

**RESULTS
AND
DISCUSSION**

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4-1- Effect of postharvest treatments and package type on lime fruits stored at room temperature:

4-1-a- Physical properties

Regarding the effect of postharvest treatments on the physical properties of lime fruits after 15 days storage at room temperature of both seasons Table (1-A) clarifies that waxed fruits treated by different postharvest treatments surpassed the unwaxed ones in all treatments under study.

However, garlic oil plus waxing and pro-Gib plus waxing treated fruits showed the highest fresh appearance and fruit Juice percentage followed by irradiation dose (0.75 KGy), plus wax among the other treatments used. Concerning irradiation doses it is clear that the highest dose (0.75 KGy) caused highest effect in maintaining fresh appearance and increasing Juice percentages as compared with the lower dose (0.50 KGy). Meanwhile, pro-Gib and garlic oil plus waxing treatments induced the lowest significant fruit decay and weight loss percentages followed by irradiation treatments and hot water as compared with the control in a descending order.

Regarding the effect of package type on fruit physical properties (seasons 1999 and 2000) Table (1-B) showed that polyethylene plus carton package significantly maintained fresh appearance and increased Juice percentages and decreased fruit decay and weight loss percentages compared with the other

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package types. With the respect to the different interactions it is clear from Table (1-C) that using of combinations of either pro-Gib or Garlic oil with waxing and package in polyethylene plus carton package were statistically higher in fresh appearance during both seasons. However, significant increase of Juice percentage occurred when irradiation plus waxing treatments and garlic oil plus waxing in either polyethylene plus carton or polyethylene packages were used. Meanwhile, using fungicides treatments in polyethylene package or fungicides and irradiation treatments in polyethylene plus carton package decreased fruit decay percentage statistically in both seasons. Furthermore, using fungicides plus waxing treatments in polyethylene and carton packages as well as irradiation plus waxing treatments as well as hot water reduced fruit weight loss percentage statistically in comparison with all other combinations of both seasons.

Regarding the effect of postharvest treatments on the physical properties of lime fruits after 30 days storage at room temperature, Table (2-A), (2-B), (2-C) and Fig. (1-6) clarify that different fruit treatments and their combinations under study behaved similarly to the trend appeared Table (1-A), (1-B) and (1-C).

It is evident from Table (3-A) that all treated fruits showed considerable loss of fresh appearance of lime fruits after 45 days storage at room temperature of both seasons. On the contrary, pro-Gib plus waxing treatment succeeded significantly in improving all physical properties as it maintained better fresh appearance and juice percentage and decreased both fruit decay

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and weight loss percentages in relation to the other treatments. Garlic oil plus waxing took the second rank then irradiation dose (0.75 kGy), fungicides plus waxing, hot water plus waxing and irradiation dose (0.50 kGy) as compared with the other treatments and the control.

A glance to Table (3-B) data of seasons (1999 and 2000) show that polyethylene plus carton package significantly maintained fresh appearance and increased fruit juice percentages and reduced fruit decay and fruit weight loss percentage as compared with carton package. However, carton package significantly increased both fruit decay and weight loss percentages up to the highest level.

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Table (1): Effect of postharvest treatments and package types on physical properties of lime fruits after 15 days storage at room temperature.

Table (1-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance scores		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.77I	3.78I	49.14I	49.13I	12.34A	12.24A	13.67A	13.16AB
Irradiation								
0.50 KGy	4.11G	4.12G	49.94F	49.90F	10.38C	10.30CD	12.93B	12.90B
0.75 KGy	4.20F	4.22F	49.97F	49.95F	9.41E	9.31EF	12.60C	12.86BC
Fungicides	4.03H	4.03H	50.00E	50.10E	7.28G	7.00GH	12.06C	12.00C
Non traditional								
Garlic oil	4.33D	4.30D	50.20E	50.20E	7.00H	7.09H	11.55DE	11.50E
Pro-Gib plus	4.37D	4.38D	50.20E	50.22E	6.83HI	6.80HI	11.51E	11.50E
Hot water	4.02H	4.02H	50.00E	50.00E	9.90D	9.70DE	13.06B	13.00BC
Yeast	3.88I	3.87I	49.20H	49.20H	10.88B	10.88B	12.50C	12.50C
Waxing								
Control + wax	4.00H	4.01H	49.87F	49.80G	10.97B	10.77BC	12.18C	12.10C
0.50 KGy+wax	4.27E	4.26E	50.27D	50.20CD	9.42E	9.00EF	11.36E	11.30E
0.75 KGy+wax	4.40C	4.42C	50.61C	50.62C	8.17F	8.10FG	10.33G	10.33G
Fungicides+wax	4.26E	4.27E	50.30D	50.30D	7.23G	7.00GH	10.79G	10.76G
Garlic oil +wax	4.49B	4.49B	50.77A	50.70AB	6.87H	6.67HI	10.26H	10.30H
Pro-Gib plus + wax	4.54A	4.53A	50.68B	50.60BC	6.61I	6.60I	11.23F	11.20F
Hot water +wax	4.20F	4.21F	50.04E	50.01E	9.36E	9.30E	12.17C	12.10C
Yeast + wax	4.13G	4.15G	49.30H	49.39H	10.08D	10.00D	12.56C	12.50C

Table (1-B): Effect of package type

Parameters Season Treatment	Fresh appearance (scores)		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	4.31B	4.00BC	52.91B	53.61BC	2.40B	2.30B	4.26B	4.97B
Carton	3.87C	3.33CD	43.95C	43.90C	24.70A	24.90A	28.9A	26.70A
Polyethylene + carton	4.38A	4.33A	53.32A	51.39A	1.82C	1.90C	2.51C	3.53BC

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Table (1-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	4.00	3.97	3.30	3.32	4.00	4.00	52.00	52.00	40.91	40.89	53.00	53.00	5.931	5.901	26.27	26.37	4.83	4.80	5.001	50.01	31.50	31.60	4.00	4.22
Control	G	GH	K	K	G	G	K	K	P	P	F	F			A	A	K	K	JK	A	A	A	N	N
Irradiation	4.30	4.33	3.73	3.81	4.30	4.30	53.00	53.00	42.81	43.79	54.00	54.10	3.93	3.914	23.87	23.87	3.33	3.33	5.231	5.201	30.57	30.50	3.00	3.10
0.50 kGy	E	E	H	H	E	E	F	F	RS	RS	B	B	MNO	MNO	C	C	Q	Q	K	K	C	C	P	OP
0.75 kGy	4.30	4.30	4.00	4.00	4.30	4.30	52.81	52.71	42.91	42.81	53.00	53.00	3.57	3.50	22.60	22.90	2.07	2.06	5.00	5.00	3.00	3.00	3.00	3.02
kGy	E	E	G	G	E	E	F	F	ST	ST	F	F	OPQ	OPQ	D	CD	T	T	KL	KL	D	D	P	P
Fungicides	4.00	4.00	3.80	3.81	4.30	4.32	52.80	52.79	44.00	44.00	54.00	54.20	0.00	0.00	21.87	21.81	0.00	0.00	9.90	9.80	30.00	30.00	3.00	3.00
Non-traditional	G	G	H	H	E	E	F	F	O	O	B	B	U	U	EF	EF	U	U	L	L	D	D	PQR	PQR
Garlic oil	4.50	4.45	4.00	4.00	4.50	4.50	52.00	52.00	43.00	43.00	52.60	52.61	0.00	0.00	21.00	21.00	0.00	0.00	4.32	4.32	20.00	20.01	2.50	2.51
Pro-Gib plus	4.50	4.50	4.00	4.00	4.60	4.62	53.00	53.00	43.21	43.20	53.80	53.76	0.00	0.00	20.50	20.45	0.00	0.00	4.00	4.00	28.00	28.10	2.50	2.50
Hot water	4.00	3.97	3.77	3.701	4.30	4.32	53.00	53.00	43.91	43.90	52.32	52.30	3.93	3.914	23.00	23.00	2.77	2.76	4.50	4.53	29.17	29.00	2.50	2.52
Yeast	4.00	4.00	3.631	3.631	4.00	4.00	52.61	52.51	42.80	42.81	52.00	52.10	4.57	4.50	24.00	24.00	4.07	4.05	5.231	5.231	30.93	30.93	3.00	3.01
Waxing Control	4.20	4.20	3.50	3.50	4.30	4.30	53.21	53.10	43.00	43.00	53.40	53.40	4.33	4.33	24.87	24.97	3.07N	3.01N	4.50	4.50	30.00	30.00	3.00	3.02
+ wax	F	F	H	H	E	E	E	E	R	R	D	D	LM	LM	B	B	OPQ	OPQ	M	M	D	D	P	P
0.50kGy + wax	4.50	4.50	3.80	3.89	4.50	4.52	54.00	54.01	42.81	42.80	54.00	54.00	3.30	3.30	22.70	22.80	2.27	2.26	4.00	4.00	30.00	30.00	2.53	2.53
0.75kGy + wax	4.50	4.50	4.20	4.21	4.50	4.52	53.11	53.11	44.11	44.00	54.61	54.91	2.87	2.86	21.63	21.58	0.00	0.00	4.00	4.00	28.00	28.00	2.00	2.00
++wax	4.30	4.30	4.00	4.00	4.47	4.46	53.00	53.00	43.91	43.81	54.00	54.00	0.00	0.00	21.70	21.60	0.00	0.00	3.50	3.50	28.17	28.16	2.03	2.03
Fungicides + wax	4.30	4.30	4.00	4.00	4.70	4.76	53.31	53.29	45.00	45.00	54.00	54.00	0.00	0.00	20.60	20.60	0.00	0.00	3.00	3.00	26.00	26.01	1.77	1.87
Garlic oil + wax	4.57	4.56	4.20	4.21	4.70	4.76	53.31	53.31	45.12	45.10	54.12	54.12	0.00	0.00	19.83	19.79	0.00	0.00	3.00	3.00	26.50	26.51	1.50	1.40
Pro-Gib plus + wax	4.73	4.72	4.20	4.21	4.70	4.81	53.81	53.81	45.12	45.10	54.12	54.12	0.00	0.00	19.83	19.79	0.00	0.00	3.00	3.00	26.50	26.51	1.50	1.40
Hot water + wax	4.30	4.30	4.00	4.00	4.30	4.32	52.81	52.79	44.11	44.00	53.21	53.12	3.33	3.30	22.17	22.16	2.57	2.57	3.50	3.52	27.07	27.06	1.80	1.80
Yeast + wax	4.27	4.28	3.80	3.79	4.33	4.30	52.11	52.00	43.81	43.71	52.00	52.10	3.83	3.80	22.93	22.83	3.47	3.46	4.00	4.00	30.00	30.00	2.50	2.50
Wax	E	E	H	H	E	E	J	J	N	N	K	K	NOP	NOP	E	E	PQ	PQ	N	N	D	D	RS	RS

Table (2): Effect of postharvest treatments and package types on the physical properties of lime fruits after 30 days storage at room temperature.

Table (2-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance scores		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.00JK	2.97KL	39.40H	37.63IH	17.86A	19.00A	17.89A	19.22A
<u>Irradiation</u>								
0.50 KGy	3.41H	3.31HI	41.37E	41.37E	16.84B	16.80B	16.72B	18.74B
0.75 KGy	3.52G	3.50G	41.33E	41.23E	15.47DE	15.40DE	16.03C	16.37BC
Fungicides	3.58F	3.50F	41.18E	41.00EF	15.24EF	15.20EF	15.87CD	15.76CD
<u>Non traditional</u>								
Garlic oil	3.82C	3.98BC	42.64CD	42.60CD	14.08I	14.07I	14.42G	14.40G
Pro-Gib plus	3.89B	3.94AB	42.56D	42.56D	14.83G	14.60GH	14.58G	14.50G
Hot water	3.66E	3.60F	41.40E	41.00EF	15.53D	15.93CD	15.38E	15.36E
Yeast	3.22J	3.00JK	40.73F	41.76F	17.03B	17.06B	16.69B	16.50BC
<u>Waxing</u>								
Control + wax	3.37I	3.30I	40.33G	40.36G	16.87B	16.97B	16.71B	16.71B
0.50 KGy+wax	3.53G	3.54G	42.48D	42.80D	16.18C	16.68BC	15.78D	15.98CD
0.75 KGy+wax	3.59F	3.50F	42.98BC	42.96BC	15.01FG	15.00FG	14.91F	14.81F
Fungicides+wax	3.73D	3.93CD	42.97BC	42.96BC	14.46H	14.40H	14.56G	14.50G
Garlic oil +wax	4.08A	4.58A	44.18A	44.55A	13.26J	13.26J	13.33I	13.00IJ
Pro-Gib plus + wax	4.10A	4.67A	44.10A	44.61A	13.89I	13.81I	13.57H	13.50H
Hot water +wax	3.84C	3.80C	43.03B	43.76AB	14.88G	14.80G	14.43G	14.00GH
Yeast + wax	3.42H	3.40H	42.53D	42.93CD	16.07C	16.00C	15.51E	15.50E

Table (2-B): Effect of package type

Parameters Season Treatment	Fresh appearance (scores)		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	3.89B	3.97AB	45.46B	46.40B	9.03B	9.67AB	8.31B	8.00B
Carton	2.97C	3.11B	33.41C	33.11C	33.54A	34.63A	32.49A	33.52A
Polyethylene + carton	4.00A	4.33A	47.32A	47.63A	3.84C	3.92C	5.40C	4.67C

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Table (2-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)					Percentage of fruit juice					Percentage of fruit decay					Percentage of fruit weight loss				
	Poly		Carton		Poly+ carton	Poly		Carton		Poly+ carton	Poly		Carton		Poly+ carton	Poly		Carton		Poly+ carton
	1999	2000	1999	2000		1999	2000	1999	2000		1999	2000	1999	2000		1999	2000	1999	2000	
Season	3.53	3.50	2.00	2.01	3.52	43.00	43.00	30.30	30.30	45.20	45.00	11.37	11.36	36.37	36.71	5.83	5.81	35.10	35.10	8.01
Control	H	H	N	N	H	N	N	X	X	JK	JK	K	K	A	A	U	U	A	A	LM
Irradiation	3.90	3.90	2.53	2.52	3.82	44.30	44.28	32.30	32.30	47.50	47.50	10.93	10.9	34.83	34.80	4.76	4.76	33.80	33.20	6.77
0.50 kGy	F	F	LM	LM	F	M	M	V	V	DE	DE	L	L	BC	BC	VW	VW	B	B	QR
0.75 kGy	4.00	4.00	2.56	2.57	4.00	44.50	44.50	32.51	32.51	47.00	47.00	9.10	9.00	33.57	33.50	3.73	3.71	33.0	33.0	5.76
0.75 kGy	D	D	LM	LM	D	LM	LM	UV	UV	EG	EG	NO	NO	EF	EF	Z	Z	CD	CD	S
Fungicides	3.73	3.70	3.00	3.01	4.00	44.30	44.26	33.73	33.61	45.50	45.41	8.20	8.20	33.60	33.62	3.93	3.93	33.13	33.12	5.84
Non traditional	FG	FG	K	K	D	M	M	RS	RS	U	U	Q	Q	EF	EF	YZ	YZ	C	C	S
Garlic oil	4.00	4.00	3.50	3.51	4.16	45.23	45.21	34.00	34.10	48.43	48.30	8.43	8.41	32.43	32.40	3.63	3.63	31.23	31.20	5.10
Pro-Gib plus	3.80	3.86	3.53	3.52	4.14	46.00	46.00	34.30	34.31	47.63	47.60	7.63	7.60	31.33	31.30	3.26	3.26	31.00	31.00	4.57
Hot water	F	F	H	H	C	HI	HI	R	R	DE	DE	R	R	J	J	Z	Z	F	F	U
Yeast	3.76	3.77	3.20	3.20	4.00	44.60	44.50	33.00	33.01	46.60	46.60	9.16	9.17	33.67	33.61	3.76	3.76	32.63	32.50	5.51
Waxing	FG	FG	D	D	D	KLM	KLM	TU	TU	FH	FH	NO	NO	E	E	Z	Z	D	D	S
Control	3.47	3.50	2.50	2.51	3.70	44.5	44.00	31.50	31.50	46.20	46.20	11.03	11.01	35.07	35.01	5.00	5.00	34.00	34.10	6.32
+ wax	H	H	M	M	G	LM	LM	W	W	H	H	KL	KL	B	B	V	V	B	B	R
0.50kGy	3.81	3.80	2.50	2.50	3.80	45.00	45.00	30.10	30.10	46.00	46.00	10.33	10.30	35.10	35.10	5.16	5.10	34.10	34.00	6.51
+ wax	F	F	M	M	F	I-L	I-L	X	X	HI	HI	M	M	B	B	V	V	B	B	R
0.75kGy	4.00	4.01	2.60	2.61	4.00	46.50	46.50	33.80	33.81	47.13	47.10	10.10	10.12	34.10	34.12	4.33	4.33	33.00	33.00	5.53
+ wax	D	D	L	L	D	GH	GH	RS	RS	E-G	E-G	M	M	D	D	XY	XY	CD	CD	S
Fungicides+wax	4.00	4.00	2.62	2.62	4.16	46.50	46.50	34.00	34.00	48.43	48.40	9.00	9.00	33.20	33.20	3.83	3.80	31.93	31.89	4.50
Fungicides+wax	D	D	L	L	C	GH	GH	RS	RS	BC	BC	NO	NO	FG	FG	YZ	YZ	E	E	U
Garlic oil+wax	4.00	4.00	3.30	3.30	3.90	46.00	46.00	35.76	35.80	47.20	47.21	7.50	7.50	31.03	31.02	3.83	3.43	31.93	31.82	4.50
+ wax	D	D	E	E	E	HI	HI	OP	OP	EF	EF	RS	RS	J	J	YZ	YZ	E	E	U
Pro-Gib plus + wax	4.20	4.20	3.80	3.81	4.30	47.00	47.00	35.30	35.30	50.00	50.00	7.20	7.20	31.83	31.81	3.63	3.60	30.00	30.00	4.01
Hot water + wax	BC	BC	F	F	A	EFG	EFG	PQ	PQ	A	A	S	S	I	I	YZ	YZ	G	G	V
Yeast + wax	4.16	4.17	3.80	3.82	4.26	47.50	47.50	36.00	36.10	48.68	48.60	6.26	6.27	31.03	31.02	3.46	3.40	30.00	30.00	3.52
+ wax	C	C	F	F	AB	DE	DE	O	O	B	B	T	T	J	J	Z	Z	G	G	W
Hot water + wax	4.03	4.04	3.50	3.50	4.00	46.50	46.50	35.00	35.0	47.60	47.60	8.76	8.76	33.01	33.01	2.86	2.86	32.10	32.10	4.31
+ wax	D	D	H	H	D	GH	GH	Q	Q	DE	DE	OP	OP	G	G	YZ	YZ	E	E	UV
Yeast + wax	3.76	3.77	2.62	2.61	3.90	46.00	46.00	33.50	33.50	48.00	48.10	90.67	90.67	34.47	34.40	4.37	4.37	33.00	33.00	5.51
+ wax	FG	FG	L	L	E	HI	HI	ST	ST	CD	CD	N	N	CD	CD	WX	WX	CD	CD	S

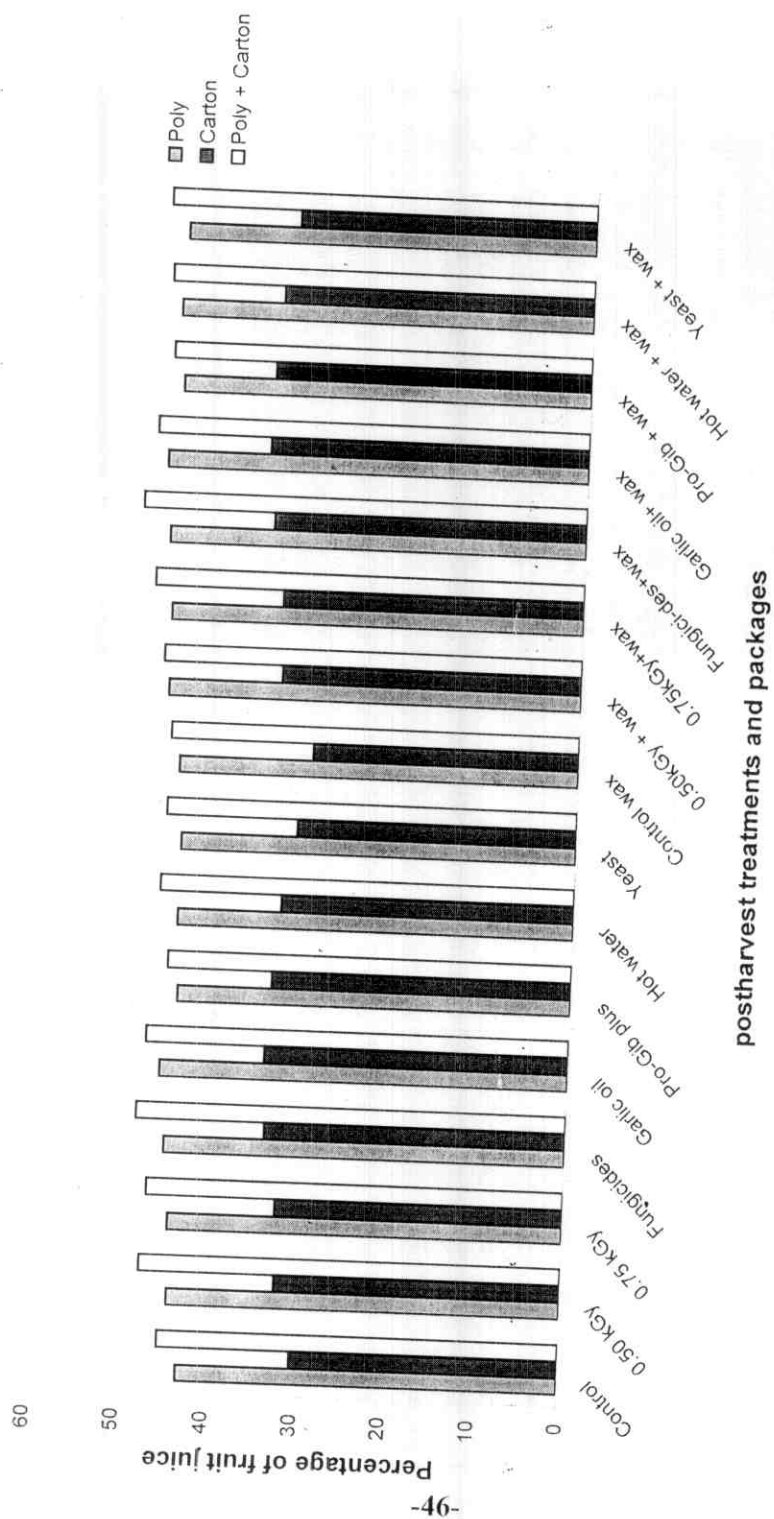


Fig. (1): Effect of postharvest treatments and package type on the physical properties of lime fruits after 30 days storage at room temperature (percentage of fruit juice, 1999)

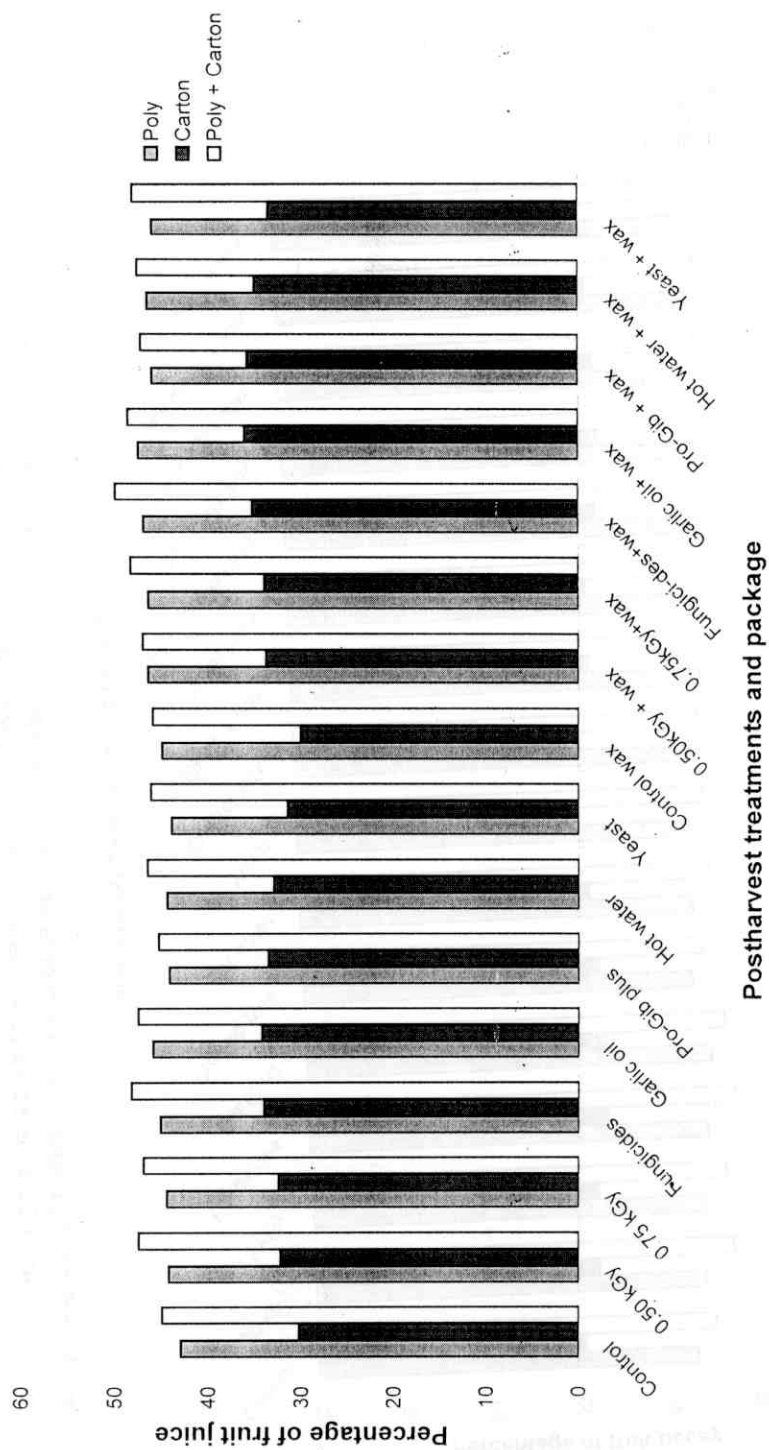


Fig. (2) Effect of postharvest treatments and package type on the physical properties of lime fruits after 30 days storage at room temperature (percentage of fruit juice, 2000)

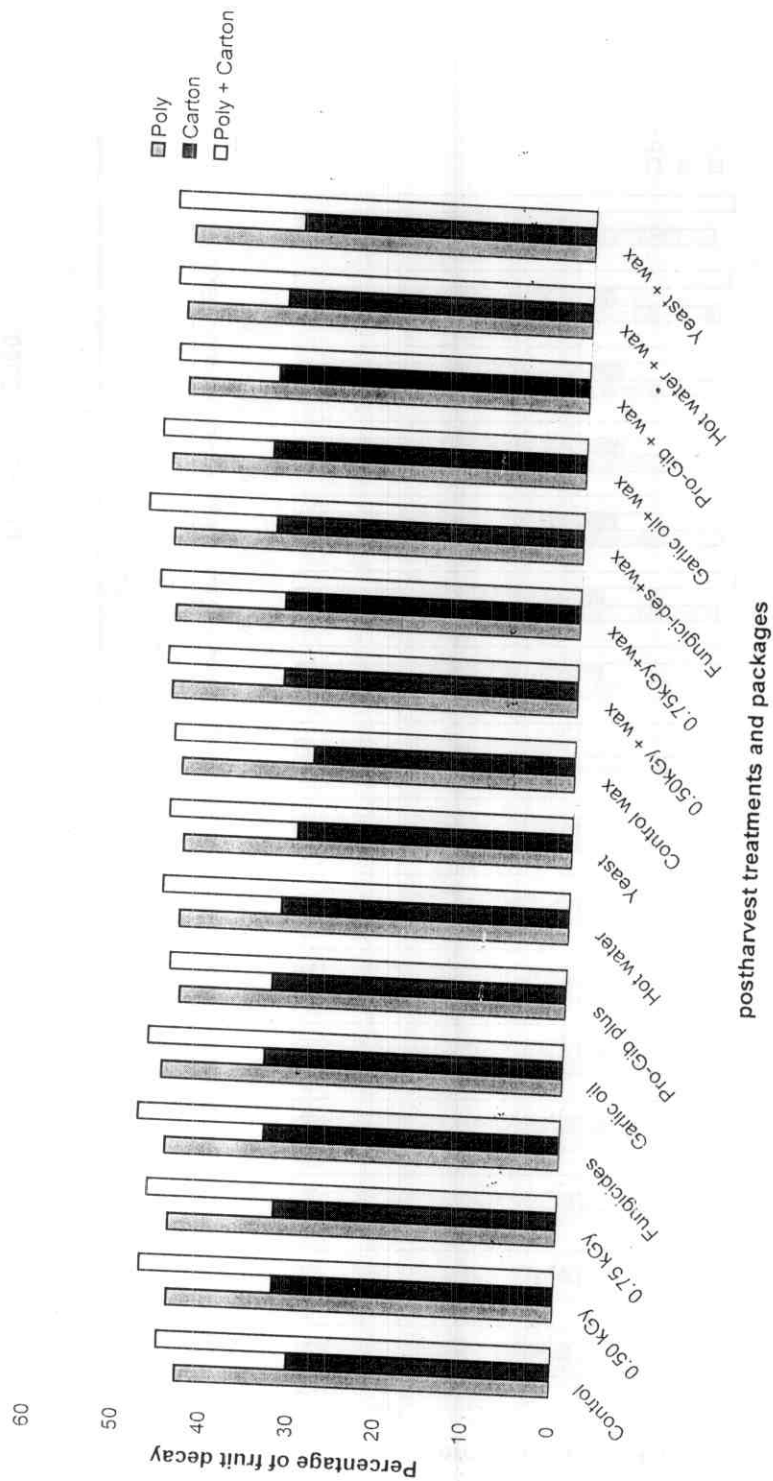


Fig. (3): Effect of postharvest treatments and package type on the physical properties of lime fruits after 30 days storage at room temperature (percentage of fruit decay , 1999)

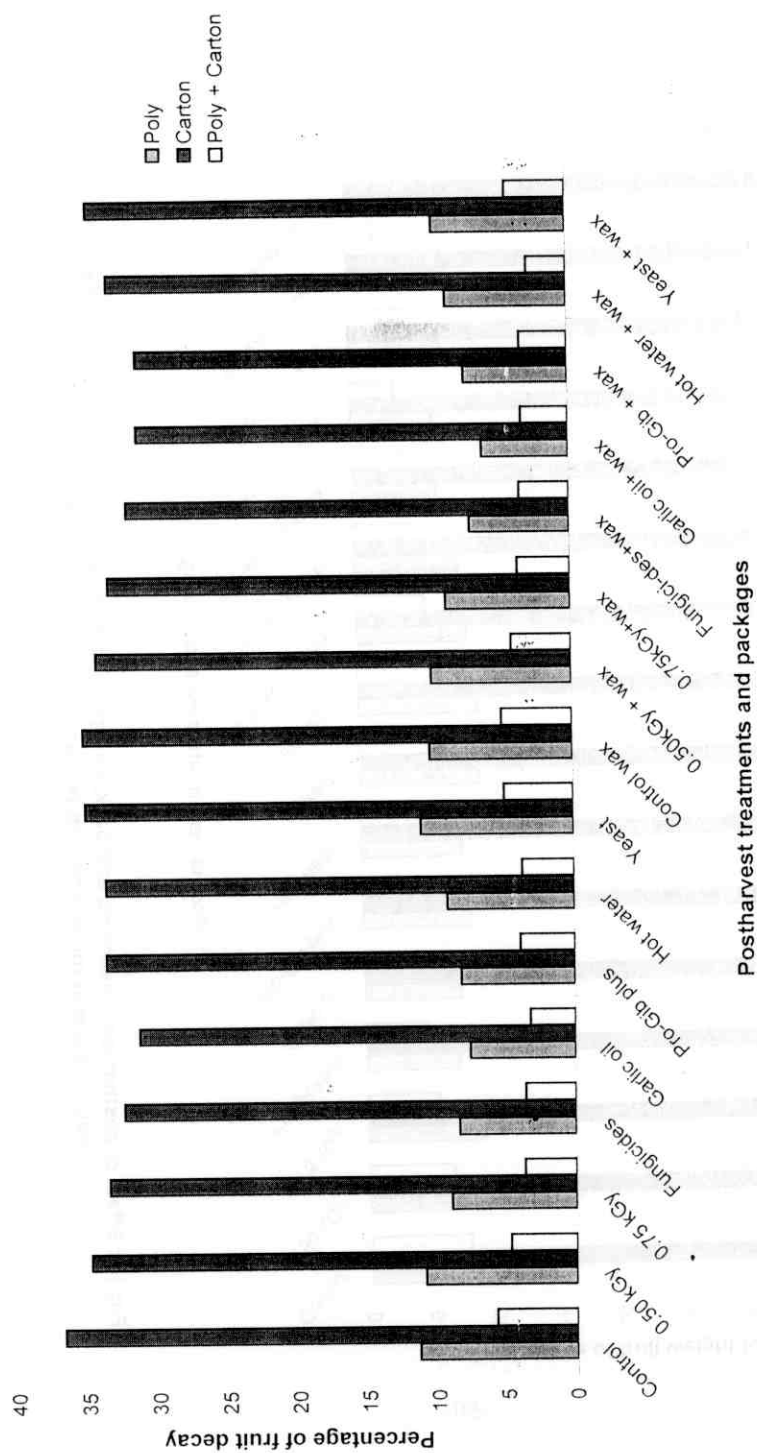


Fig. (4): Effect of postharvest treatments and package type on the physical properties of lime fruits after 30 days storage at room temperature (percentage of fruit decay , 2000)

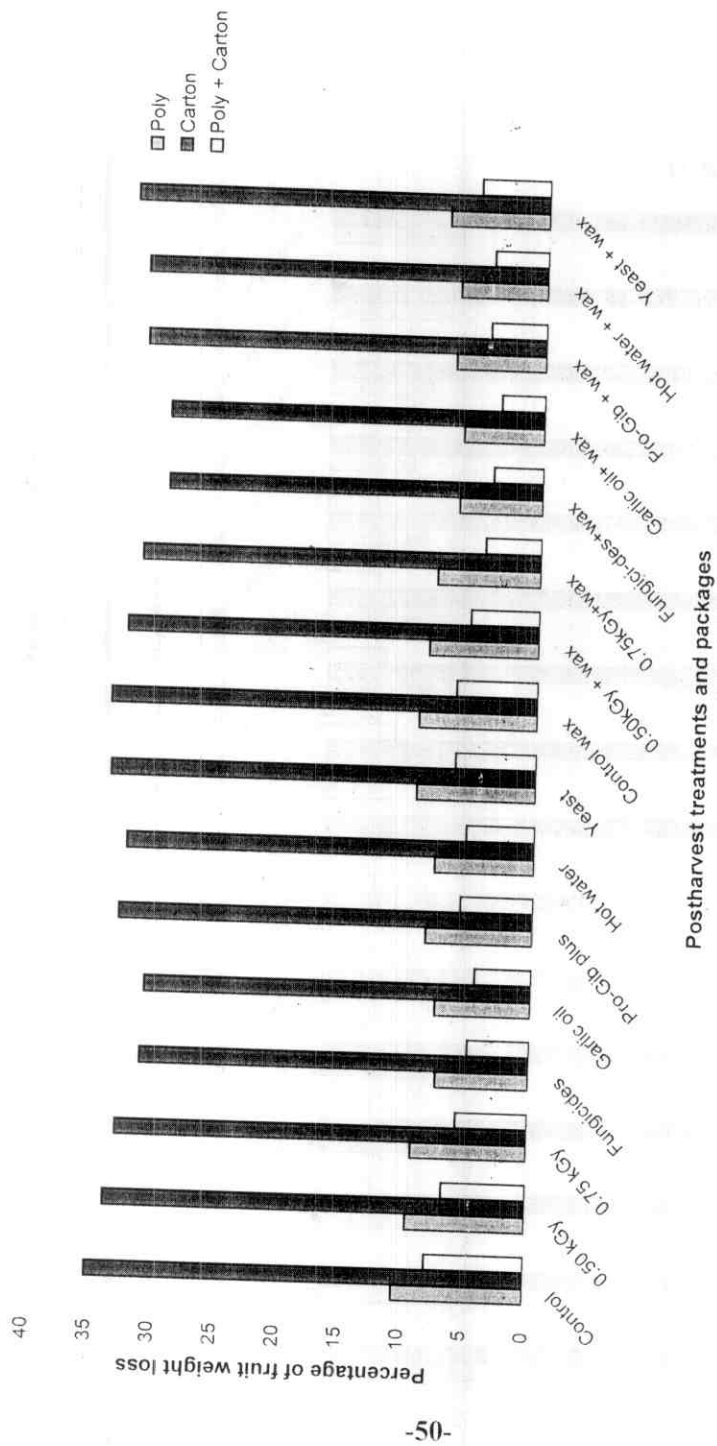


Fig. (5): Effect of postharvest treatments and package type on the physical properties of lime fruits after 30 days storage at room temperature (percentage of fruit weight loss , 1999)

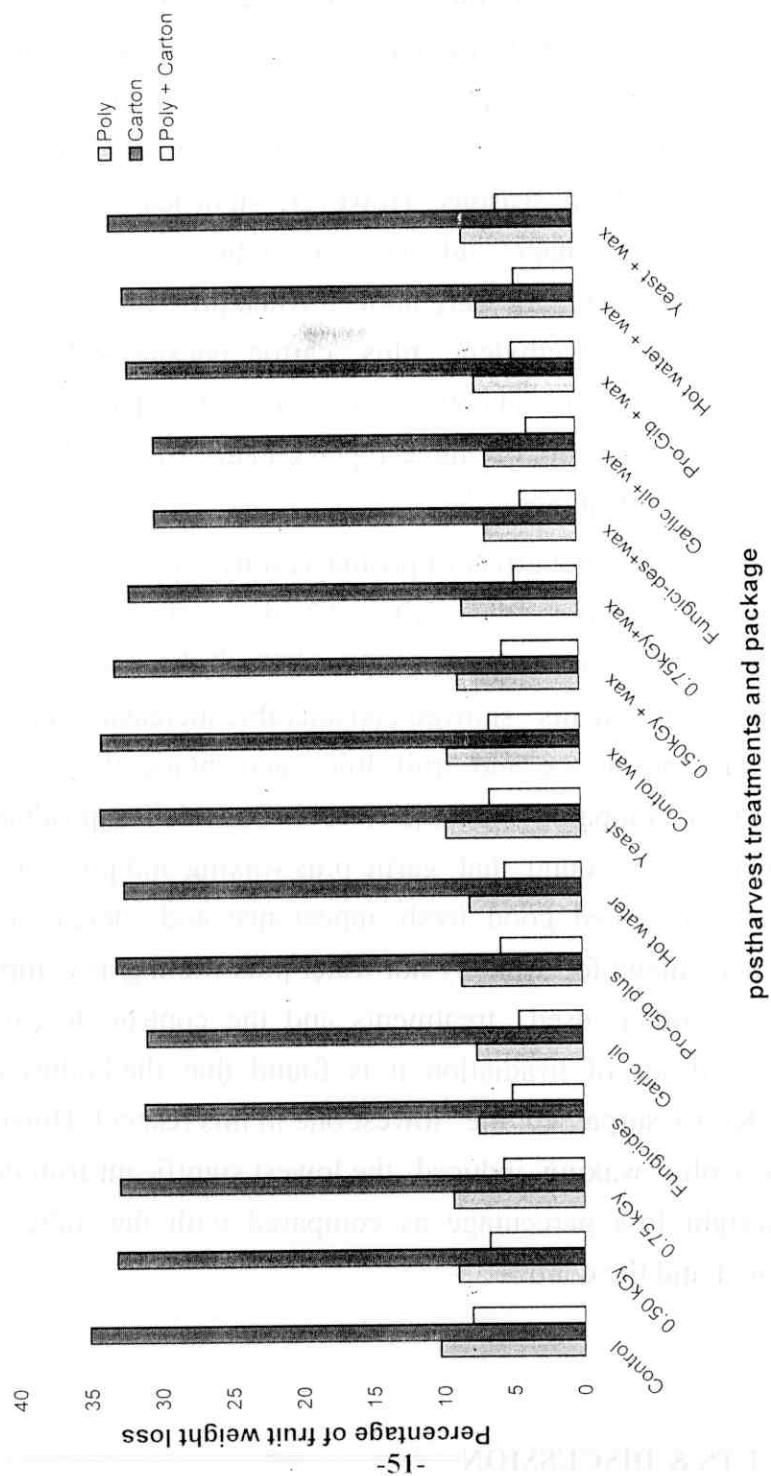


Fig. (6): Effect of postharvest treatments and package type on the physical properties of lime fruits after 30 days storage at room temperature (percentage of fruit weight loss , 2000)

With respect to the different interactions Table (3-C) pointed out that using pro-Gib plus waxing in polyethylene plus carton package as well as garlic oil + waxing and irradiation dose (0.75 KGy) plus waxing maintained statistically better fresh appearance in both seasons. However, significant increase in fruit Juice percentage and decrease in both fruit decay and weight loss percentages were noticed when pro-Gib plus waxing was used in polyethylene plus carton packages. However, postharvest treatments in combination with carton packages were discarded as a result of highest percentage of fruit decay and weight loss percentages.

Regarding the effect of postharvest treatments on physical properties of lime fruits after 60 days storage at room temperature of both seasons (1999, 2000), Table (4-A) clarifies that many treatments showed considerable increasing tendency in fresh appearance and fruit Juice percentage (till 60 days storage) as compared with the control. Considering postharvest treatments it is found that garlic plus waxing and pro-Gib plus waxing maintained good fresh appearance and increased fruit juice percentage followed by hot water plus waxing as compared with the other used treatments and the control. Regarding different doses of irradiation it is found that the highest dose (0.75 KGy) surpassed the lowest one in this respect. However, pro-Gib plus waxing induced the lowest significant fruit decay and weight loss percentage as compared with the other used treatment and the control.

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Table (3): Effect of postharvest treatments and package types on the physical properties of lime fruits after 45 days storage at room temperature.

Table (3-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance scores		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	2.00H	2.10H	34.48H	34.40H	40.86A	40.90A	21.17A	21.29A
Irradiation								
0.50 KGy	2.43F	2.46F	38.27E	38.20E	40.03C	40.04C	19.81D	19.83D
0.75 KGy	2.63E	2.64E	38.71D	38.71D	38.29D	38.96CD	19.18E	19.20E
Fungicides	2.50F	2.51F	38.39E	38.37E	37.63E	37.60E	19.17E	19.20E
Non traditional								
Garlic oil	2.77E	2.73E	39.33C	39.30C	34.23H	34.23H	17.50H	17.52H
Pro-Gib plus	2.70E	2.69E	39.38C	39.36C	33.72I	33.71I	17.64H	17.71H
Hot water	2.53F	2.52F	38.96D	38.91D	37.79E	37.71E	19.22E	19.21E
Yeast	2.34G	2.34G	37.77F	37.70F	40.42B	40.46B	20.02C	20.10C
Waxing								
Control + wax	2.60E	2.61E	35.71G	35.71G	38.41D	38.40D	20.24B	20.23B
0.50 KGy+wax	2.90D	2.93D	38.07E	38.05E	36.39F	36.36F	19.30E	19.31E
0.75 KGy+wax	3.03C	3.13C	38.12E	38.10E	34.24H	34.20H	18.31G	18.32G
Fungicides+wax	3.04C	3.13C	38.28E	38.18E	35.20G	35.91FG	18.52F	18.50F
Garlic oil +wax	3.30A	3.33A	40.20A	40.92A	31.52K	31.51K	16.59J	16.57J
Pro-Gib plus + wax	3.16B	3.20B	39.78B	39.81B	32.41J	32.40J	16.88I	16.89I
Hot water +wax	3.04C	3.06C	39.33C	39.30C	33.72I	33.70I	18.33FG	18.33FG
Yeast + wax	2.68E	2.69E	38.51E	38.50E	36.51F	36.50F	19.26E	19.21E

Table (3-B): Effect of package types

Parameters Season Treatment	Fresh appearance (scores)		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	3.22B	3.43B	41.48B	42.40B	33.02B	36.51B	12.81B	13.61B
Carton	1.46C	1.67C	30.75C	30.50C	55.28A	55.26A	35.62A	35.61A
Polyethylene + carton	3.52A	3.67A	43.51A	42.91A	20.11C	20.21C	8.04C	8.09C

... postural vest treatment and package type

[illegible]

Regarding the effect of package type of both seasons as shown in (Table 4-B), it is found that polyethylene plus carton gave the highest fresh appearance and fruit juice percentage and the lower significant fruit decay and weight loss percentages as compared with polyethylene package. However, all treatments and combinations packed in carton package failed to induce survived fruit and consequently discarded.

Furthermore Table (4-C) show the interaction between postharvest treatment and package type of both 1999 and 2000 seasons indicating that using pro-Gib plus waxing and garlic oil plus waxing in polyethylene plus carton packages maintained better fresh appearance and higher fruit juice percentage and decreased fruit decay and weight loss percentages statistically as compared with the other used treatments and the control. However, postharvest treatments and storage treatments packed in carton boxes as well as combination of control and 0.5 kGy irradiation either waxed or not in addition un waxed 0.75 kGy irradiation and yeast treatments showed poor appearance and were discarded.

Table (5) shows the effect of postharvest treatments and package type on the physical properties of lime fruits after 75 days storage at room temperature of both seasons. It is quite evident from Table (5-A) that pro-Gib plus waxing and garlic oil plus waxing treatments, succeeded in significantly maintaining better fresh appearance and higher fruit juice percentage while decreased both fruit decay and weight loss percentages as compared with the other used treatments and the control. However, waxed and unwaxed control and yeast as well as

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Table (4): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at room temperature.

Table (4-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance scores		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	1.50F	1.49F	34.50H	34.50H	44.88A	44.90A	24.59A	24.60A
Irradiation								
0.50 KGy	1.75E	1.70E	35.25G	34.90GH	41.90C	41.89C	22.33E	22.30E
0.75 KGy	2.15D	2.33D	35.00G	35.01G	40.08D	40.00D	22.51D	22.49D
Fungicides	2.75C	2.75C	38.27F	38.20F	37.33H	37.30H	21.89G	21.80G
Non traditional								
Garlic oil	2.95B	2.97B	40.23D	40.23D	36.37I	36.70IJ	19.99L	19.89L
Pro-Gib plus	3.10A	3.10A	41.37C	40.93CD	34.55J	34.00J	19.74M	19.70M
Hot water	2.75C	2.75C	39.10E	39.12E	37.75G	37.50G	21.69H	21.65H
Yeast	2.15D	2.10D	34.55O	34.50O	42.63C	42.96BC	23.00C	23.00C
Waxing								
Control + wax	1.65E	1.67E	34.90H	34.90H	43.15B	43.16B	23.83B	23.80B
0.50 KGy+wax	1.90D	1.89D	35.75G	35.70G	40.30D	40.32D	21.66E	21.60E
0.75 KGy+wax	2.75C	2.76C	39.62E	39.60E	38.68F	38.62F	21.50I	21.50I
Fungicides+wax	1.93D	1.96D	39.18E	39.19E	36.43I	36.40I	21.26J	21.24J
Garlic oil +wax	3.65A	3.67A	41.27B	41.27B	34.80J	34.87J	19.39N	19.39N
Pro-Gib plus + wax	3.25A	3.33A	41.78A	41.90A	33.48K	33.46K	19.12O	19.12O
Hot water +wax	3.10B	3.13B	40.62C	40.82C	36.70I	36.70I	21.09K	21.10K
Yeast + wax	2.75C	2.67C	38.50F	38.50F	39.93E	39.90E	22.23F	22.00F

Table (4-B): Effect of package type

Parameters Season Treatment	Fresh appearance (scores)		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	2.09B	2.10B	36.17B	36.23B	44.27A	44.19A	16.87A	16.73A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	2.93A	3.01A	40.07A	42.00A	33.03B	35.14B	12.39B	12.21B

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Table (4-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)				Percentage of fruit juice				Percentage of fruit decay				Percentage of fruit weight loss			
	Poly	Carton	Poly+	Carton	Poly	Carton	Poly+	Carton	Poly	Carton	Poly+	Carton	Poly	Carton	Poly+	Carton
Season	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 KGV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.25 KGV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Traditional	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garlic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
oil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pre-Gib	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
plus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waxing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+ wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50KGV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+ wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75KGV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+ wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dest+wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garlic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
oil+ wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pre-Gib	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
plus+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
water +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

unwaxed 0.5 kGy irradiation and hot water fruit treatments failed to survive.

Regarding the effect of package type of two seasons (1999, 2000) it is quite noticed from Table (5-B) that polyethylene plus carton package significantly had higher fresh appearance and fruit juice percentage while decreased fruit decay and weight loss percentages as compared with polyethylene package. On the other hand, the fruits kept in carton package didn't survive and were discarded.

Dealing with the interaction between postharvest treatments and package type of both seasons as shown in Table (5-C). It is clear that using garlic oil plus waxing or pro-Gib plus waxing packed in polyethylene plus carton package had better fresh appearance and fruit juice percentage while decreased fruit decay and weight loss percentages statistically as compared with the other combinations in this respect. However, combinations of all treatments under study and carton boxes as well as unwaxed treatments and waxed control, irradiation doses (0.50 & 0.75 kGy) and yeast failed in keeping fruits acceptable for marketing and discarded when polyethylene package was used.

Similarly, unwaxed 0.5 kGy irradiation and hot water as well as unwaxed control and yeast treatments were unsuitable for conservation and discarded.

Table (6) shows the effect of postharvest treatments on the physical properties of lime fruits after 90 days storage at room temperature. It is quite clear from Table (6-A) that all treatments except pro-Gib, garlic oil, pro-Gib plus waxing and garlic oil plus waxing treatments of both seasons had poor fruit

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physical properties up to 90 days at room temperature. However, garlic oil plus waxing treatment succeeded in having better fresh appearance and higher fruit juice percentage while decreased fruit decay and weight loss percentages followed by pro-Gib plus waxing then garlic oil as compared with pro-Gib in a descending order. Considering package type of both seasons it is obvious from Table (6-B) that polyethylene plus carton packages survived with acceptable physical fruit properties. Generally, treated fruits surpassed untreated ones (control) in maintaining fresh appearance and juice percentage up to 60 days of postharvest. However, combinations of waxing, for both pro-Gib and garlic oil treatments, and polyethylene plus carton packages enhanced the increase of fruit survivals with good physical properties under room temperature. Anyhow, these results confirm the finding of **Ben-Yehoshua *et al.* (2000)**. They recommended using pro-Gib for reducing fruit decay of March grapefruit during storage. Also, with the findings of **Hamouda, (2000)** who mentioned that garlic oil treatment prolonged storage period of Washington navel orange fruits with good physical properties.

Table (5): Effect of postharvest treatments and package types on the physical properties of lime fruits after 75 days storage at room temperature.

Table (5-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance scores		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
<u>Irradiation</u>								
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	1.60D	1.63D	34.30E	34.25E	50.03A	50.00A	25.42A	25.43A
Fungicides	1.65D	1.60D	33.82E	33.81E	43.73D	43.70D	25.31A	25.61A
<u>Non traditional</u>								
Garlic oil	1.76C	1.70C	34.60D	34.61D	44.68C	44.60C	24.07B	24.70B
Pro-Gib plus	1.85C	1.82C	34.80D	34.82D	41.05E	41.15E	24.00B	24.00B
Hot water	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-
<u>Waxing</u>								
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	1.60D	1.69CD	35.00D	35.00D	49.45B	49.41B	25.54A	25.61A
0.75 KGy+wax	1.75C	1.75C	35.00D	35.00D	50.22A	50.00A	25.10A	25.12A
Fungicides+wax	2.31B	2.31B	37.22C	37.23C	41.82E	41.81E	24.46B	24.40B
Garlic oil +wax	2.65A	2.67A	39.55A	39.56A	40.50F	39.90F	22.30C	22.31C
Pro-Gib plus + wax	2.76A	2.69A	39.82A	39.86A	38.55G	38.50G	22.19C	22.21C
Hot water +wax	2.36B	2.30B	38.75B	38.70B	41.90E	41.92E	24.0B	24.00B
Yeast + wax	-	-	-	-	-	-	-	-

Table (5-B): Effect of package type

Parameters Season Treatment	Fresh appearance (scores)		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	1.75B	1.60B	32.70B	32.81B	49.00A	49.92A	19.00A	19.23A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	2.72A	2.50A	38.90A	39.17A	40.20B	40.03B	15.68B	15.81B

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Table (5-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	-	-	-	-	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 kGy	-	-	-	-	2.20	2.23	-	-	-	-	37.60	37.62	-	-	-	-	46.50	46.50	-	-	-	-	17.27	17.28
0.75 kGy	-	-	-	-	2.30	2.33	-	-	-	-	36.63	36.62	-	-	-	-	42.6	42.6	-	-	-	-	16.93	16.91
Fungicide	-	-	-	-	2.50	2.50	-	-	-	-	38.20	38.20	-	-	-	-	41.77	41.70	-	-	-	-	15.20	15.21
Non traditional	-	-	-	-	2.70	2.70	-	-	-	-	38.60	38.60	-	-	-	-	41.01	41.26	-	-	-	-	15.00	15.00
Garlic oil	-	-	-	-	2.70	2.70	-	-	-	-	39.00	39.00	-	-	-	-	48.10	48.20	-	-	-	-	16.63	16.63
Pro-Gib plus	-	-	-	-	2.70	2.70	-	-	-	-	39.00	39.00	-	-	-	-	46.37	46.37	-	-	-	-	16.30	16.32
Hot water	-	-	-	-	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waxing	-	-	-	-	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control + wax	-	-	-	-	2.20	2.23	-	-	-	-	39.00	39.00	-	-	-	-	48.10	48.20	-	-	-	-	16.63	16.63
0.50kGy + wax	-	-	-	-	2.50	2.51	-	-	-	-	39.00	39.00	-	-	-	-	46.37	46.37	-	-	-	-	16.30	16.32
0.75kGy + wax	-	-	-	-	2.60	2.61	-	-	-	-	38.30	38.30	-	-	-	-	41.10	41.20	-	-	-	-	15.83	15.83
Fungicide + wax	2.03	2.03	-	-	2.80	2.80	-	-	-	-	40.60	40.60	-	-	-	-	39.50	39.50	-	-	-	-	14.57	14.50
Garlic oil + wax	2.50	2.51	-	-	3.02	3.02	-	-	-	-	41.00	41.00	-	-	-	-	37.10	37.21	-	-	-	-	14.27	14.26
Pro-Gib plus + wax	2.50	2.53	-	-	3.03	3.03	-	-	-	-	41.00	41.00	-	-	-	-	37.10	37.21	-	-	-	-	14.27	14.26
Hot water + wax	2.03	2.03	-	-	2.70	2.70	-	-	-	-	39.50	39.52	-	-	-	-	38.27	38.21	-	-	-	-	15.00	15.00
Yeast + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table (6): Effect of postharvest treatments and package types on the physical properties of lime fruits after 90 days storage at room temperature.

Table (6-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance scores		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
<u>Irradiation</u>								
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	-	-	-	-	-	-	-	-
Fungicides	-	-	-	-	-	-	-	-
<u>Non traditional</u>								
Garlic oil	1.50C	1.67C	36.00D	36.61D	42.67A	42.69A	18.00A	18.06A
Pro-Gib plus	1.30D	1.50D	37.00C	37.61C	42.27A	42.29A	18.10A	18.00A
Hot water	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-
<u>Waxing</u>								
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	-	-	-	-	-	-	-	-
0.75 KGy+wax	-	-	-	-	-	-	-	-
Fungicides+wax	-	-	-	-	-	-	-	-
Garlic oil +wax	3.00A	3.33A	39.50A	39.60A	40.50B	40.50B	16.00C	16.60C
Pro-Gib plus + wax	2.80B	2.96B	38.00B	38.33B	40.27B	40.27B	16.00B	16.03B
Hot water +wax	-	-	-	-	-	-	-	-
Yeast + wax	-	-	-	-	-	-	-	-

Table (6-B): Effect of package type

Parameters Season Treatment	Fresh appearance (scores)		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	-	-	-	-	-	-	-	-
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	2.15	2.36	37.62	38.03	41.42	41.43	17.02	17.01

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4-1-b- Chemical properties

Table (7-A) shows the effect of postharvest treatments on chemical properties of lime fruits after 15 days storage at room temperature in both seasons. It is clear that, as storage period (after 15 days) increased total soluble solids percentage also increased in all treatments. However, both irradiation doses (0.50 and 0.75 KGy), garlic oil, pro-Gib and hot water plus waxing treatments gave significantly the highest total soluble solids percentage in fruits followed by hot water and yeast plus waxing as compared with all other treatments and the control. No significant difference was noticed between the two irradiation treatments. Garlic oil treatment, on the other hand, increased total acidity value in fruit juice followed by fungicides treatments as compared with the other used treatments and the control in both seasons. Anyhow, T.S.S. / acid ratio in fruit juice increased with increasing storage period (after 15 days) that was obvious in all treatments used. While, fruits treated with garlic oil plus waxing, pro-Gib plus waxing and garlic oil treatments had the lowest values of T.S.S. / acid ratio in comparison with the other used treatments and the control of two seasons. Besides, garlic oil plus waxing and pro-Gib plus waxing treatments significantly maintained higher level of ascorbic acid content, followed by fungicides plus waxing and hot water plus waxing then the two irradiation doses plus waxing treatments as compared with all other used treatments and the control of both seasons.

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Table (7): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 15 days storage at room temperature.

Table (7-A): Effect of postharvest treatments.

Parameters Season	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
Treatments	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	8.47C	8.40C	7.77FG	7.70FG	1.08B	1.08B	56.67H	56.60H
Irradiation								
0.50 Kgy	8.78A	8.78A	7.96B-E	7.95B-E	1.10AB	1.10AB	56.88G	56.80G-H
0.75 Kgy	8.80A	8.67AB	7.97B-D	7.90B-D	1.10AB	1.10AB	57.05F	57.05F
Fungicides	8.80A	8.69AB	8.09AB	8.09AB	1.09AB	1.09AB	57.54D	57.40DE
Non traditional								
Garlic oil	8.80A	8.78A	8.18A	8.00A	1.08B	1.10AB	57.4DE	57.42DE
Pro-Gib plus	8.76A	8.77A	7.92C-F	7.95B-E	1.12A	1.12A	57.41DE	57.81D
Hot water	8.69AB	8.71AB	7.97BCD	7.79EFG	1.09AB	1.09AB	57.36E	57.30E
Yeast	8.64ABC	8.62ABC	7.79E-G	8.03A-C	1.09AB	1.09AB	57.36I	56.34I
Waxing								
Control + wax	8.71AB	8.64ABC	8.03A-C	8.03A-C	1.09AB	1.09AB	56.79GH	58.81G-H
0.50 KGy+wax	8.82A	8.82A	8.05A-C	8.04A-C	1.10AB	1.10AB	57.76C	57.69C
0.75 KGy+wax	8.82A	8.83A	7.96B-E	7.96B-E	1.11AB	1.11AB	57.79C	57.72C
Fungicides+wax	8.64ABC	8.84A	7.77FB-D	7.76B-D	1.14A	1.14A	57.94B	57.92B
Garlic oil +wax	8.82A	8.71AB	8.03A-C	8.03A-C	1.09AB	1.09AB	58.18A	58.21A
Pro-Gib plus + wax	8.84A	8.85A	7.89A-C	7.89A-C	1.12A	1.13A	58.26A	58.27A
Hot water +wax	8.82A	8.78A	7.95B-E	7.95B-E	1.10AB	1.10AB	57.98B	57.96B
Yeast + wax	8.67AB	8.78A	7.90C-F	7.96C-F	1.10AB	1.10AB	56.68H	56.97GH

Table (7-B): Effect of package type

Parameters Season	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
Treatment	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.74A	8.72A	8.03A	8.00A	1.09B	1.09B	58.49B	58.40B
Carton	8.65B	8.62B	7.89B	7.87B	1.10B	1.10B	55.01C	55.23C
Polyethylene + carton	8.80A	8.79A	7.87B	7.89B	1.12A	1.11A	58.63A	59.00A

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Table (7-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg/100 ml juice					
	Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	8.46	8.41	8.40	8.41	8.73	8.72	7.64	7.64	7.62	7.60	7.63	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65	7.65
Control	CD	CD	D	D	A-D	A-D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Irradiation 0.50 kGy	8.73	8.72	8.60	8.61	8.80	8.80	7.90	7.91	7.72	7.68	7.92	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90
	A-D	A-D	CD	CD	ABC	ABC	C	C	DE	DE	C	C	C	C	C	C	C	C	C	C	C	C	C	C
0.75 kGy	8.66	8.62	8.80	8.82	8.73	8.71	7.90	7.92	7.80	7.80	8.03	8.04	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03	8.03
	B-D	B-D	CD	CD	A-D	A-D	C	C	D	D	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Fungicides	8.65	8.65	8.73	8.71	8.80	8.81	7.92	7.90	7.80	7.85	7.98	7.97	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98	7.98
	A-D	A-D	A-D	A-D	ABC	A-C	C	C	D	D	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Non traditional Garlic oil	8.83	8.81	8.80	8.82	8.66	8.61	8.00	8.00	7.93	7.92	8.13	8.15	8.13	8.13	8.13	8.13	8.13	8.13	8.13	8.13	8.13	8.13	8.13	8.13
	A-C	A-C	ABC	A-C	A-D	A-D	BC	BC	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Pro-Gib plus	8.73	8.72	8.80	8.82	8.73	8.71	8.03	8.02	7.97	7.96	8.23	8.24	8.23	8.23	8.23	8.23	8.23	8.23	8.23	8.23	8.23	8.23	8.23	8.23
	A-D	A-D	ABC	A-C	A-D	A-C	BC	BC	BC	BC	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
Hot water	8.66	8.61	8.60	8.61	8.80	8.81	7.86	7.89	7.80	7.80	7.93	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92
	A-D	A-D	BCD	B-D	ABC	A-C	C	C	D	D	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Yeast	8.40	8.41	8.40	8.41	8.60	8.62	7.78	7.78	7.75	7.75	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90
	D	D	D	D	B-D	B-D	D	D	D	D	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Waxing Control + wax	8.80	8.81	8.46	8.48	8.86	8.67	7.92	7.92	7.67	7.65	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92	7.92
	A-C	A-C	CD	CD	AB	AB	C	C	E	E	C	C	C	C	C	C	C	C	C	C	C	C	C	C
0.50kGy + wax	8.86	8.87	8.66	8.67	8.93	8.91	7.93	7.93	7.73	7.72	8.16	8.18	8.16	8.16	8.16	8.16	8.16	8.16	8.16	8.16	8.16	8.16	8.16	8.16
	AB	AB	A-D	A-D	AB	AB	C	C	DE	DE	B	B	B	B	B	B	B	B	B	B	B	B	B	B
0.75kGy + wax	8.66	8.67	8.73	8.72	8.86	8.87	7.92	7.91	7.84	7.83	8.18	8.15	8.18	8.15	8.15	8.15	8.15	8.15	8.15	8.15	8.15	8.15	8.15	8.15
	ABC	AB	A-D	A-D	AB	AB	C	C	D	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Fungicides+wax	8.80	8.81	8.86	8.88	8.80	7.82	7.95	7.98	7.90	7.90	8.03	8.00	8.03	8.00	8.03	8.00	8.03	8.00	8.03	8.00	8.03	8.00	8.03	8.00
	A-C	A-C	AB	AB	A-C	A-C	BC	BC	C	C	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Garlic oil+wax	8.93	8.86	8.40	8.41	8.86	8.87	8.03	8.02	8.00	8.00	8.40	8.39	8.40	8.39	8.40	8.39	8.40	8.39	8.40	8.39	8.40	8.39	8.40	8.39
	AB	A-C	D	D	AB	AB	BC	BC	BC	BC	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Pro-Gib plus + wax	8.80	8.92	8.60	8.61	9.00	9.01	8.12	8.12	8.06	8.05	8.25	8.24	8.25	8.24	8.25	8.24	8.25	8.24	8.25	8.24	8.25	8.24	8.25	8.24
	ABC	AB	BCD	B-D	A	A	B	B	BC	BC	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
Hot water + wax	8.80	8.80	8.80	8.81	8.86	8.87	7.94	7.95	7.90	7.88	8.08	8.05	8.08	8.05	8.08	8.05	8.08	8.05	8.08	8.05	8.08	8.05	8.08	8.05
	ABC	A-C	ABC	ABC	A-C	AB	BC	BC	C	C	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC	BC
Yeast + wax	8.67	8.66	8.60	8.62	8.73	8.77	7.90	7.90	7.80	7.80	7.92	7.94	7.92	7.94	7.92	7.94	7.92	7.94	7.92	7.94	7.92	7.94	7.92	7.94
	A-D	A-D	BCD	B-D	A-D	A-C	C	C	D	D	C	C	C	C	C	C	C	C	C	C	C	C	C	C

A glance to Table (7-B) data of seasons (1999 & 2000) showed that polyethylene and polyethylene plus carton packages significantly increased total soluble solids percentage as compared with carton package. However, polyethylene package increased total acidity values in relation to carton and polyethylene plus carton packages. Meanwhile, polyethylene plus carton package significantly increased T.S.S. / acid ratio and ascorbic acid contents in relation to the other two packages under study of both seasons. Furthermore, Table (7-C) indicate that pro-Gib plus waxing in polyethylene plus carton package increased total soluble solids percentage statistically in both seasons. On contrast, garlic oil plus waxing in polyethylene plus carton package induced significant increase in total acidity values in fruit juice as compared with the other combinations in this respect of both seasons. On the other hand, combinations of storage treatments and package types failed to induce any statistical differences among them when T.S.S / acid ratio was concerned. However, significant increase of ascorbic acid content occurred when pro-Gib plus waxing in polyethylene plus carton package was used.

Regarding the effect of postharvest treatments on the chemical properties of lime fruits after 30 days storage at room temperature in both seasons Table (8-A) clarify that fruits treated by different treatments plus waxing surpassed the fruits of the corresponding ones without waxing in total soluble solids. However, garlic oil plus waxing, pro-Gib plus waxing and irradiation doses (0.50 and 0.75 kGy) plus waxing showed the highest values of total soluble solids followed by the control plus

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waxing among the other treatments used in both seasons. Meanwhile, hot water plus waxing treatment succeeded in increasing total acidity values after 30 days of stored lime fruits under room temperature followed by fungicides plus waxing treatment then pro-Gib as compared with the other used treatments and the control. On the other hand, no significant differences were noticed between different treatments when T.S.S. / acid ratio was concerned. Moreover, highest irradiation dose (0.75 KGy) plus waxing and pro-Gib plus waxing induced the higher significant effect in increasing ascorbic acid content followed by the lower irradiation dose (0.50 KGy) plus waxing as compared with the other used treatments and the control in both seasons.

Concerning Table (8-B) data of both seasons (1999 & 2000) showed that polyethylene plus carton package significantly increased total soluble solids percentage and T.S.S. / acid ratio as compared with polyethylene and carton packages. However, carton and polyethylene plus carton packages significantly reduced total acidity values as compared with polyethylene package. Meanwhile, polyethylene plus carton package significantly increased ascorbic acid content followed by polyethylene and carton packages in a descending order.

Furthermore, Table (8-C) and Fig. (7-12) indicates that combinations of postharvest treatments and package types failed to induce any statistical differences among them when T.S.S. / acid ratio was concerned.

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Table (8): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at room temperature.

Table (8-A): Effect of post harvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	8.33CD	8.30C-D	7.46I	7.46I	1.11A	1.10A	55.89H	55.86H
Irradiation								
0.50 KGy	8.42B-D	8.42B-D	7.54HI	7.53HI	1.11A	1.12A	55.96H	55.95H
0.75 KGy	8.40CD	8.41C-D	7.96C-F	7.96C-F	1.05A	1.06A	55.90H	55.92H
Fungicides	8.40CD	8.41CD	7.97B-F	7.88B-F	1.06A	1.07A	56.39F	56.38F
Non traditional								
Garlic oil	8.46A-D	8.47A-D	8.05B-D	8.06B-D	1.04A	1.04A	56.69E	56.68E
Pro-Gib plus	8.40CD	8.42CD	8.10BC	8.12BC	1.03A	1.02A	56.98CD	56.96CD
Hot water	8.26D	8.27D	7.87G	7.86G	1.06A	1.07A	56.51F	56.50F
Yeast	8.33CD	8.30C-D	7.67H	7.66H	1.06A	1.06A	55.61I	55.61I
Waxing								
Control + wax	8.66AB	8.61AB	7.93D-G	7.92D-G	1.09A	1.08A	56.24G	56.24G
0.50 KGy+wax	8.73A	8.74A	7.94D-G	4.92D-G	1.08A	1.09A	57.18B	57.15B
0.75 KGy+wax	8.73A	8.74A	7.90E-G	7.91E-G	1.10A	1.09A	57.48A	55.49A
Fungicides+wax	8.60ABC	8.60A-C	8.14B	8.15B	1.04A	1.05A	56.91D	56.91D
Garlic oil +wax	8.73A	8.74A	7.87FG	7.86FG	1.11A	1.11A	57.13BC	57.14BC
Pro-Gib plus + wax	8.71A	8.71A	7.87FG	7.86F-G	1.10A	1.10A	57.53A	57.59A
Hot water +wax	8.60ABC	8.60A-C	8.25A	8.26A	1.04A	1.04A	56.98CD	56.97C-D
Yeast + wax	8.53A-D	8.51A-D	8.03B-E	8.01B-E	1.11A	1.10A	55.81H	55.80H

Table (8-B): Effect of package type

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.45B	8.52B	8.02A	8.01B	1.06B	1.06B	57.51B	57.52B
Carton	8.35B	8.32B	7.80B	7.81B	1.05B	1.05B	54.34C	54.30C
Polyethylene + carton	8.76A	8.80A	7.88B	8.80A	1.11A	1.12A	57.88A	75.99A

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Table (8-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg/100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	8.20	8.21	8.00	8.00	8.40	8.40	7.68	7.65	7.10	7.12	7.80	7.80	1.12	1.13	1.12	1.13	1.11	1.12	57.00	57.01	55.30	55.30	57.35	57.36
Control	C	C	CD	CD	B	B	E	E	G	G	D	D	A	A	A	A	A	A	K	K	QR	QR	IJ	IJ
Irradiation	8.40	8.40	8.07	8.07	8.60	8.61	7.90	7.89	7.36	7.37	8.04	8.06	1.10	1.01	1.08	1.09	1.26	1.26	57.30	57.31	53.48	53.49	57.58	57.58
0.50 kGy	B	B	C	C	AB	AB	C	C	F	F	BC	B	A	A	A	A	A	A	J	K	PQ	PQ	GHI	GHI
0.75 kGy	8.40	8.40	8.12	8.10	8.80	8.82	7.90	7.90	7.72	7.75	8.06	8.07	1.03	1.03	1.01	1.01	1.12	1.12	57.30	57.31	53.48	53.40	57.28	57.28
1.00 kGy	B	B	C	C	A	A	C	C	DE	D	B	B	A	A	A	A	A	A	J	J	PQ	Q	C	C
Fungicides	8.40	8.41	8.10	8.10	8.80	8.81	7.90	7.90	7.83	7.84	8.10	8.11	1.03	1.04	1.03	1.03	1.14	1.15	57.35	57.34	54.31	54.18	57.65	57.60
Non traditional	B	B	C	C	A	A	C	C	D	D	B	B	A	A	A	A	A	A	IJ	IJ	O	O	F-H	F-H
Garlic oil	8.60	8.60	8.40	8.40	8.80	8.80	8.00	8.00	7.93	7.92	8.15	8.14	1.05	1.04	1.01	1.01	1.07	1.07	57.52	57.50	53.41	54.20	58.35	58.31
Pro-Gib plus	AB	AB	B	B	A	A	BC	BC	C	C	AB	AB	A	A	A	A	A	A	G-J	G-J	Q	Q	BC	BC
Hot water	8.60	8.60	8.40	8.40	8.80	8.81	8.00	8.00	7.95	7.95	8.22	8.20	1.04	1.03	1.02	1.03	1.05	1.06	57.50	57.52	54.21	54.30	58.53	58.50
Yeast	AB	AB	B	B	A	A	BC	BC	C	C	AB	AB	A	A	A	A	A	A	AB	AB	O	O	AB	AB
Control	8.40	8.40	8.10	8.10	8.80	8.81	7.87	7.90	7.75	7.76	8.03	8.04	1.03	1.03	1.03	1.03	1.12	1.13	57.35	57.50	54.17	54.13	57.83	57.80
+ wax	B	B	C	C	A	A	C	C	D	D	BC	BC	A	A	A	A	A	A	FJ	FJ	O	O	EF	EF
0.75kGy + wax	8.40	8.40	8.00	8.00	8.60	8.61	7.73	7.75	7.35	7.38	7.93	7.95	1.05	1.03	1.01	1.06	1.08	1.09	57.30	57.31	54.13	52.81	57.50	57.50
Fungicides + wax	B	B	CD	CD	AB	AB	DE	D	F	F	C	C	A	A	A	A	A	A	K	K	O	S	G-J	G-J
Garlic oil + wax	8.45	8.45	8.40	8.41	8.80	8.80	7.92	7.93	7.88	7.90	8.05	8.03	1.04	1.04	1.13	1.07	1.04	1.04	EFG	E-G	N	N	DE	DE
Pro-Gib plus + wax	AB	AB	B	B	A	A	BC	BC	C	C	BC	BC	A	A	A	A	A	A	AB	AB	L	L	A	A
Hot water + wax	8.65	8.65	8.60	8.60	8.81	8.82	8.10	8.09	8.05	8.06	8.27	8.25	1.06	1.05	1.13	1.13	1.43	1.43	58.60	58.61	55.00	55.00	58.75	58.75
Yeast + wax	AB	AB	AB	AB	A	A	B	B	BC	B	A	A	A	A	A	A	A	A	AB	AB	M	M	A	A
Control	8.45	8.45	8.40	8.40	8.81	8.81	7.92	7.92	7.88	7.87	8.08	8.07	1.03	1.06	1.06	1.02	1.07	1.06	57.63	57.61	55.00	53.12	58.32	58.33
+ wax	B	B	B	B	A	A	C	C	C	C	B	B	A	A	A	A	A	A	F-I	F-I	N	R	BC	BC
Yeast + wax	8.40	8.40	8.20	8.20	8.61	8.61	7.90	7.90	7.44	7.42	7.95	7.93	1.04	1.04	1.03	1.17	1.06	1.07	57.30	57.31	55.00	53.12	57.60	57.60
Control	B	B	C	C	AB	AB	C	C	F	F	C	C	A	A	A	A	A	A	J	J	N	R	F-I	F-I

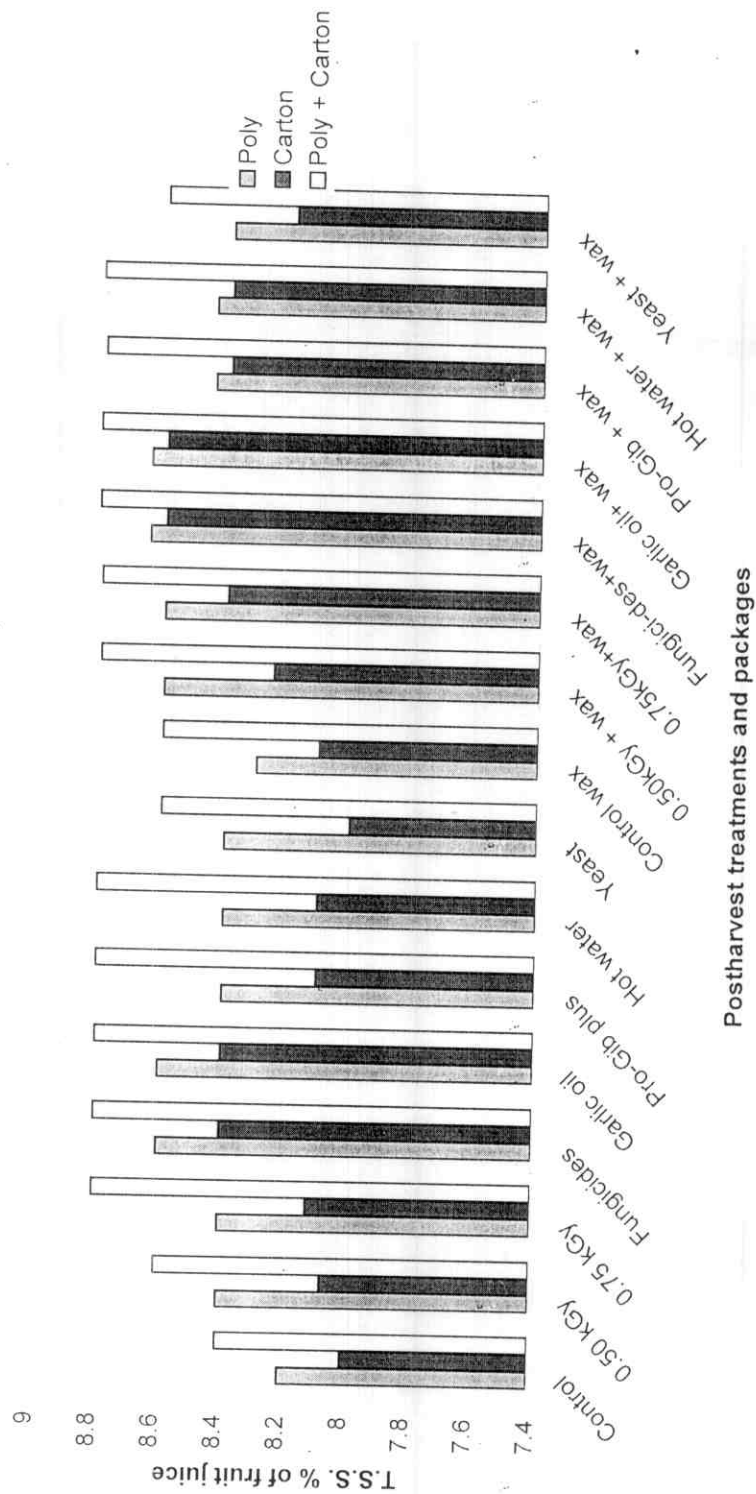


Fig. (7): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at room temperature (T.S.S. %, 1999)

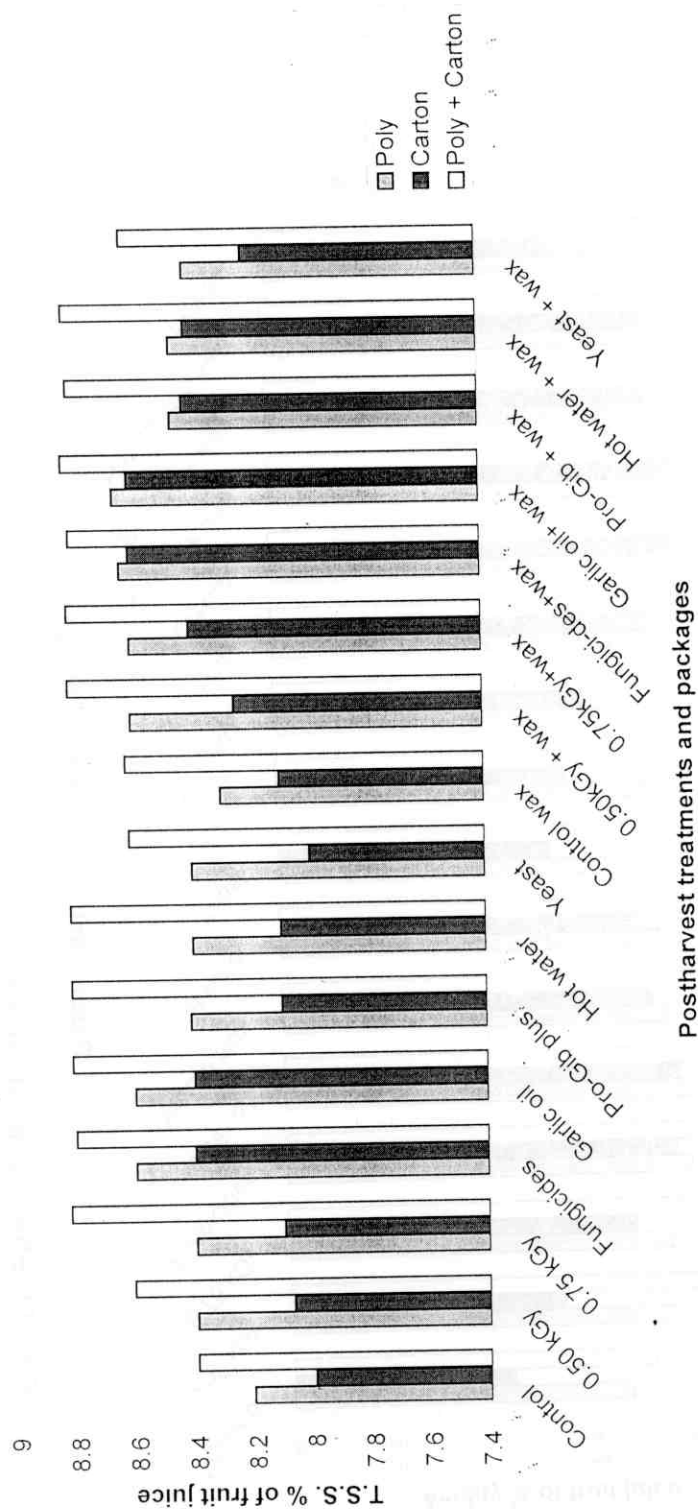


Fig. (8): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at room temperature (T.S.S. %, 2000)

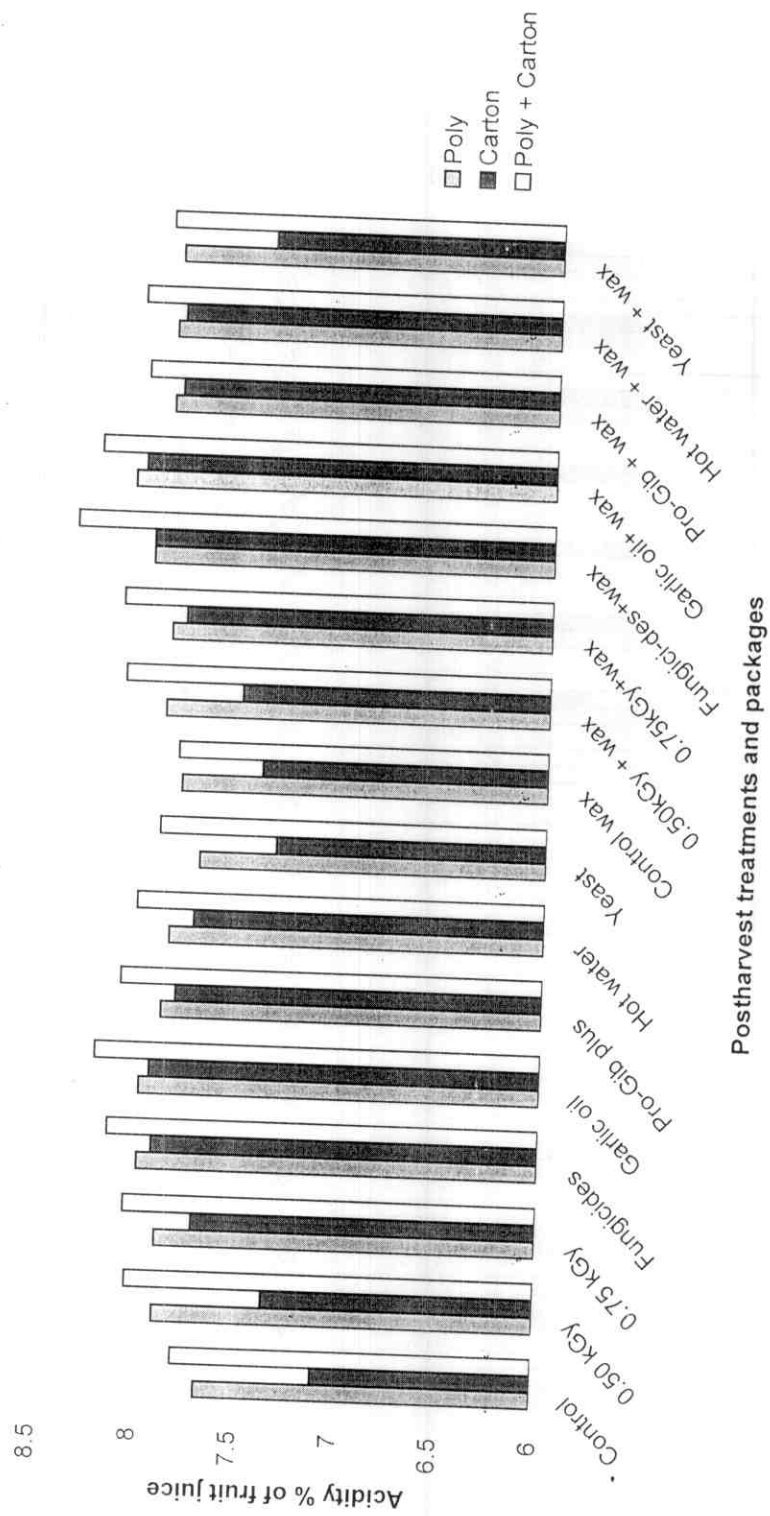


Fig. (9): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at room temperature (Acid %, 1999)

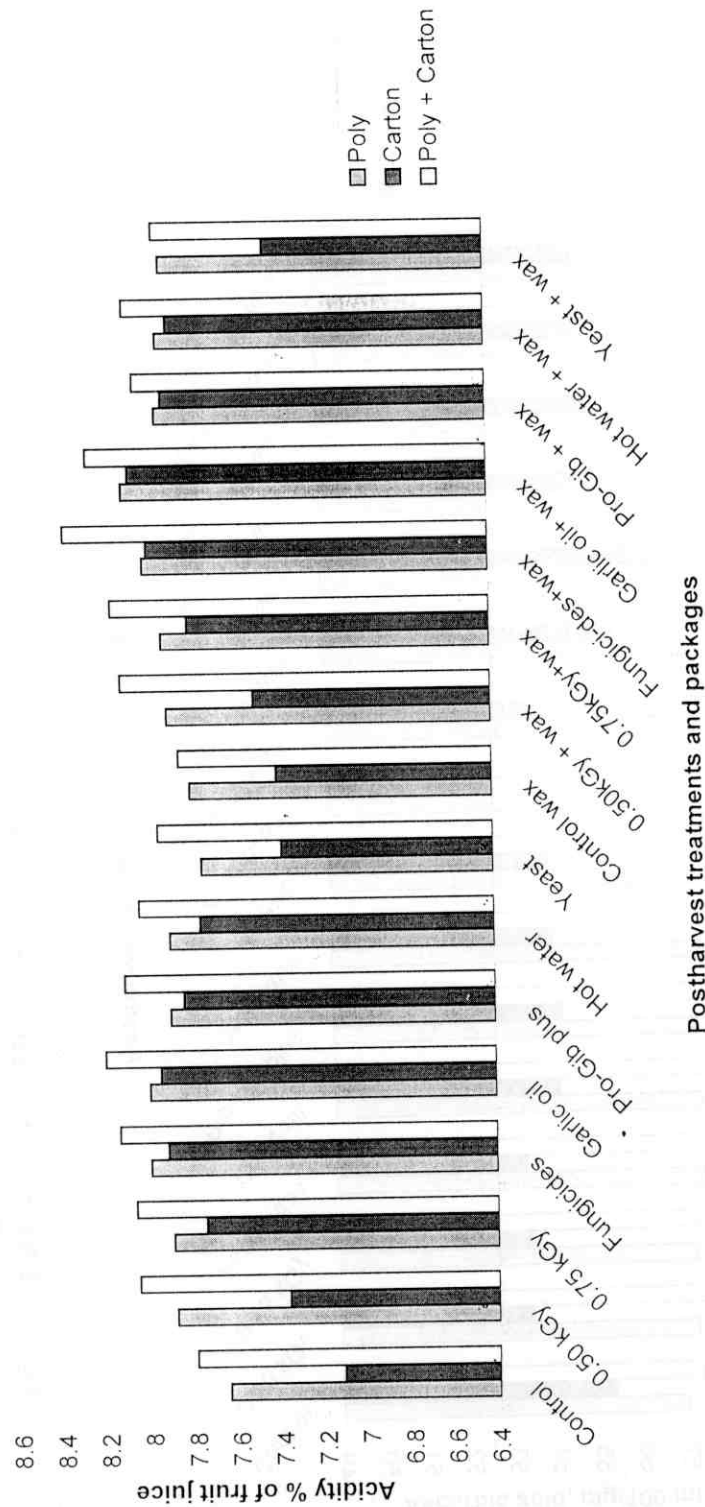


Fig. (10): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at room temperature (Acid %, 2000)

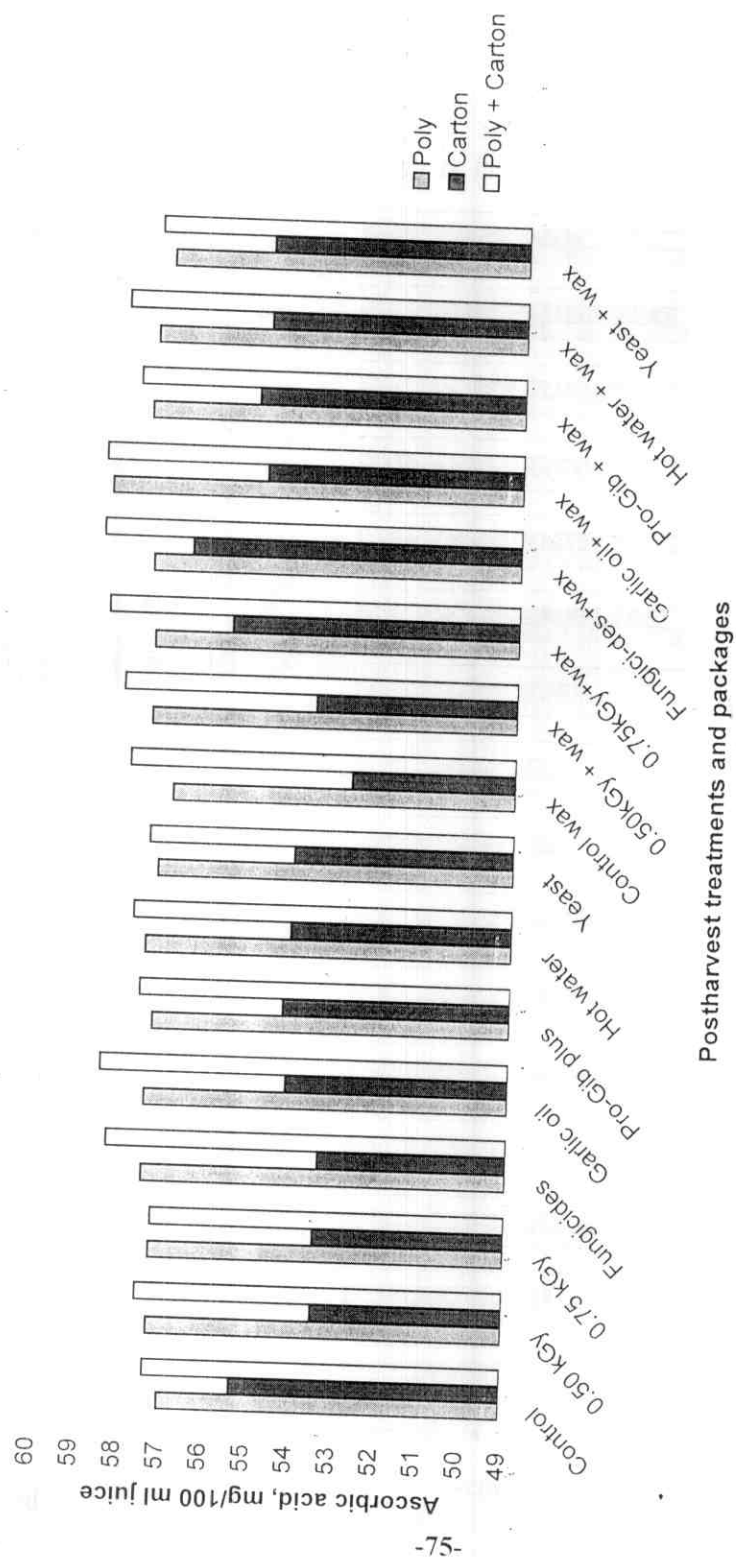


Fig. (11): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at room temperature (Ascorbic acid, 1999)

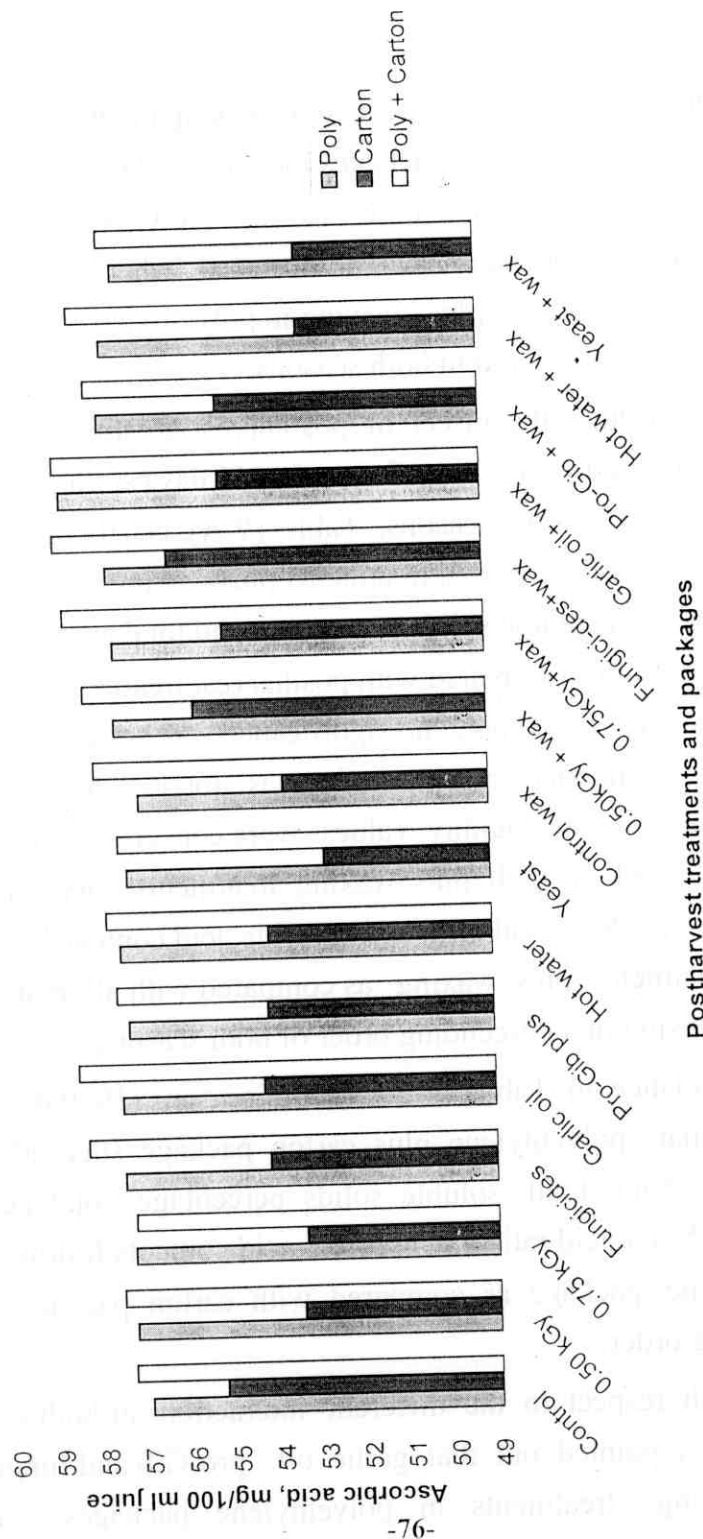


Fig. (12): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at room temperature (Ascorbic acid, 2000)

On contrast, all treatments plus waxing in either carton or polyethylene plus carton packages increased total soluble solids percentage statistically in both seasons. However, significant increase in ascorbic acid content occurred when pro-Gib plus waxing and garlic oil plus waxing in polyethylene plus carton package were considered in both seasons.

Regarding the effect of postharvest treatments on the chemical properties of lime fruits after 45 days storage at room temperature of both seasons, Table (9-A) clarify that fruits treated with different used treatments plus waxing succeeded in increasing total soluble solids percentage and total acidity values in relation to fruits treated with postharvest treatments without waxing. On the other hand, no significance was noticed between different treatments plus waxing as total soluble solids percentage and total acidity values were concerned. However, garlic oil and pro-Gib plus waxing treatments succeeded in increasing T.S.S. / acid ratio and ascorbic acid content followed by all treatments plus waxing as compared with all treatments without waxing in a descending order of both seasons.

A glance to Table (9-B) data of seasons (1999 & 2000) showed that polyethylene plus carton package succeeded in increasing fruit total soluble solids percentage, total acidity values, T.S.S. / acid ratio and ascorbic acid contents followed by polyethylene package as compared with carton package in a descending order.

With respect to the different interactions of both seasons Table (9-C) pointed out that garlic oil, pro-Gib and fungicides plus waxing treatments in polyethylene packages and all

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Table (9-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	-	-	-	-	8.61	8.61	-	-	-	-	7.13	7.13	-	-	-	-	1.07	1.07	-	-	-	-	55.33	55.30
Control	-	-	-	-	B	B	-	-	-	-	G	G	-	-	-	-	B	B	-	-	-	-	D	D
Irradiation 0.50	7.86	7.85	-	-	8.66	8.62	7.42	7.40	-	-	7.65	7.66	1.13	1.12	-	-	1.16	1.16	55.00	55.00	-	-	56.33	56.33
kGy	D	D	-	-	A	A	E	E	-	-	C	C	AB	AB	-	-	A	A	E	E	-	-	D	D
0.75	7.86	7.86	-	-	8.66	8.62	7.50	7.52	-	-	7.81	7.82	1.02	1.03	-	-	1.13	1.13	55.01	55.01	-	-	57.15	57.16
kGy	D	D	-	-	A	A	D	D	-	-	B	B	C	C	-	-	AB	AB	C	C	-	-	AB	AB
Fungicide	8.48	8.46	-	-	8.60	8.60	7.66	7.68	-	-	7.90	7.91	1.10	1.10	-	-	1.17	1.18	55.90	55.90	-	-	56.78	56.76
des	B	B	-	-	A	A	C	C	-	-	AB	A	A	A	-	-	A	A	CD	CD	-	-	D	D
Non traditional	8.41	8.40	-	-	8.63	8.64	7.80	7.82	-	-	7.95	7.96	1.05	1.06	-	-	1.13	1.13	56.32	56.30	-	-	57.12	57.13
Garlic oil	B	B	-	-	A	A	B	B	-	-	AB	AB	B	B	-	-	AB	AB	C	C	-	-	AB	AB
Pro-Gib plus	8.56	8.56	-	-	8.73	8.73	7.92	7.90	-	-	8.02	8.02	1.05	1.04	-	-	1.03	1.03	57.00	57.00	-	-	57.35	57.36
Hot water	B	B	-	-	A	A	AB	AB	-	-	A	A	B	B	-	-	C	C	B	B	-	-	A	A
Yeast	8.26	8.20	-	-	8.80	8.80	7.70	7.70	-	-	7.84	7.85	1.05	1.06	-	-	1.03	1.03	56.01	56.01	-	-	56.80	56.80
Waxing Control	C	C	-	-	A	A	C	C	-	-	B	B	B	B	-	-	C	C	C	C	-	-	E	E
+ wax	7.90	7.90	-	-	8.60	8.60	7.52	7.53	-	-	7.80	7.83	1.17	1.16	-	-	1.14	1.14	55.00	55.00	-	-	56.00	56.00
0.50kGy	D	D	-	-	A	A	D	D	-	-	B	B	A	A	-	-	A	A	E	E	-	-	C	C
+ wax	7.86	7.82	8.00	8.00	8.60	8.60	7.18	7.13	7.00	7.00	7.33	7.34	1.06	1.05	1.00	1.00	1.13	1.14	55.00	55.00	52.00	52.00	56.20	56.21
0.75kGy	D	D	C	C	A	A	G	D	H	H	7.33	7.34	B	B	C	C	A	A	E	E	G	G	C	C
+ wax	8.00	8.00	8.00	8.00	8.60	8.60	7.55	7.53	7.30	7.30	7.94	7.94	1.01	1.02	1.00	1.00	1.16	1.17	55.63	55.63	52.10	52.10	56.00	56.01
Fungicide	8.20	8.20	7.56	7.56	8.00	8.00	7.65	7.63	7.32	7.32	7.79	7.97	1.04	1.04	1.03	1.03	1.14	1.14	56.12	56.12	53.10	53.10	57.65	57.63
des+wax	C	C	E	E	A	A	C	C	F	F	AB	AB	B	B	C	C	A	A	C	C	F	F	A	A
Garlic oil	8.60	8.62	7.73	7.73	8.80	8.80	7.80	7.80	7.35	7.35	7.96	7.98	1.06	1.07	1.03	1.03	1.11	1.11	56.00	56.00	53.67	53.67	56.60	56.61
Pro-Gib plus + wax	A	A	D	D	A	A	B	B	E	E	AB	AB	B	B	C	C	AB	AB	C	C	F	F	BC	BC
Garlic oil + wax	8.60	8.61	7.70	7.70	8.60	8.60	7.90	7.90	7.50	7.50	8.06	8.07	1.13	1.14	1.03	1.03	1.14	1.15	56.77	56.70	53.65	53.65	57.67	57.68
Pro-Gib plus + wax	A	A	D	D	A	A	AB	AB	D	D	A	A	AB	AB	C	C	A	A	BC	BC	F	F	A	A
Hot water + wax	8.60	8.62	7.73	7.73	8.80	8.80	7.95	7.95	7.56	7.56	8.08	8.09	1.04	1.06	1.03	1.03	1.16	1.17	56.30	56.32	53.78	53.78	57.33	57.31
Yeast + wax	A	A	D	D	A	A	AB	AB	D	D	A	A	B	B	C	C	A	A	C	C	F	F	A	A
Hot water + wax	8.40	8.42	7.60	7.62	8.80	8.80	7.80	7.82	7.40	7.38	7.99	8.00	1.03	1.02	1.07	1.07	1.08	1.09	56.30	56.31	53.72	53.72	56.01	56.11
Yeast + wax	B	B	E	E	A	A	B	B	E	E	A	A	C	C	C	C	B	B	C	C	F	F	C	C
	8.40	8.42	7.40	7.42	8.66	8.67	7.68	7.66	7.30	7.30	7.90	7.90	1.09	1.09	1.01	1.01	1.08	1.08	55.10	55.11	52.00	52.00	56.00	56.00
	B	B	E	E	A	A	C	C	F	F	AB	AB	B	B	C	C	B	B	E	E	G	G	C	C

Regarding the effect of postharvest treatments on the chemical properties of lime fruits after 60 days storage at room temperature, Table (10-A) indicate that different fruit treatments under study behaved similarly with those mentioned before in Table (9-A).

Regarding the effect of package type in the two seasons (1999, 2000) it is quite evident from Table (10-B) that polyethylene plus carton package significantly increased T.S.S., Acidity, T.S.S./acid ratio and ascorbic acid contents as compared with polyethylene package. On the other hand, the fruits kept in carton package didn't survive and were discarded.

Dealing with the interaction between postharvest treatments and package type of both seasons as shown in Table (10-C). It is clear that all treatments in polyethylene plus carton package increased total soluble solids percentage as well as total acidity values. Meanwhile, significant increase of ascorbic acid content occurred when pro-Gib, garlic oil and hot water treatments plus waxing in polyethylene plus carton packages as well as pro-Gib and garlic oil unwaxed treatments in polyethylene plus carton packages were used in both seasons. However, combinations of all treatments under study packed in carton boxes as well as unwaxed treatments and waxed control, irradiation doses (0.50 & 0.75 kGy) and yeast treatments packed in polyethylene failed to continue in storage and were neglected.

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Table (10): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at room temperature.

Table (10-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	7.36D	7.38D	4.93E	4.92E	1.22B	1.22B	49.95F	49.90F
<u>Irradiation</u>								
0.50 KGy	7.50C	7.42CD	5.30D	5.29D	1.25A	1.24B	50.11E	49.99EF
0.75 KGy	7.63C	7.63C	5.85C	5.84C	1.09D	1.10E	50.05E	50.00E
Fungicides	8.20A	8.20A	6.65A	6.64A	1.20C	1.21C	55.55C	55.99BC
<u>Non traditional</u>								
Garlic oil	8.06B	8.05B	6.58A	6.59A	1.24B	1.23B	56.10B	56.12B
Pro-Gib plus	8.10B	8.12B	6.85A	6.84A	1.18D	1.17D	56.76A	56.79A
Hot water	7.90B	7.91B	6.24B	6.23B	1.27A	1.26A	55.80C	55.79C
Yeast	7.50C	7.42CD	6.46B	6.45B	1.10E	1.11E	49.93F	49.90F
<u>Waxing</u>								
Control + wax	7.36D	7.41CD	5.03D	5.04D	1.19C	1.20C	50.00E	50.00E
0.50 KGy+wax	7.53C	7.52C	5.64C	5.63C	1.09E	1.09E	50.21E	50.21E
0.75 KGy+wax	8.36A	8.37A	6.74A	6.72A	1.23B	1.22B	53.65D	53.60D
Fungicides+wax	8.30A	8.31A	6.72A	6.71A	1.20C	1.20C	55.88C	55.87C
Garlic oil +wax	8.43A	8.44A	6.56A	6.54A	1.26A	1.25A	56.22B	56.20B
Pro-Gib plus + wax	8.43A	8.42A	6.84A	6.83A	1.23B	1.22B	56.98A	56.96A
Hot water +wax	8.20A	8.21A	6.82A	6.80A	1.19C	1.20C	56.17B	56.17B
Yeast + wax	7.83C	7.83C	6.31B	6.30B	1.25A	1.24B	53.46D	53.43D

Table (10-B): Effect of package type

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	7.43B	7.30B	5.99B	5.98B	1.24B	1.22B	51.81B	52.10B
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	8.17A	8.19A	6.44A	6.40A	1.27A	1.28A	55.48A	55.40A

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Table (10-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicides	7.86	7.82	7.53	7.51	6.31	6.32	6.31	6.32	6.31	6.32	6.31	6.32	6.31	6.32	6.31	6.32	6.31	6.32	6.31	6.32	6.31	6.32	6.31	6.32
Non traditional	7.93	7.90	8.26	8.27	8.27	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27
Garlic oil	7.93	7.90	8.26	8.27	8.27	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27
Pro-Gib plus	7.93	7.90	8.26	8.27	8.27	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27	8.26	8.27
Hot water	7.86	7.85	7.93	7.90	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26
Yeast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waxing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75kGy + wax	8.30	8.31	8.33	8.31	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51
Fungicides + wax	8.00	8.00	8.30	8.31	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52	6.51	6.52
Garlic oil + wax	8.30	8.32	8.36	8.30	6.09	6.08	6.09	6.08	6.09	6.08	6.09	6.08	6.09	6.08	6.09	6.08	6.09	6.08	6.09	6.08	6.09	6.08	6.09	6.08
Pro-Gib plus + wax	8.30	8.30	8.36	8.32	6.77	6.76	6.77	6.76	6.77	6.76	6.77	6.76	6.77	6.76	6.77	6.76	6.77	6.76	6.77	6.76	6.77	6.76	6.77	6.76
Hot water + wax	8.00	8.00	8.30	8.31	6.60	6.61	6.60	6.61	6.60	6.61	6.60	6.61	6.60	6.61	6.60	6.61	6.60	6.61	6.60	6.61	6.60	6.61	6.60	6.61
Yeast + wax	7.73	7.70	7.93	7.95	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25	6.26	6.25

Referring to the effect of postharvest treatments on chemical properties of lime fruits after 75 days storage at room temperature, Table (11-A) clarify that pro-Gib plus waxing showed the highest total soluble solids percentage and total acidity values followed by fungicides plus waxing and garlic oil plus waxing then hot water plus waxing as compared with the other used treatments of both seasons. However, the highest irradiation dose (0.75 KGy) and fungicides treatments gave significantly the highest T.S.S. / acid ratio in fruits followed by garlic oil and pro-Gib as well as garlic oil and highest irradiation dose (0.75) treatments plus waxing as compared with other used treatments of both seasons. However, pro-gib and garlic oil treatments plus waxing increased ascorbic acid content in fruits followed by fungicides and hot water treatments plus waxing as compared with the other used treatments of two seasons.

Meanwhile, waxed and unwaxed control and yeast as well as unwaxed 0.50 and 0.75 kGy irradiation and hot water fruit treatments were failed to survive 75 days storage period.

Considering Table (11-B) it is obvious that polyethylene plus carton package gave significantly highest total soluble solids percentage, total acidity values, T.S.S. / acid ratio and ascorbic acid contents as compared with polyethylene package of both seasons.

Dealing with the interaction between postharvest treatment and package type of both seasons as shown in Table (11-C) it is obvious that pro-Gib plus waxing packed in polyethylene plus carton induced significant increase in total soluble solids percentage as compared with the other

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combinations in this respect of both seasons. However, significant increase in total acidity values occurred when pro-Gib or pro-Gib plus waxing in either polyethylene or polyethylene plus waxing were used. Furthermore, highest irradiation dose (0.75 KGy) plus waxing in polyethylene plus carton increased T.S.S. / acid ratio statistically in comparison with all other package combinations of both seasons. Meanwhile, significantly increase in ascorbic acid content occurred when pro-Gib plus waxing and fungicide treatments were used.

However, combinations of all treatments under study failed to continue in storage and were discarded when either carton and polyethylene packages were used except unwaxed pro-Gib, garlic oil, hot water and fungicides treatments packed in polyethylene. In addition, unwaxed and waxed control and yeast as well as unwaxed 0.5 kGy irradiation and hot water fruit treatments failed to survive.

Table (12-A) show the effect of postharvest treatments on chemical properties of lime fruits after 90 days storage at room temperature. It is quite evident that all treatments did not show any effect on chemical properties up to 90 days under room temperature except garlic oil and pro-Gib treatments either without waxing or plus waxing in both seasons. However, pro-Gib treatment gave significantly good total soluble solids percentage, total acidity values, T.S.S. / acid ratio and ascorbic acid contents as compared with garlic oil treatment in both seasons.

Generally, treated fruits surpassed untreated ones (control) in improving all chemical properties under study up to

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60 days of postharvest. However, combinations of waxing, pro-Gib and garlic oil treatments when packed in polyethylene plus carton prolonged fruit storage with good chemical properties under room temperature up to 90 days of storage.

These results are in partial agreement with the findings of **Chattopadhyay *et al.* (1992)** on sweet orange. They reported that fruits treated with 50 ppm GA_3 or 0.5% calcium nitrate increased T.S.S., while acidity and ascorbic acid contents decreased. Besides, **Baez-Sanudo *et al.* (1994)** concluded that fruits treated with TBZ had little effect on T.S.S. and acidity. While, **Miller and McDonald (1996)** on Florida grapefruit reported that juice T.S.S., titratable acidity and the resulting ratio were not affected by GA_3 .

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Table (11): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 75 days storage at room temperature.

Table (11-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
Irradiation								
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	7.60C	7.61C	5.30E	5.30E	1.43A	1.42A	48.00D	48.01D
Fungicides	7.50CD	7.51CD	5.38E	5.36E	1.39A	1.38A	49.92C	49.90C
Non traditional								
Garlic oil	7.40D	7.41D	5.72D	5.70D	1.29B	1.30B	48.43D	48.40D
Pro-Gib plus	7.50CD	7.51CD	5.63D	5.60D	1.33B	1.34B	49.38C	49.37C
Hot water	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-
Waxing								
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	7.50CD	7.51CD	5.40E	5.41E	1.38B	1.37B	48.66D	49.60D
0.75 KGy+wax	7.53CD	7.52CD	5.78D	5.78D	1.30B	1.30B	48.51D	48.50D
Fungicides+wax	7.90B	7.91B	6.42B	6.41B	1.23C	1.22C	51.14B	51.16B
Garlic oil +wax	7.83B	7.82B	6.31BC	6.32BC	1.24C	1.24C	51.71A	51.73A
Pro-Gib plus + wax	8.20A	8.21A	7.02A	7.03A	1.16C	1.17C	52.31A	52.36A
Hot water +wax	7.90B	7.90B	6.27BC	6.26BC	1.25C	1.24C	51.63B	51.60B
Yeast + wax	-	-	-	-	-	-	-	-

Table (11-B): Effect of package type

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	5.24B	5.20B	6.21B	6.20B	1.10B	1.09B	50.46B	50.40B
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	7.61A	7.63A	6.32A	6.31A	1.21A	1.22A	52.85A	52.95A

RESULTS & DISCUSSION

Table (11-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid %					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Package	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Season	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non traditional	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garlic oil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pro-Gib plus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waxing Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicides+wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garlic oil+wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pro-Gib plus + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot water + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table (12): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 90 days storage at room temperature.

Table (12-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
<u>Irradiation</u>								
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	-	-	-	-	-	-	-	-
Fungicides	-	-	-	-	-	-	-	-
<u>Non traditional</u>								
Garlic oil	7.60B	7.62B	5.20B	5.20B	1.46B	1.46B	46.50B	45.50B
Pro-Gib plus	8.00A	8.01A	5.60A	5.61A	1.42A	1.42A	48.76A	48.70A
Hot water	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-
<u>Waxing</u>								
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	-	-	-	-	-	-	-	-
0.75 KGy+wax	-	-	-	-	-	-	-	-
Fungicides+wax	-	-	-	-	-	-	-	-
Garlic oil +wax	7.80B	7.82B	5.40B	5.40B	1.44B	1.44B	47.52B	47.50B
Pro-Gib plus + wax	8.20A	8.20A	5.80A	5.83A	1.41A	1.40A	49.67A	49.63A
Hot water +wax	-	-	-	-	-	-	-	-
Yeast + wax	-	-	-	-	-	-	-	-

RESULTS & DISCUSSION

4-2- Effect of postharvest treatments and package types on lime fruits under cold temperature.

4-2-a- Physical properties

Regarding The effect of postharvest treatments on the physical properties of lime fruits after 15 days storage under cold temperature, Table (13-A) clarify that pro-Gib and pro-Gib plus waxing treatments showed the highest fresh appearance followed by garlic oil and yeast plus waxing as well as irradiation doses (0.5 and 0.75) either with or without waxing followed by fungicides treatment as compared with all other used treatments and the control in a descending order.

Meanwhile, pro-Gib treatment significantly increased percentage of fruit juice followed by the lower irradiation dose (0.50 KGy) and pro-Gib plus waxing then Garlic oil plus waxing compared with the other used treatments and the control in both seasons. However, garlic oil and pro-Gib treatments plus waxing induced the lowest significant fruit decay and weight loss percentages among the other treatments used. A glance to Table (13-B) show that polyethylene and polyethylene plus carton packages gave significantly full fresh appearance and fruit juice percentage and decreased percentages of fruit decay and weight loss as compared with carton package in both seasons.

With respect to the different interactions, Table (13-C) pointed out that all treatments and the control in either polyethylene or polyethylene plus carton packages as well as pro-Gib and pro-Gib plus waxing in carton package maintained better fresh appearance statistically in both seasons.

RESULTS & DISCUSSION

Table (13): Effect of postharvest treatments and package types on the physical properties of lime fruits after 15 days storage under cold temperature.

Table (13-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance scores		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	4.76E	4.75E	52.10J	52.10J	2.47A	2.48A	3.87A	3.88A
Irradiation								
0.50 KGy	4.93B	4.94B	53.30B	53.31B	1.82C	1.82C	3.28C	3.29C
0.75 KGy	4.93B	4.93B	52.90EF	52.90EF	1.14G	1.14G	3.28C	3.28C
Fungicides	4.87CD	4.88CD	52.51I	52.52H	1.21FG	1.20F	3.24DE	3.24DE
Non traditional								
Garlic oil	4.93B	4.94B	52.73H	52.73G	0.97H	0.97H	3.11F	3.12F
Pro-Gib plus	5.00A	5.00A	53.56A	53.57A	0.95H	0.95H	3.12F	3.12F
Hot water	4.84CD	4.85CD	52.49I	52.50H	1.35EF	1.35EF	3.21E	3.21E
Yeast	4.83D	4.83D	52.94EF	52.95E	1.64D	1.64D	3.26CD	3.26CD
Waxing								
Control + wax	4.82E	4.48G	51.88K	51.89J	2.25B	2.25B	3.68B	3.67B
0.50 KGy+wax	4.93B	4.93B	52.84FGH	52.85F	1.41E	1.40E	3.06G	3.05G
0.75 KGy+wax	4.93B	4.93B	53.04D	53.05D	0.92H	0.95G	3.10F	3.10F
Fungicides+wax	4.83D	4.83D	53.26BC	53.27BC	1.14G	1.14G	3.01H	3.01H
Garlic oil +wax	4.95A	4.96A	53.17C	53.18C	0.75I	0.73H	2.87I	2.86I
Pro-Gib plus + wax	5.00A	5.00A	53.32B	53.32B	0.66I	0.67H	2.81J	2.81J
Hot water +wax	4.86CD	4.87CD	52.81GH	52.82FG	1.13G	1.35FF	3.01H	3.01H
Yeast + wax	4.93B	4.93B	52.97DE	52.99DE	1.36EF	1.37EF	3.11F	3.11F

Table (13-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	5.00A	5.00A	56.15A	56.10A	0.00B	0.00B	1.43B	1.50B
Carton	4.68B	4.70B	46.43B	46.46B	3.98A	3.99A	7.11A	7.32A
Polyethylene + carton	5.00A	5.00A	56.10A	56.03A	0.00B	0.00B	1.02C	1.03C

RESULTS & DISCUSSION

Table (13-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	5.00	5.00	4.30	4.20	5.00	5.00	55.91	55.92	45.00	45.00	55.40	55.42	0.00	0.00	7.43	7.50	0.00	0.00	2.06	2.06	8.03	8.04	1.52	1.53
Control	A	A	F	F	A	A	F	F	R	T	HI	HI	A	A	A	A	A	A	J	J	A	A	L	L
Irradiation 0.50 kGy	5.00	5.00	4.80	4.80	5.00	5.00	55.90	56.98	46.10	46.11	56.92	56.95	0.00	0.00	5.46	5.47	0.00	0.00	1.42	1.42	7.52	7.53	0.91	0.92
0.75 kGy	A	A	B	B	A	A	A	A	Q	Q	A	A	A	A	C	C	A	A	M	M	B	B	Q	Q
0.75 kGy	5.00	5.00	4.80	4.80	5.00	5.00	56.40	56.41	47.00	47.00	55.31	55.31	0.00	0.00	3.43	3.43	0.00	0.00	1.41	1.41	7.51	7.55	Q	Q
Fungicides	A	A	B	B	A	A	C	C	MIN	MIN	I	I	A	A	F	F	A	A	M	M	B	B	1.03	1.03
Non traditional	5.00	5.00	4.63	4.70	5.00	5.00	55.61	55.62	46.30	46.30	55.43	55.43	0.00	0.00	3.63	3.64	0.00	0.00	1.48	1.49	7.20	7.21	pp	pp
Garlic oil	A	A	C	C	A	A	G	G	O	O	HI	HI	A	A	F	F	A	A	L	L	D	D	P	P
Pro-Gib	5.00	5.00	4.80	4.80	5.00	5.00	56.15	56.18	45.80	45.81	56.24	56.26	0.00	0.00	2.43	2.43	0.00	0.00	1.41	1.42	7.00	7.00	0.91	0.91
oil	A	A	B	B	A	A	DEF	DE	R	R	CD	CD	A	A	G	G	A	A	M	M	F	F	Q	Q
Pro-Gib plus	5.00	5.00	5.00	5.00	5.00	5.00	56.67	56.70	47.10	47.10	56.92	56.93	0.00	0.00	2.86	2.87	0.00	0.00	1.42	1.42	7.03	7.05	0.92	0.92
Hot water	A	A	A	A	A	A	B	B	M	M	A	A	A	A	G	G	A	A	M	M	F	F	Q	Q
Yeast	5.00	5.00	4.55	4.56	5.00	5.00	56.42	56.45	45.14	45.15	55.93	55.93	0.00	0.00	4.06	4.07	0.00	0.00	1.41	1.41	7.099	7.10	1.12	1.13
Waxing Control	A	A	DE	DE	A	A	C	C	S	S	F	F	A	A	E	E	A	A	M	M	E	E	O	O
+ wax	5.00	5.00	4.50	4.50	5.00	5.00	55.91	55.92	45.00	45.00	56.91	56.92	0.00	0.00	4.93	4.94	0.00	0.00	1.49	1.49	7.31	7.32	0.99	0.99
0.50kGy	A	A	E	E	A	A	F	F	S	S	A	A	A	A	D	D	A	A	L	L	C	C	P	P
0.75kGy	5.00	5.00	4.46	4.47	5.00	5.00	55.02	55.00	45.00	45.00	55.62	55.62	0.00	0.00	6.76	6.47	0.00	0.00	1.60	1.62	7.53	7.54	1.91	1.91
+ wax	A	A	E	E	A	A	J	J	S	S	G	G	A	A	B	B	A	A	K	K	B	B	J	J
Fungicides-wax	5.00	5.00	4.80	4.80	5.00	5.00	56.26	56.27	46.30	46.31	55.96	55.95	0.00	0.00	4.23	4.24	0.00	0.00	1.30	1.31	7.06	7.07	0.81	0.82
Garlic oil	A	A	B	B	A	A	CD	CD	P	P	F	F	A	A	E	E	A	A	N	N	EF	EF	R	R
Pro-Gib plus	5.00	5.00	4.80	4.80	5.00	5.00	56.41	56.42	47.10	47.11	55.61	55.62	0.00	0.00	2.76	2.77	0.00	0.00	1.36	1.36	7.05	7.05	0.91	0.92
+ wax	A	A	B	B	A	A	C	C	M	M	G	G	A	A	G	H	A	A	N	N	EF	EF	Q	Q
0.75kGy	5.00	5.00	4.60	4.60	5.00	5.00	56.68	56.70	46.90	46.91	56.20	56.21	0.00	0.00	3.43	3.44	0.00	0.00	1.33	1.33	6.80	6.81	0.92	0.92
+ wax	A	A	D	D	A	A	B	B	N	N	CDE	CD	A	A	F	F	A	A	N	N	G	G	Q	Q
Fungicides-wax	5.00	5.00	4.80	4.80	5.00	5.00	56.70	56.70	46.17	46.17	56.65	56.66	0.00	0.00	2.26	2.271	0.00	0.00	1.29	1.30	6.51	6.51	0.80	0.81
Garlic oil	A	A	B	B	A	A	AB	AB	PQ	PQ	B	B	A	A	H	H	A	A	N	N	H	H	R	R
Pro-Gib plus	5.00	5.00	5.00	5.00	5.00	5.00	55.91	55.92	48.10	48.11	55.94	55.93	0.00	0.00	2.00	2.00	0.00	0.00	1.19	1.20	6.42	6.42	0.82	0.82
+ wax	A	A	A	A	A	A	G	F	K	K	FG	F	A	A	H	H	A	A	O	O	I	I	R	R
Hot water	5.00	5.00	4.60	4.80	5.00	5.00	55.51	55.52	47.61	47.62	55.31	55.32	0.00	0.00	3.40	3.40	0.00	0.00	1.34	1.35	6.76	6.76	0.92	0.92
+ wax	A	A	D	B	A	A	HI	HJ	L	L	I	I	A	A	F	O	A	A	N	N	G	G	Q	Q
Yeast + wax	5.00	5.00	4.30	4.30	5.00	5.00	56.01	56.03	47.00	47.00	55.91	55.92	0.00	0.00	4.10	4.18	0.00	0.00	1.37	1.38	7.03	7.04	0.93	0.93
wax	A	A	H	H	A	A	EEG	EF	MIN	MIN	F	F	A	A	E	E	A	A	M	M	F	F	Q	Q

However, pro-Gib and yeast treatments in polyethylene plus carton package induced significant increase in percentage of fruit juice as well as lower irradiation dose (0.50) in either polyethylene or polyethylene plus carton package as compared with the other combinations in this respect of both seasons. On contrast, all treatments and the control in either polyethylene and polyethylene plus carton packages decreased percentages of fruit decay and weight loss statistically in both seasons.

It can be noticed from Table (14-A) that many treatments showed a considerable maintenance of fresh appearance (after 30 days storage) as compared with the control of both seasons. However, fresh appearance was highest when garlic oil plus waxing treatment was used in the two seasons. Meanwhile, pro-Gib plus waxing treated fruits showed the highest fruit juice percentage and the lowest percentages of fruit decay and weight loss followed by garlic oil plus waxing among the other treatments used. Concerning irradiation doses it is clear that the highest dose (0.75 KGy) caused highest effect in increasing fruit juice percentage as compared with the lowest dose (0.5 KGy). On the other hand, no significant difference was noticed between irradiation doses when fresh appearance parameter was concerned in both seasons.

Meanwhile, Table (14-B) indicated that, data of seasons 1999 and 2000 showed that polyethylene plus carton package significantly gave maintenance better fresh appearance and percentage of fruit juice and decreased percentages of fruit decay and weight loss followed by polyethylene as compared with carton package in a descending order in both seasons.

RESULTS & DISCUSSION

Table (14): Effect of post harvest treatments and package types on the physical properties of lime fruits after 30 days storage at cold temperature.

Table (14-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	4.76F	4.77F	45.80I	45.80I	9.94A	9.82A	6.03A	6.10A
Irradiation								
0.50 KGy	4.85DE	4.86D	45.63J	45.64J	8.62D	8.92D	5.29DE	5.30DE
0.75 KGy	4.85DE	4.86D	46.53F	46.54F	7.61G	7.62G	5.24EF	5.24EF
Fungicides	4.87CD	4.88D	46.26G	46.26G	8.60D	8.59D	5.45BC	5.45BC
Non traditional								
Garlic oil	4.89C	4.88C	47.26C	47.28C	6.92H	6.93H	5.15FG	5.15FG
Pro-Gib plus	4.91B	4.92AB	46.81E	46.92E	6.63I	6.64I	5.10GH	5.10GH
Hot water	4.85DE	4.85DE	46.53F	46.55F	8.63D	8.63D	5.52B	5.54B
Yeast	4.83E	4.83E	45.50K	45.58K	9.62B	9.62B	5.53B	5.54B
Waxing								
Control + wax	4.61G	4.61G	45.76I	45.78I	9.71B	9.72B	5.37CD	5.37CD
0.50 KGy+wax	4.92AB	4.92AB	46.78E	46.80E	8.26F	8.27E	4.89IJ	4.89IJ
0.75 KGy+wax	4.93AB	4.93AB	46.97D	46.98D	7.33H	7.30G	5.00HI	5.00HI
Fungicides+wax	4.85DE	4.85DE	47.23C	47.32C	8.22F	8.30E	5.02HI	5.00HI
Garlic oil +wax	4.95A	4.96A	47.40B	47.522B	6.75I	6.76I	4.87J	4.88J
Pro-Gib plus + wax	4.92AB	4.92B	47.80A	47.89A	6.50J	6.50J	4.75K	4.75K
Hot water +wax	4.86D	4.86D	46.93D	46.52D	8.40E	8.40E	5.06GH	5.07GH
Yeast + wax	4.84DE	4.85DE	45.86H	45.98H	8.84C	8.80C	5.17FG	5.18FG

Table (14-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	4.96B	4.97B	52.19B	52.22B	1.77B	1.78B	1.83B	1.89B
Carton	4.63C	4.64C	33.63C	33.72C	22.73A	22.90A	12.70A	14.00A
Polyethylene + carton	5.00A	5.00A	53.87A	53.88A	0.00C	0.00C	1.42C	1.42C

RESULTS & DISCUSSION

Table (14-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season Control	5.00	5.00	4.30	4.31	5.00	5.00	5.00	5.00	33.00	33.00	54.20	54.20	4.10	4.15	25.73	26.00	0.00	0.00	2.551	2.551	13.53	13.55	2.011	2.001
Irradiation 0.50 kGy	5.00	5.00	4.56	4.56	5.00	5.00	5.00	5.00	32.00	33.00	53.00	53.00	2.93	2.90	22.93	22.70	0.00	0.00	1.74	1.74	12.54	12.55	1.61	1.62
0.75 kGy	5.00	5.00	4.56	4.56	5.00	5.00	5.00	5.00	34.00	34.30	53.61	53.61	0.93	0.93	21.90	22.00	0.00	0.00	1.791	1.791	12.59	12.60	1.34	1.34
0.50 kGy	5.00	5.00	4.63	4.63	5.00	5.00	5.00	5.00	33.80	33.70	53.00	53.00	2.56	2.50	23.23	23.20	0.00	0.00	1.911	1.911	13.00	13.10	1.44	1.44
Fungicides	5.00	5.00	4.63	4.63	5.00	5.00	5.00	5.00	35.00	35.30	54.10	54.10	0.00	0.00	20.77	20.80	0.00	0.00	1.791	1.791	12.36	12.40	1.31	1.30
Non traditional Garlic oil	5.00	5.00	4.73	4.73	5.00	5.00	5.00	5.00	34.31	34.31	53.80	53.80	0.00	0.00	19.90	19.80	0.00	0.00	1.821	1.821	12.30	12.35	1.20	1.20
Pro-Gib plus	5.00	5.00	4.70	4.71	5.00	5.00	5.00	5.00	34.00	34.21	54.00	54.00	2.00	2.00	23.90	23.90	0.00	0.00	1.861	1.861	13.03	13.12	1.67	1.67
Hot water	5.00	5.00	4.30	4.30	5.00	5.00	5.00	5.00	32.80	32.70	53.00	53.00	3.06	3.06	25.80	26.00	0.00	0.00	1.911	1.911	13.07	13.10	1.62	1.62
Yeast	5.00	5.00	4.30	4.30	5.00	5.00	5.00	5.00	32.30	32.30	53.00	53.19	3.83	3.80	25.30	25.70	0.00	0.00	1.861	1.861	12.63	12.60	1.63	1.63
Waxing Control + wax	5.00	5.00	4.76	4.76	5.00	5.00	5.00	5.00	33.00	33.00	54.36	54.40	2.43	2.40	22.37	22.30	0.00	0.00	1.62	1.62	11.82	11.80	1.24	1.24
0.50kGy + wax	5.00	5.00	4.80	4.81	5.00	5.00	5.00	5.00	33.20	33.10	53.90	53.91	0.00	0.00	22.00	22.00	0.00	0.00	1.76	1.76	12.02	12.00	1.22	1.22
0.75kGy + wax	5.00	5.00	4.73	4.73	5.00	5.00	5.00	5.00	34.80	34.80	54.30	54.48	2.00	2.00	22.67	22.60	0.00	0.00	1.72	1.72	11.99	11.92	1.34	1.34
Fungicides + wax	5.00	5.00	4.86	4.87	5.00	5.00	5.00	5.00	35.00	35.00	54.60	54.70	0.00	0.00	20.27	20.20	0.00	0.00	1.75	1.75	11.63	11.60	1.25	1.25
Garlic oil + wax	5.00	5.00	4.76	4.77	5.00	5.00	5.00	5.00	35.00	35.00	54.60	54.67	0.00	0.00	19.50	19.40	0.00	0.00	1.63	1.63	11.54	11.53	1.10	1.10
Pro-Gib plus + wax	5.00	5.00	4.73	4.73	5.00	5.00	5.00	5.00	34.20	34.20	55.00	55.60	2.00	2.00	23.40	23.50	0.00	0.00	1.72	1.72	12.07	12.00	1.40	1.40
Hot water + wax	5.00	5.00	4.53	4.53	5.00	5.00	5.00	5.00	32.00	32.00	53.60	53.60	2.53	2.50	24.00	24.00	0.00	0.00	1.811	1.821	12.32	12.35	1.39	1.39
Yeast + wax	5.00	5.00	4.53	4.53	5.00	5.00	5.00	5.00	32.00	32.00	53.60	53.60	2.53	2.50	24.00	24.00	0.00	0.00	1.811	1.821	12.32	12.35	1.39	1.39

With respect to the different interactions Table (14-C) pointed out that all treatments and the control in either polyethylene or polyethylene plus carton packages maintenance better fresh appearance, statistically, in both seasons. However, significant increase in fruit juice percentage occurred when pro-Gib and garlic oil plus waxing in polyethylene plus carton package were used. Meanwhile, all treatments used and the control in polyethylene package as well as pro-Gib, garlic oil, irradiation dose (0.75) plus waxing, garlic oil plus waxing and pro-Gib plus waxing treatments reduced fruit weight loss and decay percentages statistically in comparison with all other combinations in both seasons.

It is quite evident from Table (15-A, B and C) that treated fruits with different fruit treatments and combinations under study behaved after 45 days storage at cold temperature similarly to those after 30 days storage as discussed before Table (14-A, B and C).

RESULTS & DISCUSSION

Table (15): Effect of postharvest treatments and package types on the physical properties of lime fruits after 45 days storage at cold temperature.

Table (15-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	4.15E	4.16E	42.75K	42.80K	16.33A	16.50A	7.69A	7.80A
Irradiation								
0.50 KGy	4.48B	4.48B	45.25H	45.23H	13.46E	13.50E	6.46C	6.55C
0.75 KGy	4.50B	4.50B	46.00E	46.00E	12.44H	12.40H	6.33D	6.30D
Fungicides	4.52AB	4.53AB	45.20H	45.20H	13.69E	13.50E	6.13E	6.20E
Non traditional								
Garlic oil	4.50B	4.51B	46.33C	46.39C	11.64I	11.70I	5.90G	5.91G
Pro-Gib plus	4.52AB	4.53AB	46.33C	46.40C	11.20J	11.30J	5.90G	5.91G
Hot water	4.52AB	4.52AB	45.43G	45.40G	13.24F	13.20F	6.18E	6.20E
Yeast	4.44C	4.44C	43.83J	43.80J	14.60C	14.70C	6.34D	6.33D
Waxing								
Control + wax	4.15E	4.16E	44.67I	44.65I	15.57B	15.60B	7.24B	7.35B
0.50 KGy+wax	4.40D	4.40D	45.70F	45.65F	13.27F	13.20F	6.10EF	6.15EF
0.75 KGy+wax	4.48B	4.48B	46.20CD	46.18CD	12.40H	12.50H	6.00FG	6.00FG
Fungicides+wax	4.522AB	4.53AB	46.10DE	46.15DE	12.93G	13.00G	5.78H	5.80H
Garlic oil +wax	4.52AB	4.53AB	46.87A	46.88A	10.86K	10.95K	5.48I	5.50I
Pro-Gib plus + wax	4.55A	4.56A	46.50B	46.60B	10.39L	10.50L	5.35J	5.30J
Hot water +wax	4.55A	4.60A	45.46F	45.60F	12.76G	12.80G	5.79H	5.79H
Yeast + wax	4.50B	4.51B	45.37GH	45.30GH	14.20D	14.00D	6.13EF	6.15EF

Table (15-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	4.95B	4.93B	50.98B	50.90B	2.29B	2.30B	2.97B	2.97B
Carton	3.49C	3.43C	32.26C	32.30C	35.46A	35.50A	13.40A	13.30A
Polyethylene + carton	5.00A	5.00A	53.30A	53.33A	1.46C	1.48C	2.16C	2.15C

RESULTS & DISCUSSION

Table (15-C) Effect of the interaction between postharvest treatment and package type

Parameters		Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss						
		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		
		1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	
Package	4.46	4.40	2.461	2.471	5.00	5.00	5.00	5.00	50.21	50.20	32.00	32.00	53.10	53.13	5.53	5.50	40.33	40.00	2.53	2.50	4.53	4.53	15.03	15.00	3.501	3.501
Season	4.46	4.40	2.461	2.471	5.00	5.00	5.00	5.00	50.21	50.20	32.00	32.00	53.10	53.13	5.53	5.50	40.33	40.00	2.53	2.50	4.53	4.53	15.03	15.00	3.501	3.501
Control	4.75	4.70	3.46	3.47	5.00	5.00	5.00	5.00	50.31	50.30	32.00	32.00	53.43	53.40	3.50	3.50	36.27	36.00	1.50	1.50	3.04	3.00	13.68	13.65	2.67	2.68
Irradiation	4.75	4.70	3.46	3.47	5.00	5.00	5.00	5.00	50.31	50.30	32.00	32.00	53.43	53.40	3.50	3.50	36.27	36.00	1.50	1.50	3.04	3.00	13.68	13.65	2.67	2.68
0.50 kGy	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	52.00	52.00	32.00	32.00	54.00	54.00	1.00	1.00	35.33	35.30	1.00	1.00	3.15	3.13	13.61	13.60	2.22	2.23
0.75 kGy	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	52.00	52.00	32.00	32.00	54.00	54.00	1.00	1.00	35.33	35.30	1.00	1.00	3.15	3.13	13.61	13.60	2.22	2.23
Fungicide	5.00	5.00	3.56	3.56	5.00	5.00	5.00	5.00	50.80	50.80	32.00	32.00	52.80	52.80	2.93	3.00	36.60	36.60	2.53	1.50	2.03	3.00	13.35	13.36	2.03	2.00
Fungicide	5.00	5.00	3.56	3.56	5.00	5.00	5.00	5.00	50.80	50.80	32.00	32.00	52.80	52.80	2.93	3.00	36.60	36.60	2.53	1.50	2.03	3.00	13.35	13.36	2.03	2.00
des	5.00	5.00	3.56	3.56	5.00	5.00	5.00	5.00	50.80	50.80	32.00	32.00	52.80	52.80	2.93	3.00	36.60	36.60	2.53	1.50	2.03	3.00	13.35	13.36	2.03	2.00
Non traditional	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	51.00	51.00	34.00	34.00	54.00	54.00	0.00	0.00	33.93	33.60	1.00	1.00	2.87	2.77	12.82	12.80	2.03	2.00
Garlic oil	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	51.00	51.00	34.00	34.00	54.00	54.00	0.00	0.00	33.93	33.60	1.00	1.00	2.87	2.77	12.82	12.80	2.03	2.00
Pro-Gib plus	5.00	5.00	3.56	3.66	5.00	5.00	5.00	5.00	52.00	52.00	33.50	33.50	53.50	53.50	0.00	0.00	32.60	32.50	1.00	1.00	2.94	2.93	12.88	12.85	1.90	1.80
Hot water	5.00	5.00	3.56	3.56	5.00	5.00	5.00	5.00	50.00	50.00	32.80	32.80	53.50	53.50	2.50	2.50	35.70	36.60	2.53	1.50	2.98	2.93	13.35	13.36	2.18	2.18
Yeast	5.00	5.00	3.33	3.30	5.00	5.00	5.00	5.00	51.00	51.00	28.00	28.00	52.50	52.50	3.30	3.33	37.47	37.30	3.03	3.00	3.25	3.25	13.32	13.33	2.26	2.26
Waxing	5.00	5.00	3.00	3.00	5.00	5.00	5.00	5.00	50.00	50.00	32.05	32.05	52.00	52.00	4.96	4.96	39.17	39.10	2.56	2.50	4.061	4.001	14.71	14.70	2.96	2.95
Control + wax	5.00	5.00	3.46	4.50	5.00	5.00	5.00	5.00	52.00	52.00	31.00	31.30	53.61	53.60	3.16	3.15	35.27	35.10	1.36	1.33	2.62	2.60	13.62	13.60	2.03	2.00
0.50kGy + wax	5.00	5.00	3.46	4.50	5.00	5.00	5.00	5.00	52.00	52.00	31.00	31.30	53.61	53.60	3.16	3.15	35.27	35.10	1.36	1.33	2.62	2.60	13.62	13.60	2.03	2.00
0.75kGy + wax	5.00	5.00	3.46	3.48	5.00	5.00	5.00	5.00	51.60	51.50	33.00	33.30	54.00	54.00	1.66	1.70	34.37	34.40	0.96	0.96	2.52	2.60	13.48	13.45	2.01	2.00
Fungicide + wax	5.00	5.00	3.56	3.53	5.00	5.00	5.00	5.00	51.00	51.00	33.31	33.30	54.00	54.00	2.70	2.50	34.83	34.60	1.26	1.25	2.52	2.53	13.01	13.00	1.82	1.80
Fungicide + wax	5.00	5.00	3.56	3.53	5.00	5.00	5.00	5.00	51.00	51.00	33.31	33.30	54.00	54.00	2.70	2.50	34.83	34.60	1.26	1.25	2.52	2.53	13.01	13.00	1.82	1.80
des + wax	5.00	5.00	3.56	3.56	5.00	5.00	5.00	5.00	52.00	51.80	34.00	34.30	54.60	54.50	0.00	0.00	32.57	32.50	0.00	0.00	2.21	2.20	12.62	12.60	1.62	1.60
Garlic oil + wax	5.00	5.00	3.56	3.56	5.00	5.00	5.00	5.00	52.00	51.80	34.00	34.30	54.60	54.50	0.00	0.00	32.57	32.50	0.00	0.00	2.21	2.20	12.62	12.60	1.62	1.60
Pro-Gib plus + wax	5.00	5.00	3.66	3.66	5.00	5.00	5.00	5.00	51.70	51.73	34.00	34.00	53.80	53.80	0.00	0.00	31.17	31.10	0.00	0.00	2.32	2.33	12.25	12.30	1.48	1.46
Hot water + wax	5.00	5.00	3.66	3.66	5.00	5.00	5.00	5.00	51.70	51.73	34.00	34.00	53.80	53.80	0.00	0.00	31.17	31.10	0.00	0.00	2.32	2.33	12.25	12.30	1.48	1.46
Yeast + wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00	2.62	2.63	12.86	12.85	1.89	1.80
Wax	5.00	5.00	3.50	3.50	5.00	5.00	5.00	5.00	50.00	50.00	33.00	33.00	53.10	53.00	2.43	2.40	34.83	34.80	1.00	1.00						

It is evident from Table (16-A) that all treated fruits showed considerably high fresh appearance and fruit juice percentage of lime fruits after 60 days storage at cold temperature as compared with the untreated fruits (control). On the contrary, garlic oil, pro-Gib and fungicides treatments plus waxing showed the highest fresh appearance followed by pro-Gib and hot water as well as hot water plus waxing then garlic oil and highest irradiation dose (0.75) plus waxing as compared with the other used treatments and the control in a descending order in both seasons. However, significant increase in fruit juice percentage occurred when pro-Gib plus waxing and garlic oil treatments were used. Meanwhile, pro-Gib and garlic oil plus waxing treatments succeeded in reducing the percentages of fruit decay and weight loss during the fifth period (after 60 days) of stored lime fruits under cold temperature in both seasons.

Considering the effect of package types in both seasons (Table 16-B) it is found that polyethylene plus carton package showed the highest fresh appearance and fruit juice percentage and the lowest significant fruit decay and weight loss percentages followed by polyethylene package as compared with carton package.

With respect to the different interactions Table (16-C) and Figs. (13-18) pointed out that all treatments and the control in either polyethylene or polyethylene plus carton packages maintenance higher fruit fresh appearance statistically in both seasons. However, significant increase in fruit juice percentage occurred when pro-Gib plus waxing in polyethylene plus carton package was used.

RESULTS & DISCUSSION

Table (16): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at cold temperature.

Table (16-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.83E	3.83E	41.53N	41.65N	19.11A	19.10A	13.55A	13.50A
Irradiation								
0.50 KGy	4.00D	4.00D	42.93K	42.92K	16.00C	16.30C	12.55B	12.40B
0.75 KGy	4.00D	4.00D	43.06J	43.00J	14.23F	14.20F	12.19C	12.20C
Fungicides	4.00E	4.00F	43.33H	43.30H	14.72E	14.50E	11.96D	11.95D
Non traditional								
Garlic oil	4.15C	4.16C	44.93B	44.95B	13.33i	13.30i	11.46F	11.50F
Pro-Gib plus	4.24B	4.25B	44.40D	44.36D	12.73j	12.60j	11.28F	11.20G
Hot water	4.24B	4.24B	43.53G	43.50G	14.41E	14.50E	11.95D	11.96D
Yeast	4.00D	4.00D	43.16I	43.17I	16.00C	16.50C	12.42B	12.50B
Waxing								
Control + wax	3.84F	3.84G	41.76M	42.00M	18.14B	18.17B	11.81E	11.80E
0.50 KGy+wax	4.13C	4.13C	44.00E	44.00E	15.40D	15.80D	10.47H	10.45H
0.75 KGy+wax	4.16C	4.16C	43.90F	43.88F	13.57H	13.50H	10.19 I	10.22J
Fungicides+wax	4.33A	4.33A	44.43CD	44.45CD	14.00G	14.00G	10.26HI	10.25IJ
Garlic oil +wax	4.33A	4.33A	44.43C	44.50C	12.29K	12.10K	9.52J	9.51K
Pro-Gib plus + wax	4.33A	4.33A	45.13A	45.13A	11.71L	11.50L	9.55J	9.53K
Hot water +wax	4.24B	4.24B	44.00E	44.00E	13.82G	13.80G	10.30H	10.36H
Yeast + wax	4.00D	4.00D	42.43L	42.44L	14.89E	15.00E	10.40H	10.44H

Table (16-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	4.95B	4.90B	49.46B	49.47B	4.32B	4.30B	5.65B	5.55B
Carton	2.37C	2.39C	29.59C	29.60C	37.40A	37.60A	23.89A	23.50A
Polyethylene + carton	5.00A	5.00A	51.55A	51.80A	2.30C	2.30C	4.19C	4.16C

Table (16-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	4.35	4.35	1.501	1.501	5.00	5.00	48.00	48.00	28.00	28.00	48.61	48.61	8.93	8.93	43.53	43.00	4.56	4.50	7.99	7.99	26.50	26.58	6.16	6.16
Control	4.73	4.70	2.00	2.00	5.00	5.00	45.21	45.20	29.00	29.00	52.00	52.13	6.16	6.16	38.90	38.89	2.93	2.96	6.47	6.50	26.10	26.00	5.06	5.00
Irradiation	0.50	0.50	2.00	2.00	5.00	5.00	49.20	49.20	28.00	28.00	52.00	52.10	3.93	3.93	37.00	37.10	2.36	2.37	6.03	6.10	25.93	25.90	4.65	4.65
0.5kGy	AB	AB	H	H	A	A	49.50	49.50	30.00	30.00	50.50	50.56	3.90	3.90	37.87	37.90	2.40	2.39	5.80	5.88	25.54	25.50	4.42	4.42
0.75	5.00	5.00	2.00	2.00	5.00	5.00	49.20	49.20	28.00	28.00	52.00	52.10	3.93	3.93	37.00	37.10	2.36	2.37	6.03	6.10	25.93	25.90	4.65	4.65
kGy	A	A	H	H	A	A	49.50	49.50	30.00	30.00	50.50	50.56	3.90	3.90	37.87	37.90	2.40	2.39	5.80	5.88	25.54	25.50	4.42	4.42
Fungicides	5.00	5.00	2.00	2.00	5.00	5.00	49.50	49.50	30.00	30.00	50.50	50.56	3.90	3.90	37.87	37.90	2.40	2.39	5.80	5.88	25.54	25.50	4.42	4.42
Non traditional	5.00	5.00	2.46	2.46	5.00	5.00	50.70	50.72	31.00	31.00	52.50	52.60	3.46	3.46	34.00	33.98	1.63	1.60	5.35	5.40	25.17	25.20	3.86	3.90
Garlic oil	A	A	F	F	A	A	G	J	QR	X	C	C	PQR	ST	H	981	XYZ	Z	QR	P	E	D	XY	W
Pro-Gib plus	5.00	5.00	2.73	2.73	5.00	5.00	50.00	50.10	31.20	31.10	52.00	52.10	3.06	3.06	33.08	33.93	1.20	1.10	5.03	5.00	25.03	25.00	3.76	3.78
Hot water	5.00	5.00	2.73	2.73	5.00	5.00	49.80	49.90	29.30	29.00	51.50	51.48	3.56	3.56	38.57	38.50	2.00	2.00	5.90	5.90	25.47	25.42	4.48	4.46
Yeast	5.00	5.00	2.00	2.00	5.00	5.00	49.00	49.10	29.00	28.00	51.50	51.46	4.63	4.63	38.67	39.00	3.70	3.60	6.46	6.50	26.03	26.00	4.76	4.77
Waxing	5.00	5.00	2.00	2.00	5.00	5.00	48.00	48.00	28.00	27.00	49.30	49.36	8.73	8.73	41.66	40.80	4.10	4.20	6.96	6.95	22.97	23.00	5.50	5.50
Control + wax	A	A	H	H	A	A	P	V	W	W	KL	P	L	M	B	B	O	Q	L	L	F	E	PQ	P
0.50kGy + wax	5.00	5.00	2.40	2.40	5.00	5.00	51.00	51.10	29.20	29.00	51.80	51.80	5.80	5.80	37.93	37.90	2.46	2.46	5.06	5.08	22.23	22.30	4.00	4.00
0.75kGy + wax	5.00	5.00	2.50	2.50	5.00	5.00	50.20	50.16	29.50	30.00	52.00	52.10	2.96	2.96	35.67	36.00	2.06	2.07	4.98	4.95	21.97	22.00	3.63	3.60
Fungicides + wax	5.00	5.00	3.00	3.00	5.00	5.00	49.50	49.60	30.80	31.00	53.00	53.20	3.20	3.20	36.93	37.00	1.86	1.80	5.03	5.04	22.03	22.00	3.70	3.70
Garlic oil + wax	5.00	5.00	3.00	3.00	5.00	5.00	51.00	51.00	30.80	31.00	52.30	52.30	1.93	1.93	33.93	34.00	0.00	0.00	4.59	4.60	21.10	21.00	0.00	0.00
Pro-Gib plus + wax	5.00	5.00	3.00	3.00	5.00	5.00	50.80	50.80	30.20	30.20	53.40	53.50	1.70	1.80	32.83	33.00	0.00	0.00	4.22	4.22	21.43	21.50	0.00	0.00
Hot water + wax	5.00	5.00	2.73	2.73	5.00	5.00	48.50	48.50	31.00	31.00	52.52	52.60	3.00	3.00	37.10	37.00	1.36	1.36	5.03	5.03	22.60	22.53	3.50	3.50
Yeast + wax	5.00	5.00	2.00	2.00	5.00	5.00	48.00	48.00	29.30	29.00	50.00	50.10	3.93	3.93	38.07	38.00	2.66	2.67	5.50	5.50	22.10	22.08	3.74	3.78
	A	A	H	H	A	A	P	V	U	U	J	M	OP	QR	E	F	TU	VW	PQ	P	H	GH	YZ	WX

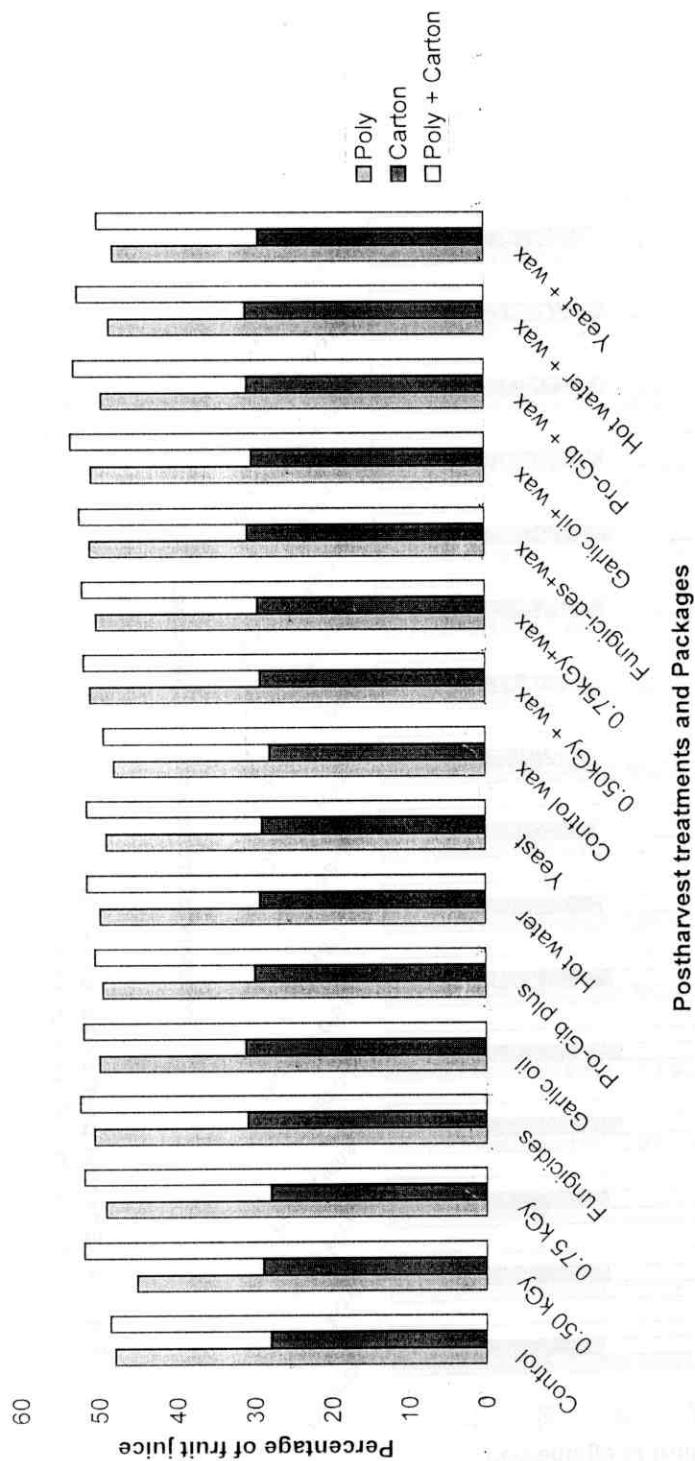


Fig. (13): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at cold temperature (Percentage of fruit juice, 1999)

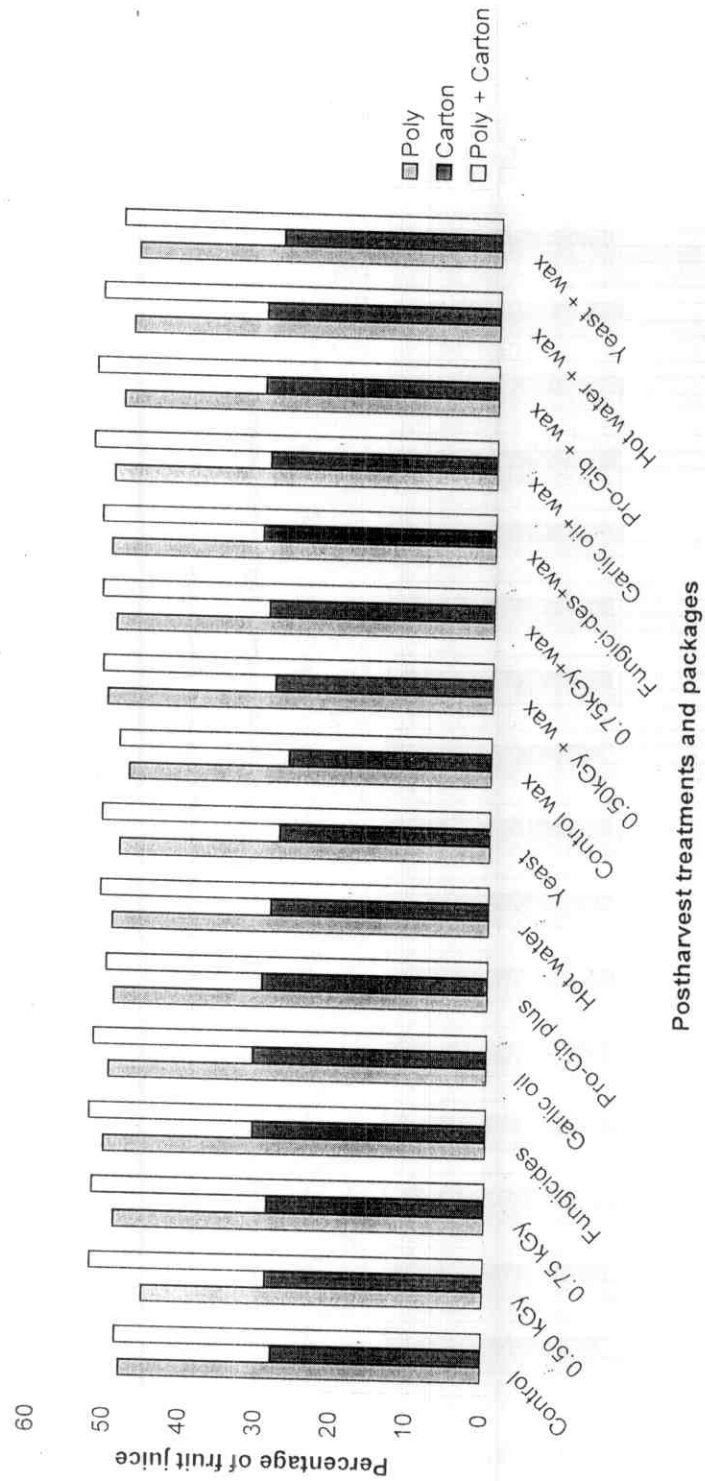


Fig. (14): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at cold temperature (Percentage of fruit juice, 2000)

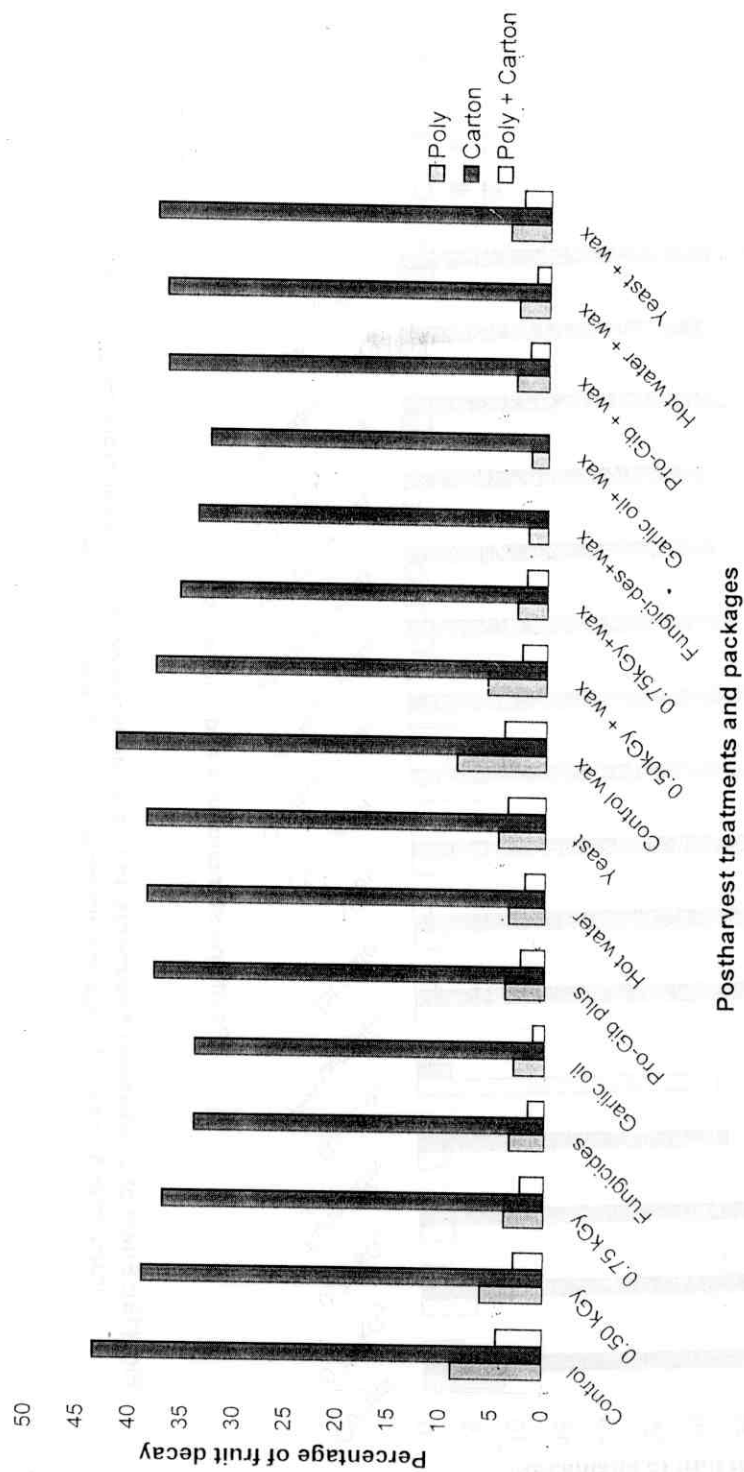


Fig. (15): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at cold temperature (Percentage of fruit decay, 1999)

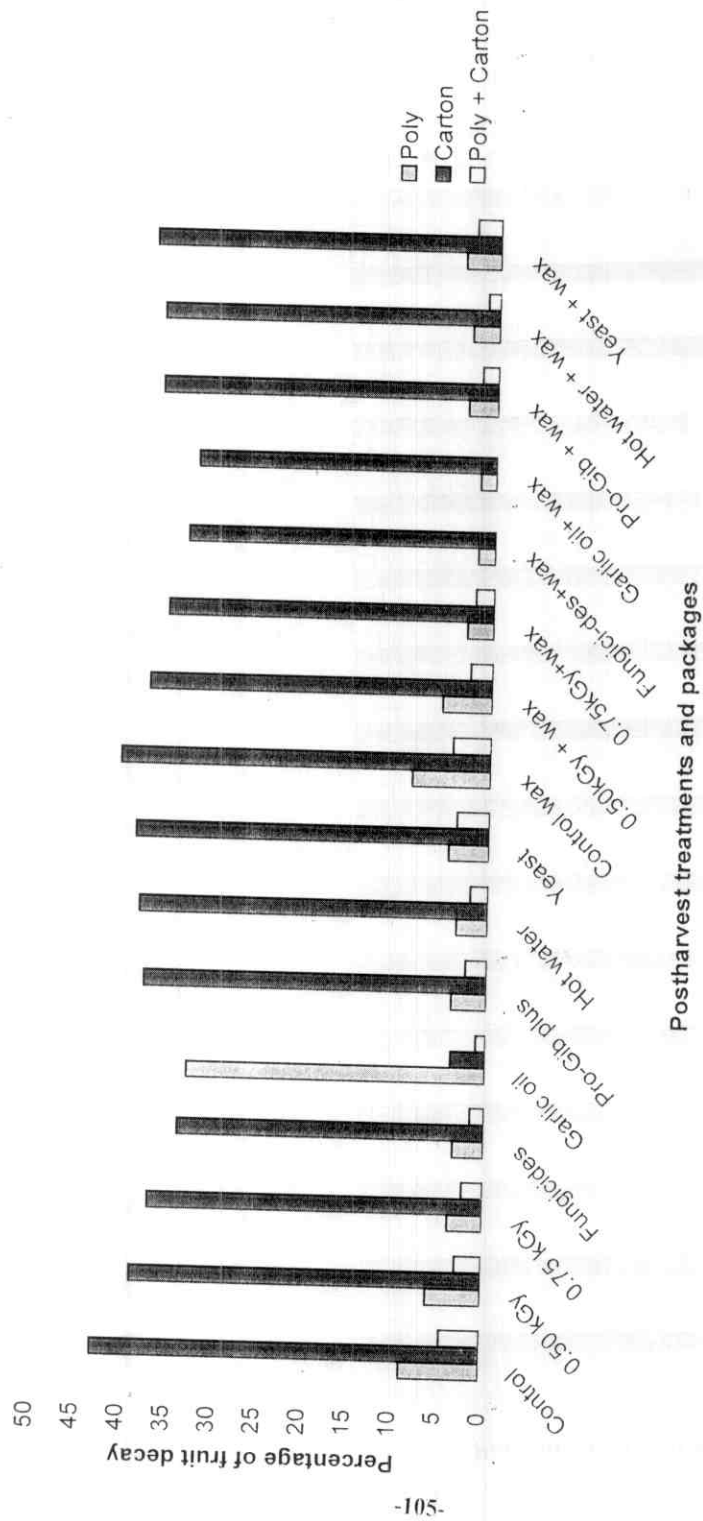


Fig. (16): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at cold temperature (Percentage of fruit decay, 2000)

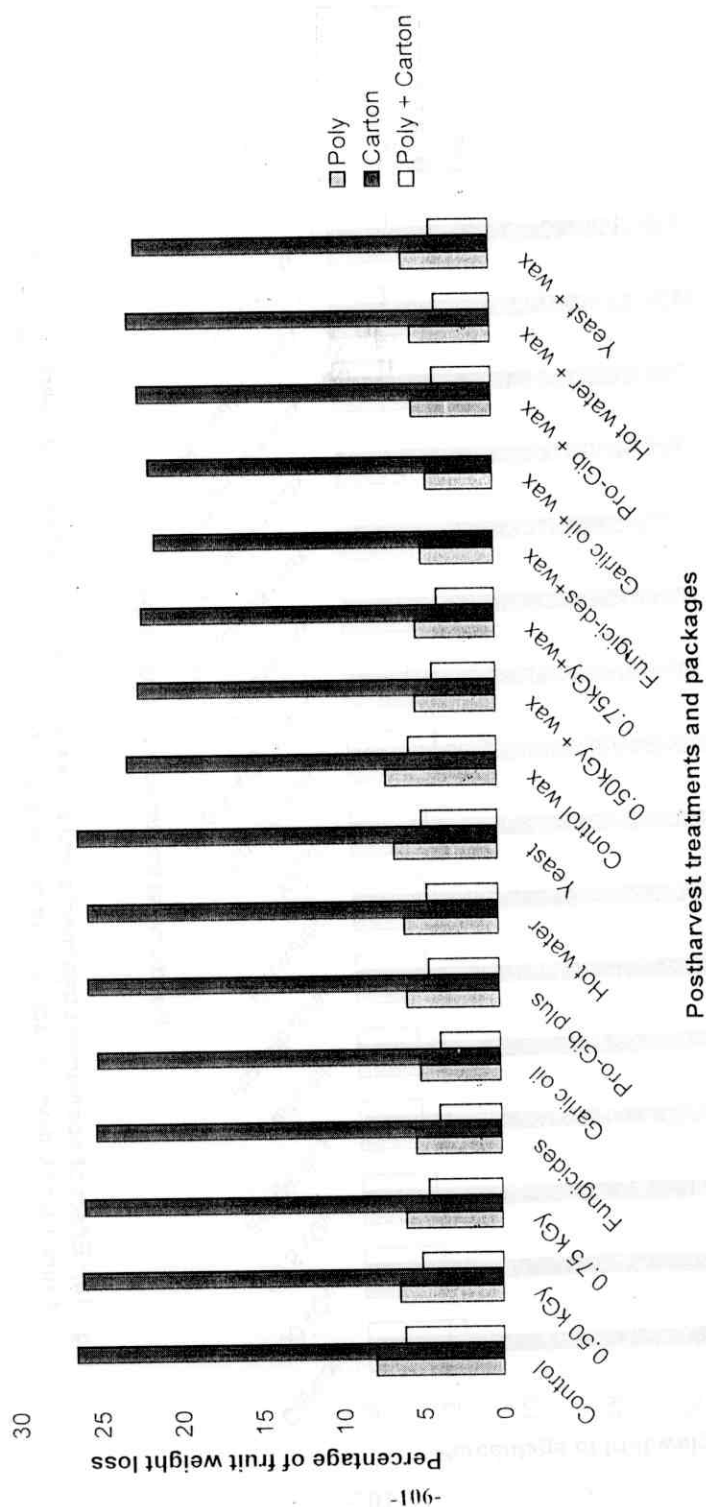


Fig. (17): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at cold temperature (Percentage of fruit weight loss, 1999)

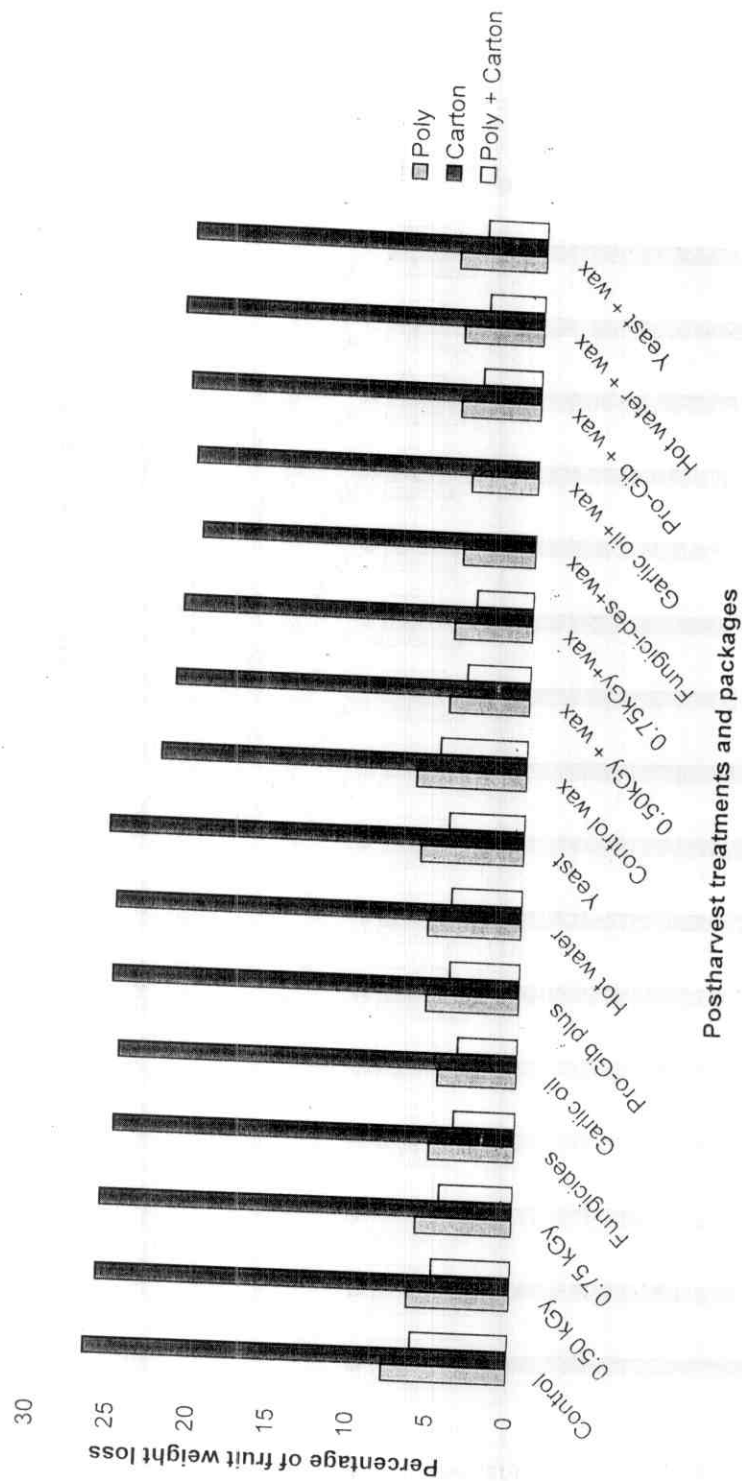


Fig. (18): Effect of postharvest treatments and package types on the physical properties of lime fruits after 60 days storage at cold temperature (Percentage of fruit weight loss, 2000)

Meanwhile, garlic oil plus waxing in polyethylene plus carton package as well as pro-Gib plus waxing treatments decreased fruit decay and weight loss percentages as compared with the other combinations in this respect in both seasons.

Considering the effect of postharvest treatments on the physical properties of lime fruits after 75 days storage at cold temperature in both seasons Table (17-A) clarifies that many treatments showed considerably acceptable fresh appearance and high fruit juice percentage and decreasing in fruit decay and weight loss percentages as compared with the control. Concerning postharvest storage treatments it is found that a significantly higher fruit fresh appearance and fruit juice percentage and a decrease in fruit decay and weight loss percentages occurred when pro-Gib and garlic oil treatments plus waxing were used in both seasons.

Moreover, Table (17-B) indicated that polyethylene plus carton package significantly maintained fruit fresh appearance and higher percentage of fruit juice and decreased fruit decay and weight loss percentages followed by polyethylene package as compared with carton package in both seasons.

Furthermore, Table (17-C) showed that all treatments and the control in polyethylene plus carton package as well as pro-Gib and garlic oil treatments plus waxing maintained better fruit fresh appearance statistically in both seasons. However, pro-Gib and garlic oil treatments plus waxing in polyethylene plus carton package increased fruit juice percentage and reduced fruit decay and weight loss percentages statistically in comparison with all other combinations in both seasons.

RESULTS & DISCUSSION

Table (17): Effect of postharvest treatments and package types on the physical properties of lime fruits after 75 days storage at cold temperature.

Table (17-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.10F	3.00F	40.00G	40.00G	25.87A	25.80A	18.57A	18.60A
Irradiation								
0.50 KGy	3.16E	3.15E	42.00E	42.00E	22.78C	22.75C	16.46D	16.50D
0.75 KGy	3.53D	3.50D	42.00E	42.00E	19.22F	19.20F	15.82EF	15.86EF
Fungicides	4.01C	4.00C	42.33E	42.35E	19.26F	19.30F	15.70EF	15.65EF
Non traditional								
Garlic oil	4.13B	4.10B	42.77D	42.78D	15.56J	15.55J	14.55G	14.60G
Pro-Gib plus	4.15B	4.13B	42.83D	42.80D	14.87K	14.85K	14.61G	14.60G
Hot water	4.03C	4.00C	42.50E	42.50E	18.89G	18.90G	15.35F	15.40F
Yeast	3.15E	3.15E	41.40F	41.50F	22.70C	22.80C	16.99C	17.00C
Waxing								
Control + wax	3.15E	3.16E	41.10F	41.00F	24.47B	24.50B	18.04B	18.00B
0.50 KGy+wax	3.25D	3.30D	42.67D	42.70D	21.59D	21.60D	15.59EF	15.65EF
0.75 KGy+wax	3.95C	3.96C	43.07C	43.00C	16.14I	16.16I	14.31G	14.50G
Fungicides+wax	4.08C	4.00C	43.50C	43.60C	16.86H	17.00H	14.09G	14.00G
Garlic oil +wax	4.30A	4.30A	44.00A	44.00A	13.92L	14.00L	12.93H	13.00H
Pro-Gib plus + wax	4.25A	4.30A	43.77B	43.80B	14.67K	14.70K	12.93H	12.95H
Hot water +wax	4.18B	4.20B	43.03C	43.00C	16.00I	16.20I	14.41G	14.40G
Yeast + wax	3.25D	3.30D	41.33F	41.35F	21.12E	21.13E	16.11DE	16.00DE

Table (17-B): Effect of package type

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	4.68B	4.70B	46.98B	47.00B	6.69B	6.70B	8.28B	8.30B
Carton	1.89C	1.89C	28.98C	29.00C	40.04A	40.10A	30.68A	30.70A
Polyethylene + carton	5.00A	5.00A	51.23A	51.25A	4.26C	4.25C	6.24C	6.30C

RESULTS & DISCUSSION

Table (17-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	4.30	4.20	1.00	1.00	5.00	5.00	43.00	43.10	-	-	49.00	49.13	12.63	12.60	-	-	7.93	7.90	12.10	12.00	-	-	8.44	8.45
Control	F	F	A	A	A	A	R	R	-	-	H	H	I	I	-	-	KL	KL	E	E	-	-	H-I	H-I
Irradiation	4.50	4.50	1.00	1.00	5.00	5.00	46.50	46.43	-	-	51.00	51.11C	8.36	8.33	-	-	5.66	5.65	9.00	9.10	-	-	7.03	7.00
0.50 kGy	E	E	A	A	A	A	O	O	-	-	C	C	K	K	-	-	N	N	GH	GH	-	-	K-P	K-P
0.75 kGy	4.60	4.50	1.00	1.00	5.00	5.00	46.00	46.00	28.00	28.33	52.00	52.11B	6.36	6.38	46.43	46.40	4.86	4.85	9.03	9.10	31.67	31.73	6.76	6.80
kGy	D	E	A	A	A	A	P	P	X	X	B	B	M	M	B	B	PQ	PQ	GH	GH	A	A	L-Q	L-Q
Fungicide	4.50	4.50	2.53	2.53	5.00	5.00	47.00	47.10	30.00	30.13	50.00F	50.00F	6.60	6.50	47.00	47.13	4.16	4.20	8.77	8.80	31.53	31.60	6.79	6.81
des	E	E	K	K	A	A	N	N	T	T	T	T	M	M	A	A	RS	RS	G-I	G-I	A	A	L-Q	L-Q
Non traditional	4.76	4.75	2.63J	2.63J	5.00	5.00	47.30	47.33	29.00	29.33	52.00	52.13B	5.06	5.00	38.53	38.50	3.06	3.10	7.66	7.60	31.00	31.00	4.97	5.00
Garlic oil	C	C	A	A	A	A	M	M	W	W	B	B	Q	Q	F	F	UV	UV	J-L	J-L	A	A	ST	ST
Pro-Gib	4.73	4.70	27.33	27.00	5.00	5.00	48.00	48.10	29.5	29.60	51.00	51.13	4.63	4.66	37.10	37.00	2.86	2.85	7.53	7.50	31.30	31.30	5.31	5.33
plus	C	C	HI	HI	A	A	J	J	V	V	D	D	QR	QR	G	G	V	V	J-M	J-M	A	A	RS	RS
Hot water	4.60	4.60	2.50	2.50	5.00	5.00	46.50	46.53	30.00	30.13	51.00	51.13	6.33	6.50	46.17	46.20	4.16	4.20	8.40	8.50	31.40	31.50	6.25	6.33
water	D	D	K	K	A	A	O	O	T	T	D	D	M	M	B	B	RS	RS	H-J	H-J	A	A	N-R	N-R
Yeast	4.46	4.45	1.00	1.00	5.00	5.00	46.00	46.33	-	-	50.20E	50.23E	8.06	8.00	-	-	5.36	5.38	9.49	9.50	-	-	7.48	7.50
Yeast	E	E	A	A	A	A	P	P	-	-	-	-	KL	KL	-	-	LP	LP	G	G	-	-	J-M	J-M
Waxing Control	4.67	4.46	1.00	1.00	5.00	5.00	45.30	45.33	-	-	50.00F	50.11F	10.77	10.70	-	-	6.46	6.46	10.79	10.80	-	-	7.57	7.60
+ wax	E	E	A	A	A	A	Q	Q	-	-	-	-	J	J	-	-	M	M	F	F	-	-	J-M	J-M
0.50kGy + wax	4.76	4.77	1.00	1.00	5.00	5.00	48.00	48.12	-	-	52.00	52.13B	7.63	7.59	-	-	4.63	4.60	7.91	7.90	-	-	5.93	6.00
+ wax	C	C	A	A	A	A	J	J	-	-	B	B	L	L	-	-	QR	QR	I-K	I-K	-	-	QR	P-R
0.75kGy + wax	4.86	4.90	2.20	2.20	5.00	5.00	48.20	48.23	29.00	29.13	52.00	52.00B	5.10	5.00	39.27	39.30	4.06	4.10	7.49	7.50	29.43	29.50	6.00	6.00
+ wax	B	B	L	L	A	A	I	I	W	W	B	B	N-Q	N-Q	E	E	R-T	R-T	J-M	J-M	BC	BC	P-R	P-R
Fungicide + wax	4.76	4.76	2.50	2.50	5.00	5.00	47.50	47.49	30.00	30.13	52.00	52.97B	5.53	5.50	41.50	41.57	3.53	3.50	7.19	7.21	29.03	29.00	6.03	6.10
des + wax	C	C	K	K	A	A	L	L	T	T	B	B	NO	NO	C	C	UV	UV	K-N	K-N	B-D	B-D	O-R	O-R
Garlic oil + wax	5.00	5.00	2.76	2.77	5.00	5.00	49.50	49.53	29.80	29.79	53.00	53.00B	4.30	4.33	37.47	37.50	2.23	2.33	6.30	6.33	28.17	28.21	4.31	4.33
oil + wax	A	A	H	H	A	A	G	G	U	U	B	B	RS	RS	G	G	W	W	N-R	N-R	D	D	T	T
Pro-Gib plus + wax	5.00	5.00	3.00	3.00	5.00	5.00	49.00	49.10	30.00	30.10	53.00	52.93	3.73	3.75	36.03	36.00	2.00	2.00	6.00	6.10	28.37	28.60	4.22	4.33
+ wax	A	A	G	G	A	A	H	H	T	T	A	A	ST	ST	H	H	W	W	P-R	P-R	CD	CD	T	T
Hot water + wax	4.90	4.90	2.66	2.70	5.00	5.00	47.80	47.83	30.30	30.33	51.00	51.11	5.16	5.19	39.83	39.80	3.00	3.10	7.06	7.00	29.87	29.90	6.30	6.40
water + wax	B	B	K	K	A	A	K	K	S	S	D	D	N-Q	N-Q	D	D	UV	UV	K-O	K-O	B	B	N-R	N-R
Yeast + wax	4.76	4.73	1.00	1.00	5.00	5.00	46.00	46.13	-	-	50.00F	50.13F	6.83	6.87	-	-	4.16	4.20	7.78	7.83	-	-	6.54	6.55
wax	C	C	A	A	A	A	P	P	-	-	-	-	M	M	-	-	RS	RS	I-L	I-L	-	-	M-Q	M-Q

However, combination of unwaxed treatments and waxed control, irradiation dose (0.5 kGy) and yeast packed in carton boxes failed to continue to be acceptable to consumer for 75 days in cold storage and were discarded.

Moreover, Table (18-A) show the effect of postharvest treatments on the physical properties of lime fruits after 90 days storage at cold temperature. It is quite evident that most treatments showed a considerable maintenance of fruit fresh appearance and higher fruit juice percentage as well as decreasing fruit decay and weight loss percentages in both seasons. However, fresh appearance and fruit juice percentage were significantly higher by pro-Gib plus waxing in comparison with other used treatments. Meanwhile, significant decrease in fruit decay and weight loss percentages were recorded when pro-Gib and garlic oil treatments plus waxing were used in the two seasons.

Moreover, Table (18-B) indicate that, data of seasons 1999 and 2000 showed that polyethylene plus carton package significantly maintained fruit fresh appearance and increased fruit juice percentage and decreased fruit decay and weight loss percentages followed by polyethylene package as compared with carton package in a descending order.

Regarding the interaction effect between postharvest treatments and package type of both seasons, Table (18-C) pointed out that pro-Gib plus waxing as well as garlic oil plus waxing treatments in polyethylene plus carton package had the best fresh appearance and fruit juice percentage and decreased fruit decay and weight loss percentages statistically as compared

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Table (18): Effect of postharvest treatments and package types on the physical properties of lime fruits after 90 days storage at cold temperature.

Table (18-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	2.92I	2.90I	46.00N	46.10N	31.20A	31.21A	20.13A	20.15A
Irradiation								
0.50 KGy	3.15G	3.16G	48.25J	48.30J	26.79C	26.83C	18.27D	18.30D
0.75 KGy	3.16G	3.17G	48.75I	48.80I	25.16F	25.17F	17.55E	17.63E
Fungicides	3.23F	3.23F	49.00H	49.00H	23.70G	23.73G	17.20F	17.23F
Non traditional								
Garlic oil	3.40D	3.43D	49.75F	49.73F	22.72I	22.73I	15.85HI	15.85HI
Pro-Gib plus	3.94B	3.97B	49.25G	49.30G	21.18L	21.19L	15.68IJ	15.67IJ
Hot water	3.26E	3.27E	48.00K	48.13K	23.40H	23.50H	16.80G	18.83G
Yeast	3.10H	3.10H	47.15L	47.10L	26.46D	26.50D	18.93C	19.00C
Waxing								
Control + wax	3.10H	3.13H	46.95M	46.93M	28.86B	28.90B	19.61B	19.65B
0.50 KGy+wax	3.26E	3.28E	50.50D	50.47D	25.40E	25.43E	17.03FG	17.00FG
0.75 KGy+wax	3.28E	3.27E	50.75C	50.73C	22.58I	22.60I	15.99H	16.00H
Fungicides+wax	3.50C	3.49C	49.85E	49.83E	21.99J	22.00J	15.50J	15.53J
Garlic oil +wax	3.48C	3.50C	51.00B	51.00B	18.10M	18.20M	14.03L	14.00L
Pro-Gib plus + wax	3.97A	4.00A	51.23A	51.20A	16.51N	16.50N	14.12L	14.10L
Hot water +wax	3.37D	3.40D	49.75F	49.80F	21.42K	21.50K	15.16K	15.20K
Yeast + wax	3.17G	3.20G	46.00N	46.10N	25.16F	25.20F	17.63E	17.67E

Table (18-B): Effect of package type

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	4.22B	4.30B	46.95B	46.90B	8.97B	8.95B	10.50B	10.48B
Carton	1.23C	1.25C	28.00C	28.00C	50.51A	50.60A	31.62A	31.50A
Polyethylene + carton	4.55A	4.60A	50.89A	50.93A	6.87C	6.85C	8.40C	8.30C

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Table (18-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	3.76	3.75	1.00	1.00	4.00J	4.00J	45.00	45.10	-	-	47.00	47.13	14.63	14.60	-	-	11.47	11.50	14.23	14.30	-	-	10.50	10.60
Control	K	K	M	M			T	T			O	O	C	C			E	E	C	C			G-I	G-I
Irradiation	4.23	4.33	1.00	1.00	4.30	4.33	45.90	45.93	-	-	50.00F	50.00F	9.70	9.70	-	-	7.66	7.67	11.63	11.60	-	-	9.16	9.20
0.50 kGy	HI	HI	M	M	GH	GH	R	R					G	G			KL	KL	F	F			L	L
0.75 kGy	4.20I	4.30	1.00	1.00	4.30	4.33	46.5	46.53	-	-	51.00E	51.13E	8.90	8.93	-	-	6.93	6.93	11.64	11.65	-	-	9.00	9.10
Fungicides	4.20I	4.18I	M	M	GH	GH	P	P					H	H			M	M	F	F			L	L
Non traditional	4.43	4.43	1.00	1.00	4.76	4.76	47.00	47.13	-	-	51.00E	51.11E	9.10	9.00	-	-	7.00	7.10	10.80	10.83	-	-	9.30	9.30
Garlic oil	F	F	M	M	EF	EF	O	O					H	H			M	M	GH	GH			KL	KL
Pro-Gib plus	4.33	4.30	2.75	2.78	4.73	4.73	47.00	47.00	28.00	28.00	51.50	51.53	7.70	7.71	-	-	5.60	5.63	8.33	8.37	-	-	7.20	7.20
Hot water	G	GH	L	L	B	B	M	M			C	C	K	K			PQ	PQ	KL	KL			N	N
Yeast	4.20I	4.20I	1.00	1.00	4.60	4.63	46.00	46.13	-	-	50.00	50.00	7.33	7.33	41.87	41.90	5.33	5.33	9.05	9.00	31.00	31.00	7.00	7.10
Waxing	4.00	4.10J	M	M	CD	CD	Q	Q			G	G	8.43I	8.40I	-	-	6.43	6.43	10.00	10.30	-	-	9.00	9.00
Control + wax	J	J	M	M	GH	GH	T	T			H	H	9.93	9.91	-	-	7.76J	7.77J	12.50	12.53	-	-	10.29	10.20
0.50kGy + wax	4.00	4.00J	1.00	1.00	4.30	4.33	45.00	45.13	-	-	48.90	48.89	13.33	13.37	-	-	10.37	10.40	13.53	13.53	-	-	9.80	9.87
0.75kGy + wax	4.30	4.33	1.00	1.00	4.50	4.53	49.00	49.33	-	-	52.00	52.11C	8.93	8.90	-	-	6.93	7.00	10.20	10.25	-	-	7.96	8.00
Fungicide + wax	4.26	4.33	1.00	1.00	4.60	4.63	49.00	49.13	-	-	52.50	52.53B	8.10J	8.13J	-	-	6.53	6.56	9.93I	10.00	-	-	8.04	8.00
Pro-Gib plus + wax	4.30	4.33	1.00	1.00	4.63	4.60	47.21	47.20	-	-	52.50	52.53B	8.06J	8.07J	-	-	5.90	5.93	9.04	9.00	-	-	8.20	8.00
Garlic oil + wax	4.46	4.47	1.00	1.00	5.00	5.13	49.00	49.13	-	-	53.00	53.11	6.83	6.80	-	-	4.86	4.87	8.12	8.17	-	-	5.96	6.00
Pro-Gib plus + wax	4.63	4.63	2.79	2.78	5.00	5.13	49.13	49.00	28.00	28.13	53.00	53.33	6.56	6.60	38.27	38.30	4.70	4.75	8.00	8.00	28.33	28.33	6.03	6.00
Hot water + wax	4.33	4.33	1.00	1.00	4.80	4.83	47.50	47.53	-	-	52.00	52.13C	7.46	7.47	-	-	5.60	5.63	8.94	8.97	-	-	8.00	8.20
Yeast + wax	4.00	4.00J	1.00	1.00	4.53	4.50	45.60	45.63	-	-	48.00L	48.13L	8.53I	8.50I	-	-	6.93	7.00	11.03	11.00	-	-	9.03	8.00
	J	J	M	M	DE	D	T	T					K	K			M	M	G	G			L	L

with the other combinations in this respect. However, combinations of all treatments packed in carton boxes as acceptable to consumer for 90 days cold storage failed to continue and were discarded except unwaxed or waxed pro-Gib treatments.

Referring to the effect of postharvest treatments on the physical properties of lime fruits after 105 days storage under cold temperature, Table (19-A) clarify that different postharvest fruit treatments plus waxing surpassed the unwaxed fruit treatments under study in both seasons. However, fruits treated with pro-Gib plus waxing showed the highest fresh appearance and fruits juice percentage and the lowest significant fruit decay and weight loss percentages followed by garlic oil plus waxing treatment as compared with the other used treatments and the control in both seasons. Comparing different package types as shown in Table (19-B) it is quite evident that polyethylene plus carton package significantly maintained fresh appearance with higher fruit juice percentage and decreased fruit decay and weight loss percentages followed by polyethylene package as compared with carton package in the two seasons of study. Dealing with the interaction between storage treatment and package type of both seasons as shown in Table (19-C), it is clear that garlic oil plus waxing treatment in polyethylene plus carton package as well as pro-Gib plus waxing gave full fresh appearance and increased fruit juice percentage beside decreasing fruit decay and weight loss percentages statistically followed by hot water plus waxing and fungicides plus waxing treatments stored in polyethylene plus carton package as compared with the other combinations in this

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Table (19): Effect of postharvest treatments and package types on the physical properties of lime fruits after 105 days storage at cold temperature.

Table (19-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.60J	3.63J	44.00O	44.10O	16.58A	16.50A	12.97A	12.96A
Irradiation								
0.50 KGy	3.83H	3.83H	47.50J	47.53J	12.85C	12.86C	10.77CD	10.75CD
0.75 KGy	3.93G	3.95G	48.00I	48.07I	11.82D	11.80D	10.55CD	10.50CD
Fungicides	3.87H	3.85H	47.50J	47.50J	11.58DE	11.30DE	10.30D	10.33D
Non traditional								
Garlic oil	4.03E	4.10E	49.66E	49.67E	10.15H	10.17H	8.66G	8.65G
Pro-Gib plus	4.15D	4.15D	49.25F	49.30F	9.68I	9.65I	8.65G	8.65G
Hot water	4.12D	4.15D	47.26K	47.30K	10.96F	10.90F	9.89E	9.85E
Yeast	3.73I	3.75I	45.75M	45.74M	12.88C	12.85C	12.00B	12.00B
Waxing								
Control + wax	3.85H	3.86H	45.32N	45.30N	15.05B	15.00B	12.43B	12.44B
0.50 KGy+wax	4.13D	4.15D	49.85D	49.83D	11.42E	11.40E	9.89E	9.90E
0.75 KGy+wax	4.25C	4.25C	50.30C	50.33C	10.65FG	10.63FG	9.82EF	9.80EF
Fungicides+wax	4.32B	4.30B	48.75H	48.80H	10.55G	10.50G	9.35F	9.37F
Garlic oil +wax	4.50A	4.50A	50.90B	50.90B	9.23J	9.25J	7.90H	7.90H
Pro-Gib plus + wax	4.50A	4.50A	51.00A	51.00A	8.83K	8.80K	7.79H	7.90H
Hot water +wax	4.32B	4.30B	49.15G	49.17G	9.98H	9.97H	8.53G	8.55G
Yeast + wax	3.98F	3.97F	46.40L	46.45L	11.55DE	11.50DE	10.83C	10.85C

Table (19-B): Effect of package type

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	3.75B	3.76B	46.07B	46.10B	13.14A	13.10A	11.16A	11.20A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	4.38A	4.40A	50.26A	50.32A	9.82B	9.80B	8.88B	8.30B

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Table (19-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	3.20	3.23	-	-	4.001	4.131	42.50	42.57	-	-	45.50	45.60R	18.07	18.13	-	-	15.10	15.30	15.01	15.30	-	-	10.93	11.00
Control	N	N	-	-	-	-	V	V	-	-	R	-	A	A	-	-	C	C	A	A	-	-	E	E
Irradiation	3.50	3.53	-	-	4.16	4.18	45.00	45.10	-	-	50.00	50.13	14.07	14.10	-	-	11.63	11.67	12.03	12.31	-	-	9.50	9.57
0.50 kGy	M	M	-	-	FG	FG	S	S	-	-	G	G	D	D	-	-	H	H	D	D	-	-	HJ	HJ
0.75 kGy	L	L	-	-	DE	DE	Q	Q	-	-	G	G	E	E	-	-	K	K	E	E	-	-	HK	HK
Fungicide	3.63	3.67	-	-	4.10	4.13	45.00	45.13	-	-	50.00	50.13	13.43	13.50	-	-	10.20	10.31	11.80	11.83	-	-	9.30	9.50
des	L	L	-	-	GH	GH	S	S	-	-	G	G	E	E	-	-	KL	KL	E	E	-	-	LMN	LMN
Non traditional	3.76	3.76	-	-	4.30	4.33	48.00	48.10	-	-	51.32F	51.47	11.67	11.73	-	-	8.63	8.73	9.83	9.90	-	-	9.30	9.50
Garlic	J	J	-	-	D	D	L	L	-	-	D	D	H	H	-	-	NO	NO	GH	GH	-	-	HK	HJ
oil	4.03	4.13	-	-	4.26	4.27	47.00	47.13	-	-	51.50	51.50	11.30	11.33	-	-	8.06	8.10	10.00	10.30	-	-	7.49	7.50
Pro-Gib	HI	HI	-	-	DE	DE	O	O	-	-	D	D	HI	HI	-	-	PQ	PQ	F-H	F-H	-	-	LM	LM
plus	3.73	3.73J	-	-	4.50	4.53	45.00	45.00	-	-	49.51	49.60	12.53	12.57	-	-	9.33	9.30	10.47	10.53	-	-	9.80	9.83
Hot water	JK	K	-	-	C	C	S	S	-	-	H	H	G	G	-	-	LM	L	E-G	E-G	-	-	GH	GH
Yeast	3.46	3.47	-	-	4.001	4.101	43.50	43.63	-	-	48.00L	48.13L	14.83	14.87	-	-	10.93	11.00	13.03	13.10	-	-	9.31	9.37
Waxing	M	M	-	-	-	-	T	T	-	-	-	-	C	B	-	-	U	U	C	C	-	-	HK	HK
Control	3.50	3.51	-	-	4.20	4.23	43.33	43.10	-	-	47.30	47.40	16.93	16.97	-	-	13.17	13.30	14.27	14.37	-	-	10.97	11.00
+ wax	M	M	-	-	EF	EF	U	U	-	-	N	N	B	B	-	-	EF	E	B	B	-	-	E	E
0.50kGy	4001	4.131	-	-	4.26	4.26	46.31	46.30	-	-	51.40E	51.43E	12.77	12.93	-	-	10.07	10.10	11.00	11.10	-	-	10.58	10.63
+ wax	M	M	-	-	DE	DE	K	K	-	-	-	-	FG	FG	-	-	K	K	E	E	-	-	EF	EF
0.75kGy	4001	4.001	-	-	4.30	4.50	48.61	48.63	-	-	52.00	52.31C	12.37	12.40	-	-	8.93	9.00	11.03	11.10	-	-	8.79J	8.80J
+ wax	M	M	-	-	C	C	J	J	-	-	C	C	G	G	-	-	MN	MN	E	E	-	-	K	K
Fungicide+wax	4001	4.001	-	-	4.63	4.65	45.50	45.57	-	-	52.00	52.10C	12.40	12.50	-	-	8.70	8.73	9.80	9.80	-	-	6.59	6.63
Garlic oil+ wax	4001	4.101	-	-	5.00	5.00	49.00	49.13	-	-	52.80	52.83B	10.77	10.79	-	-	7.70	7.79	9.001	9.111	-	-	8.60	8.63
Pro-Gib plus + wax	4001	4.001	-	-	5.00	5.00	49.00	49.00	-	-	B	B	J	J	-	-	Q	Q	-K	-K	-	-	K	K
Hot water + wax	4001	4.001	-	-	4.63	4.65	46.30	46.37	-	-	53.00	53.10	10.67	10.70	-	-	7.00	7.10	9.001	9.101	-	-	6.80	6.83
Yeast + wax	3.66	3.67	-	-	4.30	4.30	45.00	45.00	-	-	47.80	47.83	13.53	13.60	-	-	9.56	9.60	11.98	12.00	-	-	9.50	9.50
	KL	KL	-	-	D	D	S	S	-	-	M	M	E	E	-	-	L	L	D	D	-	-	HJ	HJ

respect of both seasons. However, combinations of all treatments in carton boxes failed to continue in cold storage for 105 days then were neglected.

On the other hand, Table (20-A) indicate that all treated fruits showed considerably high fresh appearance and fruit juice percentage with lower fruit decay and weight loss percentages of lime fruits after 120 days storage at cold temperature as compared with the control in both seasons. Meanwhile, pro-Gib plus waxing and garlic oil plus waxing treated fruits showed the higher fresh appearance and fruit juice percentage and the lower significant fruit decay and weight loss percentages followed by hot water plus waxing in fresh appearance and pro-Gib in fruit juice percentage and fruit decay and weight loss percentages as compared with the other used treatments and the control. Regarding different doses of irradiation it is found that the higher dose of irradiation (0.75 KGy) was superior than the lower dose in this respect. Considering package types in both seasons, Table (20-B) show that polyethylene plus carton package significantly maintained fresh appearance and increased fruit juice percentage while decreased fruit decay and weight loss percentages as compared with polyethylene package.

Furthermore, Table (20-C), pointed out that pro-Gib plus waxing in polyethylene package treatment maintained better fresh appearance and higher fruit juice percentage and decreased fruit decay and weight loss percentages statistically followed by garlic oil plus waxing as compared with the other combinations in this respect.

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Table (20): Effect of postharvest treatments and package types on the physical properties of lime fruits after 120 days storage at cold temperature.

Table (20-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.40M	3.42M	41.50P	41.55P	20.35A	20.30A	14.52A	14.50A
Irradiation								
0.50 KGy	3.71J	3.72J	45.55L	45.60L	15.75C	15.78C	11.75D	11.70D
0.75 KGy	3.81I	3.86I	46.50I	46.55I	14.53DE	14.50DE	11.50E	11.50E
Fungicides	3.81I	3.81I	46.10K	46.15K	14.67D	14.60D	11.55E	11.53E
Non traditional								
Garlic oil	3.95G	3.93G	48.10D	48.20D	12.85H	12.80H	9.55K	9.53K
Pro-Gib plus	4.10DE	4.15DE	48.73C	48.80C	12.32I	12.30I	9.51K	9.50K
Hot water	4.00F	4.00F	46.25J	46.30J	14.23E	14.20E	11.15F	11.15F
Yeast	3.65K	3.65K	44.75N	44.80N	15.93C	15.95C	13.25C	13.26C
Waxing								
Control + wax	3.56L	3.56L	42.35O	42.30O	19.02B	19.10B	13.80B	13.85B
0.50 KGy+wax	3.90H	3.90H	47.00G	47.10E	14.63D	14.60D	10.80G	10.83G
0.75 KGy+wax	4.06E	4.06E	47.60E	47.65E	13.38F	13.35F	10.59H	10.60H
Fungicides+wax	4.13D	4.13D	46.75H	46.80H	13.28FG	13.30FG	10.43I	10.45I
Garlic oil +wax	4.38B	4.35B	49.60B	49.68B	11.50J	11.50J	8.78L	8.77L
Pro-Gib plus + wax	4.50A	4.50A	49.75A	49.78A	11.10K	11.00K	8.70L	8.70L
Hot water +wax	4.25C	4.25C	47.50F	47.55F	13.00GH	13.00GH	10.05J	10.08J
Yeast + wax	3.83I	3.81I	45.50M	45.55M	14.75D	14.77D	11.91D	11.90D

Table (20-B): Effect of package type

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	3.61B	3.62B	44.04B	44.10B	15.63A	15.80A	12.33A	12.30A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	4.27A	4.30A	48.90A	49.00A	13.28B	13.20B	9.89B	9.88B

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Table (20-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	3.00	3.10	-	-	3.80	3.83	40.00	40.17	-	-	43.00	43.13	22.43	22.56	-	-	18.27	18.30	16.53	16.60	-	-	12.50	12.53
Control	M	M	-	-	H	H	T	T	-	-	Q	Q	A	A	-	-	C	C	A	A	-	-	F	F
Irradiation	3.43	3.45	-	-	4.00	4.17	42.60	42.67	-	-	48.50	48.57	16.63	16.67	-	-	14.87	14.93	12.80	12.87	-	-	10.77	10.97
0.50 kGy	J	J	-	-	F	F	R	R	-	-	G	G	E	E	-	-	H	H	E	E	-	-	K	K
0.75 kGy	3.46	3.47	-	-	4.16	4.20	44.00	44.13	-	-	49.00F	49.13F	15.70	15.82	-	-	13.37	13.40	12.50	12.53	-	-	10.50	10.53
1.00 kGy	J	J	-	-	E	E	O	O	-	-	G	G	FG	FG	-	-	KL	KL	F	F	-	-	L	L
Fungicide	3.631	3.661	-	-	4.00	4.13	43.00	43.17	-	-	49.20E	49.30E	15.87	15.90	-	-	13.47	13.53	12.50	12.53	-	-	10.60	10.67
Non traditional	-	-	-	-	F	F	Q	Q	-	-	-	-	F	F	-	-	JL	J	F	F	-	-	KL	KL
Garlic oil	3.601	3.631	-	-	4.30	4.37	46.20	46.27	-	-	50.00	50.13C	13.77	13.79	-	-	11.93	11.97	10.80	10.83	-	-	8.30	8.35
Pro-Gib plus	3.90	3.93	-	-	4.30	4.33	47.50	47.53	-	-	50.00	50.20C	13.43	13.53	-	-	11.20	11.27	11.03	11.10	-	-	7.98	8.00
Hot water	3.661	3.671	-	-	4.33	4.37	43.50	43.57	-	-	49.00F	49.10F	17.37	17.20	-	-	13.10	13.17	12.30	12.35	-	-	10.00	10.33
Yeast	3.30	3.37	-	-	4.00	4.17	42.00	42.13	-	-	47.50	44.63	20.87	20.90	-	-	14.70	14.73	14.50	14.55	-	-	12.00	12.35
Waxing	3.16	3.17	-	-	4.00	4.13	42.21	40.32	-	-	44.50	44.63	20.87	20.90	-	-	17.17	17.19	15.80	15.87	-	-	11.80	11.83
Control + wax	L	L	-	-	F	F	T	T	-	-	M	M	B	B	-	-	D	D	B	B	-	-	G	G
0.50kGy + wax	3.631	3.671	-	-	4.26	4.20	44.20	44.26	-	-	49.80	49.87	15.67	15.73	-	-	13.60	13.67	11.60	11.70	-	-	10.00	10.33
0.75kGy + wax	3.76	3.79	-	-	4.36	4.40	45.20	45.23	-	-	50.00	50.13C	14.60	14.66	-	-	12.17	12.19	11.50	11.56	-	-	9.66	9.67
Fungicide + wax	3.76	3.79	-	-	4.50	4.53	43.50	43.56	-	-	49.00	49.13C	14.50	14.53	-	-	12.07	12.13	11.15	11.17	-	-	9.70	9.73
des-wax	H	H	-	-	C	C	P	P	-	-	C	C	H	H	-	-	M	M	I	I	-	-	N	N
Garlic oil + wax	4.00	4.10	-	-	4.76	4.80	47.80	47.87	-	-	51.50	51.63	12.37	12.40	-	-	10.63	10.67	10.00	10.00	-	-	7.53	7.55
Pro-Gib plus + wax	4.00	4.13	-	-	5.00	5.00	48.00	48.13	-	-	51.50	51.55	12.07	12.10	-	-	10.13	10.30	10.20	10.27	-	-	7.20	7.25
Hot water + wax	4.00	4.10	-	-	4.50	4.50	44.00	44.17	-	-	51.00	51.17B	14.00	14.13	-	-	12.00	12.30	10.80	10.87	-	-	9.29	9.32
Yeast + wax	3.46	3.47J	-	-	4.20	4.27	43.00	43.13	-	-	48.00	48.13	15.63	15.67	-	-	13.87	13.93	13.30	13.42	-	-	10.51	10.63
Yeast + wax	J	J	-	-	E	E	Q	Q	-	-	H	H	G	G	-	-	U	U	D	D	-	-	L	L

Table (21-A) shows the effect of postharvest treatments on the physical properties of lime fruits after 135 days storage at cold temperature. It is quite evident that most treatments showed a considerable tendency to maintain fresh appearance and increase in fruit juice percentage and a decrease in both fruit decay and weight loss percentages as compared with the control in both seasons. However, garlic oil and pro-Gib treatments plus waxing showed the highest fresh appearance followed by the higher irradiation dose (0.75 KGy), fungicides and hot water treatments plus waxing as well as garlic oil and pro-Gib plus among the other treatments used. Meanwhile, significant increase in fruit juice percentage occurred when pro-Gib plus waxing treatment was used. Meanwhile, pro-Gib plus waxing treatment showed the lowest significant fruit decay and weight loss percentages as well as garlic oil plus waxing treatment as compared with the other used treatments and the control in both seasons. Comparing different package types as shown in Table (21-B) it is obvious that polyethylene plus carton package significantly maintained fresh appearance and increased fruit juice percentage as well as decreased fruit decay and weight loss percentages comparing with polyethylene package in both seasons.

Dealing with the interaction between storage treatments and package type in both seasons. Table (21-C) shows that garlic oil plus waxing as well as pro-Gib plus waxing in polyethylene plus carton package maintained better fresh appearance statistically followed by hot water plus waxing as compared with the other combinations in this respect. However, significant

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Table (21): Effect of postharvest treatments and package types on the physical properties of lime fruits after 135 days storage at cold temperature.

Table (21-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.23G	3.24I	40.88N	40.90N	24.67A	24.65A	16.00A	16.00A
Irradiation								
0.50 KGy	3.70CD	3.71EF	45.00K	45.20K	20.32D	20.30D	12.39E	12.40E
0.75 KGy	3.73CD	3.73DE	45.50J	45.50J	18.15FH	18.16FH	11.99F	12.00F
Fungicides	3.73CD	3.74DE	45.65I	45.68I	18.58F	18.55F	11.99F	11.90F
Non traditional								
Garlic oil	3.90B	3.90B	47.50D	47.60D	15.82K	15.80K	10.10J	10.00J
Pro-Gib plus	3.95B	3.95B	48.00C	48.12C	14.22L	14.20L	9.85K	9.80K
Hot water	3.73CD	3.73DE	45.75H	45.90H	17.85GI	17.85GI	11.91F	11.93F
Yeast	3.51E	3.52G	44.25L	44.35L	21.25C	21.26C	14.25C	14.27C
Waxing								
Control + wax	3.40F	3.42H	41.45M	41.80M	23.20B	23.25B	14.91B	14.90B
0.50 KGy+wax	3.78C	3.78D	46.45F	46.50F	19.23E	19.25E	11.50G	11.53G
0.75 KGy+wax	3.96B	3.97B	46.50F	46.55F	16.70J	16.75J	11.25H	11.30H
Fungicides+wax	3.88B	3.88B	46.15G	46.30G	17.32HJ	17.35HJ	11.30H	11.30H
Garlic oil +wax	4.21A	4.23A	49.00B	49.10B	14.62L	14.65L	9.45L	9.46L
Pro-Gib plus + wax	4.24A	4.23A	49.22A	49.10A	14.10L	17.20L	9.35M	9.30M
Hot water +wax	3.98B	3.98B	46.95E	47.00E	17.03IJ	11.10IJ	10.98I	10.95I
Yeast + wax	3.65D	3.65F	45.50J	45.52J	18.83EF	18.85EF	12.51D	12.50D

Table (21-B): Effect of package type

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	3.47B	3.50B	43.64B	43.70B	19.46A	19.80A	13.16A	13.15A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	4.11A	4.12A	48.12A	48.11A	17.04B	17.00B	10.55B	10.50B

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Table (21-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	2.86	2.85	-	-	3.63	3.60	39.20	39.23	-	-	42.57	42.60	26.17	26.20	-	-	23.17	23.20	18.20	18.25	-	-	13.80	13.85
Control	K	K	-	-	FH	FH	U	U	-	-	R	R	A	A	-	-	C	C	A	A	-	-	E	E
Irradiation	3.40	3.43	-	-	4.00	4.10	43.00	43.03	-	-	47.00	47.03	22.53	22.60	-	-	18.10	18.15	13.28	13.30	-	-	11.50	11.57
0.50	IJ	IJ	-	-	D	D	P	P	-	-	I	I	CD	CD	-	-	IK	IK	F	F	-	-	L	L
kGy	3.46	3.50	-	-	4.00	4.13	43.00	43.06	-	-	48.00	48.13	19.63	19.65	-	-	16.67	16.69	12.98	13.00	-	-	11.00	11.10
0.75	HI	HI	-	-	D	CD	P	P	-	-	G	G	FH	FH	-	-	LO	LO	G	G	-	-	N	N
kGy	3.46	3.47	-	-	4.00	4.07	42.80	42.83	-	-	48.50	48.53	19.93	19.95	-	-	17.23	17.37	12.98	13.00	-	-	11.00	11.13
Fungicide	HI	HI	-	-	D	D	Q	Q	-	-	F	F	FG	FG	-	-	JM	JM	G	G	-	-	N	N
des	3.73	3.70	-	-	4.20	4.23	45.80	45.83	-	-	49.20	49.23	16.93	16.95	-	-	14.70	14.75	11.53	11.50	-	-	8.70	8.77
Non traditional	EF	EF	-	-	BC	BC	L	L	-	-	D	D	KN	KN	-	-	QT	QT	L	L	-	-	S	S
Garlic oil	3.76	3.76	-	-	4.13	4.13	46.00	46.07	-	-	50.00	50.10	14.33	14.40	-	-	14.10	14.13	11.19	11.21	-	-	8.50	8.55
Pro-Gib plus	E	E	-	-	CD	CD	K	K	-	-	C	C	RU	RU	-	-	SU	SU	M	M	-	-	T	T
Hot water	3.46	3.47	-	-	4.00	4.03	43.00	43.06	-	-	48.50	48.57	19.10	19.13	-	-	16.60	16.63	13.02	13.10	-	-	10.81	10.87
Yeast	3.26	3.27J	-	-	3.76	3.77	42.00	42.07	-	-	46.50	46.53	22.10	22.15	-	-	20.40	20.46	15.80	15.85	-	-	12.70	12.77
Control	J	J	-	-	E	E	S	S	-	-	J	J	CD	CD	-	-	EF	EF	C	C	-	-	H	H
Waxing	3.00	3.10	-	-	3.80	3.83	40.00	40.03	-	-	43.50	43.55	24.87	24.85	-	-	21.53	21.60	16.88	16.93	-	-	12.93	12.97
Control	K	K	-	-	E	E	T	T	-	-	O	O	B	B	-	-	DE	DE	B	B	-	-	G	G
0.50kGy	3.36	3.37	-	-	4.20	4.23	44.00	44.13	-	-	48.90	48.93	20.87	20.85	-	-	17.60	17.65	12.50	12.57	-	-	10.50	10.57
+ wax	IJ	IJ	-	-	BC	BC	N	N	-	-	E	E	EF	EF	-	-	JL	JL	I	I	-	-	P	PP
0.75kGy	3.73	3.77	-	-	4.20	4.25	44.50	44.53	-	-	48.50	48.57	17.83	17.80	-	-	15.57	15.60	12.29	12.33	-	-	10.20	10.27
+ wax	EF	EF	-	-	BC	BC	M	M	-	-	F	F	IL	IL	-	-	QR	QR	J	J	-	-	Q	Q
Fungicide	3.56	3.57	-	-	4.20	4.25	43.00	43.09	-	-	49.30	49.37	18.47	18.50	-	-	16.17	16.20	12.30	12.35	-	-	10.31	10.37
des+ wax	GH	GH	-	-	BC	BC	P	P	-	-	D	D	HJ	HJ	-	-	MP	MP	J	J	-	-	Q	Q
Garlic oil	3.73	3.75	-	-	4.70	4.73	48.00	48.13	-	-	50.00	50.10	15.70	15.75	-	-	13.53	13.60	10.80	10.85	-	-	8.10	8.15
+ wax	EF	EF	-	-	A	A	G	G	-	-	C	C	NQ	NQ	-	-	TU	TU	O	O	-	-	U	U
Pro-Gib plus + wax	3.73	3.73	-	-	4.76	4.77	47.73	47.45	-	-	51.00	51.13	15.10	15.13	-	-	13.10	13.15	10.90	10.93	-	-	7.80	7.87
Control	EF	EF	-	-	A	A	H	H	-	-	A	A	PS	PS	-	-	U	U	NO	NO	-	-	V	V
Hot water + wax	3.66	3.67	-	-	4.30	4.37	43.50	43.57	-	-	50.40	50.45	18.07	18.10	-	-	16.00	16.10	11.97	12.00	-	-	10.00	10.12
Yeast + wax	3.30	3.33J	-	-	4.00	4.03	43.00	43.07	-	-	48.00	48.13	19.70	19.75	-	-	18.17	18.20	14.02	14.10	-	-	10.99	11.00
Control	J	J	-	-	D	D	P	P	-	-	G	G	FH	FH	-	-	IK	IK	D	D	-	-	N	N

increase in fruit juice percentage occurred when pro-Gib plus waxing in polyethylene package was used followed by hot water plus waxing then garlic oil plus waxing in comparison with all other combinations in both seasons. Meanwhile, garlic oil plus waxing and pro-Gib plus waxing in polyethylene plus carton package decreased both fruit decay and weight loss statistically followed by fungicides and hot water treatments plus waxing as compared with the other combinations in this respect.

Table (22-A) show the effect of postharvest treatments on the physical properties of lime fruits after 150 days storage at cold temperature. It is clear that most treatments showed a considerably acceptable in fresh appearance and higher fruit juice percentage and decreased fruit decay and weight loss percentages as compared with the control in both seasons. However, pro-Gib plus and garlic oil treatments plus waxing maintained the highest fresh appearance followed by fungicides plus waxing as well as hot water plus waxing then garlic oil and pro-Gib as compared with the other treatments and the control in a descending order in both seasons. Moreover, significant increase in fruit juice percentage and decrease in fruit decay and weight loss percentages occurred when pro-Gib plus waxing was used followed by garlic oil plus waxing then pro-Gib and garlic oil treatments as compared with the other used treatments and the control in both seasons. Considering package types, Table (22-B) indicate that polyethylene plus carton package significantly maintained better fresh appearance, increased fruit juice percentage and decreased both fruit decay and weight loss percentages in relation to polyethylene package.

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Table (22): Effect of postharvest treatments and package types on the physical properties of lime fruits after 150 days storage at cold temperature.

Table (22-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	3.03I	3.00I	37.85O	37.80O	36.42A	36.40A	16.90A	16.83A
<u>Irradiation</u>								
0.50 KGy	3.40G	3.37G	43.00L	43.00L	32.38D	32.35D	13.31E	13.30E
0.75 KGy	3.51F	3.50F	43.90J	43.95J	31.02F	31.00F	12.95F	12.90F
Fungicides	3.58EF	3.58EF	43.50K	43.46K	30.12G	30.10G	13.20E	13.23E
<u>Non traditional</u>								
Garlic oil	3.83BC	3.80BC	46.80D	46.90D	28.43IF	28.40IF	11.20J	11.25J
Pro-Gib plus	3.83BC	3.80BC	47.00C	47.00C	26.83K	26.80K	11.11J	11.10J
Hot water	3.63DE	3.65DE	44.30I	44.35I	29.38H	29.35H	12.95F	12.97F
Yeast	3.18H	3.20H	42.25M	42.30M	33.08C	33.00C	15.22C	15.25C
<u>Waxing</u>								
Control + wax	3.23H	3.20H	39.65N	39.70N	34.33B	34.30B	15.90B	15.95B
0.50 KGy+wax	3.56EF	3.55EF	45.00G	45.10G	30.55FG	30.50FG	12.30G	12.35G
0.75 KGy+wax	3.73CD	3.75CD	45.17F	45.20F	29.50H	29.53H	12.13H	12.15H
Fungicides+wax	3.93B	3.95B	44.90H	44.90H	28.64I	28.62I	12.20GH	12.23GH
Garlic oil +wax	4.05A	4.00A	48.15A	47.80B	27.05K	27.10K	10.30K	10.33K
Pro-Gib plus + wax	4.11A	4.11A	47.85B	48.16A	24.60L	24.60L	10.10L	10.13L
Hot water +wax	3.88B	3.90B	45.75E	45.73E	28.08J	28.00J	11.91I	11.90I
Yeast + wax	3.38G	3.40G	43.50K	43.56K	31.60E	31.60E	13.68D	13.70D

Table (22-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	3.28B	3.30B	41.30B	41.35B	31.86A	31.85A	14.55A	14.56A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	3.95A	3.97A	47.27A	47.30A	28.39B	28.39B	11.12B	11.15B

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Table (22-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	2.80	2.83	-	-	3.27	3.30	35.00	35.10	-	-	40.70	40.80	39.17	39.20	-	-	33.67	33.70	19.50	19.60	-	-	14.30	14.35
Control	K	K	-	-	I	I	U	U	-	-	Q	Q	A	A	-	-	D	D	A	A	-	-	G	G
Irradiation 0.50 kGy	3.00	3.10	-	-	3.76	3.79	40.10	40.00	-	-	46.00	46.13	33.77	33.80	-	-	31.00	31.10	14.80	14.85	-	-	11.82	11.90
0.75 kGy	3.20	3.25	-	-	3.83	3.90	41.30	41.42	-	-	46.50	46.60	32.83	32.85	-	-	29.20	29.25	14.60	14.65	-	-	11.30	11.37
Fungicides	3.43	3.45	-	-	3.73	3.77	40.10	40.00	-	-	47.00	47.15	32.43	32.50	-	-	27.80	27.92	14.80	14.85	-	-	11.60	11.63
Non traditional Garlic oil	3.46	3.47	-	-	4.20	4.25	45.00	45.11	-	-	48.60	48.70	30.00	30.00	-	-	26.87	26.90	13.90	13.95	-	-	9.50	9.63
Pro-Gib plus water	3.46	3.46	-	-	4.20	4.27	45.00	45.15	-	-	49.00	49.00	28.67	28.70	-	-	25.00	25.13	13.20	13.25	-	-	9.01	9.31
Hot water	3.43	3.43	-	-	3.80	3.85	40.60	40.70	-	-	48.00	48.13	32.00	32.10	-	-	26.77	26.70	14.50	14.57	-	-	11.40	11.45
Yeast	2.80	2.85	-	-	3.56	3.60	38.50	38.60	-	-	46.00	46.15	34.83	34.85	-	-	31.33	31.50	16.90	16.93	-	-	13.53	13.60
Waxing Control	3.00	3.10	-	-	3.46	3.50	36.80	36.85	-	-	42.50	42.60	36.27	36.30	-	-	32.40	32.50	18.30	18.37	-	-	13.50	13.50
+ wax	3.13	3.17	-	-	4.00	4.13	42.00	42.00	-	-	48.00	48.00	31.27	31.30	-	-	29.80	29.85	13.60	13.65	-	-	11.00	11.13
0.50kGy + wax	3.47	3.50	-	-	4.00	4.10	42.30	42.40	-	-	48.00	48.10	30.83	31.00	-	-	28.17	28.20	13.57	13.60	-	-	10.70	10.77
0.75kGy + wax	3.53	3.57	-	-	4.33	4.35	41.30	41.50	-	-	48.50	48.60	30.67	30.70	-	-	26.61	26.67	13.50	13.54	-	-	10.90	10.93
Fungicides + wax	3.63	3.70	-	-	4.46	4.50	46.30	46.30	-	-	50.00	50.13	30.13	30.20	-	-	25.93	25.95	11.81	11.85	-	-	8.80	8.85
Garlic oil + wax	3.63	3.65	-	-	4.60	4.70	45.20	45.30	-	-	50.50	50.63	25.87	25.90	-	-	23.33	23.36	12.00	12.10	-	-	8.20	8.23
Pro-Gib plus + wax	3.57	3.60	-	-	4.20	4.25	41.50	41.30	-	-	50.00	50.10	30.17	30.20	-	-	26.00	26.10	13.30	13.36	-	-	10.52	10.50
Hot water + wax	3.00	3.07	-	-	3.76	3.79	40.00	40.10	-	-	47.00	47.10	32.83	32.90	-	-	30.37	30.43	15.57	15.60	-	-	11.80	11.85
Yeast + wax																								

Dealing with the interaction between postharvest treatment and package type in both seasons as presented in Table (22-C) it is clear that pro-Gib plus waxing in polyethylene plus carton package treatment maintained statistically fresh appearance and higher fruit juice percentage and decreased fruit decay and weight loss percentages followed by garlic oil plus waxing as well as hot water plus waxing for fresh appearance and garlic oil plus waxing for fruit juice percentage, fruit decay and weight loss percentages as compared with the other combinations in this respect.

It is quite evident from Table (23-A) that pro-Gib plus waxing showed the highest fresh appearance followed by garlic oil plus waxing then pro-Gib plus treatments among the other used treatments in the two seasons of study. However, significant increase in fruit juice percentage and a decrease in fruit weight loss percentage was obtained when pro-Gib plus waxing as well as garlic oil plus waxing were used in both seasons. Meanwhile, pro-Gib plus waxing treatment decreased fruit decay percentage statistically followed by pro-Gib and garlic oil plus waxing then garlic oil as compared with the other used treatments and the control in a descending order.

Regarding the effect of package types in both seasons, Table (23-B) clearly showed that polyethylene plus carton package showed higher fresh appearance and juice percentage and the lower significant fruit decay and weight loss percentages as compared with polyethylene package in both seasons.

RESULTS & DISCUSSION

Table (23): Effect of postharvest treatments and package types on the physical properties of lime fruits after 165 days storage at cold temperature.

Table (23-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	20.00K	20.10K	34.00L	34.08L	54.20A	54.30A	23.83A	23.95A
Irradiation								
0.50 KGy	2.31HI	2.35HI	36.50J	36.56J	53.11CD	53.20CD	20.90E	21.00E
0.75 KGy	2.33HI	2.30HI	36.50J	36.50J	52.54E	52.50E	20.17F	20.20F
Fungicides	3.35F	3.30F	42.25G	42.40G	51.11G	51.10G	20.04F	20.10F
Non traditional								
Garlic oil	3.65D	3.66D	45.55B	45.60B	42.91IJ	43.00IJ	18.57I	18.60I
Pro-Gib plus	3.70C	3.70C	45.50C	45.50C	39.21K	39.20K	18.20J	18.20J
Hot water	3.50E	3.56E	42.85F	42.87F	50.94G	50.97G	19.74G	19.80G
Yeast	1.00L	1.00L	28.00M	28.00M	53.72B	53.80B	22.00C	22.10C
Waxing								
Control + wax	2.16J	2.15J	34.65K	34.70K	53.34C	53.40C	23.52B	23.60B
0.50 KGy+wax	2.38G	2.40G	37.30H	37.40H	52.42E	52.50E	20.32F	20.40F
0.75 KGy+wax	2.36GH	2.35GH	37.25I	37.30I	52.08F	52.10F	19.33H	19.40H
Fungicides+wax	3.51E	3.60D	43.57E	43.60E	50.59H	50.60H	18.61I	18.65I
Garlic oil +wax	3.88B	3.90B	46.50A	46.59A	41.56J	40.80K	16.84K	16.90K
Pro-Gib plus + wax	4.03A	4.10A	46.50A	46.60A	38.58L	38.58L	16.59K	16.60K
Hot water +wax	3.63D	3.60D	44.10D	44.15D	50.53H	50.60H	18.36IJ	18.40IJ
Yeast + wax	1.00L	1.00L	28.00M	28.00M	52.98D	53.00D	21.67D	21.73D

Table (23-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	2.18B	2.20B	34.81B	34.82B	46.65A	46.60A	15.74A	15.75A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	3.42A	3.40A	43.82A	43.83A	41.87B	41.80B	12.32B	12.35B

RESULTS & DISCUSSION

Table (23-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	-	-	-	-	3.00	3.10	-	-	-	-	40.00	40.07	-	-	-	-	46.67	46.70	-	-	-	-	15.50	15.60
Control	-	-	-	-	3.00	3.10	-	-	-	-	40.00	40.07	-	-	-	-	46.67	46.70	-	-	-	-	15.50	15.60
Irradiation 0.50 kGy	-	-	-	-	3.63	3.65	-	-	-	-	45.00	45.30	-	-	-	-	44.33	44.40	-	-	-	-	12.70	12.75
0.75 kGy	-	-	-	-	3.66	3.70	-	-	-	-	45.00	45.15	-	-	-	-	43.43	43.50	-	-	-	-	12.50	12.60
Fungicides	-	-	-	-	3.501	3.601	-	-	-	-	46.00	46.10	-	-	-	-	44.17	44.20	-	-	-	-	12.80	12.89
Non traditional Garlic oil	3.30	3.35	-	-	4.00	4.10	43.60	43.70	-	-	47.50	47.60	38.43	38.50	-	-	37.73	37.70	14.50	14.60	-	-	10.20	10.03
Pro-Gib plus	3.40	3.43	-	-	4.00	4.07	43.00	43.30	-	-	48.00	48.10	34.20	34.30	-	-	33.43	33.40	14.00	14.10	-	-	9.60	9.70
Hot water	-	-	-	-	3.70	3.70	-	-	-	-	46.50	46.57	-	-	-	-	44.17	44.20	-	-	-	-	12.23	12.30
Yeast	-	-	-	-	1.00	1.00	-	-	-	-	28.00	28.10	-	-	-	-	46.17	46.20	-	-	-	-	15.00	15.10
Waxing Control + wax	-	-	-	-	3.33	3.30	-	-	-	-	41.30	41.35	-	-	-	-	45.17	45.20	-	-	-	-	14.56	14.60
0.50kGy + wax	-	-	-	-	3.76	3.75	-	-	-	-	46.60	46.65	-	-	-	-	43.10	43.20	-	-	-	-	11.97	12.00
0.75kGy + wax	3.00	3.00	-	-	3.73	3.75	28.00	28.00	-	-	46.50	46.50	48.50	48.50	-	-	42.83	43.00	16.00	16.10	-	-	12.00	12.00
Fungicides + wax	3.26	3.30	-	-	3.76	3.75	40.00	40.10	-	-	47.13	47.20	48.00	48.00	-	-	43.60	43.70	14.83	14.80	-	-	12.00	12.10
Garlic oil + wax	3.56	3.60	-	-	4.20	4.25	44.50	44.58	-	-	48.50	48.55	38.50	38.50	-	-	35.17	35.20	13.03	13.10	-	-	9.50	9.56
Pro-Gib plus + wax	3.60	3.63	-	-	4.46	4.47	44.00	44.30	-	-	49.00	49.30	34.03	34.10	-	-	31.70	31.80	12.98	12.80	-	-	9.00	9.10
Hot water + wax	3.27	3.25	-	-	4.00	4.07	40.20	40.30	-	-	48.00	48.10	48.00	48.00	-	-	43.61	43.60	14.50	14.60	-	-	12.50	12.57
Yeast + wax	-	-	-	-	1.00	1.00	-	-	-	-	28.00	28.10	-	-	-	-	44.77	44.70	-	-	-	-	15.00	15.00

Dealing with the interaction between postharvest treatments and package type in both seasons, Table (23-C) show that pro-Gib plus waxing in polyethylene plus carton package had higher fresh appearance and fruit juice percentage and decreased fruit decay and weight loss percentages statistically followed by garlic oil plus waxing then garlic oil and pro-gib in the same package as compared with the other combinations in this respect. However, combinations of all treatments under study and carton package as well as unwaxed treatments except pro-Gib or Garlic oil and waxed control, irradiation dose (0.50 KGy) and yeast failed to continue and discarded when polyethylene package was used.

Table (24-A) include the effect of postharvest treatments on the physical properties of lime fruits after 180 days storage at cold temperature. It is quite evident that the lower irradiation dose (0.5 KGy) plus waxing, yeast, fungicides, irradiation dose (0.50 KGy) only, control plus waxing and the control treatments were in poor physical condition after 180 days of cold storage and were discarded. On the contrary, pro-Gib plus waxing treatment succeeded significantly in increasing fresh appearance and fruit juice percentage and decreased fruit decay and weight loss percentages as compared with the other used treatments.

Considering package type in both seasons Table (24-B) show that polyethylene plus carton package significantly maintained better fresh appearance and fruit juice percentage as compared with polyethylene package.

RESULTS & DISCUSSION

Table (24): Effect of postharvest treatments and package types on the physical properties of lime fruits after 180 days under cold temperature.

Table (24-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	2.25F	2.26F	35.00D	35.10D	55.78A	55.80A	20.28A	20.30A
Fungicides	-	-	-	-	-	-	-	-
Non traditional	-	-	-	-	-	-	-	-
Garlic oil	3.50C	3.60C	36.00C	36.13C	44.00E	44.00E	18.64C	18.70C
Pro-Gib plus	3.60B	3.65B	42.85B	42.89B	43.39F	43.50F	18.51C	18.50C
Hot water	2.25F	2.30F	35.80D	35.85D	54.09B	54.10B	20.00A	20.10A
Yeast	-	-	-	-	-	-	-	-
Waxing	-	-	-	-	-	-	-	-
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	-	-	-	-	-	-	-	-
0.75 KGy+wax	2.35E	240E	35.75D	35.80D	54.91B	54.97B	19.50B	19.50B
Fungicides+wax	2.23F	2.30F	36.00C	36.30C	53.81C	53.80C	19.17B	19.20B
Garlic oil +wax	2.50D	2.50D	36.80C	36.90C	43.26F	43.30F	17.41D	17.50D
Pro-Gib plus + wax	3.80A	3.80A	44.50A	44.60A	42.60G	42.68G	17.17D	17.20D
Hot water +wax	2.37E	2.33F	36.50C	36.50C	53.31D	53.30D	18.66C	18.70C
Yeast + wax	-	-	-	-	-	-	-	-

Table (24-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	1.42B	1.50B	29.76B	29.80B	51.89A	51.90A	15.94A	15.95A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	3.01A	3.10A	39.85A	39.90A	46.45B	46.50B	12.73B	12.75B

RESULTS & DISCUSSION

Table (24-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75 kGy	-	-	-	-	3.50	3.60	-	-	-	-	42.00	42.10	-	-	-	-	47.17	47.20	-	-	-	-	13.17	13.20
Fungicides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non traditional	3.12	3.15	-	-	3.86	3.90	28.00	28.10	-	-	44.00	44.10	-	-	-	-	41.93	41.97	14.00	14.00	-	-	10.93	11.00
Garlic oil	3.20	3.30	-	-	4.00	4.10	41.20	41.30	-	-	44.50	44.60	-	-	-	-	38.00	38.10	14.00	14.00	-	-	10.53	10.60
Pro-Gib plus	-	-	-	-	3.50	3.60	-	-	-	-	43.60	43.65	-	-	-	-	48.27	38.30	-	-	-	-	13.00	13.00
Hot water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waxing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+ wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75kGy + wax	-	-	-	-	3.70	3.75	-	-	-	-	-	-	-	-	-	-	46.43	46.50	-	-	-	-	12.53	12.60
Fungicides+ wax	-	-	-	-	3.46	3.50	-	-	-	-	-	-	-	-	-	-	48.27	48.30	-	-	-	-	12.50	12.60
Garlic oil+ wax	3.10	3.20	-	-	4.00	4.10	28.00	28.00	-	-	45.00	45.00	43.83	43.90	-	-	40.93	41.00	14.00	14.10	-	-	10.23	10.30
Pro-Gib plus + wax	3.46	3.50	-	-	4.13	4.20	43.00	43.10	-	-	45.10	45.00	41.03	41.10	-	-	36.17	37.00	14.00	14.13	-	-	9.501	9.581
Hot water + wax	-	-	-	-	3.73	3.75	-	-	-	-	-	-	-	-	-	-	47.17	47.20	-	-	-	-	12.07	12.10
Yeast + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Concerning the interaction between postharvest treatments and package type in both seasons Table (24-C) show that pro-Gib plus waxing in polyethylene plus carton package had better fresh appearance and fruit juice percentage and decreased fruit decay and weight loss percentages statistically followed by garlic oil plus waxing and pro-Gib in the same package for fresh appearance and fruit weight loss percentage, garlic oil plus waxing for fruit juice percentage and pro-Gib in fruit decay percentage as compared with the other combinations in this respect.

Table (25-A) show the effect of postharvest treatments on the physical properties of stored lime after 195 days fruits storage at cold temperature. It is quite evident that all treatments were terminated due to the loss of fruit physical properties up to 195 days of cold temperature except pro-Gib, garlic oil, pro-Gib plus waxing and garlic oil plus waxing treatments in both seasons. However, pro-Gib plus waxing treatment succeeded in maintaining acceptable fresh appearance and decreasing fruit decay and weight loss percentages followed by pro-Gib then garlic oil plus waxing as compared with garlic oil in a descending order. However, a significant increase in fruit juice percentage occurred when garlic oil plus waxing as well as pro-Gib plus waxing were used followed by pro-Gib as compared with garlic oil treatment in both seasons.

Concerning the effect of package types in the two seasons (1999 & 2000) it is quite evident from Table (25-B) that polyethylene plus carton package significantly maintained better fresh appearance and juice percentage and decreased fruit decay

RESULTS & DISCUSSION

Table (25): Effect of postharvest treatments and package types on the physical properties of lime fruits after 195 days storage at cold temperature.

Table (25-A): Effect of postharvest treatments.

Parameters Season Treatments	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
Irradiation								
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	-	-	-	-	-	-	-	-
Fungicides	-	-	-	-	-	-	-	-
Non traditional								
Garlic oil	2.30D	2.36CD	35.65C	35.61C	43.83A	43.82A	14.00A	14.12A
Pro-Gib plus	2.40B	2.43B	35.75B	35.70B	41.33C	41.32C	12.75C	12.70C
Hot water	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-
Waxing								
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	-	-	-	-	-	-	-	-
0.75 KGy+wax	-	-	-	-	-	-	-	-
Fungicides+wax	-	-	-	-	-	-	-	-
Garlic oil +wax	2.35C	2.38C	36.50A	36.49A	42.30B	42.31B	13.31B	13.30B
Pro-Gib plus + wax	2.45A	2.47A	36.50A	36.51A	40.50D	40.51D	12.25D	12.21D
Hot water +wax	-	-	-	-	-	-	-	-
Yeast + wax	-	-	-	-	-	-	-	-

Table (25-B): Effect of package types

Parameters Season Treatment	Fresh appearance		Percentage of fruit juice		Percentage of fruit decay		Percentage of fruit weight loss	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	1.00B	1.00B	28.00B	28.10B	11.05A	11.23A	14.83A	14.81A
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	3.75A	3.33A	44.20A	45.21A	40.15B	40.10B	11.35B	12.30B

RESULTS & DISCUSSION

Table (25-C) Effect of the interaction between postharvest treatment and package type

Parameters	Fresh appearance (score)						Percentage of fruit juice						Percentage of fruit decay						Percentage of fruit weight loss					
	Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Package																								
Season	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.00 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non traditional	1.00	1.00	3.60	3.62	28.00	28.31	42.10	43.30	45.00	45.10	42.67	42.61	16.00	16.21	12.00	12.01	42.67	42.61	16.00	16.21	12.00	12.01	42.67	42.61
Garlic oil	E	E	D	D	D	D	C	C	A	A	C	C	A	A	C	C	C	C	A	A	C	C	C	C
Pro-Gib plus	1.00	1.00	3.80	3.80	28.00	28.14	43.51	43.50	43.00	43.00	39.67	39.60	14.00	14.10	11.50	11.31	39.67	39.60	14.00	14.10	11.50	11.31	39.67	39.60
Hot water	E	E	B	B	D	D	D	B	BC	BC	E	E	B	B	CD	CD	E	E	B	B	CD	CD	E	E
Yeast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waxing Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+ wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicides + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garlic oil + wax	1.00	1.00	3.70	3.70	28.00	28.21	45.00	45.00	43.00	43.10	41.50	41.52	15.33	15.32	11.30	11.32	41.50	41.52	15.33	15.32	11.30	11.32	41.50	41.52
Pro-Gib plus + wax	E	E	C	C	D	D	A	A	B	B	D	D	AB	AB	CD	CD	D	D	AB	AB	CD	CD	D	D
Hot water + wax	1.00	1.00	3.90	3.92	28.00	28.31	45.10	45.00	43.00	43.10	38.50	38.52	14.00	14.00	10.50	10.51	38.50	38.52	14.00	14.00	10.50	10.51	38.50	38.52
Yeast + wax	E	E	A	A	D	D	A	A	BC	BC	F	F	B	B	D	D	F	F	B	B	D	D	F	F
Hot water + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

and weight loss percentages as compared with polyethylene package. On the other hand, fruits kept in carton package didn't survive and were discarded as mentioned earlier.

Furthermore Table (25-C), the results of both (1999 & 2000) seasons indicate that combinations of pro-Gib or garlic oil plus waxing and unwaxing enhanced the increase in fruit survivals with good physical properties of lime fruits after 195 days storage at cold temperature when polyethylene plus carton package was used.

Generally, all treated fruits showed considerably higher fresh appearance and fruit juice percentage during the whole storage, as period compared with the untreated fruits (control) which showed high fresh appearance and fruit juice percentage till only 90 days of storage, then fruits lost their fresh appearance and started to lose different parameters of quality fruit packed. In polyethylene plus carton boxes maintained acceptable parameters of physical properties until 105 days storage. Meanwhile, all the treated and untreated fruits, stored under 10°C did not show any sign of fruit decay and weight loss percentages during 45 days in polyethylene plus carton package. After words, the untreated fruits showed the maximum percentage of decay and weight loss in carton package followed by the fruits in polyethylene package then the different treatments in polyethylene plus carton package. Meanwhile, pro-Gib plus waxing treated fruits showed the higher significant fresh appearance and juice percentage and lower decay and weight loss percentages in polyethylene package during the whole storage period (195 days) followed by garlic oil plus

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waxing as compared with the other used treatments. Comparing different doses of irradiation, it is found that the high dose (0.75 KGy) was most superior than the lower one in all physical properties under cold temperature.

These results are in agreement with the findings of **Isshak et al. (1978)**. They found that the best storage temperature for lemon fruits is 8-9°C, that held the percentage of decay at 3.3% for light green lemons and in ratio 4.0% for silver green fruit after 5 months of storage. In addition, **Kaushal and Thakur (1996)** reported that fruit decay percentage increased with prolonged lime storage. Meanwhile, **Tugwell (1988)** found that wrapping of Valencia orange fruits in plastic film reduced weight loss to nearly half of that occurred when non-wrapped fruits were stored at 10°C.

4-2-b- Chemical properties

Table (26-A) show the effect of postharvest treatments on the chemical properties of lime fruits after 15 days storage at cold temperature. It is quite evident that the high irradiation dose (0.75 KGy) gave significantly the highest T.S.S. / acid ratio followed by the high irradiation dose (0.75 KGy) plus waxing as compared with the other used treatments and the control. Besides, pro-Gib treated fruits showed the highest ascorbic acid content followed by pro-Gib plus waxing among the other treatments used.

On the other hand, no significant differences were also noticed between different treatments when total soluble solids and total acidity values parameters were concerned.

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Table (26): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 15 days storage at cold temperature.

Table (26-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	9.04A	9.10A	7.03A	7.10A	1.25E	1.26DE	59.04AD	59.05AD
<u>Irradiation</u>								
0.50 KGy	8.91A	8.91A	7.11A	7.11A	1.25E	1.25E	58.95BE	58.95BE
0.75 KGy	9.00A	9.10A	7.16A	7.19A	1.30A	1.30A	58.96BE	58.96BE
Fungicides	8.96A	9.97A	7.07A	7.07A	1.26DE	1.26DE	58.99AE	58.99AE
<u>Non traditional</u>								
Garlic oil	8.96A	8.97A	7.06A	7.08A	1.26DE	1.26DE	58.90CF	58.91CF
Pro-Gib plus	8.98A	9.97A	7.04A	7.04A	1.26DE	1.26DE	59.17A	59.17A
Hot water	8.98A	9.97A	7.03A	7.05A	1.26DE	1.26DE	58.86DF	58.83DF
Yeast	8.89A	8.90A	7.06A	7.08A	1.26DE	1.26DE	58.84EF	58.84EF
<u>Waxing</u>								
Control + wax	8.96A	8.95A	7.01A	7.02A	1.27CD	1.27CD	58.73FG	58.73FG
0.50 KGy+wax	8.87A	8.90A	6.98A	7.00A	1.28BC	1.28BC	58.87DF	58.87DF
0.75 KGy+wax	8.93A	8.93A	7.03A	7.05A	1.29AB	1.29AB	58.57G	58.57G
Fungicides+wax	8.91A	8.92A	6.98A	7.00A	1.24F	1.24F	58.96BE	58.96BE
Garlic oil +wax	8.89A	8.90A	6.99A	7.00A	1.26DE	1.25E	59.01AD	59.04AD
Pro-Gib plus + wax	8.91A	8.92A	7.17A	7.20A	1.27CD	1.27CD	59.08ABC	59.12ABC
Hot water +wax	8.98A	8.98A	7.09A	7.20A	1.28BC	1.28BC	59.10AB	59.10AB
Yeast + wax	8.98A	9.00A	7.12A	7.15A	1.27CD	1.27CD	59.90ABC	59.93ABC

Table (26-B): Effect of package type

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.93A	8.98A	7.04A	7.08A	1.28A	1.28A	58.96A	58.97B
Carton	8.99A	8.98A	7.09A	7.05A	1.26C	1.26C	58.91A	58.91A
Polyethylene + carton	8.91A	8.95A	7.03A	7.05A	1.27B	1.27B	58.97A	58.98A

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Table (26-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	9.00	9.00	9.10	9.20	8.93	9.10	6.93	7.00	7.10	7.13	7.06	7.12	1.23	1.25	1.24	1.24	1.29	1.29	59.33	59.31	58.93	58.91	58.88	58.86
Control	A	A	A	A	A	A	A	A	A	A	A	A	MP	MP	KO	KO	DE	DE	B	B	EI	EI	EI	EI
Irradiation 0.50 kGy	8.80	8.90	9.00	9.00	8.93	9.12	7.20	7.28	7.06	7.10	7.06	7.15	1.26	1.26	1.25	1.26	1.251	1.251	59.07	59.05	58.85	58.85	58.93	58.95
0.75 kGy	9.00	8.80	9.20	9.12	8.80	9.10	7.00	7.33	7.16	7.21	7.00	7.10	1.33	1.33	1.26	1.26	1.31	1.31	59.07	59.03	58.90	58.90	58.93	58.95
Fungicides	8.93	9.00	9.00	9.10	8.93	9.10	7.13	7.18	7.13	7.20	6.93	7.22	1.27	1.27	1.23	1.23	1.28	1.28	58.87	58.83	58.95	58.94	59.18	59.15
Non traditional	A	A	A	A	A	A	A	A	A	A	A	A	EK	EK	MP	MP	DH	DH	FI	FI	EI	7BF	BG	BG
Garlic oil	8.93	9.00	9.00	9.10	8.93	9.13	7.00	6.96	7.20	7.20	7.16	7.20	1.27	1.27	1.251	1.251	1.26	1.26	59.00	58.78	58.76	58.93	58.93	58.95
Pro-Gib plus	8.93	9.00	9.00	9.00	9.00	9.00	7.16	7.20	7.10	7.15	6.93	7.00	1.22	1.23	1.29	1.29	1.28	1.27	59.70	59.60	58.82	58.80	59.00	59.00
Hot water	9.00	9.10	9.00	9.20	8.93	9.00	7.00	7.22	7.10	7.13	7.00	7.16	1.26	1.26	1.251	1.251	1.28	1.28	58.70	58.70	58.97	58.98	58.92	59.93
Yeast	9.00	9.00	8.80	9.00	8.93	8.95	7.03	7.10	7.06	7.00	7.06	7.13	1.30	1.30	1.26	1.26	1.22	1.22	58.50	58.48	58.48	58.83	59.15	59.13
Waxing Control	8.87	9.00	9.00	9.10	9.00	9.00	7.00	7.22	6.96	7.13	7.06	7.13	1.251	1.251	1.31	1.31	1.26	1.26	58.40	58.40	58.97	58.98	58.83	58.83
+ wax	A	A	A	A	A	A	A	A	A	A	A	A	M	M	AB	AB	HL	HL	K	K	CI	CI	FI	FI
0.50kGy + wax	8.88	9.00	9.00	9.10	8.80	8.90	6.96	7.00	7.00	7.10	6.96	7.15	1.29	1.29	1.31	1.31	1.251	1.251	58.88	58.85	58.78	58.78	58.95	58.93
0.75kGy + wax	8.93	9.00	9.00	9.00	8.87	9.00	6.96	7.12	7.13	7.15	7.00	7.00	1.30	1.30	1.30	1.30	1.26	1.26	58.01	58.00	58.78	58.75	58.93	58.95
Fungicides-wax	8.93	9.10	9.00	9.00	8.93	9.10	6.93	7.20	7.06	7.18	7.06	7.10	1.251	1.251	1.22	1.22	1.251	1.251	59.00	59.00	59.04	59.00	58.86	58.85
Garlic oil+ wax	8.87	9.00	8.87	9.13	9.00	9.00	6.93	7.00	7.00	7.00	7.03	7.10	1.26	1.26	1.26	1.26	1.251	1.251	59.00	59.00	58.98	59.00	59.14	59.13
Pro-Gib plus + wax	9.06	9.10	8.87	9.12	8.86	9.10	7.16	7.12	7.20	7.22	7.13	7.23	1.28	1.28	1.29	1.29	1.24	1.24	59.30	59.29	59.00	58.97	58.96	58.96
Hot water + wax	9.00	9.00	9.00	9.10	8.93	9.10	7.13	7.25	7.06	7.20	7.06	7.13	1.30	1.30	1.23	1.23	1.30	1.30	59.25	59.23	59.05	59.04	59.00	59.00
Yeast + wax	9.00	8.85	9.00	9.00	8.93	9.00	7.13	7.22	7.23	7.20	6.96	7.20	1.251	1.251	1.27	1.27	1.29	1.29	59.29	59.25	58.97	59.00	59.00	59.00
wax	A	A	A	A	A	A	A	A	A	A	A	A	M	M	EK	EK	BE	BE	BD	BD	CI	CI	CI	CI

Comparing different package types Table (26-B) indicate that polyethylene package significantly increased T.S.S. / acid ratio followed by polyethylene plus carton as compared with carton package in a descending order. On the other hand, there were no significant difference between all different package types when total soluble solids, total acidity values and ascorbic acid content parameters were considered in both seasons.

With respect to the different interactions Table (26-C) pointed out that high irradiation dose (0.75 KGy) in polyethylene package increased T.S.S. / acid ratio statistically in both seasons. However, significant increase in ascorbic acid content occurred when pro-Gib treated fruits were packed in polyethylene. On the other hand, combinations of postharvest treatments and package types failed to induce any statistical difference among them when total soluble solids and total acidity values were concerned in both seasons.

It is obvious from Table (27-A) that all fruit treatments attained high level of total soluble solids, total acidity values and T.S.S. / acid ratio during the following third storage period (30 days) under cold temperature in both seasons as compared with the control. However significant increase of total soluble solids percentage occurred when garlic oil and pro-Gib treatments were used. Meanwhile, garlic oil plus waxing treatment succeeded in increasing total acidity values followed by garlic oil then pro-Gib plus waxing as compared with the other used treatments and the control in both seasons. Furthermore, the lower dose of irradiation (0.50 KGy) caused highest effect in increasing T.S.S. / acid ratio followed by fungicides treatment then pro-Gib as

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well as fungicides and hot-water treatments plus waxing as compared with the other used treatments and the control in a descending order. Moreover, significant increase of ascorbic acid content occurred when pro-Gib and garlic oil treatments plus waxing were used in both seasons.

Regarding the effect of package types on fruit chemical characteristics Table (27-B) clarify that packing the fruits in polyethylene plus carton significantly increased total acidity values, T.S.S. / acid ratio and ascorbic acid contents followed by polyethylene package as compared with carton package. On the other hand, no significant difference was obtained between polyethylene, carton and polyethylene plus carton packages when total soluble solids parameter was considered in both seasons.

With respect to the different interactions Table (27-C) pointed out that hot water treatment in carton package increased total soluble solids statistically in both seasons. However, a significant increase in total acidity values was recorded when garlic oil was used in carton packages. Furthermore, lower irradiation dose (0.50 KGy) treatment packed in polyethylene as well as hot water plus waxing treatment increased T.S.S. / acid ratio statistically in both seasons. Meanwhile, significant increase of ascorbic acid content occurred when garlic oil treatment and the control fruits were packed in polyethylene in the two seasons of study.

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Table (27): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 30 days storage at cold temperature.

Table (27-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	8.55D	8.62D	7.61EG	7.61EG	1.11F	1.19G	58.21B	58.21B
<u>Irradiation</u>								
0.50 KGy	8.91AB	8.96AB	7.60FG	7.60FG	1.20A	1.20A	58.21B	58.21B
0.75 KGy	8.91AB	8.90AB	7.62EG	7.62EG	1.15E	1.16CD	58.02C	58.01C
Fungicides	8.84ABC	8.84AC	7.79CF	7.79ABC	1.18B	1.18B	57.96CD	57.97CD
<u>Non traditional</u>								
Garlic oil	8.97A	8.98A	7.82AB	7.82AB	1.16CD	1.17BC	58.32AB	58.33AB
Pro-Gib plus	8.95A	8.96A	7.60EG	7.60FG	1.17BC	1.20BC	58.32AB	58.33AB
Hot water	8.86ABC	8.85AC	7.64D-F	7.64D-F	1.10G	1.10G	57.94CD	57.96CD
Yeast	8.60CD	8.61D	7.75B-D	7.75B-D	1.10FG	1.11GH	57.54G	57.55G
<u>Waxing</u>								
Control + wax	8.88AB	8.89AC	7.57FH	7.55G	1.16CD	1.16CD	57.60FG	57.60FG
0.50 KGy+wax	8.80AB	8.81BC	7.46H	7.46H	1.16BCD	1.17BC	57.67EG	57.68E-G
0.75 KGy+wax	8.75AB	8.74C	7.60FG	7.60FG	1.14F	1.15F	57.78DF	57.78D-F
Fungicides+wax	8.88ABA	8.89AC	7.70C-E	7.70C-E	1.17BC	1.17BC	57.81CDE	57.81DE
Garlic oil +wax	8.88AC	8.88AC	7.89A	7.90A	1.15E	1.14F	58.46A	58.47A
Pro-Gib plus + wax	8.91AB	8.91AB	7.79A-C	7.79A-C	1.15E	1.15E	58.43A	58.45A
Hot water +wax	8.93AB	8.93AB	7.48GH	7.49GH	1.17BC	1.17BC	58.21B	58.22B
Yeast + wax	8.87ABA	8.87AC	7.78A-C	7.78A-C	1.15E	1.15E	58.00C	58.00C

Table (27-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.86A	8.87A	7.65B	7.68B	1.16B	1.16B	58.46B	58.45B
Carton	8.83A	8.84A	7.58C	7.60C	1.12C	1.13C	56.95C	56.95C
Polyethylene + carton	8.83A	8.84A	7.73A	7.72A	1.18A	1.18A	58.72A	58.72A

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Regarding the effect of postharvest treatments on the chemical properties of lime fruits after 45 days storage at cold temperature, Table (28-A) clarify that hot water plus waxing succeeded significantly in increasing total soluble solids followed by garlic oil and pro-Gib treatments plus waxing as well as lower irradiation dose (0.50 KGy), garlic oil and control plus waxing as compared with the other used treatments and the control in both seasons. However, significant increase of total acidity values occurred when pro-Gib, garlic oil as well as pro-Gib, garlic oil, fungicides and yeast treatments plus waxing were used in both seasons. Meanwhile, irradiation doses (0.50 and 0.75 KGy) caused great effect in increasing T.S.S. / acid ratio as compared with the other used treatments and the control. Comparing different doses of irradiation, it is quite evident that irradiation treatments had no statistical effect in this concern in both seasons. However, significant increase of ascorbic acid content occurred when garlic oil plus waxing as well as pro-Gib plus waxing treatments were used in both seasons.

Comparing different package types as shown in Table (28-B), it is clear that polyethylene and polyethylene plus carton packages significantly increased total soluble solids as compared with carton package in both seasons. Meanwhile, polyethylene plus carton package significantly increased total acidity values in relation to either polyethylene or carton packages. On the other hand, different packages showed no statistical effect when T.S.S. / acid ratio was considered. Anyhow, polyethylene plus carton package succeeded in increasing ascorbic acid content followed

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by polyethylene package as compared with carton package in both seasons.

Dealing with the interaction between postharvest treatments and package type in both seasons, Table (28-C) show that hot water plus waxing in carton package increased total soluble solids and T.S.S. / acid ratio statistically as compared with the other combinations in this respect. However, significant increase of total acidity values occurred when fruits were treated with garlic oil or pro-Gib plus waxing then packed in carton boxes as well as yeast treatment plus waxing in polyethylene plus carton package were used in both seasons. However, using pro-Gib and garlic oil treatments plus waxing in polyethylene plus carton package increased ascorbic acid content statistically followed by garlic oil then pro-Gib, fungicides and hot water treatments as compared with the other combinations in this respect in both seasons.

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Table (28): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 45 days storage at cold temperature.

Table (28-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	7.93F	7.90F	7.21D	7.20D	1.09DE	1.09DE	56.79B	56.75B
Irradiation								
0.50 KGy	8.88AB	8.85AB	7.49BC	7.50BC	1.18A	1.18A	56.65B	56.70B
0.75 KGy	8.82AC	8.82AC	7.44C	7.42C	1.18A	1.18A	55.81E	55.80E
Fungicides	8.82AC	8.80AC	7.68B	7.65B	1.15BC	1.15BC	56.32C	56.38C
Non traditional								
Garlic oil	8.88AB	8.85AB	7.85A	7.82A	1.13C	1.13C	56.76B	56.75B
Pro-Gib plus	8.82AC	8.80AC	7.89A	7.85A	1.11CD	1.12C	56.71B	56.70B
Hot water	8.88AB	8.85AB	7.69B	7.65B	1.15BC	1.16AC	56.40C	56.43C
Yeast	7.97E	7.95E	7.14D	7.20D	1.11CD	1.10DE	55.88E	55.85E
Waxing								
Control + wax	8.86AB	8.84AB	7.65B	7.62B	1.15BC	1.15BC	56.47CD	56.45CD
0.50 KGy+wax	8.75BD	8.73BD	7.44C	7.40C	1.17AB	1.17AB	56.04E	56.00E
0.75 KGy+wax	8.71CD	8.70CD	7.54C	7.50C	1.16AC	1.16AC	56.31D	56.30D
Fungicides+wax	8.84AC	8.82AC	7.88A	7.85A	1.12C	1.12C	56.06E	56.00E
Garlic oil +wax	8.88AB	8.84AB	7.98A	7.90A	1.11CD	1.11CD	57.05A	57.00A
Pro-Gib plus + wax	8.86AB	8.83AB	7.89A	7.85A	1.12C	1.12C	57.10A	57.12A
Hot water +wax	8.93A	8.90A	7.66B	7.63B	1.16AC	1.16AC	56.78B	56.75B
Yeast + wax	8.66D	8.65D	8.03A	8.00A	1.07DE	1.08DE	55.94E	55.90E

Table (28-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.81A	8.80A	7.63B	7.65B	1.15A	1.16A	56.49B	56.50B
Carton	8.56B	8.55B	7.57B	7.56B	1.12A	1.12A	54.63C	54.60C
Polyethylene + carton	8.79A	8.80A	7.76A	7.75A	1.14A	1.14A	58.21A	58.20A

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Table (28-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+	
	1999		2000		1999		2000		1999		2000		1999		2000		1999		2000		1999		2000	
	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Season	BD	BD	BD	BD	E	E	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD	CD
Control	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Irradiation 0.50 kGy	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
0.75 kGy	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Fungicide	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
des	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Non traditional	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Garlic oil	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Pro-Gib plus	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Hot water	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Yeast	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Waxing Control	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
+ wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
0.50kGy + wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
0.75kGy + wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Fungicide+wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Garlic oil+ wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Pro-Gib plus + wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Hot water + wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
Yeast + wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80
wax	8.73	8.70	8.83	8.83	8.93	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.85	8.85	8.92	8.80	8.80	8.80

Data presented in Table (29-A) deals with the effect of postharvest treatments on the chemical properties of lime fruits after 60 days storage at cold temperature, it is clear that pro-Gib plus waxing is the most superior storage treatment significantly since, it increased fruit total soluble solids, total acidity values and ascorbic acid contents in both seasons. However, significant increase in T.S.S. / acid ratio occurred also when irradiation doses (0.50 and 0.75 KGy) as well as the control plus waxing were used.

A glance to Table (29-B) data of seasons (1999 & 2000) show that polyethylene plus carton package significantly increased fruit total acidity values, T.S.S. / acid ratio and ascorbic acid contents followed by polyethylene package as compared with carton package. However, carton package significantly reduced total soluble solids in relation to polyethylene and polyethylene plus carton packages in both seasons.

With respect to the different interactions, Table (29-C) and Figs. (19-24) pointed out that pro-Gib plus waxing in either polyethylene or polyethylene plus carton packages as well as garlic oil plus waxing in polyethylene plus carton package increased fruit total soluble solids statistically in both seasons. However, significant increase in both total acidity values and ascorbic acid content occurred when pro-Gib plus waxing was used. On contrast, control plus waxing fruit treatment packed in polyethylene plus carton significantly surpassed other combinations in improving T.S.S. / acid parameter of two seasons.

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Table (29): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at cold temperature.

Table (29-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	7.88F	7.89F	7.69F	7.69F	1.02GH	1.01GH	54.85G	54.85G
Irradiation								
0.50 KGy	8.42E	8.42E	7.65G	7.66F	1.13A	1.12AB	54.81GH	54.82GH
0.75 KGy	8.51CDE	8.51CDE	7.65G	7.65F	1.13A	1.13A	54.78H	54.78H
Fungicides	8.40E	8.40E	8.11ABC	8.11A-C	1.06F	1.06F	54.68I	54.68I
Non traditional								
Garlic oil	8.62BCD	8.62BCD	7.99B-E	7.99B-E	1.10B	1.10B	55.00E	55.00E
Pro-Gib plus	8.64BC	8.64BC	8.12ABC	8.13ABC	1.07E	1.07E	55.16B	55.16B
Hot water	8.46E	8.46E	7.87DEF	7.88D-F	1.09C	1.09C	54.97F	54.97F
Yeast	7.91F	7.91F	7.90B-E	7.91B-E	1.00H	1.00G	54.33K	54.33K
Waxing								
Control + wax	8.71B	8.71B	7.67G	7.67G	1.14A	1.14A	54.40J	54.40J
0.50 KGy+wax	8.48DE	8.48DE	7.68FG	7.68EF	1.10B	1.10B	55.08D	55.08D
0.75 KGy+wax	8.62BCD	8.62BCD	7.81EFG	7.81EFG	1.10BC	1.10B	54.99F	54.99F
Fungicides+wax	8.62BCD	8.62BCD	8.10ABC	8.10ABC	1.07E	1.07E	55.04DE	55.05DE
Garlic oil +wax	8.75AB	8.75AB	8.03BCD	8.01BCD	1.10B	1.10B	55.56B	55.56B
Pro-Gib plus + wax	8.88A	8.88A	8.28A	8.28A	1.08D	1.09C	56.01A	56.00A
Hot water +wax	8.62BCD	8.62BCD	7.92BCDE	7.92B-D	1.08D	1.08D	55.24C	55.25C
Yeast + wax	8.46E	8.46E	7.91CDE	7.91CDE	1.07E	1.07E	54.80GH	54.79H

Table (29-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.73A	8.74A	7.96B	7.97B	1.10A	1.10A	55.54B	55.50B
Carton	7.98B	7.98B	7.47C	7.48C	1.05B	1.05B	51.82C	51.83C
Polyethylene + carton	8.78A	8.79A	8.03A	8.04A	1.10A	1.10A	57.67A	57.69A

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Table (29-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	8.53	8.50	8.73	8.72	7.53	7.55	7.53	7.55	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64
Control	CF	EF	AD	AD	KN	KN	KN	KN	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM
Irradiation	8.66	8.65	8.73	8.70	7.54	7.56	7.54	7.56	7.66	7.67	7.66	7.67	7.66	7.67	7.66	7.67	7.66	7.67	7.66	7.67	7.66	7.67	7.66	7.67
0.50 kGy	AE	AC	AD	AD	KN	KN	KN	KN	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM
0.75 kGy	8.86	8.85	8.73	8.70	7.83	7.83	7.80	7.83	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89
kGy	AB	AB	AD	AD	FL	FL	FL	FL	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Fungicide	8.73	8.70	8.26	8.25	8.86	8.85	8.32	8.32	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	7.63	7.64	
des	AD	AD	G	G	AB	AC	AC	AC	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Non traditional																								
Garlic	8.73	8.70	8.33	8.30	8.86	8.85	8.31	8.30	7.69	7.67	8.38	8.36	8.38	8.36	8.38	8.36	8.38	8.36	8.38	8.36	8.38	8.36	8.38	8.36
oil	AD	AD	FG	G	AB	AB	AD	AD	HM	HM	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
Pro-Gib	8.66	8.65	7.80	7.80	8.73	8.70	8.16	8.16	7.80	7.80	8.38	8.37	8.38	8.37	8.38	8.37	8.38	8.37	8.38	8.37	8.38	8.37	8.38	8.37
plus	AE	AE	H	H	AD	AD	AF	AF	FL	FL	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
Hot	8.66	8.65	8.00	8.00	8.73	8.70	7.89	7.87	7.70	7.72	8.03	8.02	8.03	8.02	8.03	8.02	8.03	8.02	8.03	8.02	8.03	8.02	8.03	8.02
water	AE	AE	H	H	AD	AD	EL	EL	GM	GM	AI	AI	AI	AI	AI	AI	AI	AI	AI	AI	AI	AI	AI	AI
Yeast	8.60	8.60	6.40	8.37	8.73	8.73	7.90	7.88	6.00	6.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
	BE	BE			AD	AD	EL	EL	O	O	CJ	CJ	CJ	CJ	CJ	CJ	CJ	CJ	CJ	CJ	CJ	CJ	CJ	CJ
Waxing	8.73	8.70	8.46	8.43	8.93	8.92	7.54	7.52	7.74	7.73	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74
Control	AD	AD	DG	DH	A	A	LN	LN	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM
+ wax																								
0.50kGy	8.80	8.80	8.00	8.00	8.66	8.65	7.62	7.60	7.69	7.67	7.73	7.74	7.73	7.74	7.73	7.74	7.73	7.74	7.73	7.74	7.73	7.74	7.73	7.74
+ wax	AC	AC	H	H	AE	AE	M	M	HM	HM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM
0.75kGy	8.80	8.80	8.40	8.42	8.66	8.65	7.90	7.90	7.38	7.35	8.16	8.15	8.16	8.15	8.16	8.15	8.16	8.15	8.16	8.15	8.16	8.15	8.16	8.15
+wax	AC	AC	EG	EG	AE	AE	EL	EL	MN	MN	AF	AF	HK	GJ	BF	BD	PR	NR	NO	NO	NO	NO	NO	NO
Fungicide	8.80	8.80	8.53	8.50	8.93	8.91	8.39	8.37	7.66	7.65	8.03	8.00	8.08	1.08	1.01	1.01	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
des +wax	AC	AC	CF	EF	A	A	AC	AC	HM	HM	AI	AI	AI	AI	KN	KN	L	L	L	L	L	L	L	L
Garlic	8.93	8.90	8.80	8.80	8.93	8.90	8.35	8.37	8.10	8.12	8.40	8.42	8.40	8.42	8.40	8.42	8.40	8.42	8.40	8.42	8.40	8.42	8.40	8.42
oil+ wax	A	A	AC	AC	A	A	AC	AC	AG	AG	A	A	A	A	NR	MP	FJ	GJ	NQ	KN	I	Q	Q	A
Pro-Gib	8.80	8.80	8.26	8.25	8.80	8.82	8.24	8.22	7.70	7.73	8.37	8.36	8.37	8.36	8.37	8.36	8.37	8.36	8.37	8.36	8.37	8.36	8.37	8.36
plus + wax	AC	AC	G	G	AC	AC	AE	AE	HM	HM	AC	AC	AC	AC	AC	NP	NP	NP	NP	NP	NP	NP	NP	NP
Hot	8.80	8.80	8.26	8.25	8.80	8.80	8.91	8.90	7.79	7.77	8.06	8.05	8.06	8.05	8.06	8.05	8.06	8.05	8.06	8.05	8.06	8.05	8.06	8.05
water + wax	AC	AC	G	G	AC	AC	EL	EL	FL	FL	FL	AH	AH	AH	EL	EL	OR	NR	NR	NR	NR	NR	NR	NR
Yeast + wax	8.66	8.65	8.00	8.00	8.73	8.70	7.94	7.92	7.76	7.75	8.01	8.00	8.01	8.00	8.01	8.00	8.01	8.00	8.01	8.00	8.01	8.00	8.01	8.00
	AE	AE	H	H	AD	AD	DK	DK	GM	GM	GM	BJ	CJ	CJ	M	M	S	S	S	S	S	S	S	S

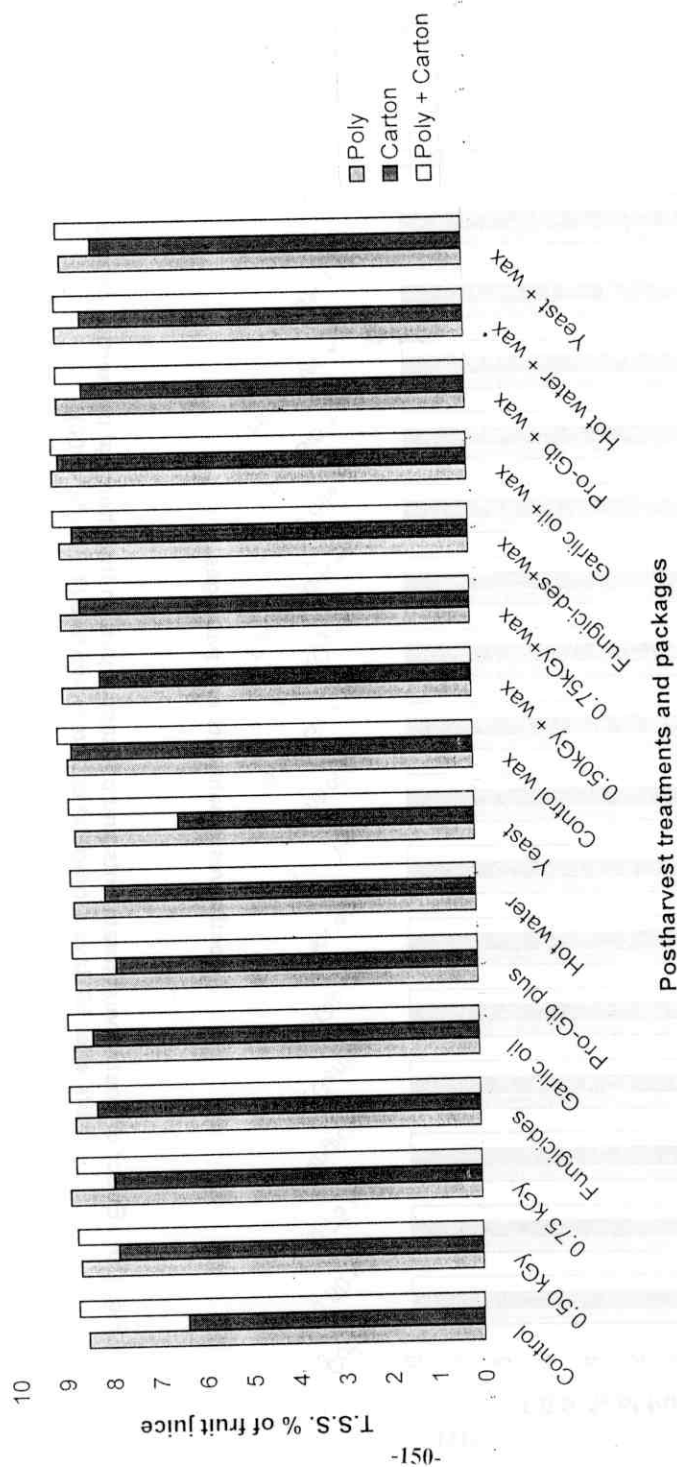


Fig. (19) : Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at cold temperature (T.S.S. %, 1999)

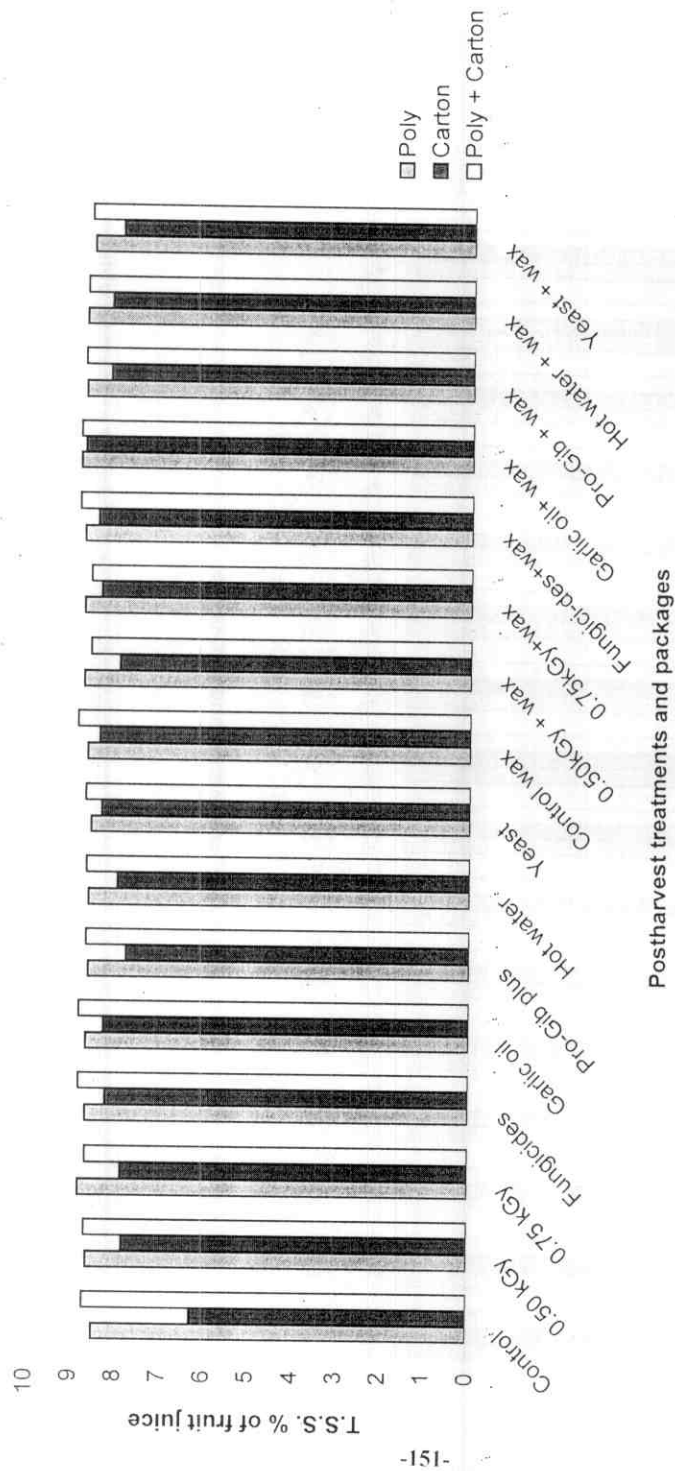


Fig. (20) : Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at cold temperature (T.S.S. %, 2000)

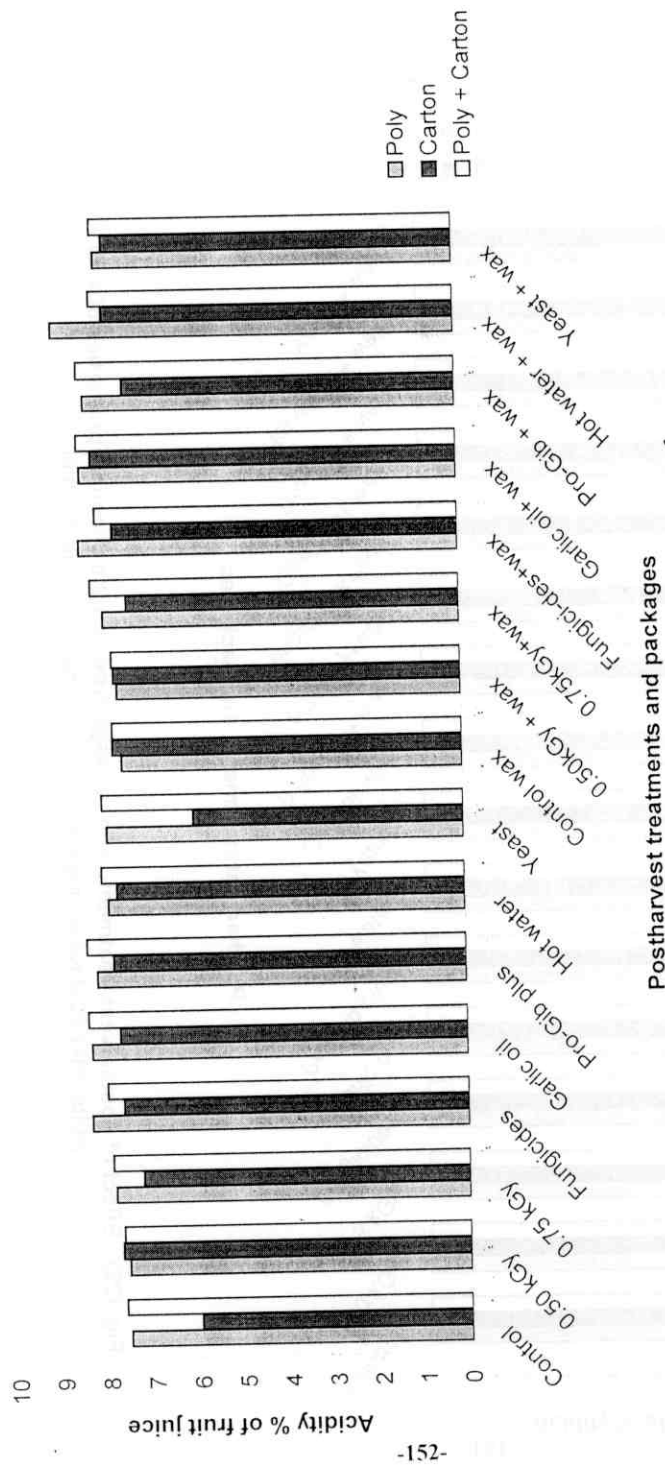


Fig. (21) : Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at cold temperature (Acid %, 1999)

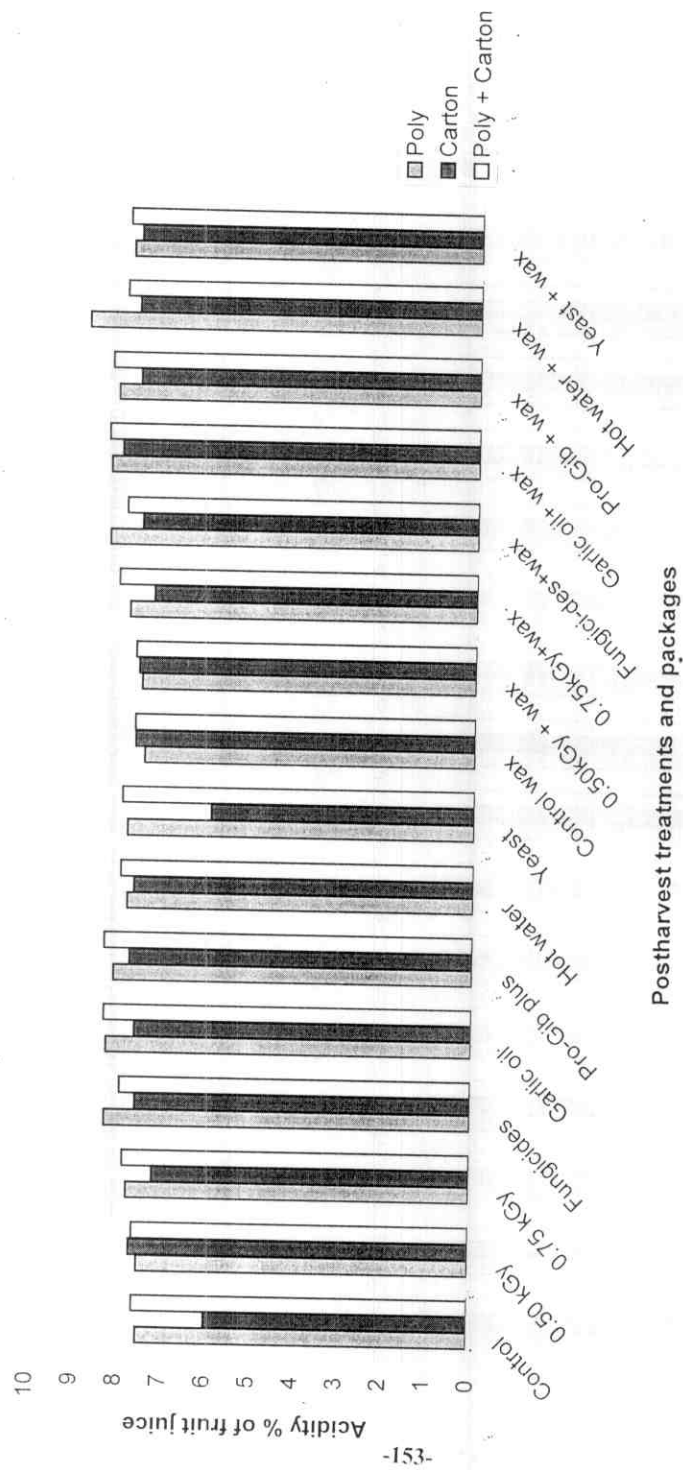


Fig. (22) : Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at cold temperature (Acid %, 2000)

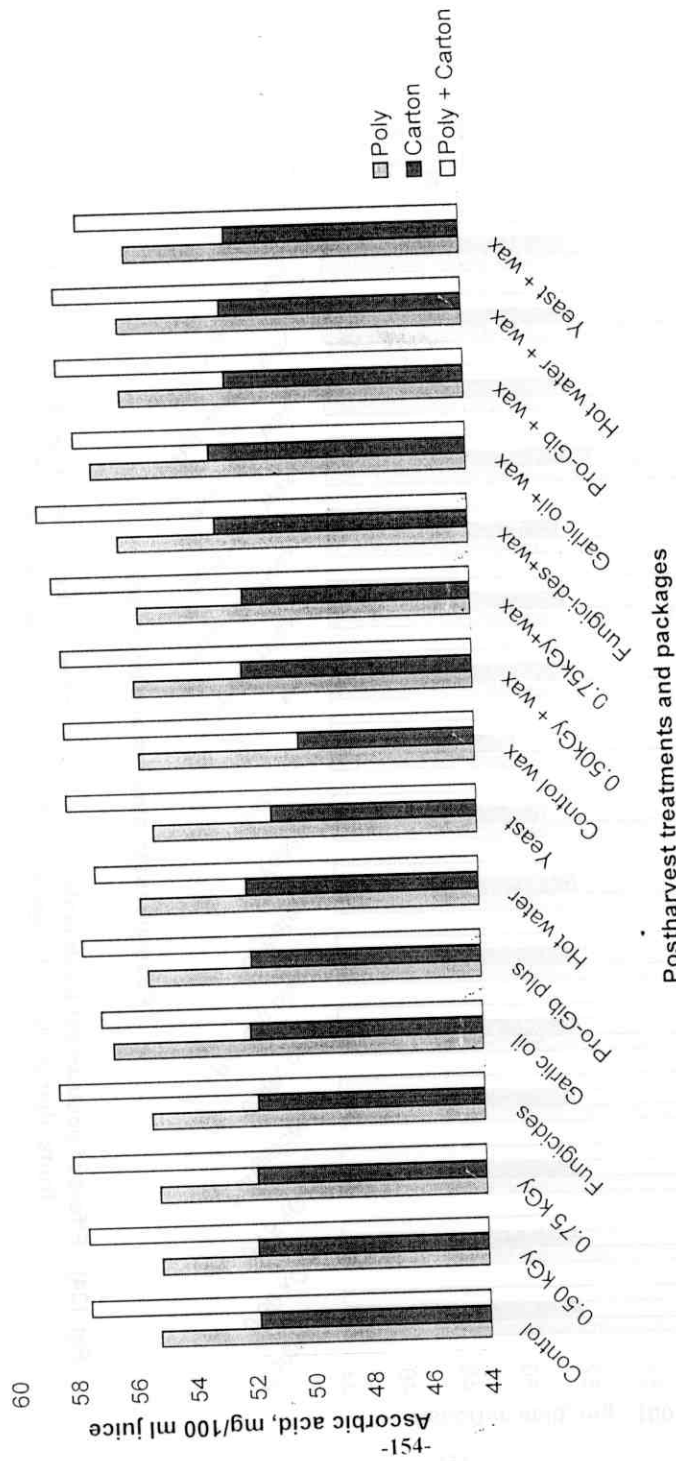


Fig. (23) : Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at cold temperature (Ascorbic acid, 1999)

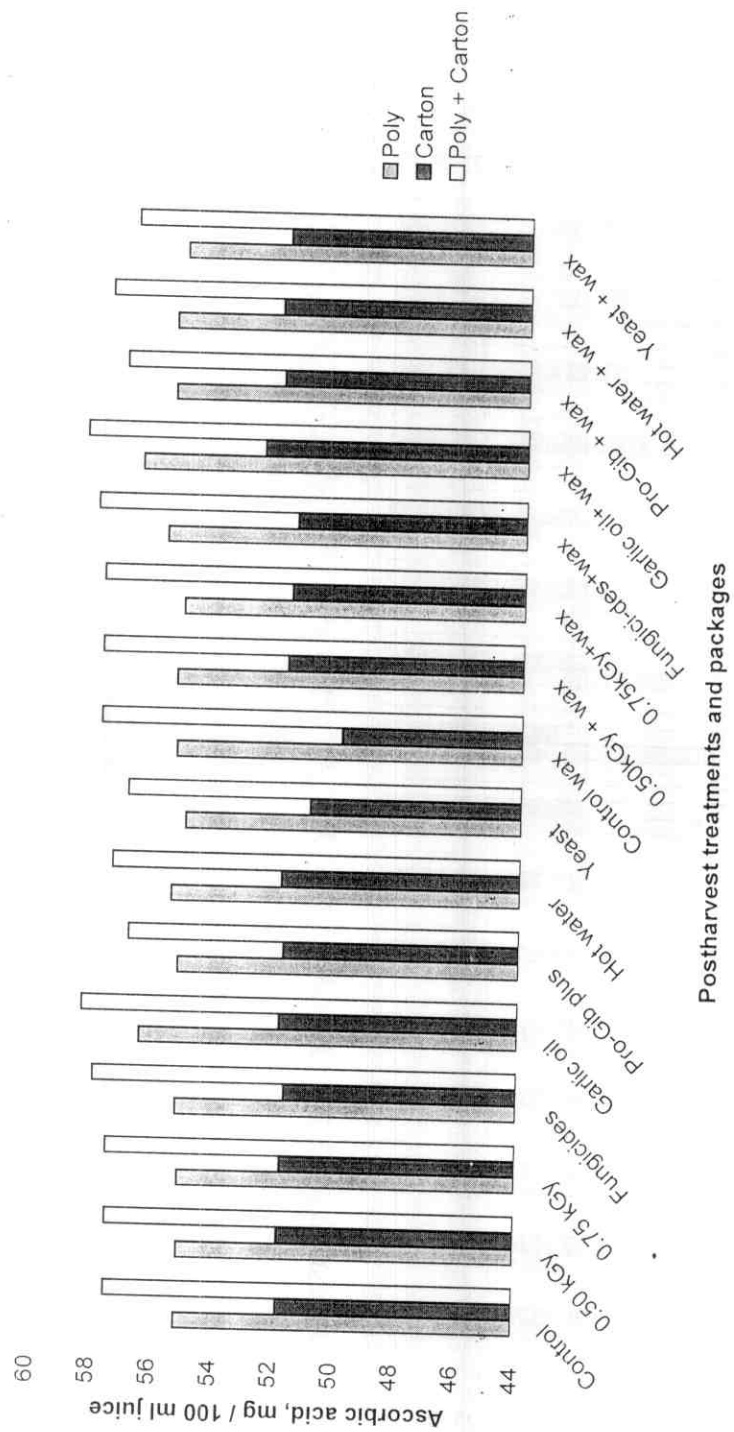


Fig. (24) : Effect of postharvest treatments and package types on the chemical properties of lime fruits after 60 days storage at cold temperature (Ascorbic acid, 2000)

Furthermore, Table (30-A) show the effect of postharvest treatments on the chemical properties of lime fruits after 75 days storage at cold temperature in both seasons. It is quite evident that other non-traditional treatments (pro-Gib or garlic oil) plus waxing or unwaxing were superior in comparison with other used treatments and the control in all parameters under study. In addition, total soluble solids and ascorbic acid contents were increased significantly, while both total acidity and T.S.S. / acid ratio were significantly increased when pro-Gib plus waxing treatment was used.

Regarding the effect of package type Table (30-B), It is quite evident that polyethylene plus carton package significantly increased total acidity values, T.S.S. / acid ratio and ascorbic acid contents, followed by polyethylene as compared with carton package. Nevertheless, no significant differences were noticed between polyethylene and polyethylene plus carton package when total soluble solids was concerned. With respect to the different interactions Table (30-C) pointed out that all treatments packed in either polyethylene or polyethylene plus carton increased all parameters under study. In addition, pro-Gib plus waxing in polyethylene package increased total soluble solids statistically in both seasons. Meanwhile, pro-Gib plus waxing in either polyethylene or polyethylene plus carton packages increased total acidity values statistically as compared with the other combinations in this respect. However, a significant increase in T.S.S. / acid ratio occurred when the control plus waxing in polyethylene package was used. Furthermore, pro-Gib treatment in polyethylene package increased ascorbic acid content statistically in comparison with all other combinations in both seasons.

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Table (30): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 75 days storage at cold temperature.

Table (30-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	7.86D	7.85D	7.08E	7.10E	1.10AB	1.10AB	51.67HI	51.65HI
Irradiation								
0.50 KGy	7.97C	7.98C	7.10E	7.10E	1.12A	1.13A	51.83FH	51.85FH
0.75 KGy	7.91C	7.91C	7.19D	7.20D	1.10AB	1.10AB	51.78GHI	51.75GHI
Fungicides	7.91C	7.93C	7.82C	7.80C	1.01I	1.02I	52.17EFG	52.20EFG
Non traditional								
Garlic oil	8.51B	8.55B	7.96B	7.98B	1.08B	1.08B	54.47C	54.50C
Pro-Gib plus	8.68A	8.70A	7.95B	7.94B	1.08B	1.09B	55.55A	55.60A
Hot water	7.93C	7.90C	7.87C	7.89C	1.00GH	1.00GH	52.54E	52.56E
Yeast	7.90C	7.90C	7.21D	7.25D	1.01F	1.02F	51.33I	51.35I
Waxing								
Control + wax	7.90C	7.90C	7.09E	7.10E	1.06CD	1.05CD	52.33EF	52.35EF
0.50 KGy+wax	7.93C	7.90C	7.16D	7.18D	1.10AB	1.09AB	52.49E	52.50E
0.75 KGy+wax	8.40B	8.40B	7.79C	7.80C	1.07BC	1.07BC	54.01D	54.00D
Fungicides+wax	7.93C	7.95C	7.90B	7.90B	1.00DE	1.00DE	52.58E	52.60E
Garlic oil +wax	8.57A	8.58A	8.03B	8.00B	1.07BC	1.07BC	55.20AB	55.22AB
Pro-Gib plus + wax	8.77A	8.79A	8.15A	8.20A	1.09B	1.10AB	55.33A	55.35A
Hot water +wax	8.53B	8.50B	8.04B	8.00B	1.06C	1.05C	54.81BC	54.83BC
Yeast + wax	7.93C	7.90C	7.14E	7.15E	1.10AB	1.13AB	52.27EG	52.30EG

Table (30-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.71A	8.70A	7.89B	7.90B	1.09B	1.10B	54.80B	54.82B
Carton	7.17B	7.13B	6.94C	6.95C	0.90C	0.91C	48.06C	48.00C
Polyethylene + carton	8.72A	8.73A	8.06A	8.10A	1.11A	1.12A	56.59A	56.60A

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Table (30-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	8.60	8.60	-	-	8.60	8.50	7.50	7.48	-	-	7.74	7.73	1.13	1.13	-	-	1.07	1.07	54.00	54.00	-	-	55.00	55.00
Control	A-D	A-D	-	-	A-D	A-D	CD	CD	-	-	AD	AD	CE	CE	-	-	KL	KL	U	U	-	-	FJ	FJ
Irradiation	8.80	8.83	-	-	8.73	8.70	7.49	7.50	-	-	7.83	7.80	1.17	1.17	-	-	1.13	1.13	45.20	45.20	-	-	55.30	55.00
0.50 kGy	AD	AD	-	-	AD	AD	CD	CD	-	-	AD	AD	AB	AB	-	-	G	G	HJ	HJ	-	-	FH	FJ
0.75 kGy	8.66	8.65	6.40	6.50	8.66	8.70	7.75	7.73	6.00	6.00	7.82	7.80	1.13	1.13	1.08	1.08	1.13	1.13	54.10	54.10	46.00	46.00	55.23	55.20
0.75 kGy	AD	AD	E	E	AD	AD	AD	AD	F	F	AD	AD	CE	CE	JK	JK	DG	DG	HJ	HJ	N	N	FI	FI
Fungicides	8.66	8.65	6.40	6.50	8.65	8.70	8.20	8.20	6.80	6.80	8.35	8.37	1.05	1.05	0.94	1.00	1.06	1.06	54.52	54.52	46.00	46.00	56.00	56.00
Non-traditional	AD	AD	E	E	AD	AD	AD	AD	E	E	ABC	ABC	LM	LM	R	PQ	KM	KM	HJ	HJ	N	N	CF	CF
Garlic oil	8.66	8.65	8.00	8.00	8.80	8.85	8.26	8.25	7.61	7.70	8.01	8.00	1.05	1.05	1.05	1.05	1.13	1.13	55.75	55.70	50.71	50.70	56.96	56.95
Garlic oil	AD	AD	D	D	AC	AC	AD	AD	AD	AD	AD	AD	LM	LM	LM	LM	DG	DG	EG	EG	M	M	AD	AD
Pro-Gib plus	8.66	8.65	8.46	8.50	8.93	8.95	8.26	8.25	7.68	7.70	7.43	8.40	1.05	1.05	1.10	1.10	1.07	1.07	58.13	58.10	51.00	51.00	57.52	55.50
Hot water	AD	AD	AD	AD	AD	AD	AD	AD	AD	AD	AD	AD	LM	LM	H	H	KL	KL	A	A	LM	LM	AB	AB
Yeast	8.73	8.70	-	-	8.60	8.60	7.85	7.86	-	-	7.80	7.85	1.11	1.11	-	-	1.14	1.14	53.95	53.90	-	-	54.03	54.00
Yeast	AD	AD	-	-	AD	AD	AD	AD	-	-	AD	AD	FI	FI	-	-	CE	CE	J	J	-	-	U	U
Waxing	8.73	8.70	-	-	8.73	8.70	7.40	7.42	-	-	7.80	7.83	1.18	1.19	-	-	1.15	1.15	54.00	54.00	-	-	57.00	57.00
Control + wax	AD	AD	-	-	AD	AD	D	D	-	-	AD	AD	A	A	-	-	BC	BC	U	U	-	-	AD	AD
0.50kGy + wax	8.80	8.83	-	-	8.60	8.60	7.60	7.65	-	-	7.90	7.85	1.15	1.15	-	-	1.10	1.10	54.27	54.25	-	-	57.22	57.20
0.50kGy + wax	AD	AD	-	-	AD	AD	AD	AD	-	-	AD	AD	BC	BC	-	-	GH	GH	HJ	HJ	-	-	AB	AB
0.75kGy + wax	8.46	8.50	8.06	8.10	8.66	8.65	7.53	7.50	7.89	7.85	7.96	7.90	1.12	1.12	1.02	1.02	1.081	1.081	54.00	54.00	50.93	50.70	57.10	57.08
Fungicides + wax	AD	AD	CD	CD	AD	AD	BCD	BCD	AD	AD	AD	AD	EH	EH	Q	Q	K	K	U	U	LM	LM	AC	AC
Fungicides	9.70	8.70	7.40	7.40	8.66	8.65	8.15	8.13	7.62	7.63	8.33	8.30	1.11	1.11	0.97	0.97	1.05	1.05	54.75	54.72	46.00	46.00	57.00	57.00
des-wax	AD	AD	CE	CE	AD	AD	AD	AD	AD	AD	AD	AD	FI	FI	R	R	LM	LM	GJ	GJ	N	N	AD	AD
Garlic oil + wax	8.80	8.83	8.00	8.00	8.93	8.90	8.23	7.25	7.61	7.50	8.25	8.20	1.10	1.10	1.04	1.04	1.06	1.06	55.82	55.80	52.00	52.00	57.80	57.70
Garlic oil + wax	AD	AD	D	D	AD	AD	AD	AD	AD	AD	AD	AD	H	H	OP	OP	KM	KM	DG	DG	KL	KL	AB	AB
Pro-Gib plus + wax	9.00	9.50	8.60	8.70	8.73	8.70	7.46	8.50	7.48	7.45	8.50	8.50	1.08J	1.08J	1.15	1.15	1.05	1.05	55.80	55.80	52.30	52.00	57.90	59.80
Pro-Gib plus + wax	AD	AD	AD	AD	AD	AD	A	A	CD	CD	A	A	K	K	BC	BC	LM	LM	DG	DG	K	K	AB	AB
Hot water + wax	8.73	8.75	8.13	8.13	8.73	8.70	8.23	8.20	7.75	7.70	8.14	8.20	1.07	1.07	1.03	1.03	1.06	1.06	54.82	54.80	52.00	52.00	57.60	57.80
Hot water + wax	AD	AD	BCD	BCD	AD	AD	AD	AD	AD	AD	AD	AD	KL	KL	PQ	PQ	KM	KM	FJ	FJ	KL	KL	AB	AB
Yeast + wax	8.66	8.70	-	-	8.73	8.70	7.49	7.50	-	-	7.93	7.90	1.17	1.17	-	-	1.121	1.121	54.00	54.00	-	-	56.80	56.70
Yeast + wax	AD	AD	-	-	AD	AD	CD	CD	-	-	AD	AD	AB	AB	-	-	H	H	U	U	-	-	BF	BF

Besides, it is evident from Table (31-A) that pro-Gib treated fruits showed the highest total soluble solids and ascorbic acid contents followed by pro-Gib plus waxing then garlic oil plus waxing as compared with the other used treatments and the control in a descending order in both seasons.

In additions, pro-Gib plus waxing treatment induced the highest significantly total acidity values followed by pro-Gib then fungicides as well as garlic oil plus waxing as compared with the other used treatments and the control. However, significant increase of T.S.S. / acid ratio occurred when control plus waxing was used of two seasons (1999 & 2000).

A glance to Table (31-B) data of seasons (1999 & 2000) show that polyethylene plus carton package significantly increased total soluble solids, total acidity values and ascorbic acid contents followed by polyethylene package as compared with carton package. However, carton package significantly reduced T.S.S. / acid ratio in relation to polyethylene and polyethylene plus carton packages.

With respect to the different interactions Table (31-C) pointed out that pro-Gib plus waxing treatment packed in polyethylene plus carton boxes increased total soluble solids and ascorbic acid contents statistically. in both seasons. However, significant increase in total acidity values when pro-Gib plus waxing in either carton and polyethylene plus carton packages were used. Meanwhile, highest irradiation dose (0.75 KGy) in polyethylene plus carton package as well as hot water plus waxing increased statistically as compared with the other combinations in this respect. However, combinations of all treatments under study and carton package was unsuitable for consumption and discarded.

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Table (31): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 90 days storage at cold temperature.

Table (31-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	7.85E-G	7.85E-G	7.07 I	7.05 I	1.11AC	1.10BC	50.73I	50.75I
Irradiation								
0.50 KGy	7.93CF	7.95CF	7.08GI	7.08GI	1.12AB	1.11AC	50.67I	50.70I
0.75 KGy	7.91CG	7.92CG	7.18GH	7.20GH	1.10BC	1.11AC	51.06G	51.0G
Fungicides	7.91C-G	7.92C-G	7.59C	7.60C	1.04C	1.03C	50.93H	50.90H
Non traditional								
Garlic oil	7.97BD	7.98BD	7.40E	7.40E	1.07BC	1.08BC	51.53E	51.55E
Pro-Gib plus	8.40A	8.42A	8.04B	8.03B	1.04C	1.03C	54.02A	54.00A
Hot water	7.84E-G	7.85E-G	7.34EF	7.35EF	1.06BC	1.05BC	51.05G	51.00G
Yeast	7.83E-G	7.85E-G	7.22FG	7.25FG	1.08BC	1.07BC	51.67I	50.70I
Waxing								
Control + wax	7.85E-G	7.85E-G	6.97I	6.98I	1.13A	1.13A	51.80D	51.80D
0.50 KGy+wax	7.95C-F	7.95C-F	7.04I	7.05I	1.10BC	1.11AC	51.52E	51.50E
0.75 KGy+wax	7.84E-G	7.85E-G	7.05I	7.05I	1.11AC	1.10BC	51.34F	51.40F
Fungicides+wax	7.93C-F	7.95C-F	7.38E	7.40E	1.07BC	1.06BC	51.51E	51.50E
Garlic oil +wax	8.00BC	8.00BC	7.52CD	7.54CD	1.06BC	1.07BC	51.96C	51.95C
Pro-Gib plus + wax	8.04B	8.05B	8.38A	8.40A	0.95D	0.96D	52.38B	52.35B
Hot water +wax	7.95C-F	7.95C-F	7.38E	7.40E	1.07BC	1.07BC	51.57E	51.55E
Yeast + wax	7.86EG	7.85EG	6.98I	7.00I	1.12AB	1.11AC	51.14G	51.15G

Table (31-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.65B	8.62B	7.76B	7.75B	1.11A	1.11A	53.67B	53.50B
Carton	6.47C	6.45C	6.25C	6.26C	0.82B	0.80B	46.39C	46.40C
Polyethylene + carton	8.72A	8.75A	8.04A	8.10A	1.11A	1.11A	54.42A	54.5A

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Table (31-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	8.60	8.50	-	-	8.66	8.65	7.50	7.50	7.731	7.701	1.14	1.14	1.14	1.14	-	-	1.10	1.10	53.20	53.22	-	-	53.00	53.00
Control	CF	DF	-	-	BE	BE	LM	LM	L	L	AC	AC	AC	AC	-	-	BC	BC	LM	LM	-	-	N	N
Irradiation	8.66	8.60	-	-	8.73	8.70	7.55	7.55	7.711	7.701	1.14	1.14	1.14	1.14	-	-	1.13	1.13	53.00	53.00	-	-	53.00	53.00
0.50	DE	CF	-	-	AD	AD	KL	KL	L	L	AC	AC	AC	AC	-	-	AC	AC	N	N	-	-	N	N
kGy	8.66	8.66	-	-	8.66	8.65	7.731	7.701	7.82	7.80	1.08	1.08	1.09	1.09	-	-	1.33	1.13	53.10	53.00	-	-	54.07	54.00
0.75	BE	BE	-	-	BE	BE	L	L	HL	HL	BC	BC	BC	BC	-	-	AC	AC	N	N	-	-	I	I
kGy	8.60	8.50	-	-	8.73	8.70	8.45	8.40	8.32	8.32	1.05	1.05	1.05	1.05	-	-	1.05	1.07	53.35	53.36	-	-	53.45	53.40
Fungicides	CF	DF	-	-	AD	AD	A	A	AD	AD	BC	BC	BC	BC	-	-	BC	BC	KL	KL	-	-	K	K
Non	8.80	8.80	-	-	8.73	8.70	8.24	8.25	7.95	7.95	1.04	1.05	1.05	1.05	-	-	1.10	1.10	53.32	53.30	-	-	55.00	55.00
traditional	AC	AC	-	-	AD	AD	AE	AE	EJ	EJ	BC	BC	BC	BC	-	-	BC	BC	KL	KL	-	-	E	E
Garlic	8.80	8.80	-	-	8.86	8.85	8.33	8.30	8.12	8.13	1.03	1.03	1.03	1.03	0.95	0.95	1.03	1.03	54.50	54.50	-	-	55.80	55.80
oil	ABC	ABC	-	-	AB	AB	AC	AC	AH	AH	BC	BC	BC	BC	C	C	BC	BC	G	G	-	-	C	C
Pro-Gib	8.40	8.50	-	-	8.73	8.70	7.86	7.85	8.18	8.20	1.08	1.08	1.08	1.08	-	-	1.06	1.08	53.35	53.40	-	-	53.80	53.80
plus	F	DF	-	-	AD	AD	FK	FK	AG	AG	BC	BC	BC	BC	-	-	BC	BC	KL	KL	-	-	J	J
water	8.53	8.50	-	-	8.53	8.50	7.85	7.85	7.80	7.80	1.07	1.05	1.05	1.05	-	-	1.13	1.13	53.00	53.00	-	-	53.00	53.00
Yeast	DF	DF	-	-	DF	DF	GK	GK	HL	HL	BC	BC	BC	BC	-	-	AC	AC	N	N	-	-	N	N
Waxing	8.66	8.60	-	-	8.73	8.70	7.02	7.00	7.89	7.90F	1.22	1.21	1.21	1.21	-	-	1.10	1.11	53.40	53.40	-	-	56.00	56.00
Control	BE	CF	-	-	AD	AD	N	N	FK	K	AB	AB	AB	AB	-	-	BC	BC	K	K	-	-	B	B
+ wax	8.73	8.70	-	-	8.73	8.70	7.10	7.08	8.03	8.00	1.21	1.22	1.22	1.22	-	-	1.08	1.07	55.55	55.50	-	-	53.00	53.00
0.50kGy	AD	AD	-	-	AD	AD	N	N	BI	BI	AB	AB	AB	AB	-	-	BC	BC	D	D	-	-	N	N
+ wax	8.46	8.50	-	-	8.66	8.65	7.21	7.20	7.95	7.95	1.16	1.15	1.16	1.15	-	-	1.32	1.30	53.71	53.70	-	-	54.32	54.30
0.75kGy	EF	DF	-	-	BE	BE	MN	MN	EJ	EJ	AC	AC	AC	AC	-	-	A	A	J	J	-	-	H	H
+ wax	8.66	8.65	-	-	8.73	8.70	7.94	7.95	8.21	8.20	1.08	1.08	1.08	1.08	-	-	1.03	1.04	53.70	53.75	-	-	54.82	54.80
Fungicides	BE	BE	-	-	AD	AD	EJ	EJ	AF	AF	BC	BC	BC	BC	-	-	BC	BC	J	J	-	-	F	F
+ wax	8.80	8.80	-	-	8.80	8.80	8.20	8.20	8.37	8.40	1.10	1.10	1.10	1.10	-	-	1.06	1.07	53.77	53.75	-	-	56.12	56.00
Garlic	ABC	ABC	-	-	ABC	ABC	AG	AG	AB	AB	BC	BC	BC	BC	-	-	BC	BC	J	J	-	-	B	B
oil+ wax	8.80	8.80	-	-	8.93	8.90	8.26	8.25	8.45	8.45	1.07	1.08	1.08	1.08	-	-	1.06	1.08	54.60	54.60	-	-	56.40	56.50
Pro-Gib	8.80	8.80	-	-	8.93	8.90	8.02	8.03	8.13	8.15	1.07	1.05	1.05	1.05	-	-	1.31	1.30	53.70	53.70	-	-	55.00	55.00
plus + wax	ABC	ABC	-	-	A	A	AE	AE	A	A	BC	BC	BC	BC	-	-	BC	BC	G	G	-	-	A	A
Hot	8.73	8.70	-	-	8.73	8.70	8.02	8.03	8.13	8.15	1.07	1.05	1.05	1.05	-	-	1.31	1.30	53.70	53.70	-	-	55.00	55.00
water + wax	AD	AD	-	-	AD	AD	CI	CI	AD	AD	AE	AE	AE	AE	-	-	1.09	1.10	53.42	53.40	-	-	E	E
Yeast + wax	8.60	8.60	-	-	8.60	8.60	6.96	6.95	7.98	7.95	1.22	1.22	1.22	1.22	-	-	1.09	1.10	53.42	53.40	-	-	54.00	54.00
wax	CF	CF	-	-	CF	CF	N	N	DJ	EJ	AB	AB	AB	AB	-	-	BC	BC	K	K	-	-	I	I

Regarding the effect of postharvest treatments on the chemical properties of lime fruits after 105 days storage at cold temperature in both seasons, Table (32-A) clarify that postharvest fruit treatments plus waxing surpassed the unwaxed fruit treatments with regard to total soluble solids. However, garlic oil and pro-Gib plus waxing treatments showed the highest total soluble solids as compared with all other used treatments and the control. Concerning irradiation doses it is clear that the lower dose (0.50 KGy) caused considerable effect in increasing total soluble solids as compared with the higher dose (0.75 KGy). Meanwhile, significant increase in fruit total acidity values occurred when pro-Gib plus waxing and pro-Gib only followed by fungicides treatment then hot water plus waxing as compared with the other used treatments and the control.

On the other hand, no significance was noticed between different treatments when T.S.S. / acid ratio parameter was concerned. However, pro-Gib plus waxing treatment increased ascorbic acid content followed by garlic oil plus waxing then pro-Gib as compared with the other used treatments and the control in a descending order.

Referring to Table (32-B), data of both seasons (1999 & 2000) showed that polyethylene plus carton package significantly increased total acidity values and ascorbic acid contents but decreased T.S.S. / acid ratio in relation to polyethylene package. Besides, packages had no statistical effect when T.S.S. was considered. Furthermore, Table (32-C) indicate that combinations of postharvest treatments and package types failed to induce any statistical differences among them when

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Table (32-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	8.53	8.54	-	-	8.66	8.69	7.15J	7.50J	-	-	7.59J	7.59J	1.15	1.15	-	-	1.10	1.11	51.00	51.00	-	-	52.00	52.00
Control	A	A	-	-	A	A	KL	KL	-	-	K	K	AC	AC	-	-	BD	BD	O	O	-	-	M	M
Irradiation	8.53	8.52	-	-	8.66	8.65	7.48	7.44	-	-	7.69	7.70	1.13	1.13	-	-	1.09	1.10	51.30	51.40	-	-	52.20	52.25
0.50 kGy	A	A	-	-	A	A	KL	KL	-	-	GK	GK	AC	AC	-	-	BD	BD	NO	NO	-	-	LM	LM
0.75 kGy	8.60	8.60	-	-	8.60	8.50	7.71	7.70	-	-	7.83	7.83	1.10	1.11	-	-	1.13	1.13	51.55	51.60	-	-	51.00	51.00
A	A	A	-	-	A	A	GK	GK	-	-	EK	EK	BD	BD	-	-	AC	AC	N	N	-	-	O	O
Fungicides	8.66	8.60	-	-	8.66	8.63	8.22	8.20	-	-	8.30	8.30	1.26	1.25	-	-	1.00	1.00	52.00	53.20	-	-	52.57	52.55
A	A	A	-	-	A	A	AD	AD	-	-	AC	AC	AB	AB	-	-	CD	CD	M	M	-	-	IK	IK
Non traditional	8.60	8.60	-	-	8.66	8.65	8.11	8.10	-	-	7.98	7.97	1.07	1.07	-	-	1.10	1.10	53.00	53.00	-	-	54.00	54.00
Garlic oil	A	A	-	-	A	A	AF	AF	-	-	CH	CH	BD	BD	-	-	BD	BD	FH	FH	-	-	DE	DE
Pro-Gib plus	8.66	8.65	-	-	8.60	8.63	8.28	8.27	-	-	8.44	8.45	1.20	1.20	-	-	0.90	0.93	53.23	53.20	-	-	54.00	54.00
A	A	A	-	-	A	A	AC	AC	-	-	A	A	AC	AC	-	-	D	D	F	F	-	-	D	D
Hot water	8.36	8.35	-	-	8.60	8.63	7.85	7.85	-	-	8.18	8.18	1.12	1.12	-	-	1.05	1.09	52.23	53.20	-	-	52.75	52.75
A	A	A	-	-	A	A	EJ	EJ	-	-	AE	AE	BC	BC	-	-	BD	BD	LM	LM	-	-	HI	HI
Yeast	8.60	8.60	-	-	8.53	8.53	7.83	7.83	-	-	7.79	7.79F	1.11	1.11	-	-	1.11	1.11	52.18	52.18	-	-	52.88	52.85
A	A	A	-	-	A	A	EK	EK	-	-	FK	K	BC	BC	-	-	BD	BD	LM	LM	-	-	GI	GI
Waxing Control	8.73	8.70	-	-	8.73	8.70	7.02	7.02	-	-	7.90	7.92	1.19	1.18	-	-	1.11	1.11	51.40	51.40	-	-	55.00	55.00
+ wax	A	A	-	-	A	A	M	M	-	-	DI	DI	AC	AC	-	-	BD	BD	N	N	-	-	C	C
0.50kGy	8.46	8.45	-	-	8.73	8.70	7.07	7.05	-	-	8.01	8.00	1.33	1.33	-	-	1.11	1.11	52.17	52.17	-	-	52.28	52.25
+ wax	A	A	-	-	A	A	M	M	-	-	BG	BG	A	A	-	-	BD	BD	LM	LM	-	-	KM	KM
0.75kGy	8.66	8.63	-	-	8.66	8.65	7.20	7.20	-	-	7.96	7.95	1.17	1.18	-	-	1.11	1.11	52.70	52.73	-	-	53.00	53.00
+ wax	A	A	-	-	A	A	LM	LM	-	-	CH	CH	AC	AC	-	-	BD	BD	HJ	HJ	-	-	FH	FH
Fungicides+wax	8.66	8.60	-	-	8.66	8.63	7.65	7.65	-	-	8.12	8.12	1.03	1.04	-	-	1.10	1.10	52.70	52.70	-	-	53.20	53.20
A	A	A	-	-	A	A	HK	HK	-	-	AF	AF	CD	CD	-	-	BD	BD	HJ	HJ	-	-	FG	FG
Garlic oil+wax	8.80	8.75	-	-	8.80	8.80	8.23	8.24	-	-	8.35	8.34	1.07	1.07	-	-	1.05	1.09	53.20	53.20	-	-	55.68	55.65
A	A	A	-	-	A	A	AD	AD	-	-	AB	AB	BD	BD	-	-	BD	BD	FG	FG	-	-	B	B
Pro-Gib plus + wax	8.80	8.80	-	-	8.80	8.80	8.18	8.19	-	-	8.21	8.21	1.11	1.11	-	-	1.07	1.09	53.80	53.80	-	-	56.00	56.00
A	A	A	-	-	A	A	AE	AE	-	-	AD	AD	BD	BD	-	-	BD	BD	E	E	-	-	A	A
Hot water + wax	8.66	8.60	-	-	8.66	8.65	8.01	8.02	-	-	7.99	7.99	1.11	1.11	-	-	1.05	1.08	52.40	52.50	-	-	54.30	54.35
A	A	A	-	-	A	A	BG	BG	-	-	BH	BH	BD	BD	-	-	BD	BD	HL	JL	-	-	D	D
Yeast + wax	8.53	8.50	-	-	8.66	8.65	6.94	8.95	-	-	-	-	1.12	1.20	-	-	1.09	1.09	51.61	51.60	-	-	53.00	53.00
A	A	A	-	-	A	A	M	M	-	-	-	-	AC	AC	-	-	BD	BD	N	N	-	-	FH	FH

Table (32): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 105 days storage at cold temperature.

Table (32-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	8.60BC	8.50BC	7.55HI	7.53HI	1.12A	1.11A	51.50K	51.40K
Irradiation								
0.50 KGy	8.63AC	8.66AC	7.59GI	7.58GI	1.11A	1.12A	51.75J	51.73J
0.75 KGy	8.60BC	8.57BC	7.77FH	7.76FH	1.12A	1.12A	51.28L	51.26L
Fungicides	8.66AC	8.63AC	8.26AC	8.25AC	1.13A	1.13A	53.28IH	52.25IH
Non traditional								
Garlic oil	8.63AC	8.68AC	8.04CD	8.05CD	1.08A	1.08A	53.50CD	53.50CD
Pro-Gib plus	8.63AC	8.66AC	8.36A	8.35A	1.05A	1.05A	53.72C	53.70C
Hot water	8.63AC	8.63AC	8.01DE	8.02DE	1.09A	1.10A	52.49GH	52.45GH
Yeast	8.55C	8.55C	7.81EG	7.80EG	1.11A	1.11A	52.53G	52.50G
Waxing								
Control + wax	8.66AC	8.63AC	7.46I	7.45I	1.15A	1.12A	53.20E	53.00E
0.50 KGy+wax	8.73AB	8.75AB	7.54HI	7.52HI	1.22A	1.20A	52.23I	52.20I
0.75 KGy+wax	8.56BC	8.57BC	7.58GI	7.58GI	1.14A	1.14A	52.85F	52.83F
Fungicides+wax	8.66A	8.63A	7.13DF	7.90DF	1.06A	1.08A	52.95F	52.90F
Garlic oil +wax	8.80A	8.85A	8.29AB	8.28AB	1.06A	1.05A	54.44B	54.40B
Pro-Gib plus + wax	8.80A	8.80A	8.31A	8.30A	1.09A	1.08A	54.90A	54.83A
Hot water +wax	8.66A	8.63A	8.07BD	8.08BD	1.08A	1.06A	53.35DE	53.30DE
Yeast + wax	8.60BC	8.60BC	7.46I	7.45I	1.15A	1.13A	52.31HI	52.30HI

Table (32-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.63A	8.62A	7.70B	7.71B	1.15A	1.15A	52.28B	52.25B
Carton								
Polyethylene + carton	8.67A	8.69A	8.05A	8.08A	1.07B	1.08B	53.38A	53.35A

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total soluble solids percentage was concerned in both seasons of study. On contrast, pro-Gib and pro-Gib plus waxing treatments in polyethylene plus carton package induced significant increase in total acidity values as compared with the other combinations in this respect.

However, a significant increase in T.S.S. / acid ratio occurred when the control and yeast plus waxing treatments in polyethylene package were used. Meanwhile, pro-Gib plus waxing treatment in polyethylene plus carton package increased ascorbic acid content statistically in comparison with all other combinations. On the other hand, combinations of all treatments under study packed in carton boxes failed to continue in storage for 120 days and were discarded.

Data of the effect of postharvest treatments Table (33-A) clarify that pro-Gib plus waxing treated fruits showed the highest total soluble solids and ascorbic acid contents followed by garlic oil plus waxing then pro-Gib and garlic oil treatments as compared with the other used treatments and the control in a descending order in both seasons. However, a significant increase in total acidity values occurred when pro-Gib plus waxing and pro-Gib as well as garlic plus waxing treatments were used. Moreover, lower irradiation dose (0.50 KGy) plus waxing treatment succeeded in increasing T.S.S. / acid ratio after 120 days of stored lime fruits under cold temperature.

Comparing different package types as shown in Table (33-B) it is quite evident that polyethylene plus carton package was superior than polyethylene package, for all parameters under study. Dealing with the interaction between storage treatments

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and package type in both seasons Table (33-C) indicate that pro-Gib plus waxing in polyethylene plus carton package increased total soluble solids and ascorbic acid contents statistically as compared with other combinations in this respect in both seasons. However, significant increase in total acidity was obtained when pro-Gib plus waxing as well as garlic oil plus waxing in polyethylene plus carton package were used. Meanwhile, the control and yeast plus waxing treatments in polyethylene package increased T.S.S. / acid ratio statistically in comparison with all other combinations in both seasons.

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Table (33): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 120 days storage at cold temperature.

Table (33-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	8.40CE	8.50BC	7.48F	7.45F	1.09AD	1.10AC	50.60P	50.50P
Irradiation								
0.50 KGy	8.40CE	8.40CE	7.56F	7.55F	1.10AC	1.10AC	51.00N	51.00N
0.75 KGy	8.30DF	8.40CE	7.73E	7.75E	1.07BF	1.07BF	51.60J	51.60J
Fungicides	8.36CF	8.33CF	8.18AB	8.20AB	1.04DG	1.04DG	51.40K	51.40K
Non traditional								
Garlic oil	8.50BC	8.40CE	8.15AC	8.17AC	1.04DG	1.05CG	52.70D	52.60D
Pro-Gib plus	8.56B	8.55B	8.28A	8.25A	1.02FG	1.02FG	53.22C	53.20C
Hot water	8.36CF	8.33CF	7.92D	7.90D	1.03EG	1.04DG	51.88H	51.85H
Yeast	8.13G	8.15G	7.79E	7.77E	1.00G	1.00G	51.16M	51.20M
Waxing								
Control + wax	8.40CE	8.45CE	7.41F	7.50F	1.12AB	1.13AB	50.67O	50.65O
0.50 KGy+wax	8.26EF	8.28EF	7.55F	7.53F	1.14A	1.15A	51.26L	51.28L
0.75 KGy+wax	8.40CE	8.43CE	7.54F	7.55F	1.10AC	1.10AC	52.04G	52.00G
Fungicides+wax	8.33DF	8.35DF	8.02CD	8.00CD	1.03DG	1.04DG	52.31F	52.30F
Garlic oil +wax	8.56B	8.55B	8.25A	8.30A	1.06CG	1.06CG	53.83B	53.80B
Pro-Gib plus + wax	8.76A	8.75A	8.27A	8.28A	1.05CG	1.05CG	53.94A	53.90A
Hot water +wax	8.46BD	8.45BD	8.04BD	8.05BD	1.03EG	1.04DG	52.50E	52.55E
Yeast + wax	8.23FG	8.25FG	7.42F	7.40F	1.08AE	1.08AE	51.76I	51.75I

Table (33-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	8.24B	8.25B	7.64B	7.60B	1.06A	1.05A	51.63B	51.65B
Carton								
Polyethylene + carton	8.56A	8.58A	8.02A	8.00A	1.07A	1.08A	52.35A	52.40A

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Table (33-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+		Poly		Carton		Poly+	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	8.26	8.25	-	-	8.53	8.55	7.44J	7.45J	-	-	7.51	7.50	1.08	1.06	-	-	1.11	1.10	30.20	30.20	-	-	51.00	51.00
Control	DF	DF	-	-	AD	AD	AD	AD	-	-	J	J	AE	AE	-	-	AE	AD	N	N	-	-	L	L
Irradiation	8.26	8.25	-	-	8.53	8.53	7.45J	7.45J	-	-	7.66J	7.65J	1.10	1.10	-	-	1.11	1.10	51.00	51.00	-	-	51.00	51.00
0.50 kGy	DF	DF	-	-	AD	AD	AD	AD	-	-	J	J	AD	AD	-	-	AD	AD	L	L	-	-	L	L
0.75 kGy	8.06	8.03	-	-	8.60	8.50	7.66J	7.65J	-	-	7.79	7.80	1.04	1.04	-	-	1.10	1.11	51.20	51.20	-	-	52.00	52.00
Fungicide	8.26	8.25	-	-	8.46	8.45	8.07	8.05	-	-	8.28	8.30	1.01	1.00	-	-	1.07	1.06	51.25	51.26	-	-	51.55	51.50
des	DF	DF	-	-	BE	BE	BG	BG	-	-	AC	AB	DE	DE	-	-	AE	AE	K	K	-	-	J	J
Non traditional	8.26	8.25	-	-	8.73	8.70	8.22	8.20	-	-	8.08	8.08	1.00	1.00	-	-	1.08	1.07	52.40	52.50	-	-	53.00	53.00
Garlic oil	DF	DF	-	-	AB	AB	AD	AD	-	-	BG	BG	DE	DE	-	-	AE	AD	FG	F	-	-	D	D
Pro-Gib plus	8.40	8.45	-	-	8.73	8.70	8.22	8.20	-	-	8.34	8.35	1.01	1.00	-	-	1.04	1.04	52.32	52.50	-	-	53.92	53.90
Hot water	CE	CE	-	-	AB	AB	AD	AD	-	-	AB	AB	DE	DE	-	-	BE	BE	F	F	-	-	C	C
Yeast	8.20	8.20	-	-	8.53	8.50	7.79	7.80	-	-	8.05	8.05	1.04	1.04	-	-	1.01	1.00	51.80	51.83	-	-	51.95	51.90
Waxing	8.00	8.00	-	-	8.26	8.25	7.78	7.79	-	-	7.80	7.80	0.97	0.95	-	-	1.03	1.03	51.32	51.30	-	-	51.00	51.00
Control	DF	DF	-	-	DF	DF	HI	HI	-	-	HI	HI	E	E	-	-	CE	CE	K	K	-	-	L	L
+ wax	8.26	8.25	-	-	8.53	8.50	6.97	6.95	-	-	7.86	7.85	1.16	1.15	-	-	1.09	1.10	50.33	50.30	-	-	51.00	51.00
0.50kGy	8.06	8.05	-	-	8.46	8.45	7.11	7.10	-	-	8.00	8.00	1.12	1.12	-	-	1.17	1.17	51.31	51.30	-	-	51.22	51.20
+ wax	DF	DF	-	-	BE	BE	K	K	-	-	DH	DH	AD	AD	-	-	A	A	K	K	-	-	K	K
0.75kGy	8.26	8.26	-	-	8.73	8.70	7.17	7.15	-	-	7.90	7.93	1.13	1.12	-	-	1.07	1.06	51.73	51.70	-	-	52.35	52.33
Fungicide	DF	DF	-	-	AB	AB	K	K	-	-	FI	FI	AC	AC	-	-	AE	AE	I	I	-	-	G	G
des	8.00	8.03	-	-	8.53	8.50	7.88	7.87	-	-	8.17	8.15	1.00	1.00	-	-	1.07	1.06	51.80	51.80	-	-	52.82	52.80
+ wax	F	F	-	-	AD	AD	GI	GI	-	-	AF	AF	DE	DE	-	-	AE	AE	I	I	-	-	E	E
Garlic oil	8.40	8.43	-	-	8.80	8.83	8.14	8.15	-	-	8.36	8.35	1.06	1.05	-	-	1.06	1.07	52.80	52.80	-	-	54.85	53.80
+ wax	CE	CE	-	-	A	A	AG	AG	-	-	A	A	AE	AE	-	-	AE	AE	E	E	-	-	B	B
Pro-Gib plus	8.73	8.73	-	-	8.66	8.65	8.16	8.15	-	-	8.36	8.37	1.07	1.06	-	-	1.04	1.04	52.90	52.93	-	-	54.98	54.95
+ wax	AB	AB	-	-	AC	AC	AE	AE	-	-	A	A	AE	AE	-	-	BE	BE	DE	DE	-	-	A	A
Hot water	8.40	8.50	-	-	8.40	8.50	7.92	7.95	-	-	8.17	8.15	1.01	1.00	-	-	1.05	1.06	52.00	52.00	-	-	53.00	53.00
Yeast	CE	CE	-	-	CE	CE	EI	EI	-	-	AF	AF	DE	DE	-	-	AE	AE	H	H	-	-	D	D
+ wax	8.06	8.03	-	-	7.51	7.42	6.86	6.85	-	-	7.98	7.96	1.12	1.12	-	-	1.05	1.06	51.21	51.50	-	-	52.00	52.00
Wax	F	F	-	-	EF	EF	L	L	-	-	DH	DH	AD	AD	-	-	AE	AE	J	J	-	-	H	H

Considering the effect of postharvest treatments on the chemical properties of lime fruits after 135 days storage at cold temperature, in both seasons Table (34-A) clarifies that pro-Gib plus waxing showed the highest percentage of total soluble solids followed by garlic oil plus waxing as well as fungicides treatments then hot water plus waxing treatment as compared with the other used treatments and the control. However, a significant increase in total acidity values occurred when fungicides, pro-Gib and garlic oil, plus waxing as well as pro-Gib plus waxing treatments were used. Meanwhile, irradiation doses plus waxing treatments and the control induced the highest significant T.S.S. / acid ratio as compared with the other used treatments. On the other hand, there were no significant differences between storage treatments when ascorbic acid content was considered.

A glance to Table (34-B) show that fruits packed in polyethylene plus carton package significantly had higher total soluble solids, total acidity and ascorbic acid contents in relation to fruits stored in polyethylene package. On the other hand, packages used had no statistical effect on fruit T.S.S. / acid ratio with respect to the different interactions. In addition Table (34-C) pointed out that fungicides treatment for fruits packed in polyethylene plus carton had statistically higher total soluble solids in both seasons. However, significant increase in total acidity values occurred when pro-Gib plus waxing in polyethylene plus carton package was used. Furthermore, control, control plus waxing as well as irradiation dose (0.50 KGy) plus waxing in polyethylene plus carton package increased

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Table (34): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 135 days storage at cold temperature.

Table (34-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	8.03EG	8.03EG	7.48E	7.50E	1.07A	1.07A	49.94A	50.00A
Irradiation								
0.50 KGy	8.10DF	8.10DF	7.58DE	7.59DE	1.05A	1.08A	51.10A	51.12A
0.75 KGy	8.00EG	8.00EG	7.66D	7.65D	1.03AE	1.03AE	51.82A	51.80A
Fungicides	8.40AB	8.43AB	8.14A	8.15A	1.03AF	1.03AF	51.03A	52.10A
Non traditional								
Garlic oil	8.23CD	8.20CD	7.95B	7.93B	1.03AE	1.03AE	52.00A	52.00A
Pro-Gib plus	8.23CD	8.25CD	8.27A	8.25A	0.99EF	0.98EF	52.10A	52.10A
Hot water	8.16DE	8.18DE	7.87BC	7.86BC	1.03AF	1.03AF	51.45A	51.45A
Yeast	7.90G	7.93G	7.73CD	7.75CD	1.02AF	1.02AF	50.83A	50.85A
Waxing								
Control + wax	8.03EG	8.05EG	7.19F	7.20F	1.03AF	1.03AF	49.50A	49.56A
0.50 KGy+wax	8.13DF	8.13DF	7.36F	7.28F	1.07A	1.07A	51.12A	51.10A
0.75 KGy+wax	8.10DF	8.12DF	7.33F	7.35F	1.07A	1.07A	51.85A	51.80A
Fungicides+wax	7.96FG	7.95FG	7.93B	7.95B	1.00EF	1.00EF	51.18A	51.20A
Garlic oil +wax	8.36AC	8.35AC	8.16A	8.18A	1.02AF	1.02AF	52.11A	51.79A
Pro-Gib plus + wax	8.50A	8.50A	8.27A	8.28A	1.05AC	1.05AC	52.50A	52.10A
Hot water +wax	8.26BD	8.25BD	7.98B	7.95B	0.99EF	0.99EF	51.72A	51.70A
Yeast + wax	7.30H	7.33H	7.28F	7.30F	1.01BF	1.01BF	51.13A	51.15A

Table (34-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	7.90B	7.95B	7.63B	7.68B	1.03A	1.03A	51.83B	51.85B
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	8.30A	8.35A	7.88A	7.90A	1.01A	1.02A	52.15A	52.18A

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Table (34-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	7.60	7.50	-	-	8.46	8.46	7.45	7.45	-	-	7.521	7.551	1.01	1.00	-	-	1.12	1.12	49.50	49.50	-	-	49.97	49.95
Control	HI	HI	-	-	AC	AC	K	K	-	-	K	K	BD	BD	-	-	AB	AB	A	A	-	-	A	A
Irradiation	7.86	7.87	-	-	8.33	8.33	7.531	7.531	-	-	7.63	7.65	1.03	1.02	-	-	1.07	1.08	49.95	49.93	-	-	49.99	49.95
0.50 kGy	FH	FH	-	-	AD	AD	K	K	-	-	HK	HK	BD	BD	-	-	AC	AC	A	A	-	-	A	A
0.75 kGy	7.80	7.80	-	-	8.20	8.30	7.62	7.60	-	-	7.71	7.73F	1.00	1.01	-	-	1.06	1.09	51.05	51.03	-	-	51.00	51.00
GH	GH	GH	-	-	BE	AB	HK	HK	-	-	FK	K	BD	BD	-	-	AD	AC	A	A	-	-	A	A
Fungicides	8.20	8.25	-	-	8.60	8.63	8.01	8.08	-	-	8.27	8.30	1.01	1.02	-	-	1.01	1.03	51.00	51.00	-	-	51.07	51.00
BE	BE	BE	-	-	A	A	BG	BG	-	-	AB	AB	BD	BD	-	-	BD	BD	A	A	-	-	A	A
Non traditional	8.13	8.15	-	-	8.33	8.35	8.16	8.15	-	-	7.73	7.75F	1.02	1.02	-	-	1.02	1.07	51.98	51.95	-	-	52.23	52.20
Garlic oil	CF	CF	-	-	AD	AD	AC	AC	-	-	FK	K	BD	BD	-	-	BD	AC	A	A	-	-	A	A
Pro-Gib plus	8.20	8.25	-	-	8.26	8.25	8.22	8.20	-	-	8.33	8.30	1.01	1.01	-	-	0.95	0.99	52.10	52.00	-	-	52.95	52.90
BE	BE	BE	-	-	BE	BE	AB	AB	-	-	AB	AB	BD	BD	-	-	D	D	A	A	-	-	A	A
Hot water	8.00	8.00	-	-	8.33	8.35	7.74	7.75	-	-	8.01	8.00	1.02	1.02	-	-	1.01	1.04	51.55	51.50	-	-	51.90	51.90
EG	EG	EG	-	-	AD	AD	FK	FK	-	-	BG	BG	BD	BD	-	-	BD	BD	A	A	-	-	A	A
Yeast	7.80	7.80	-	-	8.00	8.00	7.73	7.73	-	-	7.73	7.73F	1.01	1.01	-	-	1.01	1.03	51.00	51.00	-	-	50.67	50.65
GH	GH	GH	-	-	EG	EG	FK	FK	-	-	FK	K	BD	BD	-	-	BD	BD	A	A	-	-	A	A
Waxing Control + wax	7.60	7.65	-	-	8.40	8.45	6.95	6.90	-	-	7.44	7.45	1.07	1.07	-	-	1.12	1.13	49.00	49.00	-	-	50.00	50.00
HI	HI	HI	-	-	AD	AD	L	L	-	-	K	K	AD	AD	-	-	AB	AB	A	A	-	-	A	A
0.50kGy + wax	7.86	7.85	-	-	8.40	8.43	7.04	7.00	-	-	7.48	7.50	1.10	1.10	-	-	1.13	1.12	49.98	49.95	-	-	50.00	50.00
FH	FH	FH	-	-	AD	AC	L	L	-	-	JK	K	AB	AB	-	-	AB	AB	A	A	-	-	A	A
0.75kGy + wax	7.80	7.83	-	-	8.40	8.40	6.96	6.93	-	-	7.70	7.70	1.08	1.07	-	-	1.05	1.09	50.00	50.00	-	-	51.58	51.55
GH	GH	GH	-	-	AD	AC	L	L	-	-	GK	GK	AD	AD	-	-	AD	AC	A	A	-	-	A	A
Fungicides+wax	7.66	7.65	-	-	8.26	8.25	7.84	7.85	-	-	8.03	8.03	1.01	1.00	-	-	1.02	1.02	51.48	51.45	-	-	52.88	52.85
HI	HI	HI	-	-	BE	BE	DI	DI	-	-	BF	BF	BD	BD	-	-	BD	BD	A	A	-	-	A	A
Garlic oil+ wax	8.26	8.25	-	-	8.46	8.45	8.06	8.00	-	-	8.26	8.25	1.02	1.02	-	-	1.01	1.02	50.98	50.95	-	-	52.55	52.53
BE	BE	BE	-	-	AC	AC	BE	BG	-	-	AB	AB	BD	BD	-	-	BD	BD	A	A	-	-	A	A
Pro-Gib plus + wax	8.46	8.45	-	-	8.53	8.55	8.19	8.20	-	-	8.36	8.35	1.16	1.16	-	-	1.01	1.02	51.57	51.55	-	-	52.60	52.55
AC	AC	AC	-	-	AB	AB	AB	AB	-	-	A	A	A	A	-	-	BD	BD	A	A	-	-	A	A
Hot water + wax	8.06	8.07	-	-	8.46	8.45	7.86	7.87	-	-	8.10	8.10	1.03	1.03	-	-	1.04	1.04	51.90	51.90	-	-	51.00	51.00
DG	DG	DG	-	-	AC	AC	BH	BH	-	-	AD	AD	BD	BD	-	-	BD	BD	A	A	-	-	A	A
Yeast + wax	7.13	7.15	-	-	7.461	7.451	6.79	6.80	-	-	7.78	7.78	1.01	1.02	-	-	0.95	0.95	51.00	51.00	-	-	51.25	51.20
J	J	J	-	-	-	-	L	L	-	-	EJ	EJ	BD	BD	-	-	D	D	A	A	-	-	A	A

T.S.S. / acid ratio statistically in comparison with all other combinations in both seasons. On the other hand, combinations of storage treatments and package type failed to induce any statistical differences among them when ascorbic acid content was concerned in the two seasons (1999 & 2000).

Regarding the effect of postharvest treatments on chemical properties of lime fruits after 150 days storage at cold temperature in both seasons Table (35-A) clarify that pro-Gib plus waxing treated fruits showed the highest total soluble solids, total acidity values and ascorbic acid contents and the lowest T.S.S. / acid ratio followed by garlic plus waxing among the other treatments used.

Comparing different package types as shown in Table (35-B) it is quite evident that polyethylene plus carton package was superior than polyethylene package only for all parameters under study.

With respect to the different interactions Table (35-C) pointed out that pro-Gib plus waxing as well as garlic oil plus waxing in polyethylene plus carton package increased total soluble solids, total acidity and ascorbic acid contents statistically followed by pro-Gib and garlic oil as compared with the other combinations in this respect. However, significant increase in T.S.S. / acid ratio was obtained when control and control plus waxing treatments were used.

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Table (35): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 150 days storage at cold temperature.

Table (35-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	7.33G	7.30G	6.63G	6.65G	1.10A	1.09A	47.75G	47.75G
Irradiation								
0.50 KGy	7.43FG	7.40FG	7.22EF	7.25EF	1.02C	1.03CD	47.94FG	47.93FG
0.75 KGy	7.46FG	7.45FG	7.49DE	7.50DF	0.99E	0.99E	47.95FG	47.94FG
Fungicides	7.40FG	7.50F	7.72BD	7.75BD	0.95DE	0.99E	48.20DF	48.25DF
Non traditional								
Garlic oil	8.00BC	8.00BC	7.78ABC	7.80AC	1.02D	1.02D	48.53BC	48.50BC
Pro-Gib plus	8.20AB	8.20AB	8.17AB	8.18AB	1.01DE	1.02D	48.70B	48.65B
Hot water	7.93CD	7.90CD	7.66BD	7.65BD	1.03CD	1.02D	48.29CE	48.30CE
Yeast	6.83H	6.85H	7.28DE	7.30DE	0.93G	0.95F	48.14EF	48.15EF
Waxing								
Control + wax	7.30G	7.33G	6.60G	6.63G	1.10A	1.10A	47.95FG	47.95FG
0.50 KGy+wax	7.43FG	7.45FG	7.07F	7.05F	1.05C	1.04C	48.07EF	48.07EF
0.75 KGy+wax	7.73DE	7.75DE	7.19EF	7.20EF	1.07B	1.06B	48.07EF	48.07EF
Fungicides+wax	7.60EF	7.63EF	7.87AC	7.88AC	0.96F	0.95F	48.40CD	48.40CD
Garlic oil +wax	8.13ABC	8.15AC	7.92ABC	7.95ABC	1.02D	1.03CD	49.03A	49.00A
Pro-Gib plus + wax	8.33A	8.35A	8.24A	8.25A	1.00E	1.00E	49.19A	49.20A
Hot water +wax	8.20AB	8.25AB	7.88AC	7.88AC	1.04C	1.03CD	48.45BD	48.45BD
Yeast + wax	7.60H	7.65H	6.37G	6.35G	1.03CD	1.03CD	48.08EF	48.07EF

Table (35-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	7.23B	7.25B	7.29B	7.30B	1.00B	1.01B	47.98B	47.99B
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	8.01A	8.02A	7.59A	7.60A	1.05A	1.07A	48.56A	48.60A

RESULTS & DISCUSSION

Table (35-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Package	6.86	6.85	-	-	7.80	7.83	6.66	6.65	-	-	6.60	6.63	1.03	1.02	-	-	1.18	1.15	47.53	47.53	-	-	48.00	48.05
Season	FH	FH	-	-	DE	DE	FH	FH	-	-	FH	FH	CE	DG	-	-	A	A	J	J	-	-	FI	FI
Control	6.80	6.83	-	-	8.00	8.00	6.88	6.86	-	-	7.56	7.55	0.98	0.97	-	-	1.05	1.05	47.70	47.70	-	-	48.24	48.30
Irradiation	GH	GH	-	-	BE	BE	EG	EG	-	-	BE	BE	H	H	-	-	C	C	U	U	-	-	DG	DG
0.50 kGy	6.80	6.83	-	-	8.13	8.12	7.30	7.33	-	-	7.69	7.67	0.931	0.941	-	-	1.05	1.05	47.80	47.80	-	-	48.35	48.43
0.75 kGy	GH	GH	-	-	AD	AD	DF	DF	-	-	AD	AD	AD	AD	-	-	C	C	HI	HI	-	-	CF	CF
0.75 kGy	6.80	6.83	-	-	8.00	8.00	7.46	7.45	-	-	7.79	7.95	0.851	0.831	-	-	1.00	1.00	48.00	48.10	-	-	48.40	48.45
Fungicides	6.86	6.83	-	-	BE	BE	CE	CE	-	-	AD	AD	AD	AD	-	-	G	G	FI	FI	-	-	BF	BF
Non traditional	7.82	7.85	-	-	8.00	8.00	7.86	7.85	-	-	7.69	7.67	1.01	1.01	-	-	1.05	1.04	48.60	48.60	-	-	48.66	48.65
Garlic oil	BE	CE	-	-	BE	BE	AD	AD	-	-	AD	AD	FG	FG	-	-	C	C	BE	BE	-	-	BD	BD
Pro-Gib plus	8.00	8.00	-	-	8.40	8.40	8.66	8.65	-	-	8.28	8.30	0.941	0.931	-	-	1.01	1.01	48.60	48.60	-	-	48.80	48.85
Hot water	BE	BE	-	-	A	A	AC	AC	-	-	AB	AB	AB	AB	-	-	FG	FG	BE	BE	-	-	B	B
Yeast	7.73	7.75	-	-	8.13	8.12	7.67	7.65	-	-	7.65	7.63	1.00	1.00	-	-	1.06	1.06	48.20	48.23	-	-	48.38	48.35
Waxing Control	6.86	6.83	-	-	AD	AD	AD	AD	-	-	AD	AD	G	G	-	-	BC	BC	EH	EH	-	-	CF	CF
Control + wax	6.60	6.63	-	-	8.00	8.00	6.56	6.55	-	-	6.66	6.65	1.00	1.00	-	-	1.20	1.20	49.56	49.55	-	-	48.00	48.10
0.50kGy + wax	HI	HI	-	-	BE	BE	GH	GH	-	-	FH	FH	G	G	-	-	A	A	J	J	-	-	FI	FI
0.75kGy + wax	6.80	6.83	-	-	8.06	8.05	6.68	6.66	-	-	7.46	7.45	1.01	1.01	-	-	1.08	1.08	47.73	47.73	-	-	48.31	48.30
Fungicides + wax	GH	GH	-	-	AE	AE	FH	FH	-	-	CE	CE	EG	EG	-	-	B	B	U	U	-	-	CG	CG
Garlic oil + wax	7.20	7.25	-	-	8.26	8.25	6.74	6.75	-	-	7.65	7.63	1.06	1.05	-	-	1.07	1.08	47.83	47.85	-	-	48.40	48.38
Pro-Gib plus + wax	F	F	-	-	AB	AB	AD	AD	-	-	AD	AD	BC	C	-	-	B	B	HI	HI	-	-	BF	BF
Yeast + wax	7.25	7.23	-	-	8.33	8.30	7.78	7.76	-	-	7.70	7.73	0.881	0.881	-	-	1.08	1.07	48.20	48.20	-	-	48.62	48.60
Waxing Control	F	F	-	-	AB	AB	AD	AD	-	-	AD	AD	AD	AD	-	-	B	B	EH	EH	-	-	BE	BE
Garlic oil + wax	8.00	7.85	-	-	8.40	8.40	7.64	7.65	-	-	8.20	8.23	1.02	1.01	-	-	1.02	1.02	48.90	48.90	-	-	49.86	49.85
Pro-Gib plus + wax	BE	CE	-	-	A	A	AD	AD	-	-	AB	AB	DG	EG	-	-	DG	DG	BE	BE	-	-	A	A
Hot water + wax	8.20	8.00	-	-	8.40	8.40	8.12	8.13	-	-	8.36	8.25	0.98	0.97	-	-	1.00	1.00	48.67	48.65	-	-	49.72	49.70
Yeast + wax	8.00	8.00	-	-	8.40	8.40	7.84	7.82	-	-	A	A	H	H	-	-	G	G	BC	BC	-	-	A	A
Waxing Control	BE	BE	-	-	A	A	AC	AC	-	-	AD	AD	DG	EG	-	-	1.05	1.05	48.30	48.33	-	-	48.59	48.60
Garlic oil + wax	6.001	6.101	-	-	7.00	7.03	6.14	6.15	-	-	6.60	6.60	0.97	0.98	-	-	1.06	1.05	48.00	48.00	-	-	48.49	48.55
Pro-Gib plus + wax	BE	BE	-	-	FG	FG	H	H	-	-	FH	FH	H	H	-	-	BC	BC	FI	FI	-	-	BE	BE
Yeast + wax	6.001	6.101	-	-	7.00	7.03	6.14	6.15	-	-	6.60	6.60	0.97	0.98	-	-	1.06	1.05	48.00	48.00	-	-	48.49	48.55

Referring the effect of postharvest treatment on the chemical properties of lime fruits after 165 days storage at cold temperature in both seasons, it is evident from Table (36-A) that pro-Gib plus waxing treatment showed the highest total soluble solids followed by pro-Gib then garlic oil plus waxing as compared with the other used treatments and the control. Meanwhile, non-traditional treatments plus waxing were superior than the other used treatments and the control in increasing total acidity values and ascorbic acid contents. However, significant increase in T.S.S. / acid ratio occurred when control plus waxing was used in both seasons.

Concerning the effect of package types on the chemical properties, Table (36-B) clarify that fruits packed polyethylene plus carton significantly had higher total soluble solids, total acidity and ascorbic acid contents but decreased T.S.S. / acid ratio as compared with polyethylene package.

Dealing with the interaction between postharvest treatment and package type in both seasons as shown in Table (36-C) it is clear that pro-Gib plus waxing and pro-Gib as well as garlic oil plus waxing in polyethylene plus carton package treatments had higher total soluble solids, total acidity and ascorbic acid contents statistically as compared with the other combinations in this respect. However, significant increase in T.S.S. / acid ratio occurred when yeast plus waxing and yeast as well as control plus waxing in polyethylene plus carton package were used in both seasons. On the other hand, combinations of all treatments under study and carton package as well as all unwaxed treatments except garlic oil or pro-Gib and waxed control, irradiation doses (0.50 kGy), hot water and yeast packed in polyethylene failed to continue in storage and were neglected.

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Table (36): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 165 days storage at cold temperature.

Table (36-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	6.63G	6.62G	6.48G	6.45G	1.02C	1.02C	47.55G	47.53G
Irradiation								
0.50 KGy	7.10E	7.11E	7.00F	7.00F	1.01C	1.01C	47.85E	47.83E
0.75 KGy	7.15E	7.12E	7.15E	7.13E	1.04BC	1.00D	47.90DE	47.90DE
Fungicides	7.20E	7.20E	7.20DE	7.20DE	1.00D	1.00D	48.00D	48.00D
Non traditional								
Garlic oil	7.33D	7.30D	7.58C	7.56C	0.97E	0.96E	48.20B	48.19B
Pro-Gib plus	7.76B	7.76B	7.63BC	7.60BC	1.02C	1.01C	48.20B	48.20B
Hot water	7.30D	7.33D	7.19E	7.19E	1.01CD	1.01CD	48.00D	48.00D
Yeast	6.40H	6.42H	6.00H	6.00H	1.06B	1.06B	47.20DE	47.20DE
Waxing								
Control + wax	7.03E	7.00E	6.48G	6.47G	1.08A	1.08A	47.65F	47.65F
0.50 KGy+wax	7.10E	7.08E	7.05F	7.03F	1.00D	1.00D	47.90DE	47.90DE
0.75 KGy+wax	7.10E	7.10E	7.10E	7.11E	1.00D	1.00D	47.95D	47.95D
Fungicides+wax	6.95F	6.93F	7.46C	7.45C	0.93E	0.93E	48.10C	48.13C
Garlic oil +wax	7.43C	7.40C	7.70B	7.70B	0.96E	0.96E	48.27A	48.27A
Pro-Gib plus + wax	8.06A	8.05A	7.92A	7.92A	1.01C	1.01C	48.29A	48.29A
Hot water +wax	7.50C	7.50C	7.35D	7.35D	1.02C	1.02C	48.15C	48.13C
Yeast + wax	6.40H	6.43H	6.00H	6.00H	1.06B	1.06B	47.95D	47.95D

Table (36-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	7.10B	7.10B	7.12B	7.10B	0.99B	1.00B	47.60B	47.60B
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	7.60A	7.63A	7.42A	7.45A	1.02A	1.02A	47.92A	47.90A

Table (36-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	-	-	-	-	6.63	6.65	-	-	-	-	6.48	6.46	-	-	-	-	1.02	1.02	-	-	-	-	47.55	47.53
Control	-	-	-	-	G	G	-	-	-	-	G	G	-	-	-	-	B	B	-	-	-	-	G	G
Irradiation	-	-	-	-	7.13	7.15	-	-	-	-	7.00	7.00	-	-	-	-	1.01	1.01	-	-	-	-	47.88	47.88
0.50 kGy	-	-	-	-	EF	EF	-	-	-	-	E	E	-	-	-	-	B	B	-	-	-	-	CE	CE
0.75 kGy	-	-	-	-	7.10	7.10	-	-	-	-	7.15	7.14	-	-	-	-	0.99	0.99	-	-	-	-	47.92	47.92
Fungicides	-	-	-	-	EF	EF	-	-	-	-	D	D	-	-	-	-	BC	BC	-	-	-	-	CD	CD
Non traditional	-	-	-	-	7.20	7.20	-	-	-	-	7.20	7.20	-	-	-	-	0.97	0.98	-	-	-	-	48.00	48.00
Garlic oil	7.00	7.02	-	-	7.46	7.45	7.22	7.20	-	-	7.94	7.92	0.93	0.94	-	-	0.93	0.94	47.62	47.63	-	-	48.23	48.22
Pro-Gib plus	7.46	7.45	-	-	D	D	D	D	-	-	BC	BC	D	D	-	-	D	D	DG	DG	-	-	AB	AB
Hot water	-	-	-	-	8.06	8.04	7.03	7.01	-	-	8.23	8.20	0.92	0.92	-	-	0.93	0.94	47.92	47.92	-	-	48.27	48.27
Yeast	-	-	-	-	B	B	E	E	-	-	A	A	D	D	-	-	D	D	CD	CD	-	-	A	A
Waxing	-	-	-	-	7.30	7.33	-	-	-	-	7.19	7.20	-	-	-	-	1.00	1.00	-	-	-	-	48.00	48.00
Control + wax	-	-	-	-	DE	DE	-	-	-	-	D	D	-	-	-	-	BC	BC	-	-	-	-	B	B
0.50kGy + wax	-	-	-	-	6.40	6.43	-	-	-	-	6.00	6.00	-	-	-	-	1.01	1.01	-	-	-	-	47.92	47.92
0.75kGy + wax	-	-	-	-	H	H	-	-	-	-	H	H	-	-	-	-	B	B	-	-	-	-	CD	CD
Fungicides + wax	6.40	7.42	-	-	7.03	7.03	-	-	-	-	7.05	7.03	-	-	-	-	1.08	1.08	-	-	-	-	47.90	47.90
Garlic oil + wax	6.40	6.43	-	-	F	F	6.00	6.00	-	-	7.59	7.60	1.06	1.06	-	-	A	A	47.50	47.50	-	-	47.97	47.97
Pro-Gib plus + wax	6.80	6.83	-	-	8.26	8.25	6.90	6.90	-	-	8.03	8.03	0.92	0.93	-	-	BC	BC	H	H	-	-	BC	BC
Hot water + wax	7.86	7.85	-	-	7.80	7.83	7.33	7.30	-	-	8.08	8.19	0.92	0.93	-	-	1.00	1.00	47.55	47.53	-	-	48.20	48.20
Yeast + wax	7.86	7.85	-	-	BC	BC	CD	CD	-	-	AB	AB	D	D	-	-	1.02	1.03	47.96	47.95	-	-	48.27	48.26
Control + wax	7.86	7.85	-	-	8.06	8.05	7.77	7.75	-	-	8.19	8.20	1.01	1.01	-	-	B	B	BC	BC	-	-	A	A
Hot water + wax	6.93	6.90	-	-	B	B	C	C	-	-	A	A	B	B	-	-	0.99	0.99	47.96	47.95	-	-	48.29	48.29
Yeast + wax	6.93	6.90	-	-	7.50	7.52	6.81	6.80	-	-	7.90	7.92	1.01	1.01	-	-	0.93	0.94	47.58	47.56	-	-	48.20	48.20
Control + wax	-	-	-	-	C	C	F	F	-	-	BC	BC	B	B	-	-	D	D	FG	FG	-	-	AC	AC
Yeast + wax	-	-	-	-	8.06	8.05	-	-	-	-	6.00	6.00	-	-	-	-	1.02	1.02	-	-	-	-	47.95	47.95

A glance to Table (37-A) data of seasons 1999 & 2000 showed that pro-Gib and garlic oil as well as pro-Gib plus waxing and garlic oil plus waxing as a non traditional postharvest treatments had higher total soluble solids, total acidity, T.S.S. / acid ratio and ascorbic acid contents after 180 days of stored lime fruits under cold temperature in both seasons as compared with the other used treatments. However, waxed and unwaxed control, yeast and irradiation dose (0.50 kGy) failed to survive. Comparing different package types Table (37-B) show that lime fruits packed in polyethylene plus carton significantly had higher total soluble solids, total acidity and ascorbic acid contents as compared with polyethylene package in both seasons. Furthermore Table (37-C) indicate that pro-Gib plus waxing and garlic oil plus waxing in polyethylene plus carton package had higher total soluble solids and total acidity values over other postharvest treatments in both seasons. Meanwhile, pro-Gib in either polyethylene or polyethylene plus carton packages as well as pro-Gib plus waxing or garlic oil plus waxing in polyethylene plus carton package increased T.S.S. / acid ratio statistically as compared with the other combinations in this respect. However, significant increase in ascorbic acid content occurred when pro-Gib plus waxing was used in both seasons.

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Table (37): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 180 days storage at cold temperature.

Table (37-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
Irradiation								
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	6.58C	6.58C	6.60C	6.60C	0.97B	0.97B	46.82D	46.80D
Fungicides	-	-	-	-	-	-	-	-
Non traditional								
Garlic oil	6.90B	6.90B	6.93B	6.93B	0.95B	0.95B	47.30BC	47.30BC
Pro-Gib plus	7.33A	7.33A	7.00B	7.00B	0.92B	0.92B	47.83A	47.82A
Hot water	6.65C	6.65C	6.60C	6.60C	1.00A	1.00A	47.16C	47.15C
Yeast	-	-	-	-	-	-	-	-
Waxing								
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	-	-	-	-	-	-	-	-
0.75 KGy+wax	6.65BC	6.65BC	6.65C	6.65C	1.00A	1.00A	47.00C	47.00C
Fungicides+wax	6.65BC	6.65BC	6.63C	6.63C	1.00A	1.00A	47.20C	47.20C
Garlic oil +wax	7.20A	7.20A	7.15A	7.15A	1.00A	1.00A	47.55AB	47.57AB
Pro-Gib plus + wax	7.20A	7.20A	7.18A	7.18A	1.00A	1.00A	47.96A	47.95A
Hot water +wax	6.65BC	6.65BC	6.65C	6.65C	1.00A	1.00A	47.20C	47.20C
Yeast + wax	-	-	-	-	-	-	-	-

Table (37-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	7.03B	7.03B	7.03B	7.03B	1.00A	1.00A	47.58B	47.55B
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	7.10A	7.09A	7.09A	7.09A	1.00A	1.00A	47.70A	47.72A

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Table (37-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Package	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Season	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75 kGy	-	-	-	-	6.58	6.57	-	-	-	-	6.60	6.60	-	-	-	-	0.99	0.99	-	-	-	-	46.83	46.82
0.75 kGy	-	-	-	-	F	F	-	-	-	-	DE	DE	-	-	-	-	B	B	-	-	-	-	D	D
Fungicides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non traditional	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garlic oil	6.85	6.85	-	-	6.95	6.95	6.90	6.90	-	-	6.95	6.97	0.99	0.99	-	-	1.00	0.99	47.00	47.00	-	-	47.56	47.55
Pro-Gib plus	7.10	7.10	-	-	7.23	7.22	7.00	7.00	-	-	7.00	7.00	1.01	1.01	-	-	1.03	1.03	47.91	47.90	-	-	47.75	47.73
Hot water	-	-	-	-	6.65	6.65	-	-	-	-	6.60	6.60	-	-	-	-	1.00	1.00	-	-	-	-	47.16	47.15
Yeast	-	-	-	-	E	E	-	-	-	-	DE	DE	-	-	-	-	B	B	-	-	-	-	-	-
Waxing Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
+ wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50kGy + wax	-	-	-	-	6.65	6.65	-	-	-	-	6.65	6.65	-	-	-	-	1.00	1.00	-	-	-	-	47.00	47.00
0.75kGy + wax	-	-	-	-	E	E	-	-	-	-	D	D	-	-	-	-	B	B	-	-	-	-	C	C
Fungicide + wax	-	-	-	-	6.65	6.65	-	-	-	-	6.63	6.62	-	-	-	-	1.00	1.00	-	-	-	-	48.20	48.20
dest-wax	-	-	-	-	E	E	-	-	-	-	D	D	-	-	-	-	B	B	-	-	-	-	BC	BC
Garlic oil + wax	7.10	7.10	-	-	7.30	7.30	7.10	7.10	-	-	7.20	7.20	1.00	1.00	-	-	1.01	1.01	47.50	47.50	-	-	47.61	47.60
Pro-Gib plus + wax	7.10	7.10	-	-	A	A	B	B	-	-	A	A	B	B	-	-	A	A	47.92	47.92	-	-	48.00	48.00
Hot water + wax	-	-	-	-	7.30	7.30	7.16	7.15	-	-	7.20	7.20	1.00	0.99	-	-	1.00	1.00	47.92	47.92	-	-	48.00	48.00
Yeast + wax	-	-	-	-	6.65	6.65	-	-	-	-	6.65	6.65	-	-	-	-	1.00	1.00	-	-	-	-	47.20	47.20
Wax	-	-	-	-	E	E	-	-	-	-	D	D	-	-	-	-	B	B	-	-	-	-	BC	BC

Considering Table (38-A) it is found that fruits treated with garlic oil and pro-Gib plus waxing or unwaxing treatments had lowest values of T.S.S., total acidity values, T.S.S. / acid ratio and ascorbic acid contents in comparison with all other used treatments and the control, which had nearly similar values at 195 days storage. On the same time, at the end of cold storage (195 days) fruits treated with pro-Gib plus waxing surpassed all different treatments under study. On the other hand, no significant differences were noticed between different treatments when T.S.S. / acid ratio parameter was concerned in both seasons. Moreover, Table (38-B) indicate that, data of seasons 1999 & 2000 showed that polyethylene plus carton package significantly had higher total soluble solids, total acidity values and ascorbic acid contents as compared with polyethylene package only. However, there was no significant difference between polyethylene and polyethylene plus carton packages when T.S.S. / acid ratio parameter was considered.

Dealing with the interaction between postharvest treatments and package types in both seasons as shown in Table (38-C) it is clear that pro-Gib plus waxing as well as garlic oil plus waxing in either polyethylene or polyethylene plus carton package and pro-Gib in polyethylene package had higher total soluble solids and total acidity values as compared with the other combinations in this respect. On the other hand, combinations of postharvest treatments and package type failed in inducing any statistical differences among them when T.S.S. / acid ratio was concerned. However, combinations of waxing pro-Gib or garlic oil and polyethylene plus carton package enhanced prolonged of fruit survivals with good chemical properties under cold temperature up to 195 days of storage.

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Table (38): Effect of postharvest treatments and package types on the chemical properties of lime fruits after 195 days storage at cold temperature.

Table (38-A): Effect of postharvest treatments.

Parameters Season Treatments	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Control (untreated)	-	-	-	-	-	-	-	-
Irradiation								
0.50 KGy	-	-	-	-	-	-	-	-
0.75 KGy	-	-	-	-	-	-	-	-
Fungicides	-	-	-	-	-	-	-	-
Non traditional								
Garlic oil	6.72B	6.70B	6.70B	6.70B	1.00A	1.00A	46.75C	46.74C
Pro-Gib plus	6.90A	6.90A	6.80B	6.81B	1.00A	1.00A	47.15B	47.14B
Hot water	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-
Waxing								
Control + wax	-	-	-	-	-	-	-	-
0.50 KGy+wax	-	-	-	-	-	-	-	-
0.75 KGy+wax	-	-	-	-	-	-	-	-
Fungicides+wax	-	-	-	-	-	-	-	-
Garlic oil +wax	7.05A	7.05A	7.05A	7.06A	1.00A	1.00A	47.10B	47.10B
Pro-Gib plus + wax	7.05A	7.06A	7.05A	7.05A	1.00A	1.00A	47.35A	47.36A
Hot water +wax	-	-	-	-	-	-	-	-
Yeast + wax	-	-	-	-	-	-	-	-

Table (38-B): Effect of package types

Parameters Season Treatment	T.S.S. %		Acid %		T.S.S. / acid ratio		Ascorbic acid mg/100ml juice	
	1999	2000	1999	2000	1999	2000	1999	2000
Polyethylene	6.86B	6.86B	6.82B	6.82B	1.00A	1.00A	46.95B	46.94B
Carton	-	-	-	-	-	-	-	-
Polyethylene + carton	7.00A	7.00A	6.97A	6.97A	1.00A	1.00A	47.22A	47.23A

Table (38-C) Effect of the interaction between postharvest treatment and package type

Parameters	T.S.S. %						Acid %						T.S.S. / acid ratio						Ascorbic acid mg / 100 ml juice					
	Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton		Poly		Carton		Poly+ carton	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
Season	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irradiation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75 kGy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non traditional	6.65	6.64	-	-	6.80	6.80	6.60	6.60	-	-	6.80	6.80	6.80	6.80	-	-	1.00	1.00	46.30	46.30	-	-	47.00	47.00
Garlic oil	6.80	6.80	-	-	7.00	7.00	6.80	6.70	-	-	6.90	6.90	6.90	6.90	-	-	1.00	1.00	47.00	47.00	-	-	47.30	47.30
Pro-Gib plus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yeast	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waxing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Control + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.50kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75kGy + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fungicide + wax	7.00	7.00	-	-	7.10	7.10	7.00	7.00	-	-	7.10	7.10	7.10	7.10	-	-	1.00	1.00	47.10	47.10	-	-	47.10	47.10
Garlic oil + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pro-Gib plus + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot water + wax	7.00	7.00	-	-	7.10	7.10	7.00	7.00	-	-	7.10	7.10	7.10	7.10	-	-	1.00	1.00	47.20	47.20	-	-	47.50	47.50
Yeast + wax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

On contrast higher significance in ascorbic acid content occurred when pro-Gib and pro-Gib plus waxing in polyethylene package were used. Generally, total soluble solids, total acidity values, ascorbic acid contents and T.S.S. / acid ratio increased in fruits by prolonging the storage period in all postharvest treatments and different packages under study till 90 days storage, then they decreased more quickly, till the end of their storage (195 days) at cold temperature. However, polyethylene plus carton increased the chemical parameters followed by polyethylene package as compared with carton package in a descending order. In addition, higher irradiation treatment (0.75 KGy) succeeded in increasing chemical parameters as compared with lower irradiation treatment (0.50 KGy). Concerning fungicides and non traditional treatments data indicate that at 165 days of cold storage, fruits treated with all different postharvest treatments and the control were inferior in all chemical parameters under study.

On the other hand, at the end of cold storage (195 days) fruits treated with pro-Gib, garlic oil, pro-Gib plus waxing and garlic oil plus waxing surpassed fungicides treatment in fruit total soluble solids, total acidity values, T.S.S. / acid ratio and ascorbic acid contents. These results are in partial agreement with the findings of **Chattopadhyay et al., (1992)** on sweet orange who they reported that fruits treated with 50 ppm GA₃ or 0.5% calcium nitrate increased T.S.S., while acidity and ascorbic acid contents decreased. Besides, **Attia (1995)** on Balady orange concluded that during storage, GA₃ caused a significant decrease in ascorbic acid and citric acid contents in fruit juice, while

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T.S.S. was increased. Also, **Miller and McDonald (1996)** on grape fruit concluded that GA_3 had no effect on fruit juice T.S.S., acidity and the resulted T.S.S. / acid ratio.

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5- CONCLUSION

The obtained results indicate that the fruits under all postharvest treatments when wax coated, they surpassed the unwaxed fruits in all treatments under study. Referring to storage period, data disclosed that under all treatments, all fruit quality parameters were affected negatively by prolonging storage period. But fruit quality parameters were better maintained in fruits under proGib and garlic oil postharvest treatments.

Considering storage temperature, the results clearly showed that fruits under cold had higher fruit total soluble solids, titratable acidity, T.S.S. / acid ratio and ascorbic acid contents and a noticeable maintainance of better fruit fresh appearance, juice percentage, less fruit decay and weight loss, simultaneously as compared with room temperature storage.

Referring to package type, data disclosed that polyethylene plus carton packages were best in maintaining good fruit physical and chemical properties up to 195 days of cold temperature and 90 days of room temperature followed by polyethylene package as compared with carton boxes in a descending order.

Concerning irradiation doses, data indicate that high irradiation dose (0.75 kGy) surpassed low irradiation dose (0.50 kGy) in maintaining higher fruit total soluble solids, titratable acidity, TSS / acid ratio and ascorbic acid contents and higher juice percentage, fresh appearance, less fruit decay and weight loss percentages. Besides, fruits treated with pro-Gib and garlic

oil as non-traditional treatment, then stored under cold temperature gave together the least percentage of fruit decay and weight loss even after 195 days of cold storage followed by fungicides treatments as compared with the other used treatments. In addition, fruits treated with garlic oil had highest values of TSS, TSS / acid ratio, titratable acidity and ascorbic acid contents as compared with other remaining treatments which were more or less nearly similar in their values at 195 days storage.

CONCLUSION
