and chemical characters used to determine maturity

(a) Fruit weight

Season	Cultivars			Days from full bloom		
	StarRuby	RedBluch	RioRed	215	225	235
2000	397.9 b	520.6 a	380.6 b	363.4 C	424.9 B	505.8 A
2001	370.7 b	495.9 a	371.6 b	351.1 C	419.0 B	468.1 A
(b) Shape index						
2000	0.7 c	0.8 b	1.1 a	0.9 A	0.9 A	0.8 B
2001	0.7 c	0.8 b	1.1 a	0.9 A	0.9 A	0.8 B
(c) Peel thickness						
2000	1.1 c	1.5 b	1.8 a	1.7 A	1.5 B	1.3 C
2001	1.2 c	1.6 b	1.7 a	1.7 A	1.5 B	1.3 C
(d) Juice percentage						
2000	46.6 a	43.1 b	39.0 c	37.8 C	43.0 B	47.9 A
2001	48.5 a	42.6 b	39.5 c	39.5 C	43.6 B	47.5 A
(e) T. S. S %						
2000	9.6 b	10.4 a	8.5 c	7.9 C	9.6 B	11.1 A
2001	9.3 b	10.2 a	8.4 c	7.6 C	9.2 B	11.1 A
(f) Acidity %						
2000	1.8 a	1.8 a	1.8 a	1.9 A	1.7 B	1.7 B
2001	1.8 a	1.6 c	1.7 b	1.9 A	1.7 B	1.6 C
(g) T. S. S : Acid ratio						
2000	5.4 b	5.8 a	4.8 c	4.0 C	5.5 B	6.9 A
2001	5.3 b	6.4 a	4.9 c	4.1 C	5.5 B	6.9 A

Mean separation by L. S. D at 0.05

Table (2) Color at maturity

Season	Red Blush			Star Ruby		Rio Red	
	Value	Peel	pulp	Peel	pulp	Peel	pulp
2000	a	0.90	8.9	-1.80	21.5	6.03	23.6
	b	44.7	18.4	44.2	15.9	35.8	11.9
	a/b	0.02	0.46	-0.04	1.35	0.17	1.98
2001	a	0.46	9.0	-1.90	22.9	7.57	25.2
	b	46.7	19.4	45.7	16.1	35.3	12.5
	a/b	0.01	0.46	-0.04	1.42	0.20	2.01

Table (3) Effect of pre-storage treatment on weight loss percentage of three cultivars of grapefruit at cold storage at 10°C**First season 2000**

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
1	3.3	2.3	2.7	2.1	3.2	2.9
2	6.6	3.9	5.6	4.0	5.4	6.0
3	8.8	5.9	7.5	5.9	7.6	7.1
4	11.5	7.6	8.8	7.4	10.1	9.0
Mean	7.4 A	4.8 B	6.0 A	4.9 B	6.6 A	6.3 B
V x M	6.1 b		5.4 c		6.4 a	

Second Season 2001

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
1	3.0	2.5	3.0	2.7	3.9	3.7
2	5.3	4.6	6.3	5.5	6.9	6.8
3	7.7	6.6	8.7	7.5	8.6	8.0
4	10.7	8.4	9.4	8.2	10.4	9.5
Mean	6.7 A	5.5 B	6.9 A	6.0 B	7.5 A	7.0 B
V x M	6.1 c		6.4 b		7.2 a	

are in line with those of (Ting et al., 1980) and (Lee,2000) who found that those cultivars had excellent color in the flesh and the juice and (a) value is a good indicator for pigmentation in red grapefruit.

1.1.5. Juice percentage : Juice percentage showed an increase during maturation period in the three cultivars. The lowest juice percentage was observed in Rio Red cultivar during the two seasons of the study, Table (1 d).

1.2. Chemical characters :

1.2.1. Total soluble solids : T. S. S percentage of the juice increased significantly and gradually during maturation period for the three cultivars in both seasons. Results presented in Table (1 e) revealed that Rio Red cultivar fruits had the lowest T. S. S contents than the other two cultivars.

1.2.2. Acidity : It was noticed in Table (1 f) that, the juice acidity of the three cultivars decreased gradually and significantly with advanced time. In the second season, Star Ruby cultivar recorded the highest values of juice acidity (1.8%), while Red Blush recorded the lowest percentage (1.6%).

1.2.3. Total soluble solids/acid ratio : T. S. S/acid ratio increased from 215 days till 235 days from full bloom in both season and in the three cultivars. These results are in agreement with the finding of (Ting et al., 1980).

According to California food and agricultural code (Kader, 1985) Star Ruby and Red Blush reached maturity at the age of 225 days from full bloom when T. S. S/acid ratio was 5.4 : 1 and 5.8 : 1 for the two cultivars, respectively. Rio Red reached maturity at the age of 235 days and with a T. S. S/acid ratio of 6.9 : 1. Similar results were obtained in the second season, Table (1 g).

2. Cold storage :

2.1. Weight loss : It is evident from Table (3) that weight loss percentage increased with advanced storage period in either treated or untreated fruits in the three cultivars. These results agree with (Ismail et al., 1997). Moreover, there was significant differences in weight loss percentage between untreated and treated fruits. Rio Red had the highest weight loss in both seasons.

These results are in agreement with those reported by (Martinze et al., 1998) who found that both edible and wax coatings delayed the incidence of weight loss.

- 2.2. Juice percentage : The effect of prolonged storage on the juice percentage of the fruits can be noticed from table (4), as the % juice percentage of the fruits slightly increased compared with the untreated fruits. There was no significant differences between the three cultivars in % juice during storage except ReoRed had the lowest value in the second season.
- 2.3. T. S. S : It is evident from Table (5) that a gradual increase in T. S. S occurred as the storage duration advanced. There was no obvious differences between treated and untreated fruits except the treated fruits in Rio Red cultivar which had lowest T. S. S contents during the two seasons. It can be noticed that there was no significant differences between the three cultivars in T. S. S content.
- 2.4. Acidity: Data presented in Table (6) illustrated that total acidity significantly decreased at the end of storage period (Ismail et al., 1997). Considering treated and untreated fruits, data show that treated fruits in Star Ruby and Red Blush had high contents of acidity in first season. It can be noticed that there was no significant differences between the three cultivars at the end of the storage period these results agree with the findings of (Martinze et al., 1998).
- 2.5. T. S. S/acid ratio : Concerning the effect of storage period on T. S. S/acid ratio, an increase took place with advanced period of storage. These findings are in accordance with those obtained by (Salem and Khareiby, 1991).

Treated fruits had the lowest T. S. S/acid ratio in the three cultivars, it's also evident from Table (7) that the differences between the three cultivars was not obvious.

- 2.6. Peel and pulp color : The color of the peel of the three cultivars as measured by the hunder a/b ratio showed gradual increase with storage period, Table (8). Generally, treating fruits with coatings delayed the development of peel and pulp color during storage as shown by the decrease of the hunter a/b ratio in comparison with untreated fruits. The color of the pulp of Red Blush was shown to be about 1/3 of that of Star Ruby and Rio Red as determined by their hunter a/b ratio Table (9).

**Table (4) Effect of pre-storage treatment on juice percentage
First season 2000**

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
start	39.8	45.8	39.6	43.9	41.1	43.0
1	46.1	47.3	42.2	40.8	39.2	40.2
2	43.9	47.0	40.1	46.4	41.4	44.8
3	46.4	46.0	49.0	45.8	43.7	48.4
4	41.9	47.9	43.8	46.5	45.2	45.7
Mean	43.6 B	46.8 A	42.9 B	44.7 A	42.1 B	44.4 A
V x M	45.2 a		43.8 a		43.3 a	

Second Season 2001

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
start	41.1	45.9	41.8	44.3	37.2	39.1
1	44.7	43.9	41.1	42.4	36.8	39.2
2	44.3	48.8	42.1	43.7	39.1	44.0
3	47.1	47.2	42.1	47.3	39.9	40.9
4	45.7	45.2	43.0	46.5	39.9	42.7
Mean	44.6 B	46.2 A	42.0 B	44.8 A	38.6 B	41.2 A
V x M	45.4 a		43.4 a		39.9 b	

**Table (5) Effect of pre-storage treatment on total soluble solids %
First season 2000**

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
start	9.5	9.3	10.4	10.2	9.7	9.3
1	10.4	10.0	11.5	10.8	11.2	10.3
2	12.8	12.0	11.9	11.5	12.6	10.7
3	12.7	12.3	11.9	11.8	12.7	11.3
4	13.3	12.3	11.9	11.3	13.3	10.7
Mean	11.7 A	11.2 A	11.5 A	11.1 A	11.9 A	10.5 B
V x M	11.5 a		11.3 a		11.2 a	

Second Season 2001

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
start	9.7	9.2	10.4	10.0	9.3	9.2
1	11.0	9.9	10.6	10.2	9.9	9.8
2	11.7	10.0	10.9	10.0	10.7	9.8
3	11.3	9.8	10.7	10.5	11.3	10.0
4	12.3	11.5	11.5	10.3	12.8	10.3
Mean	11.2 A	10.1 B	10.8 A	10.2 A	10.8 A	9.8 B
V x M	10.9 a		10.0 b		10.5 ab	

Table (6) Effect of pre-storage treatment on total acidity
First season 2000

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
start	1.6	1.7	1.7	1.7	1.7	1.7
1	1.7	1.8	1.8	1.7	1.6	1.7
2	1.7	1.7	1.8	1.8	1.8	1.8
3	1.4	1.6	1.4	1.9	1.7	1.8
4	1.4	1.6	1.6	1.6	1.6	1.7
Mean	1.6 A	1.7 A	1.7 A	1.8 A	1.7 A	1.7 A
V x M	1.6 a		1.7 a		1.7 a	

Second Season 2001

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
start	1.7	1.7	1.9	1.8	1.9	1.9
1	1.7	1.7	1.8	1.7	1.8	1.8
2	1.6	1.6	1.8	1.7	1.6	1.7
3	1.7	1.7	1.7	1.8	1.6	1.6
4	1.6	1.8	1.6	1.7	1.5	1.6
Mean	1.7 A	1.7 A	1.8 A	1.7 A	1.7 A	1.7 A
V x M	1.7 a		1.8 a		1.7 a	

Table (7) Effect of pre-storage treatment on T. S. S : Acid ratio
First season 2000

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
start	5.8	5.4	5.9	6.0	5.5	5.4
1	6.0	5.5	6.4	6.2	7.2	6.1
2	7.0	7.0	6.7	6.6	7.1	6.0
3	9.1	7.5	8.3	6.2	7.6	6.4
4	9.5	7.5	7.6	7.0	8.5	6.7
Mean	7.5 A	6.6 B	7.0 A	6.4 B	7.2 A	6.1 B
V x M	7.0 a		6.7 a		6.6 a	

Second Season 2001

Months at storage	Star Ruby		Red Blush		Rio Red	
	Untreated	treated	Untreated	treated	Untreated	treated
Start	5.5	5.4	5.5	5.4	5.0	5.0
1	6.4	5.7	5.7	5.8	5.4	5.3
2	7.1	6.0	6.0	5.8	6.6	5.7
3	6.7	5.7	6.2	5.9	6.9	6.1
4	7.8	6.2	7.0	6.1	8.7	6.3
Mean	6.7 A	5.8 B	6.1 A	5.8 B	6.5 A	5.7 B
V x M	6.3 a		6.0 a		6.1 a	

Table (8) Changes in peel color during storage at 10°C

season	Start				30 days			60 days			90 days		
	a	b	a/b		a	B	a/b	a	b	a/b	a	b	a/b
2000	Red Blush			U	12.7	57.5	0.22	13.8	29.0	0.23	20.3	32.1	0.63
	0.90	44.7	-0.02	T	11.3	55.1	0.19	10.3	57.0	0.18	18.8	36.2	0.52
	Star Ruby			U	8.5	50.2	0.17	20.1	44.3	0.45	27.4	27.8	0.98
	-1.80	44.2	-0.04	T	8.0	44.5	0.18	18.0	43.3	0.42	17.2	32.0	0.54
	Rio Red			U	16.6	48.3	0.34	20.6	48.9	0.42	29.0	25.8	1.10
	6.03	35.8	0.17	T	18.7	51.5	0.36	18.1	49.1	0.37	27.3	26.1	1.05
2001	Red Blush			U	11.3	59.1	0.19	15.1	58.7	0.28	20.3	32.1	0.63
	0.46	46.7	0.01	T	10.7	58.3	0.18	10.5	57.4	0.18	16.5	36.5	0.45
	Star Ruby			U	8.0	44.5	0.18	23.2	42.8	0.54	24.2	28.8	0.84
	-1.90	45.7	-0.04	T	6.6	43.6	0.15	17.2	41.1	0.41	20.3	33.0	0.61
	Rio Red			U	18.0	49.0	0.37	21.5	50.7	0.42	28.0	24.0	1.17
	7.57	35.3	0.20	T	18.0	51.8	0.35	16.5	50.3	0.33	27.8	24.0	1.16

Table (9) Changes in pulp color during storage at 10°C

season	Start				30 days			60 days			90 days		
	a	b	A/b		a	b	a/b	a	b	a/b	a	b	a/b
2000	Red Blush			U	8.6	19.5	0.44	8.5	20.7	0.41	8.1	17.4	0.47
	8.5	18.6	0.16	T	8.3	19.5	0.43	8.0	20.0	0.40	7.5	17.2	0.73
	Star Ruby			U	22.8	15.3	1.49	23.9	16.1	1.48	22.0	14.6	1.50
	21.5	15.9	1.35	T	22.0	15.7	1.40	23.0	16.0	1.43	20.5	14.1	1.45
	Rio Red			U	23.1	16.0	1.44	28.6	17.9	1.59	29.0	18.0	1.61
	236	11.9	1.98	T	25.2	17.7	1.42	29.0	18.5	1.56	30.1	17.0	1.58
2001	Red Blush			U	9.0	20.4	0.46	9.5	20.0	0.47	9.5	18.0	0.52
	9.0	19.4	0.46	T	8.5	20.0	0.42	9.1	20.3	0.45	8.5	18.1	0.47
	Star Ruby			U	21.6	15.2	1.42	23.9	16.1	1.48	24.0	15.4	1.55
	21.0	15.0	1.40	T	20.1	15.0	1.34	23.5	16.4	1.43	21.3	14.0	1.51
	Rio Red			U	25.1	15.1	1.66	28.4	19.1	1.49	28.9	18.8	1.54
	25.0	12.5	2.01	T	25.4	15.9	1.50	27.2	18.5	1.47	28.5	19.0	1.50

**Table (10) Effect of pre-storage treatment on fruit quality of three cultivars of grapefruit after cold storage of 10°C plus 7 days as a marketing period at (18 – 20°C).
First season 2000**

cultivars		Star Ruby				Red Blush				Rio Red			
month		Weight loss	T.S.S. / acid	App.	Disorder	Weight loss	T.S.S. / acid	App.	Disorder	Weight loss	T.S.S. / acid	App.	Disorder
1	U	4.7	8.3	V. G	-	3.5	12.1	V.G	-	4.5	7.3	V.G	-
	T	3.1	8.7	E. X	-	2.8	12.5	E. X	-	2.8	7.8	E. X	-
2	U	9.0	10.0	V. G	-	6.5	12.0	V. G	-	9.7	7.6	V. G	-
	T	5.2	9.4	EX	-	5.0	11.0	EX	-	7.4	7.5	EX	-
3	U	11.1	10.0	V. G	30%	9.6	12.0	G	28%	10.3	8.0	V. G	33%
	T	6.7	8.1	EX	-	7.1	12.0	EX	-	8.3	8.0	EX	-
4	U	-	-	-	-	-	-	-	-	-	-	-	-
	T	10.0	8.1	V. G	-	9.1	11.0	EX	-	10.9	8.1	EX	-

**Table (10) Effect of pre-storage treatment on fruit quality of three cultivars of grapefruit after cold storage of 10°C plus 7 days as a marketing period at (18 – 20°C).
First season 2000**

cultivars		Star Ruby				Red Blush				Rio Red			
month		Weight loss	T.S.S. / acid	App.	Disorder	Weight loss	T.S.S. / acid	App.	Disorder	Weight loss	T.S.S. / acid	App.	Disorder
1	U	4.7	8.3	V. G	-	3.5	12.1	V.G	-	4.5	7.3	V.G	-
	T	3.1	8.7	E. X	-	2.8	12.5	E. X	-	2.8	7.8	E. X	-
2	U	9.0	10.0	V. G	-	6.5	12.0	V. G	-	9.7	7.6	V. G	-
	T	5.2	9.4	EX	-	5.0	11.0	EX	-	7.4	7.5	EX	-
3	U	11.1	10.0	V. G	30%	9.6	12.0	G	28%	10.3	8.0	V. G	33%
	T	6.7	8.1	EX	-	7.1	12.0	EX	-	8.3	8.0	EX	-
4	U	-	-	-	-	-	-	-	-	-	-	-	-
	T	10.0	8.1	V. G	-	9.1	11.0	EX	-	10.9	8.1	EX	-

Second season 2001

cultivars		Star Ruby				Red Blush				Rio Red			
Month		Weight loss	T.S.S. / acid	App.	Disorder	Weight loss	T.S.S. / acid	App.	Disorder	Weight loss	T.S.S. / acid	App.	Disorder
1	U	4.4	7.3	V. G	-	3.9	7.1	V. G	-	4.4	8.6	V. G	-
	T	3.1	6.6	EX	-	2.8	7.6	EX	-	3.9	7.8	EX	-
2	U	8.8	8.3	V. G	-	7.0	7.5	V. G	-	7.3	11.3	V. G	-
	T	5.9	7.2	EX	-	5.1	7.1	EX	-	7.8	7.8	EX	-
3	U	11.3	8.9	V. G	16%	9.5	8.3	V. G	38%	10.0	8.6	V. G	42%
	T	7.8	8.3	EX	-	7.2	7.2	EX	-	8.6	7.5	EX	-
4	U	-	-	-	-	-	-	-	-	-	-	-	-
	T	9.0	8.7	EX	-	8.9	8.0	EX	-	11.1	8.0	EX	-

The results of the two seasons confirmed. Those results of (Grierson, 1986).

3. Characters of fruits during the marketing period after cold storage : After one, two, three and four months of storage plus 7 days at ambient temperature (18 - 20 °C), the data of the three cultivars show that weight loss percentage of treated fruits was less than untreated ones. The weight loss of untreated fruits after storage for 3 months plus 7 days as a marketing period was nearly equal to the weight loss of the treated fruits after storage four (4) months plus 7 days as a marketing period Table (10).

Physiological disorders which studied included ring break down, aging and fruits without button. There was no incidence of physiological disorders during storage and marketing except few fruits without button.

This disorder did not appear in treated fruits till the end of the storage period. Fruits without button appear in untreated fruits after 3 months of storage with the percentage of 30 , 28 , 33 for Star Ruby, Red Blush and Rio Red, respectively. This result was also observed in the second season. This findings are in accordance with those obtained by Sinclair, (1972) and Pantastico, (1979).

Generally, treated fruits were stored for a period of 4 months plus 7 days marketing. Untreated fruits had only 3 months in storage plus 7 days marketing period and very good appearance.

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تحديد اكتمال النمو والتخزين المبرد لثلاثة أصناف جديدة من الجريب فروت
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الملخص

أجري هذا البحث عام ٢٠٠٠ ، ٢٠٠١ لتحديد جودة ثمار ثلاثة أصناف جديدة من الجريب فروت (ستار روبي - ريد بلش - ريو ريد) ودراسة القدرة التخزينية والتسويقية .

أخذت الثمار من منطقة جنوب التحرير - محافظة البحيرة وتم دراسة تأثير معاملة ما قبل التخزين على جودة الثمار خلال التخزين على درجة ١٠°م ، أخذت قياسات وزن الثمار ، لون القشرة ، اللب الداخلي ، سمك القشرة ، القطر ، نسبة العصير ، المواد الصلبة الذائبة ، الحموضة والنسبة بين المواد الصلبة الذائبة إلي الحموضة ، كذلك دراسة الفقد في الوزن والتشوهات الفسيولوجية خلال فترة التخزين .

أظهرت النتائج أن الصنف ريو ريد يصل لاكمال النمو متأخراً عن ستار روبي وريد بلش وهو أكثر ميلاً للاستدارة ، لون لب ثمار الجريب ستار روبي وريو ريد أكثر احمراراً من الصنف ريد بلش ، فترة التخزين للثلاثة أصناف ٩٠ يوم/١٠°م بالإضافة إلي أسبوع على درجة الغرفة كفترة تسويقية ، بينما الثمار المعاملة أطالت فترة تخزينها ١٢٠ يوم بالإضافة إلي أسبوع التسويق .