

EFFECT OF FOUR CITRUS ROOTSTOCKS ON FRUIT QUALITY AND STORABILITY OF FREMONT TANGERINE

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ABSTRACT

This study was carried out on Fremont fruits taken from Southern Tahrer region, Behera Governorate during two successive seasons 2000-2001.

Fremont tangerine budded on four rootstocks:- Volkamer lemon (*Citrus volkameriana*), Rangpur lime (*Citrus limonia*), Carrizo citrange (*Poncirus trifoliata* x *Citrus sinensis*) as newly introduced rootstocks for citrus and sour orange (*Citrus aurantium*) which is the most common rootstock were used in this study.

Fruits were picked at maturity stage and stored at 5°C and 85% RH to detect the effect of rootstocks on fruit characters, market ability and storability.

The major findings are summarized as follows :

Fremont tangerine fruit on sour orange, Rangpur lime and Carrizo citrange reached maturity earlier than fruits on Volkameriana. Fremont tangerine fruit weight gave best values on Volkameriana and Rangpur lime. The highest juice percentage were from fremont fruits on sour orange. The best rind color was of fruits on sour orange. Rind color increased during storage life, also pulp of fruits budded on Volkameriana was the most red. Percentage of weight loss during storage recorded lowest values on Volkameriana followed by Rangpur lime. The juice content was affected by storage period. The lowest values of juice were from fruits on sour orange. Carrizo citrange had the highest total soluble solids. Percentage of acidity decreased during storage period to lower values on Volkameriana and the highest values on sour orange. Fremont could be marketed in good condition with less weight loss or decay after 60 days at 5°C and 6 days at 20°C on Volkameriana and Rangpur lime rootstocks, while Fremont on sour orange gave the highest percentage of weight loss, most shrivel and lowest vitamin c with chilling injury.

INTRODUCTION

All citrus varieties are mainly budded on sour orange rootstock. It can be grown on sandy to loam or clay soils and the produced fruits on it are characterized by their high total soluble solids and acid content. (Abd El-Rahman 1999). Sour orange rootstock had to be replaced in some areas as a result of its susceptibility to citrus tristeza virus. Selection of rootstock is an important decision for growers because rootstock has a significant effect on fruit quality. Fremont tangerine is an early variety (Nov.), medium to large, slightly flat, rind color is red orange, rind texture is smooth, easy to peel, excellent flavor, few seeds number and good quality. Citrus volkameriana induced the best mean fruit weight for Fremont and the lowest juice percentage (El-Shafee, 1999). C. volkameriana gave large fruits of Washington Navel Orange (Tuzcu et al., 1995). For "Rhode Red" Valencia (Davies and Zelman, 2001). Lowest T. S. S for Fairchild mandarin (Fallahi and Rodney, 1991), lowest T. S. S for Orlando tangelo (Fallahi et al., 1991), for Shamouti (Shaked et al., 1991) and for Minneola tangelo (Levey and Lifshitz, 1995). Rangpur lime reached maturity early and had the best values of Fremont fruit weight (El-Shafee, 1999). Carrizo Citrange had the highest T. S. S in Fremont and Minneola (El-Shafee, 1999) Carrizo citrange had the brightest rind of Parent Novel Orange (Abd El-Rahman, 1994). The highest T. S. S.: acid ratio for Valencia (Hassan, 1999) for Fairchild mandarin (Fallahi and Rodney, 1991).

Quality parameters were affected by rootstocks at harvest and remained constant during storage and shelf-life (Hollewin et al., 1994).

The aim of this study is to determine :

1. The effect of rootstocks on fruit maturity and quality.
2. The effect of rootstocks on fruit characters during cold storage.
3. The effect of rootstocks on maintaining fruit characters during shelf-life.

MATERIAL AND METHODS

This study was carried out during two seasons 2000-2001 on Fremont fruit grown at southern Tahrer orchard, Behera, Governorate. Fremont tangerine trees (8 years old) are budded on four rootstocks. Volkamer lemon, Rangpur lime, Carrizo citrange and sour orange, the study comprises the following :-

1. The effect of rootstocks on fruit maturity :

Samples of fruits were taken 200 days after full bloom to determine fruit weight, juice percentage, percentage of total soluble solids, total acidity and total soluble solids : acid ratio.

2. Effect of rootstocks on fruit characters during cold storage :

Fruits were picked at maturity stage according to previous studies, transferred immediately to the laboratory, washed, packed in 3 kilos Carton boxes with enough ventilation holes in one layer and stored at 5°C and 85% RH. Fruits were examined every 15 days to detect weight loss, juice percentage, T. S. S, acidity and T. S. S acid ratio.

3. Effect of rootstocks on fruit characters during shelf-life.

At the beginning, middle and the end of storage period, fruits were taken and left at ambient temperature (18-20°C) for 6 days to simulate the marketing period. Changes in fruit characters were recorded : weight loss, juice percentage, decay percentage, chilling injury, shrivel, T. S. S. acid, T. S. S : acid ratio rind and juice color quantified using Hunter colorimeter model DP 9000 (a: green – red) , (b: blue – Yellow) . (L: lightness (Mc Gjuire, 1992).

Data obtained were statistically analyzed according to (Snedecor and Cochran, 1972).

RESULTS

(1) Effect of rootstocks on fruit characters and maturity :

Data presented in table (1) showed that, Fremont fruits on Carrizo citrange, sour orange and Rangpur lime reached maturity early at 220 days from full bloom while Volkamer lemon reached maturity later (at 230 days).

Fruit weight was affected by rootstocks. The highest fruit weight was recorded for Fremont on Volkameriana lemon (124.2 . 120.6 gm) in both seasons. On the other hand the lowest fruit weight was recorded on sour orange (90.7 , 93.8 gm). No significant differences were detected between Rangpur lime and Carrizo citrange rootstocks.

These results are in agreement with those of (Tuzcu et al., 1995) and (Salem et al., 1994) who found that Valencia fruits on C. Volkameriana had the greater weight, (Valbucna, 1996) who declared that average weight was greater from Clatifolia trees on C. Volkameriana than on Cleopatra mandarin, also El-Shafee, 1999) who found that the best Fremont fruit weight values were from trees grafted on Rangpur and Volkameriana.

Concerning juice percentage, it is clear that, fruits produced on sour orange rootstock gave the highest percentage of juice (51.2% 45.8) while the lowest values were on Volkameriana rootstocks (42.2% , 4.28%) in both seasons. No significant differences in percent juice content of fruits were found between Rangpur lime and Carrizo citrange rootstocks. In the second season, data showed that juice % were not significantly different this is in

Table 1. Effect of rootstocks on Fremont fruit characters at maturity
(Season 2000)

Rootstocks (R)	Fruit weight				% Juice				T. S. S			
	Days from full bloom				Days from full bloom				Days from full bloom			
	210	220	230	TM	210	220	230	RM	210	220	230	RM
A	95.0	115.0	163.3	124.4	44.8	43.4	38.5	42.2	9.3	9.5	10.8	9.9
B	89.7	103.5	126.5	106.6	44.3	47.5	41.5	44.5	10.1	10.5	10.9	10.5
C	87.4	93.9	120.3	100.5	46.7	48.3	45.6	46.9	11.1	12.3	12.6	12.0
D	79.3	92.0	100.8	90.7	48.5	54.2	50.8	51.2	10.8	11.7	12.7	11.7
D.M	87.9	101.1	127.7	105.6	46.1	48.4	44.1	46.2	10.4	11.0	11.8	11.0
	R 11.2	D 7.1	DxR 14.1		R 3.8	D 2.6	DxR n. s.		R 0.7	D 0.2	DxR 0.5	

Rootstocks (R)	Acidity				T. S. S : Acid			
	Days from full bloom				Days from full bloom			
	210	220	230	RM	210	220	230	RM
A	2.9	1.6	1.1	1.9	3.2	6.1	10.1	6.5
B	2.3	1.5	1.1	1.6	4.5	7.1	9.6	7.1
C	2.3	1.4	1.1	1.6	4.9	9.0	11.1	8.3
D	2.4	1.7	1.3	1.8	4.5	7.0	9.8	7.1
D.M	2.5	1.6	1.2	1.7	4.3	7.3	10.2	7.2
	R n. s.	D 0.2	DxR n. s.		R n. s.	D 0.8	DxR n. s.	

Table 1. Cont. (Season 2001)

Rootstocks (R)	Fruit weight				% Juice				T. S. S			
	Days from full bloom				Days from full bloom				Days from full bloom			
	210	220	230	RM	210	220	230	RM	210	220	230	RM
A	93.9	113.0	156.8	126.6	43.1	43.1	42.1	42.8	9.2	9.5	10.5	9.7
B	91.7	123.1	143.3	119.4	44.5	45.7	41.5	43.9	9.7	10.4	10.7	10.2
C	92.2	103.5	127.2	167.7	44.1	63.3	42.6	44.3	10.8	11.9	12.4	11.6
D	81.2	92.9	106.6	93.8	44.7	45.2	47.6	45.8	10.7	11.3	12.2	11.6
D.M	89.9	108.1	133.0	110.3	44.1	45.1	43.5	44.2	10.1	10.7	11.4	10.7
R 11.1 D 5.0 DxR 9.9					R n. s D n. s DxR n. s				R 0.4 D 0.2 DxR n. s			

Rootstocks (R)	Acidity				T. S. S : Acid			
	Days from full bloom				Days from full bloom			
	210	220	230	RM	210	220	230	RM
A	2.7	1.6	1.1	1.8	3.3	6.1	9.3	6.2
B	2.4	1.4	1.2	1.7	4.0	7.2	8.7	6.6
C	2.2	1.6	1.2	1.7	4.9	7.4	10.1	7.5
D	2.0	1.4	1.1	1.5	5.4	8.3	11.1	8.3
D.M	2.3	1.5	1.0	1.7	4.4	7.2	9.8	7.1
R 0.1 D 0.1 DxR 0.1					R 0.3 D 0.3 DxR 0.5			

Mean separation L. S. D at 0.05.

Rootstock® : A : Volkamer lemon B : Rangpur lime C : Carrizo citrange D : Sour orange

parallel with those results of Tuzcu et al (1995) who studied the effect of some citrus rootstocks on Washington Navel orange variety, found that trees on *C. Volkameriana* gave large fruits with a low juice content, also El-Shafee (1999) cleared that juice percentage was the best to Fremont on sour orange.

On the contrary, (Abd El-Rahman 1999) stated that rootstocks had no significant difference on fruit juice of Partent Navel orange. Salem et al., (1994) reported that fruit of trees on Volkamer lemon had the highest juice percentage.

It's clear that T. S. S % values increased with season advancement. Fremont fruits on Carrizo citrange recorded the highest T. S. S % (12.0 . 11.6%), while the lowest T. S. S % was in fruits on Volkamer lemon rootstock (9.9 , 9.7 %) in both season.

This result, are in line with those of Fallahi et al., (1991) who found that citrange rootstocks had the highest T. S. S for Orlando tangelo, Fallaki and Rodney (1992) for Fairchild mandaren, Levy and Lifshitz (1995) for Minneola tangelo and El-Shafee (1999) for Fremont tangarine.

It's obvious that % juice acidity content decreased as fruit reach maturity. The highest value was attained on Volkamer lemon (1.9 . 1.8) in both seasons, the lowest value was on Carrizo Citrang (1.6) in the first season and sour orange (1.5) in the second one. The differences are not significant in the first season.

These results are in harmony with those of Kimbal (1984) who found that % juice acidity decreased by advanced fruit growth towards maturity. On the other hand, Salem et al., (1994) found that Valencia orange on sour orange had the highest values, El-Shafee (1999) reported that % acidity of Fremont tangarine was not affected by rootstocks.

T.S.S.: acid ratio increased gradually by increasing T.S.S. and decreasing acidity, the lowest values are (6.5 : 1 . 6.2 : 1) with fruits on Volkamer lemon, the highest values were on Carrizo citrange (8.3) in the first season and sour orange (8.3 : 1) in the second one. The fruit maturity depended on T. S S : acid ratio, it's evident that fruits on Carrizo which recorded 9.0 : 1 in the first season and fruits on sour orange which recorded (8.3 : 1) in the second one reached maturity earlier than fruits on Volkamer lemon.

2. Effect of rootstocks on fruit characters at cold storage (5 °C) :-

Weight loss % increased significantly at 5 °C till the end of the storage period after 60 days. It's evident from table (2) that physiological weight loss was the lowest value on Volkamer lemon and Rangpur lime (5.3% , 7.3%), respectively in the first season and 6.8% , 7.5% on the second one, while the highest weight loss was recorded by Carrizo citrange (9.4%) in the first season and by sour orange (8.8%) in the second one. These findings coincide with those of Hassan (1999) who stated that sour orange rootstock gave the highest value of weight loss for Valencia orange at 4°C and the lowest value were Cleopatra mandarin and Volkamer lemon.

Percentage of juice : fruit juice content increased during storage period in the first season (starting with 44.9% and attaining 46.4% at the end of storage). The highest values were noticed with the fruits on Carrizo citrange (46.4%), while the lowest values were recorded with fruits on sour orange. In the second season no significant differences were detected between rootstocks. In this regard, Fahmy (1967) found that juice percentage of Baladi orange fruit tended to increase steadily with prolonged storage at 40 °F. the effect of rootstocks (sour orange, Rough lemon, Egyptian lime) on the juice content during storage was negligible.

Abd El-Moneim (1999) stated that juice content of Valencia orange at 5°C for 18 weeks increased with the increase of storage period. The increase was not significant in the first two weeks and a gradual increase after the second week was noted. On the other hand, Hassan (1999) found that the highest % juice value of Valencia at 4 °C was noticed with fruits on sour orange. The lowest values were on Volkamer lemon, no significant difference was detected between Carrizo citrange and Cleopatra mandarine.

T. S. S content increased significantly during storage till the end of the storage period. It increased from (11.3 , 11.2) to (13.7 , 11.4) at the end of storage in both season, respectively. Fruits on Carrizo citrange gave the highest T. S. S (14.1 , 12.3) followed by sour orange (13.6 , 12.5), while the lowest values are recorded for fruits on Volkamer lemon (12.1 . 10.4) and Rangpur lime (12.7 , 10.5) in both seasons.

These results are in line with those of (Hallewin et al., (1994) who found that quality parameters of Avana mandarin from trees on sour orange, Citremon 1449, Poncirus trifoliata, Arlodo tangelo and Troyer citrange affected by rootstocks than by storage temperature at 2 or 8°C for one month. Hassan, 1999 stated that fruit T.S.S of Valencia (stored at 4°C) on Troyer citrange and sour orange recorded the highest values without significant differences followed by Carrizo citrange and Cleopatra mandarin, while the lowest values were recorded on Volkamer lemon.

Table 2. Effect of rootstocks on fruit Characters at cold storage 5°C
Season 2000

Days of storage	Weight loss					% Juice					T. S. S				
	A	B	C	D	D-M	A	B	C	D	D-M	A	B	C	D	D-M
start	0.0	0.0	0.0	0.0	0.0	45.1	41.1	43.1	50.4	44.9	10.3	10.4	13.1	12.8	11.7
15	2.3	3.0	4.1	2.4	2.9	43.1	49.3	39.1	51.4	45.7	12.0	12.0	13.7	13.0	12.7
30	4.3	6.2	7.8	7.2	6.4	41.9	46.0	39.5	46.8	43.5	13.0	13.8	13.8	13.7	13.6
45	6.4	8.8	11.0	9.9	9.0	43.5	45.0	44.5	41.4	43.6	12.6	13.7	15.3	14.3	14.0
60	8.2	11.1	14.6	13.9	11.9	42.5	46.3	45.0	41.9	46.4	12.4	13.7	14.5	14.4	13.7
R-M	5.3	7.3	9.4	8.3	7.6	43.2	45.5	42.2	46.4	44.3	12.1	12.7	14.1	13.6	13.1
D 1.8 R 0.5 DxR 1.0					D n. s R n. s DxR 6.1					D 0.5 R 0.7 DxR 1.0					

Days of storage	Acidity					T. S. S : ACID				
	A	B	C	D	D-M	A	B	C	D	D-M
start	1.38	1.36	1.68	1.64	1.52	7.5	7.6	7.8	7.8	7.7
15	1.00	0.96	1.44	1.44	1.21	12.0	12.5	9.5	4.0	10.7
30	0.98	1.04	1.20	1.31	1.13	13.3	13.3	11.6	10.5	12.2
45	0.72	0.94	1.13	1.26	1.01	17.6	14.8	13.6	11.3	14.3
60	0.72	0.85	1.11	1.06	0.93	17.2	16.3	13.1	13.5	15.0
R-M	0.96	1.03	1.31	1.34	1.16	13.5	12.9	11.1	10.4	12.0
D 0.06 R 0.14 DxR 0.13					D 1.0 R 1.3 DxR 1.9					

Table 2. Cont. (Season 2001)

Days of storage	Weight loss					% Juice					T. S. S				
	A	B	C	D	D-M	A	B	C	D	D-M	A	B	C	D	D-M
start	0.0	0.0	0.0	0.0	0.0	45.4	46.0	49.4	47.7	47.1	10.4	10.3	12.2	11.9	11.2
15	2.9	3.2	3.4	3.4	3.2	45.1	47.8	43.8	44.4	45.3	10.1	10.1	11.2	11.8	10.8
30	6.0	6.6	6.9	7.0	6.6	48.6	45.1	44.3	49.7	46.9	10.2	10.7	12.0	12.1	11.3
45	8.1	8.4	10.0	10.3	4.2	44.6	49.2	42.4	49.4	46.2	11.0	10.5	13.7	13.3	12.1
60	10.2	11.8	14.5	14.4	12.7	45.2	46.7	38.8	52.1	45.7	10.5	10.7	12.3	13.4	11.7
R-M	6.8	7.5	8.7	8.8	7.9	45.7	47.0	43.7	48.6	46.3	10.4	10.5	12.3	12.5	11.4
D 0.7 R 0.3 D x R 0.6					D n.s R n. s D x R n. s					D 0.6 R 0.9 D x R n. s					

Days of storage	Acidity					T. S. S : ACID				
	A	B	C	D	D-M	A	B	C	D	D-M
start	1.16	1.48	1.49	1.58	1.23	9.0	7.6	8.2	7.5	7.9
15	1.10	1.08	1.08	1.63	1.22	9.1	9.3	10.2	7.5	9.0
30	1.06	1.21	1.26	1.40	1.23	9.6	9.1	4.5	8.6	9.2
45	1.04	1.21	1.43	1.60	1.32	10.6	8.7	9.6	8.3	9.3
60	1.02	0.89	1.24	1.40	1.14	10.2	12.0	9.9	9.5	10.4
R-M	1.08	1.18	1.30	1.52	1.27	9.7	9.2	9.5	8.3	9.2
D 0.13 R 0.10 D x R n. s					D 0.8 R 0.7 D x R n. s					

Mean separation L. S. D at 0.05.

Rootstock ® : A : Volkamer lemon B : Rangpur lime C : Carrizo citrange D : Sour orange

Percentage of total acidity : It's evident that fruit acidity % decreased with the advancing of storage period. The highest acidity was obtained from sour orange (1.36 % , 1.52%) while Volkamer lemon gave the lowest values (0.96 % , 1.08 %) in both seasons. respectively. In this regard, Hassan (1999) suggested that juice acidity in Valencia fruits at on five different rootstocks were close to each other without significant difference.

T. S. S : acid ratio, showed significant increases till the end of storage period the highest ratio (13.5: 1, 9.7 : 1) on Volkamer lemon. while sour orange had scored the lowest values (10.4 : 1 . 8.3 : 1) in both seasons.

On the contrary, Hassan (1999) found that there was no significant results as the highest values came from Cleopatra followed by Carrizo and sour orange while the lowest was on Volkamer lemon.

Effect of rootstocks on maintaining fruit characters during shelf- life

During shelf-life at ambient temperature (18 - 20 °C) at the beginning, middle and the end of the storage period, data from table (3) showed that, that weight loss % and T. S. S percentage increased, acidity and Vitamin c. content decreased with prolonged storage. The lowest weight loss, T. S. S. and acidity were of fruits on Volkamer rootstock, while it had the highest juice and vitamin (c) percentage.

Both external color of the peel and juice were increased during storage. Fruits on sour orange had the best rind color while the lowest was on Carrizo citrang. The best lightness rind and juice color values were on Carrizo citrange. Concerning juice color, it's clear that Volkamer lemon had the highest value of a/b ratio.

This is in agreement with those results of Fahmy (1967) who found that mature Egyptian Baladi orange fruits on sour orange attained the richest and deepest rind color, also, Abd el-Rahman (1990) who found that, rind color of "Parent" navel orange on both sour orange, Carrizo citrange and Cleopatra mandarin had the brightest and most attractive color, while Citrus volkamariana and Troyer citrange rootstocks resulted in poorest rind color. While Hassan (1999) found that Valencia fruits on Carrizo citrange had the best color followed by sour orange, Cleopatra mandarin, Volkamer lemon and Troyer citrange, besides, fruit juice color was not affected by rootstocks.

Concerning the contents of juice, no obvious changes during storage could be detected except fruits produced on sour orange rootstock as it decreased with prolonged storage.

Table 3. Effect of rootstock ks on fruit characters at shelf-life

First season

Rootstocks	Period	Weight loss %	Rind color		% juice	Juice color		T. S. S	Acidity	Vitamin C	Shrivel	Chilling injury	Decay
			a/b	L		a/b	L						
A	1.	2.0	0.90	43.0	43.8	0.56	56.9	10.0	1.2	34.2	-	-	-
	2.	2.7	1.09	46.3	44.2	0.60	58.6	13.0	1.0	32.9	-	-	-
	3.	3.6	1.17	48.2	46.4	0.90	60.2	13.0	0.9	32.3	-	-	-
B	1.	2.2	0.83	45.3	49.7	0.50	54.0	10.5	1.2	32.3	-	-	-
	2.	3.2	0.97	47.1	47.3	0.59	57.0	12.5	0.9	33.7	-	-	-
	3.	4.5	1.05	50.1	45.6	0.66	55.0	13.5	0.9	32.8	-	-	-
C	1.	2.5	0.51	50.2	42.1	0.48	60.0	11.5	1.3	31.3	-	-	-
	2.	3.5	0.56	52.1	43.3	0.56	59.4	13.0	1.2	32.0	-	-	-
	3.	5.6	0.60	61.0	45.0	0.78	60.9	14.0	1.1	32.0	-	-	-
D	1.	3.6	0.99	42.0	48.0	0.47	55.0	11.0	1.5	35.0	-	-	-
	2.	4.3	1.20	47.0	46.0	0.60	57.0	13.2	1.2	33.0	-	-	-
	3.	7.2	1.30	48.1	42.0	0.66	49.8	13.6	1.0	30.5	20.0	10.0	5.2

Second season

Rootstocks	Period	Weight loss%	Rind color		% juice	Juice color		T. S. S	Acidity	Vitamin c	Shrivel	Cl	Decay
			a/b	L		a/b	L						
A	1.	2.0	0.92	42.0	45.2	0.55	57.1	10.5	1.2	36.0	-	-	-
	2.	2.5	0.97	47.0	45.0	0.65	58.2	13.0	1.1	34.2	-	-	-
	3.	3.8	1.16	52.0	46.4	0.99	61.2	13.5	0.7	34.2	-	-	-
B	1.	2.4	0.74	44.0	44.1	0.50	55.0	10.5	1.2	32.4	-	-	-
	2.	3.0	0.89	50.0	42.0	0.60	57.6	13.0	1.2	33.1	-	-	-
	3.	4.0	1.10	50.0	45.0	0.68	52.0	14.0	0.8	32.2	-	-	-
C	1.	2.8	0.48	50.0	43.3	0.44	60.0	12.0	1.4	34.7	-	-	-
	2.	3.2	0.60	60.0	40.4	0.55	59.0	13.5	1.2	35.0	-	-	-
	3.	5.2	0.61	62.0	42.5	0.83	62.0	15.0	1.1	32.0	-	-	-
D	1.	3.0	1.03	47.0	46.2	0.50	54.0	12.0	1.5	33.8	-	-	-
	2.	5.1	1.24	48.0	44.1	0.59	53.0	13.5	1.3	35.1	-	-	-
	3.	8.0	1.26	48.5	40.2	0.62	54.0	14.0	1.2	31.0	30.0	15.0	8.8

Rootstock :

A : Volkamer lemon.

B : Rangpur lime.

C : Carrizo citrange.

D : sour orange.

Period :

1. Beginning.

2. Middle.

3. End of storage.

Some signs of peel shrinkage start to appear for sour orange rootstock at the end of storage period. It presented the percentage of 20 . 30 in both seasons. Also, brown spots percentage (chilling injury) were 10.0 %, 15.0% in the same time.

The fruits showed no signs of decay after storage and during shelf-life periods except the fruits on sour orange as it showed a percentage of decay 5.2 % . 8.8 % in both season at the end of the storage period.

These results are in line with Hassan (1999). who found that the highest percentage of decay, shriveling and brown spots under 4 °C happened in Valencia on sour orange.

Fremont fruits on Volkamer lemon was stored safely and considered marketable for 60 days at 5 °C plus 6 days at 18 - 20 °C and the loss in weight was in the acceptable range.

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الملخص العربي

تأثير أربعة أصول على جودة الثمار والقدرة التخزينية لثمار اليوسفي فرمونت

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أجري البحث على ثمار صنف اليوسفي فرمونت المأخوذة من منطقة جنوب التحرير - محافظة البحيرة خلال موسمي ٢٠٠٠/٢٠٠١ وهو من الأصناف المبكرة (نوفمبر) جودته عالية ، ثماره من متوسطة إلى كبيرة الحجم ، سهلة التقشير ، ولون القشرة أحمر برتقالي ، ولون اللب برتقالي داكن ، وقد شملت الدراسة هذا الصنف المطعوم على أربعة أصول مختلفة { أصل الفولكاماريانا ، أصل الرانجبورليم ، أصل الكاريزوسترانج } كأصول جديدة ، بالإضافة إلى أصل النارنج وهو الأصل الشائع في مصر ، حيث قطعت الثمار في مرحلة اكتمال النمو وخزنت على درجة حرارة ٥°م لمعرفة تأثير الأصول على صفات الثمار والسلوك التخزيني والتسويقي لها وكانت أهم النتائج :-

وصول ثمار اليوسفي فرمونت المطعومة على أصل النارنج والرانجبورليم و كاريزوسترانج لاكمال النمو مبكرا عن الأصل فولكاماريانا ، أعطت ثمار اليوسفي فرمونت المطعومة على أصل الفولكاماريانا والرانجبورليم أعلى قيمة لوزن الثمار أما نسبة العصير فكان أصل النارنج أفضلها ، أفضل تلوين لقشرة ثمار اليوسفي فرمونت المطعومة على أصل النارنج ويستطوّر لون القشرة خلال فترة تخزينها وكذلك فإن لب الثمار المطعومة على أصل الفولكاماريانا أكثر احمرارا ، سجلت نسبة اللفقد في الوزن خلال فترة التخزين للثمار المطعومة على أصل الفولكاماريانا أقل معدل يليها أصل الرانجبورليم ، تأثر محتوى الثمار من العصير خلال فترة التخزين حيث أعطت أعلى معدل في التناقص للثمار المطعومة على أصل النارنج ، زادت نسبة الميواد الصلبة الكلية الذاتية في الثمار المطعومة على أصل الكاريزوسترانج ثم النارنج ، انخفضت نسبة الحموضة خلال فترة التخزين إلى أقل معدل لها في الثمار المطعومة على أصل الفولكاماريانا وأعلاها على أصل النارنج .

يمكن أن تسوق الثمار بحالة جيدة بعد تخزينها ٦٠ يوم على درجة حرارة ٥°م بالإضافة إلى أسبوع على درجة ٢٠°م مع أقل فقد في الوزن وبدون تلف خاصة في الثمار المطعومة على الأصل فولكاماريانا ، الأصل رانجبورليم ، أما ثمار أصل النارنج فقد زادت نسبة اللفقد في الوزن ، أكثر عرضة للتكرمش وانخفاض فيتامين ج مع بداية ظهور أضرار برودة .