STUDIES ON MATURATION AND STORABILITY OF CRIMSON SEEDLESS TABLE GRAPES

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Abstract

This investigation was carried out during two successive seasons (2003 & 2004) at Hort. Res. Ins. Giza, Egypt. Samples were taken at weekly intervals from the third week of June (nearly month before harvest) until fruit reached maturity stage. Samples for storage studies were picked in the early morning and packed into 24 carton boxes lined with perforated polyethylene pags with or without (control) SO_2 generating sheets and stored at room temperature for 14 & 18 days and at 0°c for 84 & 98 days during the first and the second seasons, respectively.

Crimson seedless could be considered as mature grapes during the last week of July when TSS is more than 19% and total acidity % is less than 0.65% and TSS / acid ratio is more than 30: 1. Also at this time, berry firmness should be less than 50 gm /cm² and hue angel less than 50. However, physical properties are more sensitive to agricultural practice, so it is not always suitable for maturity stage determination of grapes.

Fumigation with SO_2 generators and low storage temperature significantly reduced all parameters decreasing storage life of grapes. This study confirmed that Crimson seedless grape is able to be stored for 7 or 14 days at room temperature (with or without) SO_2 generators, respectively. While this period could be reached within 35 and 90 days at 0° c (with or without) SO_2 generators, respectively.

INTRODUCTION

Grape is one of the most important and favorable crops in Egypt. The planted area in 2004 reached 159929 feddan, while the productive area reached 138499 feddan producing 1275288 ton according to Horticulture General Administration, M.O.A, (unpublished data).

One of the most promising new cultivars planted in Egypt is Crimson seedless as a late variety of seedless and colored berries. However, there is a lack of available knowledge for Egyptian producers about its handling and storage.

Mohamed (1994), reported that, bunch weight, berry weight and size, juice percentage, total soluble solid, and total soluble solids / total acidity ratio increased continuously while total acidity and berry firmness decreased during the developmental stages of grapes. Some trends were reported by Mohamed and Hassan (2003).

Grapes could be harvested near to full maturity as possible, unlike many other fruits, grapes don't ripe after harvest and they should be picked only after they reach the optimum stage of maturity with the most favorable appearance, flavor, taste, and texture. Mohamed (1994), Mohamed and Hassan 2003 and the last authors added that, to determine fruit maturity, non individual physical and chemical constituents could be taken as an indicator for maturity in grapes, but most of them together may contribute to be a proper index. Chikkasubbanna *et al* (1991) reported that, TSS/Acid ratio could be used as an index of maturity. On contrast, Mohamed (1994) mentioned that, total soluble solids /total acidity ratio could not be used as an indicator for maturity stage in grapes. Also they added that, the proper indices to define maturity stage in grapes were total soluble solids and total acidity contents. Same results were obtained by Mohamed (1994), Uhlig (1998), and Mohamed and Hassan (2003).

Mohamed (1994) mentioned that, total soluble solids /total acidity ratio could not be used as an indicator for maturity stage in grapes. Also they added that, the proper indices to define maturity stage in grapes were total soluble solids and total acidity contents. Same results were obtained by Mohamed and Hassan (2003).

Mohamed *et al.* (1994) reported that, weight loss, decay, shatter, total spoilage, stem browning, and dryness, total soluble solids contents of grapes increased while berry firmness, general bunch appearance and total acidity decreased with prolonging the storage period. The same results were reported by Young *et al* (1998) and Mohamed and Hassan (2003).

Total soluble solid contents of grapes and total soluble solid /total acidty ratio increased while total acidity decreased during storage, Hussien *et al* (1998).

Partap *et al.* (1996), reported that, weight loss percentage of grapes increased and total acidity decreased with increasing the storage period, while total soluble solids and total soluble solid / total acidity ratio increased and then decreased.

It has been reported that, sulfur dioxide postharvest fumigation reduced weight loss, decay, shatter incidence in table grapes during storage. Baneh *et al.* (1999), Munoz *et al.* (2000) Mohamed and Hassan (2003).

Mohamed (1994), found that, post harvest SO_2 treatment significantly reduced total spoilage of grapes during storage. Similar results were mentioned by Mohamed and Hassan (2003).

Mohamed (1994) mentioned that, berries treated with SO_2were firmer than untreated ones. The same results were suggested by Mohamed and Hassan (2003).

Baneh *et al.* (1999), found that, stem drying and browning was reduced in Banaty grapes when using SO_2 generators pad during storage the stem remained green and relatively fresh. The same results were mentioned by Mohamed and Hassan (2003). On contrast, Castro *et al.* (1998) reported that, the SO_2 generating pads had no effect on cluster appearance or stem browning.

Mohamed (1994) mentioned that, fumigation with SO_2 significantly reduced TSS in fumigated grapes. Moreover fumigation with SO_2 had no obvious effect on total acidity. Similar results were reported by Mohamed and Hassan (2003). On the other side Cenci and Ferreira (1996), mentioned that, post harvest treatment with SO2 had no effect on TSS or total acidity contents of grapes during storage. The same results were mentioned by Yigiang *et al.* (1998).

Many researchers noted that, grapes stored at low temperature had a long storage period and less decay, weight loss, shatter incidence compared with grapes stored at room temperature. Fruit quality and storability of grapes increased as the storage temperature decreased. The most causing losses (decay, shatter, and water loss) and deterioration of grapes were inhibited at low storage temperature, (Mohamed (1994), Munoz (2000), and Mohamed and Hassan (2003)). Also the last authors added that, low storage temperature decreased the deterioration rate of bunch freshness and berry firmness but had no effect on juice percentage.

Sandhu et al (1992) reported that, weight loss percentage of grapes and stem dryness increased with high storage temperature.

This investigation was carried out to determine: a- fruit properties of Crimson seedless table grapes during maturation and at maturity stage. b - Storability of Crimson seedless either at room temperature or at 0ºc with or without SO2 fumigation

MATERIALS AND METHODS

This investigation was carried out during two successive seasons (2003 & 2004) at Hort. Res. Inst. Gizza, Egypt. Fruits were picked from a private farm at Cairo Alex. desert road. The Vines were 5 years old, planted on a space of 1.5 x 3 m in sandy soil, trained according to cane pruning and applying drip irrigation system. During the first week of June, vines were selected to be the source of samples during maturity indices study. Samples were taken at weekly intervals from the third week of June (nearly month before harvest). During preharvest study, all fruit quality parameters, such as bunch weight average, berry weight and size average, berry color and firmness, juice percentage, total soluble solid contents and total acidity contents, were measured and tabulated. Three cluster samples were left under room temperature for 5 days at every harvest date. Fruit samples were tested at the third and fifth day for bunch weight loss percentage, bunch conditions, berry firmness, TSS, total acidity and TSS / total acidity ratio to determine maturity stage. When fruit reached maturity stage, samples for storage study were taken .Fruits were picked in the early morning and directly transported to the laboratory and packed into 24 carton box (2Kg / box) lined with perforated polyethylene (40 µ, 400 walls / m^2, 1hall = 0.5cm) with SO_2 generators sheet (12 boxes) or without SO_2 generators (control, (12 boxes)). All

treatments were stored at room temperature for 14 & 18 days and at 0°c for 84 & 98 days during the first and the second seasons, respectively. Fruits stored at room temperature were tested two times per week while fruits stored at low temperature were tested at 14 day intervals for all fruit physical and chemical parameters. Decay, shatter, weight loss percentage were calculated according to the equal (weight of decayed or shattered berries or weight loss per box * 100 / the initial weight of box), total spoilage percentage was calculated as the sum of the last three parameters. Berry firmness were estimated in 15 berries by Ifra texture analyzer instrument using a penetrating cylinder of 1 mm of diameter to a constant distance 1 mm inside the skin of berry and by a constant speed 2 mm per sec. and the peak of resistance was recorded per gram. Bunch freshness was calculated as the average of stem color, stems dryness and berry appearance, and were estimated as follow:

Degree / The property	1	2	3	4
Stem color	Green	L. brown	Little green	Brown
Stem dryness	Plump	50% Dry	Dry	Very dry
Berry appearance	Excellent	Good	Acceptable	Poor

Total soluble solids were estimated by using the abbè refractometer. (A.O.A.C., 1980). Total acidity contents were measured by titration against 0.1 N. Sodium hydroxide using phenolphthalein as indicator. (A.O.A.C., 1980).

Data were subjected to analysis of variance as a complete randomized design for the preharvest studies and as two factorial experiments in random complete design and all means were compared by the less significant differences as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

I-Maturity indices

I-A - Physical characteristics:

Data presented in tables (1) and (2) and figure (1) show that, bunch weight, berry weight and size, juice percentage increased gradually and significantly till reached its maxim before harvest, while berry firmness and hue angel decreased with the increasing of fruit age during the two seasons in this investigation. Also berry color changed from green (hue angel > 90) to light red (hue angel > 60) till dark red (hue angel <45) during the two seasons under this work. These results are in harmony with those obtained by Mohamed (1994) and Uzun *et al.* (1997).

I-B- Chemical characteristics:

It is clear from data illustrated in tables (1 and 2) and figure (1) that, total soluble solids and TSS / total acidity ratio increased gradually and significantly till reached the

maximum values at maturity stage. On the other side total acidity decreased gradually and significantly till reached the minimum value at maturity stage.These results are in agreement with those found by Mohamed (1994) and Mohamed and Hassan (2003).

I-C- Determination of maturity stage:

According to the last illustrated tables and figures and the changes of the physical and chemical properties of crimson seedless during shelf life at different developmental growth stages, shown in table (3), it is clear that, because bunch weight, size, berry weight firmness varied widely from year to another, it was not able to use as an indicator to maturity stage of grape. On contrary total soluble solids, total acidity and total soluble solids / total acidity ratio were nearly the same during the two seasons. So we can demonstrate that, Crimson seedless could be considered as mature grape during the last week of July when TSS is more than 19% and total acidity percentage is less than 0.63 % and TSS/ acidity ratio is more than 30:1.

Table 1. Development of Physical and Chemical Properties of Crimson Seedless Grapes During Growing Season (2003).

Properties / Days before harvest	Bunch weight	Berry. weight	Berry firmness	Hue angle	Juice %	TSS %	T. Acidity %	TSS / Acidity ratio
21	244.03	2.18	54.47	65.83	54.41	11.47	1.80	6.39
14	266.57	2.62	49.60	52.11	60.23	15.80	0.83	19.14
7	347.67	3.27	50.40	49.53	64.37	18.73	0.60	31.40
0	446.37	3.23	38.67	49.19	66.97	19.87	0.58	34.30
LSD	109.60	0.25	12.31	13.11	6.66	1.08	0.09	2.52

Table 2. Development of Physical and Chemical Properties of Crimson Seedless Grapes During Growing Season (2004).

Properties / Days before harvest	Bunch weight	Berry. weight	Berry firmness	Hue angle	Juice %	TSS %	T. Acidity %	TSS / Acidity ratio
28	187.90	1.97	67.80	84.17	54.17	5.30	2.88	1.86
21	227.47	2.02	65.27	65.01	58.39	10.13	1.16	8.92
14	388.43	2.50	57.00	61.28	60.62	14.60	0.89	16.31
7	391.00	2.91	55.27	54.05	64.12	17.50	0.79	22.10
0	418.53	3.10	52.80	39.67	64.20	19.83	0.63	31.65
LSD	98.30	0.30	9.22	6.33	8.15	2.00	0.25	2.77

These results are in agreement with those obtained by Mohamed (1994), and Mohamed and Hassan (2003).

Table 3. Changes of Physical and Chemical Properties of Crimson seedless Berries during maturation in 2003 and 2004.

D.B.H.	Weight loss %		Bunch condition		Berry firmness		T.S.S		T. Acidity		TSS / Acid ratio	
Se.	F.	S.	F.	S.	F.	S.	F.	S.	F.	S.	F.	S.
28		0		G		67.8		5.3		2.88		1.84
		30.9		SH		53.6		6.3		3.11		2.03
		22.5		SH		49.8		7.7		1.93		3.98
21	0	0	G	G	54.4	65.2	11.4	10.1	1.80	1.16	6.37	8.73
	9.5	37.1	SH	G	49.4	56.7	12.1	11.3	1.58	1.18	7.73	9.64
	35.1	42.1	SH	SH	46.5	49.8	15.2	13.6	1.47	1.01	10.3	13.5
14	0	0	G	G	49.6	57.0	15.8	14.6	0.83	0.89	19.0	16.4
	26.2	18	G	G	46.3	47.4	16.4	17.2	0.81	1.13	20.2	15.2
	31.1	25.7	SH	SH	44.7	46.3	18.7	17.1	0.88	0.81	21.3	21.1
7	0	0	G	G	50.4	55.3	18.7	17.5	0.60	0.79	31.2	22.2
	19.9	6.22	G	G	45.4	40.7	20.2	18.1	0.65	0.92	31.1	19.7
	25.5	15.3	SH	G	39.3	37.9	22.9	19.9	0.71	0.85	32.2	23.5
0	0	0	G	G	38.7	52.8	19.9	19.8	0.58	0.63	34.3	31.5

D.B.H =Days before harvest | Se. = Season | F.= First | S. = Second

II - Storage studies

II – A- **Decay, weight loss, shatter and total spoilage percentage:**

Data presented in tables (4, 5, 6 and 7) and figure (2 and 3) clearly indicated that, decay, weight loss, shatter and total spoilage increased gradually and significantly with prolonging the storage period during the two season in this investigation either stored at room temperature or at 0°c. These results are in accordance with those obtained by Mohamed (1994), Young *et al* (1998) and Mohamed and Hassan (2003). They mentioned that, weight loss, decay, shatter and total spoilage increased gradually and significantly with prolonging the storage period.

Data also cleared that, fumigation with SO_2 significantly decreased all these parameters (weight loss, decay, shatter and total spoilage) during storage either at room temperature or at 0°c temperature.

These results are in line with those obtained by Mohamed (1994), Baneh *et al.* (1999), Munoz *et al.* (2000), Mohamed and Hassan (2003) .

They reported that fumigation with SO_2 significantly decreased weight loss, decay, and shutter incidence of grapes during storage.

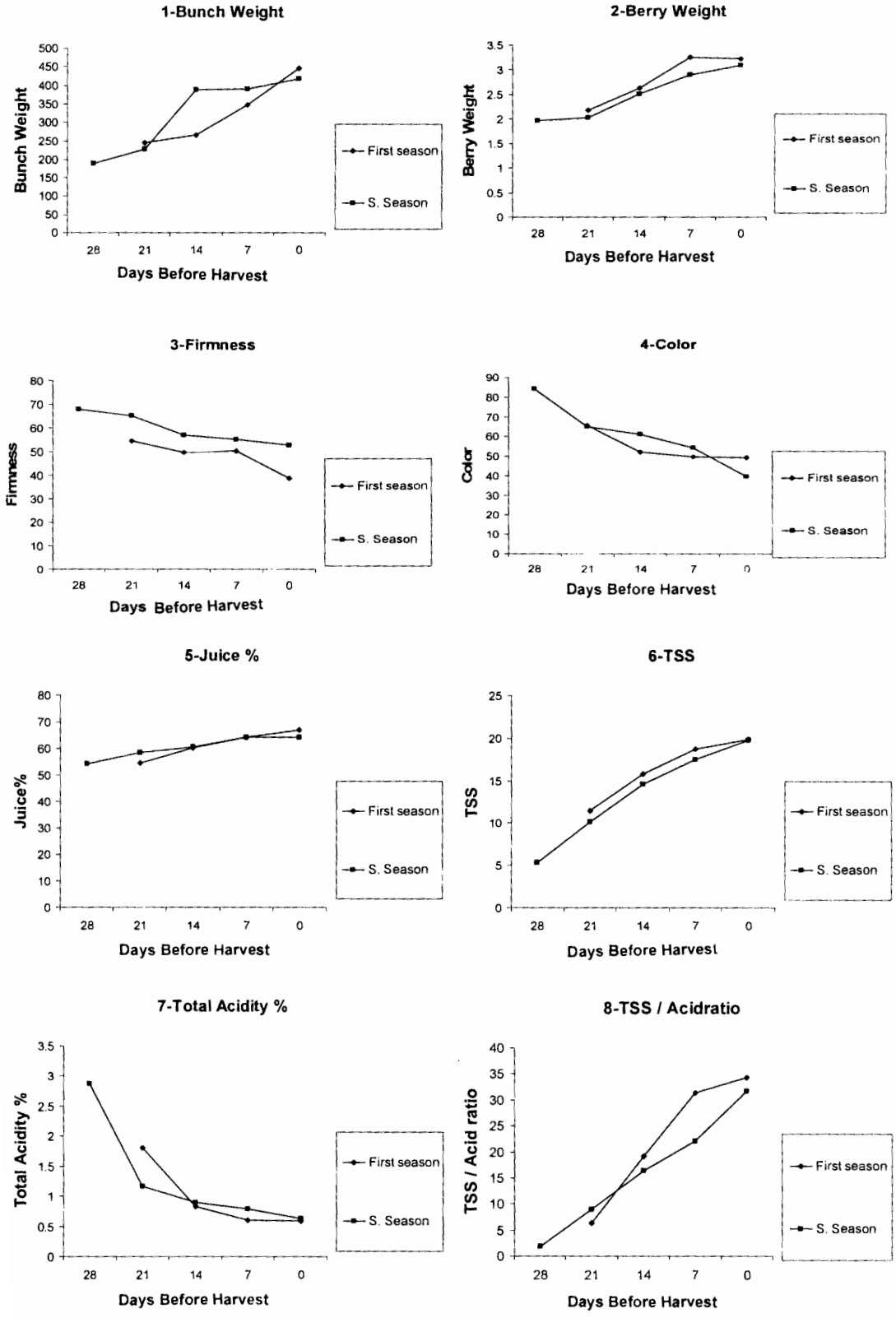

Fig. 1. Changes of Physical and Chemical properties of Crimson seedless grapes during growth and maturation in 2003 and 2004.

Table 4. Effect of Fumigation with So2 on Weight loss percentage of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
4	0.33	0.27	0.30	0.87	0.17	0.52	14	1.91	1.30	1.60	1.20	0.77	0.98
7	5.43	2.03	3.73	2.45	0.50	1.47	28	4.47	2.80	3.63	2.62	1.60	2.11
11	7.20	3.83	5.52	3.70	1.83	2.77	42	6.37	4.20	5.28	4.03	2.63	3.33
14	12.63	5.39	9.01	5.13	3.13	4.13	56	7.70	5.53	6.62	6.65	4.17	5.41
18				7.20	4.53	5.86	70	10.08	7.57	8.82	9.60	5.33	7.47
							84	11.63	8.97	10.30	11.95	6.00	8.97
							98				13.67	7.60	10.63
Means	5.12	2.30	---	3.22	1.69	---	Means	6.02	4.34	---	6.21	3.51	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	0.53	0.84	1.19	0.24	0.42	0.59		0.45	0.84	1.19	0.40	0.80	1.13

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 5. Effect of Fumigation with So2 on Decay Percentage of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
4	0.87	0.00	0.43	0.07	0.00	0.03	14	0.68	0.22	0.45	0.13	0.03	0.08
7	7.93	1.37	4.65	0.40	0.23	0.32	28	1.73	0.37	1.05	1.00	0.20	0.60
11	10.90	3.23	7.07	2.77	0.73	1.75	42	5.40	1.10	3.25	1.83	0.57	1.20
14	33.77	8.33	21.05	7.57	1.33	4.45	56	9.60	2.53	6.07	5.03	0.98	3.01
18				27.54	7.23	17.39	70	17.27	4.93	11.10	14.00	1.73	7.87
							84	19.30	7.24	13.27	22.20	3.93	13.07
							98				31.71	6.03	18.87
Means	10.69	2.59	---	6.39	1.59	---	Means	7.71	2.34	---	9.49	1.68	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	2.91	4.61	6.52	0.67	1.16	1.65		1.34	2.51	3.55	0.59	1.17	1.17

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 6. Effect of Fumigation with So2 on Shatter Percentage of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.07
4	0.63	0.20	0.42	0.37	0.27	0.32	14	0.40	0.67	0.53	0.20	0.17	0.18
7	1.20	0.37	0.79	0.73	0.40	0.57	28	1.73	1.33	1.53	0.47	0.27	0.37
11	3.03	0.97	2.00	1.60	0.90	1.25	42	3.60	2.30	2.95	2.00	0.50	1.25
14	5.86	2.53	4.20	7.17	2.52	4.84	56	9.00	3.27	6.13	4.31	0.93	2.62
18				19.13	7.54	13.34	70	13.34	5.40	9.37	6.26	1.92	4.09
							84	16.77	7.13	11.95	14.67	4.67	9.67
							98				16.87	7.50	12.18
Means	2.15	0.81	---	4.83	1.94	---	Means	6.41	2.87	---	5.60	1.99	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	0.49	0.77	1.08	1.22	2.11	2.98		1.02	1.90	2.69	1.09	2.18	3.08

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 7. Effect of Fumigation with So2 on Total Spoilage percentage of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00
4	1.83	0.47	1.15	1.30	0.43	0.87	14	2.99	2.19	2.59	1.53	0.97	1.25
7	14.56	3.77	9.17	3.58	1.13	2.36	28	7.93	4.50	6.22	4.09	2.07	3.08
11	21.13	8.03	14.58	8.06	3.47	5.77	42	15.37	7.60	11.48	7.87	3.70	5.79
14	52.26	16.25	34.26	19.87	6.98	13.42	56	26.30	11.33	18.82	15.99	6.08	11.03
18				53.88	19.30	36.59	70	40.69	17.90	29.30	29.86	8.98	19.42
							84	47.70	23.34	35.52	48.81	14.60	31.71
							98				62.24	21.13	41.69
Means	17.96	5.70	---	14.45	5.22	---	Means	20.14	9.55	---	21.30	7.19	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	3.70	5.85	8.28	1.19	2.06	2.91		1.75	3.27	4.62	1.65	2.29	4.67

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Also these results are in line with those found by Mohamed (1994), and Mohamed and Hassan (2003). They reported that, fumigation with SO_2 significantly decreased total spoilage of grapes during storage.

Also it is clear from the last illustrated data that, regardless of fumigation, low storage temperature decreased all these parameters during storage compared with storage at room temperature. These results are in line with those obtained by Mohamed (1994), and Mohamed and Hassan (2003).

II-b - Berry firmness, General bunch appearance and Juice percentage

Data presented in tables (8, 9, 10 and 11) clearly indicated that, Berry firmness, and Juice percentage significantly decreased with prolonging the storage period either stored at room temperature or at low storage temperature. While General bunch appearance significantly deteriorated with prolonged storage. These results are in Harmony with those obtained by Mohamed (1994), and Mohamed and Hassan (2003).

Data also indicated that, fumigation with SO_2 significantly reduced the softening rate of berry firmness and the deterioration rate of bunch general appearance during storage compared with untreated fruits either stored at room temperature or at low storage temperature. Also data cleared that, fumigation with SO_2 had no effect on juice percentage during storage.

These results are in accordance with those demonstrated by Mohamed (1994), Baneh *et al* (1999), Mohamed and Hassan (2003).

On contrast these results disagree with those obtained by Castro *et al* (1999), they mentioned that SO_2 fumigation had no effect on bunch appearance or stem browning of grape during storage.

II-C-Total soluble solids, Total acidity and T.S.S / total acidity ratio

Data illustrated in tables (11& 12 and 13) indicated that , total soluble solids and total soluble solids / total acidity ratio increased gradually and significantly while total acidity decreased gradually and significantly with prolonging of storage period.

These results are in accordance with those demonstrated by Mohamed (1994), and Mohamed and Hassan (2003).They reported that, T.S.S and T.S.S / total acidity ratio increased while total acidity, juice contents of grapes decreased with prolonging the storage period.

Also it is obvious from the same tables that fumigation with SO_2 had no effect on juice contents of T.S.S and total acidity during storage. However total soluble solid contents of grapes stored at low storage temperature (0°c) was hardly significant in grape fumigation with SO_2.

Table 8. Effect of Fumigation with So2 on Berry Firmness of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	38.67	38.67	38.67	52.80	52.80	52.80	0	38.67	38.67	38.67	52.80	52.80	52.80
4	36.40	40.07	38.23	49.53	52.67	51.10	14	38.87	41.47	40.17	50.80	53.53	52.17
7	33.13	37.73	35.43	47.27	50.13	48.70	28	40.63	40.07	40.35	54.80	52.40	53.60
11	27.13	37.00	32.07	44.67	48.60	46.63	42	36.53	39.20	37.87	49.27	52.87	51.07
14	25.13	34.53	29.83	39.73	45.67	42.70	56	34.60	37.87	36.23	42.53	47.40	44.97
18				36.33	46.07	41.20	70	25.27	36.60	30.93	36.87	45.00	40.93
							84	23.20	34.53	28.87	37.00	44.87	40.93
							98				22.73	38.20	30.47
Means	32.09	37.60	---	45.06	49.32	---	Means	33.97	38.34	---	43.35	48.38	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	2.03	3.21	4.54	2.28	3.96	5.60		1.54	2.88	4.07	2.50	5.00	7.07

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 9. Effect of Fumigation with So2 on Bunch General Appearance of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	1.00	1.00	1.00	1.00	1.00	1.00	0	1.00	1.00	1.00	1.00	1.00	1.00
4	1.22	1.00	1.11	1.11	1.00	1.06	14	1.11	1.00	1.06	1.00	1.00	1.00
7	2.11	1.00	1.56	2.11	1.00	1.56	28	1.22	1.00	1.11	1.11	1.00	1.06
11	3.22	1.89	2.56	3.00	1.78	2.39	42	1.89	1.11	1.50	1.67	1.00	1.33
14	4.00	2.89	3.44	3.89	2.89	3.39	56	2.67	1.67	2.17	2.56	1.33	1.94
18				4.00	3.00	3.50	70	3.33	2.00	2.67	3.11	1.78	2.44
							84	4.00	2.78	3.39	4.00	2.33	3.17
							98				4.00	3.00	3.50
Means	2.31	1.56	---	2.52	1.78	---	Means	2.17	1.51	---	2.31	1.56	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	0.19	0.30	0.43	0.11	0.19	0.27		0.12	0.23	0.32	0.10	0.20	0.29

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 10. Effect of Fumigation with So2 on Juice Percentage of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	64.37	64.37	64.37	60.62	60.62	60.62	0	64.37	64.37	64.37	60.62	60.62	60.62
4	59.13	61.57	60.35	59.70	61.53	60.62	14	62.60	60.60	61.60	57.00	60.09	58.54
7	61.33	59.67	60.50	57.00	60.37	58.68	28	58.10	60.31	59.21	53.80	56.53	55.17
11	54.17	55.37	54.77	62.90	61.03	61.97	42	58.13	59.53	58.83	55.03	54.73	54.88
14	53.67	56.68	55.18	53.33	59.70	56.52	56	55.40	59.30	57.35	51.40	52.80	52.10
18				52.47	55.17	53.82	70	55.60	57.00	56.30	50.50	53.97	52.23
							84	45.13	54.59	49.86	48.71	52.20	50.45
							98				41.20	52.40	46.80
Means	58.53	59.53	---	57.67	59.74	---	Means	57.05	59.39	---	52.28	55.42	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	N.S	6.18	8.74	N.S	6.83	9.66		N.S	4.95	6.99	N.S	5.12	7.24

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 11. Effect of Fumigation with So2 on Total Soluble Solids Contents of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	19.87	19.87	19.87	19.83	19.83	19.83	0	19.87	19.87	19.87	19.83	19.83	19.83
4	19.77	20.03	19.90	19.90	19.87	19.88	14	19.83	20.03	19.93	20.20	20.00	21.10
7	20.57	20.30	20.43	20.33	20.00	20.17	28	20.20	21.07	20.63	20.13	20.27	20.20
11	20.20	20.13	20.17	20.77	20.23	20.50	42	20.97	21.23	21.10	21.47	21.23	21.35
14	21.83	20.07	20.95	20.83	20.53	20.68	56	21.20	21.77	21.48	21.03	21.83	21.43
18				20.50	21.30	20.90	70	19.90	21.53	20.72	20.80	21.07	20.93
							84	19.60	22.00	20.80	20.60	22.20	21.40
							98				19.67	22.20	20.93
Means	20.45	20.08	---	20.36	20.29	---	Means	20.22	21.07	---	20.47	21.08	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	N.S	0.91	1.28	N.S	0.96	1.36		0.55	1.03	1.46	0.35	0.69	0.98

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 12. Effect of Fumigation with So2 on Total Acidity Contents of Crimson Seedless Table Grapes during storage in 2003 & 2004.

Room temperature							Low Storage temperature (0°C)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	0.58	0.58	0.58	0.63	0.63	0.63	0	0.58	0.58	0.58	0.63	0.63	0.63
4	0.55	0.59	0.57	0.61	0.61	0.61	14	0.56	0.59	0.58	0.57	0.62	0.60
7	0.54	0.55	0.54	0.59	0.60	0.59	28	0.55	0.57	0.56	0.56	0.61	0.59
11	0.53	0.55	0.54	0.58	0.59	0.59	42	0.52	0.55	0.54	0.53	0.62	0.58
14	0.60	0.53	0.57	0.52	0.54	0.53	56	0.53	0.55	0.54	0.54	0.61	0.58
18				0.61	0.52	0.57	70	0.56	0.54	0.55	0.57	0.61	0.59
							84	0.57	0.53	0.55	0.60	0.58	0.59
							98				0.63	0.55	0.59
Means	0.56	0.56	---	0.59	0.58	---	Means	0.55	0.56	---	0.58	0.60	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	N.S	0.04	0.05	N.S	0.04	0.05		N.S	0.04	0.05	N.S	0.05	0.07

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

Table 13. Effect of Fumigation with So2 on Total Soluble Solids / Total Acidity ratio of Crimson Seedless Table grapes during storage in 2003 & 2004.

Room Storage temperature							Low Storage temperature (0°c)						
Season	F. Season (2003)			S. Season (2004)			Season	F. Season (2003)			S. Season (2004)		
St. period	No So2	SO2	Means	No So2	SO2	Means	St. period	No So2	SO2	Means	No So2	SO2	Means
0	34.30	34.30	34.30	31.65	31.65	31.65	0	34.30	34.30	34.30	31.65	31.65	31.65
4	36.12	33.98	35.05	32.62	32.57	32.60	14	35.23	33.99	34.61	35.64	32.20	33.92
7	38.03	37.25	37.64	34.46	34.04	34.25	28	36.68	37.03	36.85	35.95	33.24	34.60
11	37.92	36.74	37.33	35.80	34.11	34.96	42	40.61	38.41	39.51	40.56	34.30	37.43
14	36.52	37.99	37.26	39.95	38.02	38.99	56	40.32	39.37	39.84	38.80	35.81	37.30
18				33.61	41.04	37.32	70	35.43	39.74	37.59	36.79	34.91	35.85
							84	34.20	41.35	37.78	35.41	38.16	36.78
							98				31.27	40.62	35.95
Means	36.58	36.05	---	34.68	35.24	---	Means	36.68	37.74	---	35.76	35.11	---
LSD at 5% level													
Factor	Tre.	S.P	Inter.	Tre.	S.P	Inter		Tre.	S.P	Inter	Tre.	S.P	Inter
LSD values	N.S	3.20	4.52	N.S	2.99	4.23		N.S	3.24	4.58	N.S	3.67	5.19

Tre = treatment S.P = storage period Inter = Interaction N.S = No significant

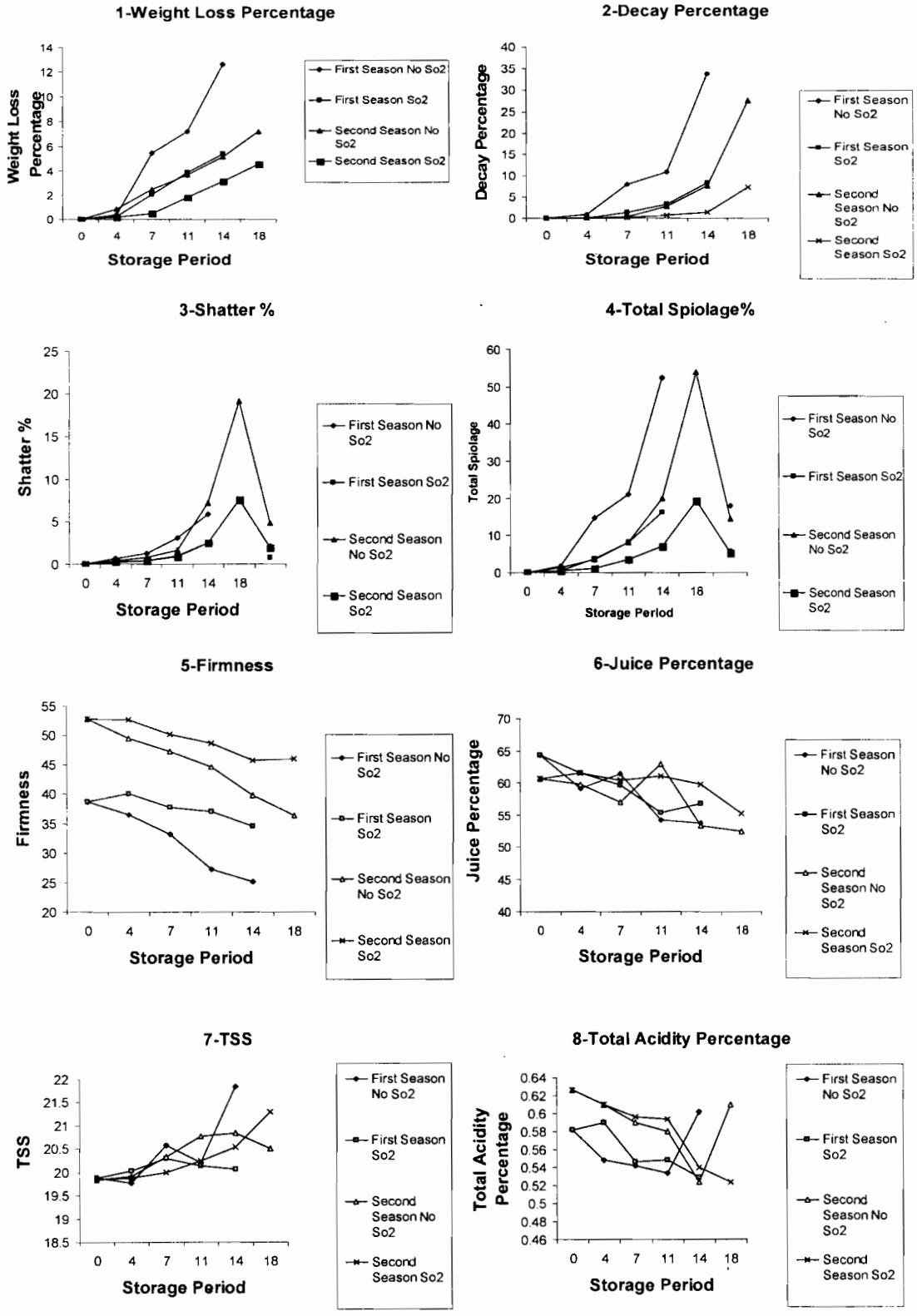

Fig. 2. Effect of treatment with sulfur dioxideon properties of Crimson seedless grapes during storage at Room temperature in 2003 and 2004.

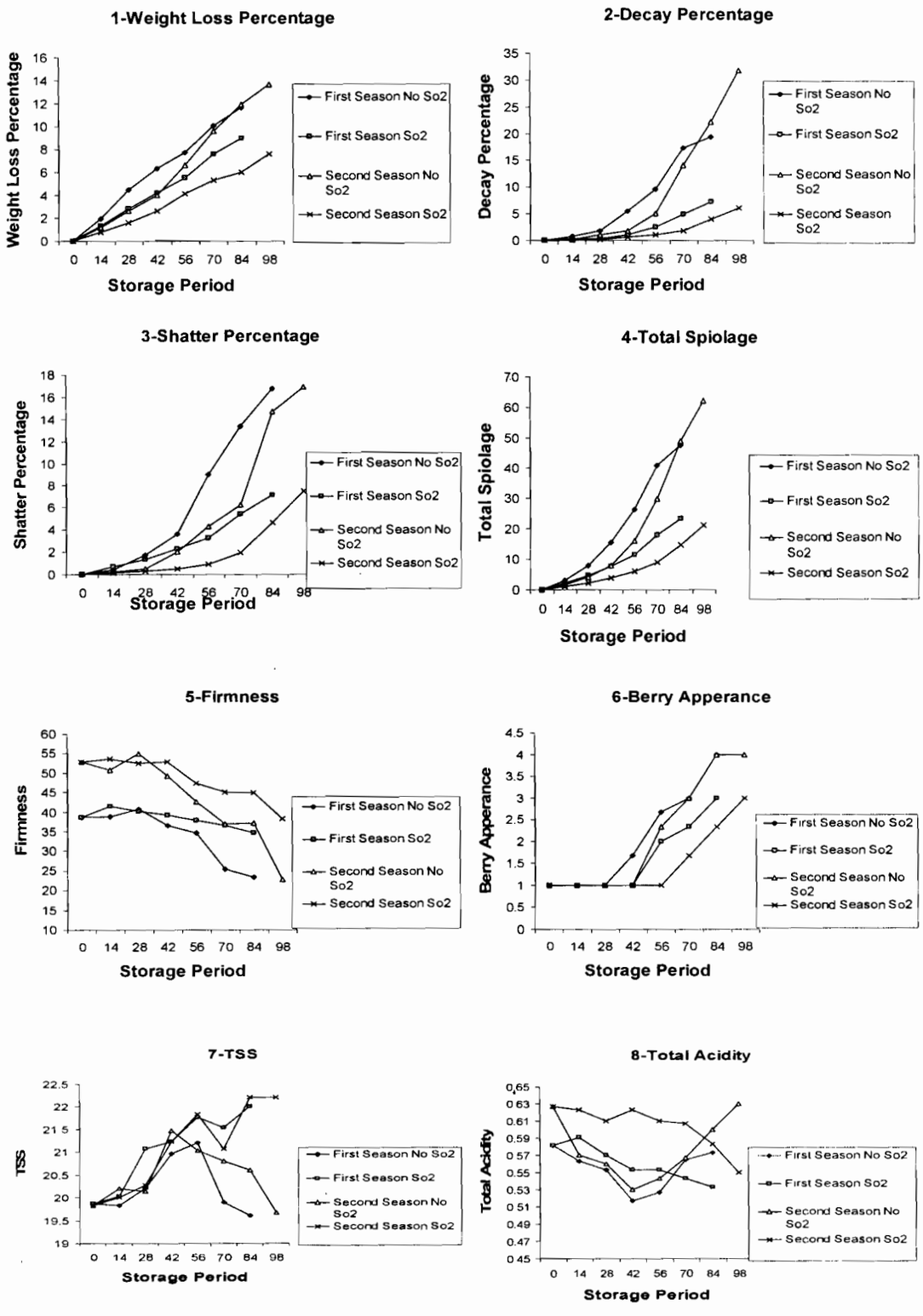

Fig. 3. Effect of treatment with sulfur dioxid on properties of Crimson seedless grapes during storage at cold temperature (0ºC) in 2003 and 2004.

Moreover data illustrated in figures (2 and 3) clearly show that, fumigation with SO_2 forbid the reverse point in the total soluble solids (during cold storage only) and total acidity of grapes which appeared at the last period of storage.

These results are in line with those obtained by Mohamed and Hassan (2003).

On contrary these results disagree with those reported by Mohamed (1994) who mentioned that fumigation with SO2 significantly reduced total soluble solids. Also these results disagree with those obtained by Yigiang *et al.* (1998). They mentioned that, fumigation with SO2 significantly reduced total acidity.

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دراسات علي اكتمال النمو والقدرة التخزينية للعنب كريمسون سيدلس

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اجرى هذا البحث خلال موسمى ٢٠٠٣ & ٢٠٠٤ بمعهد بحوث البساتين – قسم بحوث تداول الفاكهة اخذت الثمار اسبوعيا ابتداء من النصف الثانى من شهر يونيو وحتى الوصول الى مرحلة اكتمال النضج .

وعند الوصول الى مرحلة اكتمال النمو اخذت عينات للتخزين حيث فرزت وعبئت فى عبوات كرتون سعة ٢ كجم مع التبطين بالبولى ايثيلين المثقب مع استخدام مولدات ثانى اكسيد الكبريت فى نصف العبوات وتم تخزين الثمار على درجة حرارة الغرفة لمدة ١٤ & ١٨ يوما فى الموسم الاول والثانى على التوالى وعلى درجة الصفر المئوى لمدة ٨٤ & ٩٨ يوما فى الموسم الاول والثانى على التوالى.

يمكن اعتبار الصنف كريمسون سيدلس مكتمل النمو فى الاسبوع الاخير من شهر يوليو وعندها تكون نسبة المواد الصلبة الذائبة اكبر من ١٩ % ونسبة الحموضة الكلية اقل من، ٠،٦٥% ونسبة المواد الصلبة الذائبة الى الحموضة اكبر من ٣٠ : ١ وكذلك تكون صلابة الحبات اقل من ٥٠ جرام / سم٢ وكان اللون اقل من ٥٠ درجة ولما كانت الصفات الطبيعية يمكن ان تتاثر بالعمليات الزراعية فانها ليست على الدوام مناسبة للحكم على وصول ثمار العنب الى مرحلة اكتمال النمو .

ولقد تبين من الدراسة ان استخدام مولدات ثانى اكسيد الكبريت وبالمثل التخزين على درجة حرارة الصفر المئوى من العوامل الهامة فى زيادة القدرة التخزينية للعنب صنف كريمسون سيدلس . ولقد تبين من الدراسة ان العنب كريمسون سيدلس يمكن ان يخزن لمدة ٧ او ١٤ يوما على درجة حرارة الغرفة بدون او باستخدام مولدات ثانى اكسيد الكبريت وترتفع هذه الفترة لتصل الى ٣٥ & ٩٠ يوما فى حالة التخزين على درجة الصفر المئوى.