Effects of Postharvest Treatments on Physiological Disorders and Fungal Rots of '0900 Ziraat' Sweet Cherry

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Abstract

The aim of the study was to extend the storage period and maintain the fruit quality of '0900 Ziraat' sweet cherry (*Prunus avium* L.), which is extensively grown in Amasya province of Turkey, by precooling (no precooling, precooling with air and precooling with water) and by packaging with different materials (paper, cardboard or plastic). Cherry fruit were stored at 0 to 1°C and 90 to 95% RH after packing. Physiological disorders and fungal rots increased during storage, especially after the third week. Fungal rot and physiological disorder rates were 4% in the first week, 15% in the third and 28% in the fourth week of storage. The fungal rots of the fruits packed in plastic material were more extensive than in the other packages. Surface pitting was the predominant physiological disorder, whereas *Alternaria* spp. and *Cladosporium* spp. were the most prevalent fungal rot pathogens. Precooling applications reduced physiological disorders and fungal rots, particularly in the plastic packaging.

INTRODUCTION

Sweet cherry (*Prunus avium* L.) is amongst the favorite and most consumed fruit in the world. Cherry production in Turkey reached 250,000 t in 2001, which was 14% of the world's cherry production (Anonymous, 2003). Turkey is among the most important cherry growing and export countries because of its suitable geographical location and ecological conditions (Eriş, 1997). Cherry is sensitive to transportation and has a short shelf life. The many physiological disorders and fungal decay problems that occur during storage have been attributed to the 82% water content of the fruit (Akbulut, 1997). Production and export of high quality cherries depend on postharvest handling and treatment of the fruit to control post-harvest disorders and diseases.

Precooling and the packing process have become important in high quality fresh fruit production (Karaçalı, 1993). The aim of packing and precooling applications is to decrease respiration during storage, with a resultant reduction in post-harvest spoilage. The most common postharvest diseases of cherries are blue mold (*Penicillium expansum* LK. ex. Thom.), brown rot (*Monilinia* spp.), gray mold (*Botrytis cinerea* Pers. ex Fr.), Cladosporium rot (*Cladosporium* spp.), Alternaria rot (Alternaria spp.) and Rhizopus rot (*Rhizopus* spp.) (Meheriuk and McPhee, 1986).

In this study, different packing materials and precooling applications were investigated for the effective management of physiological disorders and fungal rots of '0900 Ziraat' grown in Amasya province.

MATERIALS AND METHODS

Fruit of '0900 Ziraat' sweet cherry was obtained from orchards in Amasya province in 2001 and 2002. Three types of packing material (paper, cardboard and plastic) were used in the study. Package sizes of plastic, cardboard and paper materials were 60 x 100 cm, 38 x 29 x 11 cm and 100 x 100 cm, respectively. Plastic material was made from homopolymer polyethylene (PE-120; d=0.93 g/cm^3) with 12.0 L/m^3/day/atm of CO^2 permeability and 4.0 L/m^3/day/atm of O^2 permeability. Precooling with air, precooling

with water (containing sodium hypochlorite and active chlorine) and no precooling were applied after harvest. Fruit temperature was 19.6°C prior to precooling applications; however, it was reduced from to 4°C in 128 min and 9 min by air precooling and hydrocooling, respectively. Fruits were stored at 0 to 1°C and 90 to 95% relative humidity (RH) for four weeks. Physical changes in the fruit were examined and the incidence of fruit showing rots and disorders was determined. Fungal decay agents were identified by visual and microscopic examination. Experiments were planned in accordance with a factorial design in randomized blocks and the results were statistically analyzed.

RESULTS AND DISCUSSION

The amount of physiological disorders and fungal rots were determined for each packing type and preecooling treatment. The mean value of rots and disorders was 4.9% in the first week, increasing to 5.8% in the second week, 14.3% in the third week and 38.9% in the fourth week in 2001 (Table 1). In 2002, the rates of physiological disorders and rots for weeks 1, 2, 3 and 4 were 3.3%, 3.0%, 14.8% and 16.2%, respectively (Table 2). Identification of rot fungi at the genus level was studied in 2002. The most predominant fungi were *Cladosporium* spp*., Alternaria* spp., *Penicillium* spp*., Botrytis* spp. and *Monilina* spp. Surface pitting was the main post-harvest physiological problem in paper and cardboard box materials in the fourth week while fungal rots were the predominant cause of spoilage in plastic material (Table 3). The results of this study were similar to previous studies (Meheriuk and PcPhee, 1986; Ceponis et al., 1988; Showden, 1991; Karaçalı, 1993).

CONCLUSIONS

It was shown that physiological disorders and rots increased during the storage of sweet cherry fruits, particularly after the third week of storage, both in 2001 and 2002. Surface pitting was the predominant physiological disorder of cherry fruit in this study, but it is estimated that it would not seriously affect the market value of the product. It was established that the fungal agents *Alternaria* spp. and *Cladosporium* spp. were the most common pathogens under the storage conditions (0 to 1^{o}C and 90 to 95% RH) in this study. The plastic package increased fungal rots more than the other packing materials because it maintained a higher presence of moisture during storage. However, precooling with both air and water were effective in reducing rots and disorders in the plastic packing during both years, and in the second year, after 4 weeks storage, by water precooling. Fruit rots were reduced by both means of precooling fruit stored in all packages but not always significantly.

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Tables

Table 1. Effects of precooling applications and package materials on the incidence of fruit spoilage (%) of '0900 Ziraat' sweet cherry (2001).

Package	Precooling	Week								Package mean
		1		2		3		4		
PA	CP	4.1	*h-j*	5.5	*g-j*	25.6	*c-e*	35.6	*a-c*	15.4 *B*
	AP	3.7	*h-j*	3.3	*h-j*	8.8	*f-i*	31.6	*bc*	
	WP	2.1	*ij*	3.7	*h-j*	9.0	*f-i*	51.9	*a*	
CB	CP	4.0	*h-j*	6.5	*f-j*	15.9	*e-g*	39.7	*a-c*	15.8 *B*
	AP	1.8	*ij*	5.2	*g-j*	15.5	*e-g*	36.6	*a-c*	
	WP	1.7	*j*	4.4	*h-j*	16.9	*d-f*	41.0	*ab*	
PL	CP	11.4	*pq*	12.6	*f-h*	10.3	*c*	41.6	*ab*	16.7 *A*
	AP	7.2	*f-j*	5.6	*g-j*	15.3	*e-g*	29.9	*b-d*	
	WP	8.4	*f-i*	5.3	*g-j*	10.9	*f-h*	41.8	*ab*	
Time mean		4.9 *C* [1]		5.8 *C*		14.3 *B*		38.9 *A*		
Precooling mean		CP	17.7 *A*	AP		13.7 *B*	WP	16.4 *AB*		

[1]Means separation at 5% level (DMRT); capital letters between mean values, small letters between precooling, packaging and week treatment combinations.
CP: Control (No Precooling); AP: Precooling with Air; WP: Precooling with Water; PA: Paper Material; CB: Cardboard Box; PL: Plastic Material.

Table 2. Effects of precooling applications and package materials on the incidence of fruit spoilage (%) of '0900 Ziraat' sweet cherry (2002).

Package	Precooling	Week								Package mean
		1		2		3		4		
PA	CP	3.4	*g-j*	1.5	*j*	11.4	*b-f*	14.8	*b-d*	8.9 *B*
	AP	2.7	*g-j*	2.0	*j*	19.0	*bc*	15.4	*b-d*	
	WP	3.2	*g-j*	2.6	*hj*	16.2	*b-d*	14.8	*b-d*	
CB	CP	3.5	*g-j*	4.7	*e-j*	8.6	*d-i*	9.3	*c-g*	6.8 *B*
	AP	3.1	*g-j*	3.4	*g-j*	9.2	*c-g*	9.1	*c-h*	
	WP	4.0	*f-j*	2.9	*g-j*	12.3	*b-e*	11.0	*b-f*	
PL	CP	4.9	*e-j*	5.0	*e-j*	21.2	*ab*	32.0	*a*	12.3 *A*
	AP	2.6	*h-j*	3.0	*g-j*	20.0	*b*	21.0	*b*	
	WP	2.4	*ij*	2.1	*ij*	15.5	*b-d*	18.4	*b-d*	
Time mean		3.3 *C* [1]		3.0 *C*		14.8 *B*		16.2 *A*		
Precooling mean		CP	10.0	AP		9.2	WP	8.8		

[1]Means separation at 5% level (DMRT); capital letters between mean values, small letters between precooling, packaging and week treatment combinations.

Table 3. The proportions of physiological disorders and fungal rots in the total spoiled fruit of '0900 Ziraat' sweet cherry in the fourth week (2002).

Treatment	Physiological Disorders (%)	Fungal Rots (%)				
		Total	*Alternaria Cladosporium*	*Penicillium*	Botrytis	Monilinia
PA-CP	79.8	20.2	11.4	4.2	4.2	0.5
PA-AP	64.3	35.7	24.2	5.8	1.0	4.8
PA-WP	54.0	46.0	18.8	8.5	4.0	14.7
CB-CP	53.5	46.5	20.4	12.2	2.9	11.0
CB-AP	62.6	37.4	24.6	7.0	3.2	2.7
CB-WP	56.6	43.4	28.8	2.4	2.9	9.3
PL-CP	15.1	84.9	26.7	24.7	7.9	25.6
PL-AP	22.2	77.8	34.1	19.3	1.5	23.1
PL-WP	43.7	56.3	17.5	10.5	4.6	23.8