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Shelf life and quality components of Parvin mango after 15-day storage^{1,2}

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ABSTRACT

In order to determine the possible effect of two storage temperatures on the quality and shelf life of Parvin mangoes (*Mangifera indica* L.), mature green fruits were stored for 15 days under 75 to 80% relative humidity and at 10.6° C (51° F) or 13° C (55° F) temperature. Then both groups were divided and exposed to one of two temperatures that prevail during marketing, 20° C (68° F) or 27° C (80° F), until ripe, just starting to soften (consumer eating stage). No significant differences were observed in fruit weight loss during storage. When ripe, the mangoes were not significantly different in skin color, anthracnose decay and stem-end rot decay. The most days required for ripening after storage (9.1) and the highest weight loss (15.8%) were observed in the 10° C/27° C treatment. Titrable acidity was relatively lower for all fruits exposed to a temperature of 27° C, and as a result higher values for °Brix acid ratio were obtained. Under similar conditions, quality Parvin mangoes from Puerto Rico could have an expected market shelf life of at least 7 days.

RESUMEN

Duración y algunos componentes de la calidad del mangó Parvin después de un período de almacenamiento de 15 días.

Para poder determinar el posible efecto de dos temperaturas de almacenamiento sobre la calidad y la capacidad de almacenamiento del mangó Parvin, *Mangifera indica*, se almacenaron frutas verdes, pero fisiológicamente hechas, durante 15 días. Esto se realizó bajo condiciones controladas a una humedad relativa de 75 a 80% y con una de dos temperaturas, 10.6° C. (51° F.) o 13° C. (55° F.). Luego, las frutas almacenadas en cada una de estas temperaturas se dividieron en dos grupos, los cuales se expusieron a una de dos temperaturas prevalecientes en condiciones de

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mercadeo, 20° C. (68° F.) ó 27° C. (80° F.), donde se mantuvieron hasta madurar y apenas comenzando a ablandar (el estado óptimo para consumirlas). No se observaron diferencias significativas en pérdida de peso al finalizar los 15 días de almacenamiento. Al momento de alcanzar la madurez, no hubo diferencias significativas en el color de la cáscara ni de deterioro por antracnosis ni por pudrición en el extremo del pedúnculo. El máximo de días en almacenamiento para alcanzar la madurez (9.1) y la pérdida de peso al alcanzar la madurez (15.8%) se registró a 10.6° C./27° C. La acidez fue relativamente más baja en todas las frutas expuestas a una temperatura de mercadeo de 27° C., y como resultado, la razón °Brix/acidez fue más alta. En condiciones similares, es posible que las frutas de mangó Parvin procedentes de Puerto Rico conserven en el mercado una calidad aceptable durante por lo menos 7 días.

INTRODUCTION

The value of mangoes grown in Puerto Rico for the export market has been increasing dramatically during the past few years. For fiscal year 1983-84, this value was \$213,291; in 1986-87 it increased to \$3,643,700 (3). At present, practically all the crop is exported to Europe. The fruits are kept in refrigerated shipping containers for approximately 15 days, which is the in-transit period from a local packinghouse to some terminal markets in Europe. The container thermostat is set in many cases at a temperature close to 10.6° C (51° F).

In order to compete in these or any other export markets, high quality mangoes at arrival are a must. Two of the postharvest factors influencing composition and quality of a given horticultural cultivar are environmental temperature and interval between harvesting and consumption or previous to processing (2,6). According to the United States Department of Agriculture, the best storage or transit temperature for mangoes for up to 2 weeks is 13° C (55° F), although some cultivars could do well at 10° C (50° F) without showing chilling injury symptoms (1). In general, the best ripening temperature range for mangoes is 21° C to 24° C (1), but differences in market temperatures from one location to another will also affect fruit quality and shelf life.

The objective of this study was to determine the effect of two storage and two subsequent market temperatures (10.6° or 13° C, and 20° or 27° C, respectively) on shelf-life and some quality components of the Parvin cultivar, grown under our local conditions.

MATERIALS AND METHODS

Mangoes of the Parvin cultivar were obtained 16 July 1987 from a commercial packinghouse at a farm located in southern Puerto Rico. They were harvested at the mature-green stage, classified by size and packed in single-layer boxes for the export market. Fruits were free of anthracnose and stem-end rot visual symptoms. Twenty single-layer boxes with 8 mangoes each, with an average net weight per box of 4.56 kg, were sent to the Food Technology Laboratory in Río Piedras and stored for

15 days. Ten boxes were stored at 10.6° C (51° F), and the other 10 boxes at 13° C (55° F), both groups with a controlled relative humidity of 75 to 80%. After this period, in order to simulate two market conditions, 5 boxes from each group were placed in an average ambient temperature of 27° C (80° F), and the other 5 boxes in an air conditioned room at an average temperature of 20° C (68° F). The mangoes were kept under these conditions until ripe, i.e., just starting to soften (consumer eating stage). The four combinations of transit and market temperatures represented the 4 treatments, each of them in 5 boxes (repetitions).

Mangoes from each box were weighed to measure losses after storage and upon reaching the ripe stage. When ripe, the fruits were rated for skin color, decay and ripening time (4, 5). Color development in the skin was subjectively determined and rated on a scale of 1 through 5, on the basis of percentage of non-green surface area: 1 = 0% (green); 2 = 1 to 25% yellow red color; 3 = 26 to 50%; 4 = 50 to 75%; and 5 = 76 to 100% yellow-red. We determined ripening time following storage by manually evaluating fruit firmness every 2 to 3 days until ripening and just starting to soften.

Decay was visually determined and rated by the percentage of surface area affected by anthracnose, *Colletotrichum gloeosporioides*, and stem-end rot, *Diplodia natalensis* (4). Scoring for decay was as follows:

<i>Rating</i>	<i>Anthracnose (% surface area)</i>	<i>Stem-end rot (mm from stem)</i>
1 (none)	0	0
2 (trace)	≤2	≤3
3 (slight)	3 - 10	4 - 13
4 (moderate)	11 - 20	14 - 25
5 (severe)	>20	>25

A composite sample of 10 ripe fruits from each treatment was used to determine °Brix, pH and acidity. Soluble solids (°Brix) were determined with a bench top Abbe Bausch & Lomb refractometer⁴; pH on the Beckman Expandomatic pH Meter; and a percentage acidity by titrating to pH 8.1 with 0.01 N NaOH.

RESULTS AND DISCUSSION

Differences in mean values for storage fruit weight loss, skin color, anthracnose decay and stem-end rot decay were not statistically significant among the four treatments (table 1). Mean number of days to ripen after storage under in-transit temperature was significantly higher at

⁴Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

TABLE 1.—*Shelf-life and some quality components of Parvin mangoes after storage for 15 days simulating in-transit temperature and subsequently exposed to market temperature until ripening*

Treatment		Days to ripening ¹	Storage weight loss	At the ripe stage			
In-transit temp./Market temp.				Total weight loss	Surface color index ²	Anthracnose index ³	SER index ⁴
BC	°C	%	%				
10.6°	/ 27°	9.10 b	2.56 a ⁶	15.80 a	4.93 a	2.10 a	1.43 a
13°	/ 27°	8.59 ab	2.35 a	13.71 ab	4.98 a	2.29 a	1.51 a
10.6°	/ 20°	8.38 ab	2.85 a	8.37 b	4.88 a	2.55 a	1.20 a
13°	/ 20°	7.45 a	1.95 a	7.95 b	4.75 a	2.65 a	1.23 a

¹Days under market conditions to achieve ripening after a storage period of 15 days simulating in-transit temperature.

²Surface color index: 1 = 0% (green); 2 = 1-25%; 3 = 26-50%; 4 = 51-75%; 5 = 76-100% yellow-red.

³Anthracnose index: surface area affected, 1 = 0%; 2 = ≤2%; 3 = 3-10%; 4 = 11-20%; 5 = >20%.

⁴Stem-end rot index: radius in mm of area affected, 1 = none; 2 = <3mm; 3 = 4-13mm/ 4 = 14-25mm; 5 = >25mm.

⁶Means in the same column followed by one or more letters in common do not differ statistically at the 5% probability level by T test.

10.6° C/27° C than at 13° C/20° C treatments. There were no significant differences in shelf life and quality components between treatments with different in-transit (storage) temperatures (10.6° C and 13° C) and the same market temperatures (27° C or 20° C). Therefore, apparently significant differences might be attributed to effects of market temperature rather than to the in-transit temperature.

Minor differences were observed with respect to °Brix, which ranged from 15.4 to 16.0 (table 2). The pH ranged from 4.0 to 4.8. The values for percentage acidity were lower in the two treatments subjected to a market temperature of 27° C than in those at 20° C. As a result, higher °Brix/acid ratio values were observed in the treatments with a 27° C market temperature.

Under conditions similar to the ones in this experiment, salable mangoes can be expected to have a shelf life of at least 7 days after being in storage for a 15-day period. Fruit weight loss of 3 to 16% could be expected, depending on market conditions and interval between harvesting

TABLE 2.—*°Brix, pH, percent acidity and °Brix/Acid of ripe Parvin mangoes after storage for 15 days to simulate transit and subsequently exposed to market conditions*

Treatment		°Brix	pH	Acidity	°Brix/acid
Transit temp./Market temp.					
°C	°C			%	
10.6°	/ 27°	15.4	4.80	0.19	81.0
13°	/ 27°	15.8	4.00	0.18	87.8
10.6°	/ 20°	16.0	4.21	0.32	50.0
13°	/ 20°	15.7	4.31	0.32	49.1

and final marketing. When ripe, the surface color of an average mango is mostly yellow-red; less than 3% of the surface color area has any anthracnose symptom, and the fruit has only negligible traces of stem-end rot.

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