Journal of Horticultural Science & Ornamental Plants 2 (2): 88-92, 2010
ISSN 2079-2158

Studies on Extending Storage Life of 'Flame Seedless' Grapes

[1]B.V.C. Mahajan, [2]N.K. Arora, [2]M.I.S. Gill and [1]B.S. Ghuman

[1]Punjab Horticultural Postharvest Technology Centre, India
[2]Department of Horticulture, Punjab Agricultural University Ludhiana, Punjab, India

Abstract: Postharvest problems like, berry shattering, decay and stem browning are some of the important factors that limit the marketing of table grapes to distant markets. Flame Seedless' an important cultivar of table grapes is also facing similar problems during postharvest handling. Therefore, present investigation was planned to find out suitable control measures to prevent postharvest problems and to extend the storage life of 'Flame Seedless' grapes under cold storage conditions. The freshly harvested grapes were packed in corrugated fibre board boxes (2 kilograms capacity) lined with low density polyethylene liner (LDPE) alongwith one and two sheets of SO_2 generating pad / grape guard. These boxes were stored in cold store maintained at 0-2°C and 90-95% RH. The data revealed that the use of single sheet of grape guard proved quite effective to maintain stem freshness, minimize berry shatter, spoilage and retained all the quality attributes till 50 days of storage. The control grapes (without grape guard) could be stored for 15 days only under 0-2°C.

Key words: Flame Seedless Grapes · Grape guard · CFB box · Storage · Quality

INTRODUCTION

Flame Seedless is an important cultivar of table grapes recommended for commercial cultivation in Northern India region [1]. It is crimson red in colour, having good yield potential and highly acceptable quality. Harvesting of grapes in region coincides with pre-monsoon rains, which often leads to panic harvesting vis-a-vis deterioration of fruit quality. Such fruit fetches low return to growers. Therefore, storage of grapes in cold stores is an option for curtailing postharvest losses and getting premium price in the market. Generally, in grapes, berry shattering, stem browning and decay are the main problems which reduce its postharvest quality [2]. The table grape is a non- climacteric fruit with low physiological activity and is sensitive to water loss and fungal infection during postharvest handling [3]. The most common method to control decay during cold storage of grapes is periodic fumigation with SO_2 [4]. However, SO_2 causes injuries to rachis and berries if used excessively [5]. Now-a-days some alternative techniques like grape guard (slow release SO_2 generating pad) are being used by the traders to prevent decay in table grapes. Much is known about the postharvest behaviour of many cultivars of *Vitis*, although there is little information available on Flame Seedless. Therefore, present investigations were planned to find out suitable packaging methos for extending the storage life and maintaining quality of of Flame Seedless grapes during cold storage.

MATERIALS AND METHODS

Materials: Grapes (*Vitis vinifera* L) cv. Flame Seedless was harvested at optimum maturity with firm berries having crimson red colour. The bruised and damaged berries were sorted out from the cluster of grapes. The healthy clusters were divided into requisite lots for further handling.

Methods

Treatments, Packaging and Storage: The fruits were packed in corrugated fibre board boxes (CFB) of two kilograms capacity. These boxes were lined with low density polyethylene (LDPE) of 100 guage thickness or news paper liner. There were four treatments. In first treatment one sheet of SO_2 generating pad (grape guard) was placed above the grapes inside the polythene bag, whereas in second treatment two sheets of SO_2 generating pad were used i.e. one sheet is placed on the bottom and second sheet on the top inside polyethylene bag in carton. The details of treatments are as under.

Corresponding Author: B.V.C. Mahajan, Punjab Horticultural Postharvest Technology Centre, India
E-mail: bvc_mahajan@rediffmail.com.

T1= CFB box + LDPE liner 100 guage thickness + One sheet of Grape guard
T2= CFB box + LDPE liner 100 guage thickness + Two sheets of Grape guard
T3= CFB box + LDPE liner (control) - without Grape guard
T4= CFB box + Newspaper liner (control) - without Grape guard

After packing the grape bunches in CFB boxes (2 kilograms capacity), these were stored in walk-in-cold room maintained at 0-2°C and 90-95% RH.

Analytical Methods: The observations for various physico-chemical parameters were recorded at 15, 30, 45, 50 and 55 days after storage. The stem freshness was recorded using a scale of 0-2, wherein 0 represented green, 1 –initiation of browning in rachis, 2 –browning of full rachis. Stem score of 1 was considered as cut off level for deciding the acceptable colour of rachis during storage. The berry shatter was recorded on per cent weight basis. The spoilage was recorded by counting rotten or brown berries in a bunch and expressed in per cent. The total soluble solids (TSS) content of the fruit was measured with hand refractometer and correction at 20^0 C was applied and the results were expressed in percent. The acidity of the fruit was estimated by titrating the known volume of juice against N/10 sodium hydroxide [6] and results were expressed in percent tartaric acid. Organoleptic quality was evaluated by ten judges on a 5 point scale viz. 5-excellent, 4- very good, 3- good, 2-fair, 1-poor.

Statistical Analysis: The experiment was laid out in a completely randomized block design [7]. There were three replications for each treatment (3 boxes of 2 kilograms capacity in each replication). In total 60 boxes were stored to evaluate the quality of grapes at different storage intervals. The experiment was conducted for three years from 2007-2009 and data for all attributes were pooled and analyzed statistically.

RESULTS AND DISCUSSION

Berry Shatter: The berry shatter increased with the advancement in storage period (Table 1). However, grapes packed with double sheet of grape guard (T2) recorded low level of berry shattering (0-4.75%), closely followed by single sheet grape guard (T1), whereas it was very high in control grapes without grape guard (T3) in LDPE liner (6.0- 20.50%) and (T4) in news paper liner (3.65-14.75) after 30 to 55 days of storage respectively. The increase in berry shattering in control package is probably due to fungal infection. It has been reported that grapes wrapped and stored without SO_2 treatment had the greatest amount of berry shatter than those packed with SO_2 generators [8, 9].

Spoilage (rotting): The spoilage of control berries (T3) was found to be very high (5.0 – 40.0%) and T4 (5.0 – 30.0%) after 30 to 55 days of storage as compared to those packed with grape guard (T1 and T2) wherein initially up to 45 days no spoilage of berries was noticed and thereafter initiation of spoilage of berries was noticed (Table 1). The increase in decay in control packages was rapid and progressive probably because of more humid condition around the fruit, encouraging fungal infection, thereby leading to shattering and decay than in grape guard packed fruit where sufficient SO_2 was available to suppress the fungal infection resulting in protecting the berries from shattering and decay [10]. A properly working SO_2 pad placed in the top of a box was sufficient to control rotting in grapes even when moderate levels of initial inoculums were present [11]. The use of SO_2 generating pads in combination with polythene liner reduces water loss and assures decay control because polythene liner check the SO_2 diffusion out of the box thereby maintained the contact of grape berry with SO_2 for longer period of time [12].

Stem Freshness: The browning of stem/rachis increased during storage (Table 1). However, it was maximum in case of control fruits (T3 and T4), compared to grape guard packed fruits (T1 and T2). The rachis of control bunches attained stem score 2 (complete brown), after 30 days of storage. However, the rachis of grape guard packed fruits were still green (score 0) even after 30 days of storage and score 1(initiation of browning) was observed after 45 days of storage. Stem freshness is one of the outstanding attributes of grapes. Stem browning or blackening is believed to be caused by fungal infection in the packages during storage [13]. In the present investigation the difference in stem freshness among grape guard packed fruits and that of control was highly significant, indicating antifungal action of SO_2 in checking the stem browning during storage under humid conditions. SO_2 application has been reported to have a strong effect in maintaining the stem freshness of grape bunches during storage [14].

Table 1: Effect of different treatments on shattering (%), spoilage (%), stem freshness and firmness of grapes during storage

	Treatments				
Storage period (days)	T1	T2	T3	T4	Mean
Shattering (%)					
15	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	6.00	3.65	2.41
45	1.90	1.75	10.00	7.10	5.18
50	3.00	2.75	13.00	10.25	7.25
55	4.80	4.75	20.50	14.75	11.2
Mean	1.94	1.85	9.90	7.15	
LSD at 5% Treatment = 0.39 Storage = 0.44 TxS = 0.86					
Spoilage (%)					
15	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	5.0	5.0	2.5
45	0.0	0.0	15	10.0	6.25
50	3.0	3.0	25.0	15.0	11.5
55	18.0	15.0	40.0	30.0	24.5
Mean	4.2	3.6	17.0	11.0	
LSD at 5% Treatment = 0.89 Storage = 0.96 TxS =1.52					
Stem freshness					
15	0	0	1	1	0.5
30	0	0	2	2	1.0
45	1	1	2	2	1.5
50	1	1	2	2	1.5
55	1.5	1.5	2	2	1.8
Mean	0.7	0.7	1.8	1.8	
LSD at 5% Treatment = 0.05 Storage = 0.06 TxS =0.10					
Firmness (gram force)					
15	452	455	441	446	448.5
30	405	416	356	350	381.7
45	370	382	280	268	325
50	280	292	186	170	232
55	166	180	130	136	153
Mean	334.6	345.0	278.6	274.0	
Firmness of grapes at harvest = 560 gram force.					
LSD at 5% Treatment = 1.99 Storage = 2.23 TxS = 4.46					

Table 2: Effect of different treatments on TSS (%), acidity (%), organoleptic quality of grapes during storage

	Treatments				
Storage period (days)	T1	T2	T3	T4	Mean
TSS (%)					
15	17.20	17.20	17.50	17.50	17.35
30	17.65	17.40	18.20	18.20	17.86
45	18.30	18.50	17.75	17.80	18.08
50	18.00	18.10	17.45	17.50	17.76
55	17.50	17.90	17.00	17.10	17.35
Mean	17.73	17.82	17.58	17.62	
TSS of grapes at harvest = 16.9					
LSD at 5% Treatment = 0.10 Storage = 0.11 TxS = 0.23					
Acidity (%)					
15	0.53	0.55	0.52	0.53	0.53
30	0.47	0.49	0.48	0.45	0.47
45	0.42	0.44	0.40	0.39	0.41
50	0.38	0.40	0.34	0.34	0.36
55	0.35	0.37	0.30	0.29	0.32
Mean	0.43	0.45	0.40	0.40	
Acidity of grapes at harvest = 0.59					
LSD at 5% Treatment = 0.02 Storage = 0.21 TxS = NS					
Organoleptic quality					
15	4	4	4	4	4
30	4	4	2	2	3
45	4	4	1	1	3
50	3	3	1	1	2
55	2	2	1	1	2
Mean	3	3	2	2	
LSD at 5% Treatment = 0.02 Storage = 0.05 TxS = 0.6					

Firmness: The firmness of berries followed a declining trend during storage (Table 1). However, the decline in firmness was more rapid in control grapes (T3 and T4) which ranged between 441-130 g force and 446-136 g force respectively from 15 to 55 days of storage. On the other hand, decline in firmness found to be gradual in grape guard packed fruits i.e. T1 (452-166 g force) and T2 (455-180 g force). Fruit firmness is one of the most important factors which determine the post-harvest quality of fruits. Softening of fruits is caused by cellular disintegration leading to membrane permeability [15]. The maintenance of better firmness in grape guard packed fruits may be due to the role of sulfur dioxide in preventing decay, which leads to softening of fruits [16].

Total Soluble Solids (TSS): The TSS content of the control fruit (T3 and T4) increased during storage and reached a peak value at 30 days and then gradually declined afterwards till 55 days of storage (Table 2). However, in case of fruits packed with grape guards (T1 and T2), the TSS content increased up to 45 days of storage and then declined, thereby indicating delay in metabolic activities of the fruit. However, the TSS content did not vary significantly among treatments. The probable reason of maintenance of TSS content in grape guard packed fruits for 45 days and thereafter decline as compared to control, could be attributed to delay in metabolic activities and senescence of fruit as a result of sulfur dioxide application [17].

Acidity: In general, the acidity of the fruits declined gradually during storage irrespective of treatments (Table 2), but the level of acidity did not alter significantly in grape guard and without grape guard packed fruits. It has been reported that the use of SO_2 generators had insignificant effect on acidity of grape fruits (Morris *et al,* 1992). The decrease in acidity during storage may be attributed to utilization of organic acids in respiratory process or other biodegradable metabolic reactions [18].

Organoleptic quality: The grapes packed with grape guard (T1 and T2) maintained very good quality till 45 days of storage, thereafter quality declined and fruits were rated as good and fare after 50 and 55 days of storage. The control grapes were found fair in quality after 30 days of storage and thereafter poor quality was noticed. The maintenance of better organoleptic quality in grape guard packed fruits is obvious due to role of sulfur dioxide in improving the physico –chemical attribute of grapes during storage [19].

It could be concluded that the Flame Seedless grapes harvested at optimum maturity with firm berries having light purple colour, packed in ventilated corrugated fibre board boxes (2 kilgrame) lined with LDPE film containing one sheet of grape guard can be stored with acceptable quality for 45-50 days at 0-2°C and 90-95% RH.

REFERENCES

1. Anonymous, 2009. Package of practices for cultivation of fruits. Punjab Agricultural University Ludhiana, India, pp: 60-70.
2. Zutkhi, Y., T. Kaplunov, A. Litcher, R. Ben-Arie, S. Lurie, I. Kusto and E. Raban, 2001. Extended storage of Redglobe grapes. Acta Hort., 553: 617-618.
3. Hernandez, F.A., E. Aguayo and F. Artes, 2004. Alternative atmosphere treatments for keeping quality of 'Autumn Seedless' table grapes during long term cold storage. Postharvest Biol. Technol., 31: 59-67.
4. Crisosto, C.H., J.L. Smilanick, N.K. Dokoozlian and D.A. Luvisi, 1994. Maintaining table grapes postharvest quality for long distant markets. Int. Sympo on Table grape production, June 28-29, American Society of Enology and Viticulture, pp: 195-199.
5. Nelson, K.E., 1985. Harvesting and handling California table grapes for market. Bull. 1913, Univ. Calif, DANR Publications, Oakland, CA., pp: 72.
6. AOAC, 1995. Official Methods of Analysis, 13th Edn. Association of Official Analytical Chemists. Washington, DC.
7. Sendecor, G.W. and W.G. Cochran, 1987. Statistical methods (7th Edn). Ames, IAUSA: The Iowa State University Press, pp: 221-222.
8. Morris, J.R., O.l. Oswald, G.L. Main, J.N. Moore and J.R. Clark, 1992. Storage of new seedless grape cultivars with sulfur dioxide generators. Am. J. Enol. Viticult., 43: 230-232.
9. Soylemezoglu, G. and Y.S. Agaaolu, 1996. The effects of slow release sulfur dioxide generators during cold storage of table grapes. Turkish J. Agric. Forest., 20: 309-312.
10. Kokkalos, T.I., 1986. Post-harvest decay control of grapes by using sodium metabisulfite in cartons enclosed in plastic bags. Am. J. Enol. Viticult., 37: 149-151.
11. Mustonen, H.M., 1992. The efficacy of range of sulfur dioxide generating pads against Botrytis cinerea infection and on out turn quality of table grapes. Aust. J. Exp. Agric., 32: 389-393.

12. Franc, J., B.A. Latorre, R. Torres and J.P. Zoffoli, 2005. The effect of Preharvest fungicide and postharvest sulfur dioxide use on postharvest decay of table grapes caused by Penicillium expansum. Postharvest Biol. Technol., 37: 20-30.
13. Sandhu, S.S., P.S. Dhillon and A.S. Bindra, 1990. Effect of package and storage conditions on the keeping quality of Perlette grapes. Vitis, 29: 97-107.
14. Zutkhi, Y.A. Litcher, T. Kaplunov and S. Lurie, 2001. Extended storage of Redglobe grapes in modified generating pads. Postharvest Biol. Technol., 50: 12-17.
15. Mattoo, A.K., T. Murata, E.B. Pantastico, K. Chachin, K. Ogata and C.T. Phan, 1975. Chemical changes during ripening and senescence, In: Pantastico E.B. (ed.). Post-harvest physiology, handling and utilization of tropical and sub-tropical fruits and vegetables. AVI Publishing, Westport, Connecticut.
16. Nelson, K.E. and M. Ahmedullah, 1976. Packaging and decay control system for storage and transit of table grapes for export. Amer. J. Enol.Vitic., 24: 74-79.
17. Athanasopoulous, P. and A. Thanos, 1998. Quality characteristics of Sultanina table grapes stored in a pilot plant scale. Fruits, 53: 199-206
18. Ulrich, R., 1974. Organic acids. In: Biochemistry of fruits and their products. Hulme, A. C. (ed) Academic Press, New York..
19. Mahajan, B.V.C., A.S. Dhatt, S. Kumar and L. Manohar, 2009. Study on cool storage of grapes for extended marketability. J. Food Sci. Technol., 46: 363-366.