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POSTHARVEST STORAGE OF THE POMERAC UNDER REFRIGERATION

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ABSTRACT

A postharvest storage trial was conducted to determine the effects of four different storage temperatures, ambient (28°C), 5°C, 10°C and 15°C on the shelf-life of the pomerac (Eugenia malaccensis) or French Cashew. The aim of the experiment was to determine the best storage conditions for extending the shelf-life of the pomerac, while maintaining acceptable physical, chemical and organoleptic properties. The physical parameters measured included fruit firmness, percent fresh weight loss and specific gravity. The chemical parameters studied were ascorbic acid, titratable acidity, total soluble solids, pH and anthocyanins. Sensory measurements included color, firmness, odor, decay and shrivelling. Preliminary results showed that under ambient conditions the pomerac had a shelf-life of 4-6 days. Fruits held at 10°C and 15°C were shrivelled, decayed and showing color loss in the skin after 10-15 days in storage. At 5°C fruits were acceptable in terms of color, firmness, taste and odor even after 20 days in storage.

INTRODUCTION

The fresh fruit of pomerac like the breadfruit and other tropical fruits, is generally known to have a short storage life of 4-6 days after harvest. The pomerac is considered acceptable when fully mature- ripe, but as soon as the fruit begins to soften it is considered inedible. This creates handling problems even in the local market. Additionally, postharvest handling is complicated by the fruit's thin epidermis, thus causing the fruit to be easily damaged.

Refrigerated storage is an effective means of prolonging the postharvest life of many fruits (Campbell, Huber and Koch, 1989). General commercial practice has been to store tropical fruits at 10°C or higher to avoid possible chilling injury (Campbell, Huber and Koch, 1989).

Important quality attributes for pomerac as with carambola fruits (Campbell, Huber and Koch, 1989) include size, color and taste, the latter being described generally in terms of sweetness and acidity.

At present there is little information on the postharvest behavior of the pomerac and consequently the objectives of this study is to evaluate the postharvest behavior of the pomerac under refrigerated were 5°C, 10°C and 15°C and ambient conditions 28°C.

MATERIALS AND METHODS

Firm, red ripe pomerac were harvested from the fields of El Carmen Research Station in St. Helena in Trinidad and transported to the Agricultural Processing Laboratory of the faculty of Engineering, University of the West Indies. The indicies used to determine harvest quality included firm, red, ripe fruit which are free of blemishes, pests and diseases.

The fruits selected were those that showed minimal signs of external blemishes or excessive bruising and fruits of similar size and color. These fruits were washed with tap water and air-dried. The fruits were randomly selected, wrapped with household tissue paper and packed

into cushioned, ventilated, cardboard boxes. The fruits were stored at four (4) different temperatures; 5°C, 10°C, 15°C and 28°C (ambient).

On the day of harvest, four fruits were selected for evaluating percent fresh weight loss (as a % of the loss in weight over the initial weight) Specific gravity was calculated from weight and volume determinations. Firmness was measured objectively using a Seta Penetrometer, with a cone and a 50 gram weight. The penetration depth was measured in millimeters after a period of 5 seconds with the depth of penetration being inversely proportional to firmness. Total soluble solids (TSS) in Brix % was measured with an Abbe Refractometer using a 1:1 dilution of pomerac pulp to water. Titratable Acidity was estimated as the percent citric acid content, determined by the titration method with 0.1N sodium hydroxide to a pH of 8.1-8.2. pH of a 1:1 dilution of pulp to water was measured using a pH meter (Analytical Measurement, model 707). Anthocyanin determination was measured using a 0.1N methanol-hydrochloric acid extraction process and color measured at 535 um wavelength using the spectrophotometer. Pulp color was also rated on a scale of 1 to 5 as follows: 1: white, 2: white with signs of cream, 3: light cream, 4: cream, 5: yellow.

Shrivelling was rated as follows: 1: none, 2: slight, 3: moderate, 4: severe.

At two day intervals, four fruits stored at 28°C and at five day intervals, four fruits from each of the other three temperatures were removed from their respective storage environments and evaluated for the above mentioned parameters. All results were statistically analyzed by the Analysis of Variance Method (ANOVA).

RESULTS AND DISCUSSION

Weight Loss

The weight loss (%) of Pomerac in storage was significantly affected by storage temperature($P < 0.05$). Weight loss increased with time for all treatments(Fig. 1). Under ambient conditions(28°C), there was a rapid increase to 36.6% after 8 days in storage.

At 15°C, the rate at which weight loss occurred was less than under ambient conditions and as shown in Figure 1, the rate was considerably reduced at 5°C and 10°C compared to both 15°C and ambient.

The result is expected since weight loss is attributed principally to water lost through transpiration and dry matter losses through respiration and both of these processes are retarded as storage temperatures are reduced.

Specific Gravity (S.G.)

The specific gravity of the freshly harvested Pomerac fruits prior to storage averaged 1.14. However, during storage, the specific gravity changed significantly and these changes(Fig. 2) were affected by the storage temperature($P<0.05$) and storage time($P<0.01$). The specific gravity of fruits stored under ambient conditions showed an increase to 1.20 after 8 days in storage(Fig. 2). At 15°C the S.G. increased to 1.35 after 15 days. Fruits stored at 10°C had a S.G. of 1.43 after 25 days and at 5°C the S.G. was 1.46 after 30 days in storage.

These results indicated an increase in denseness of the fruit, especially those stored at 10°C and 5°C. This may be attributed to a greater reduction in volume compared to that of weight, with time.

This fruit shrinkage, above that normally associated with transpiration, is possibly attributed to an overall reduction in fruit volume due to thermal contraction of the fruit cells with storage at low temperature(5°C and 10°C).

FIRMNESS

The firmness of the stored fruits was significantly affected by storage temperature($P<0.05$)and storage time($P<0.05$). Firmness of the fruit is inversely proportional to the penetration depths recorded by the penetrometer. Fruits stored under ambient conditions showed a gradual decrease in penetration depth. This was also observed at 15°C and 10°C (Fig. 3). When freshly harvested, the fruits had a penetration depth of 5.8 mm. After 8 days at ambient, the penetration depth was 5.5mm For fruits stored at 10°C, the penetration depth after 25 days was 3.4 mm and for 15°C, 5.1mm after 15 days in storage. However, for fruits stored at 5°C, fruit firmness appeared rather steady up to 25 days in storage, beyond which time, considerable softening was observed (Fig. 3).

The increase in fruit firmness in storage may be attributed to the fact that as the fruit lost excessive amounts of moisture (Fig. 1), the skin and flesh became tougher and thus the penetration depth reduced.

Fruits stored at 5°C had less moisture loss (Fig. 1) and the fruits remained supple and turgid for most of the storage period, with a rather constant firmness, until over ripening occurred beyond 25 days.

SUGAR/ACID RATIOS

The general trend for the sugar/acid ratio of Pomerac fruit was that it increased with storage time. However, fruits stored under ambient conditions showed a slight increase in the sugar/acid ratio, but at day 6 it decreased to 4.5 by day 8 (Fig. 4). At 10°C and 15°C°C, fruits' sugar/acid ratio increased from 3.6 and 3.8 respectively to 16.2 and 13.4 respectively. Fruits stored at 5°C, showed the highest increase in ratio where by the sugar/acid ratio rose from 3.6 to 18.9 by day 30 (Fig. 4). This increase in the sugar/acid ratio is attributed to the increase in Total Soluble Solids and the decline in acidity which was observed for fruits held at 5°C, 10°C and 15°C. Under ambient conditions, an initial increase in Total soluble solids (TSS) was also observed but this was followed by a rapid decline in TSS. This may have been due to the onset of decay of such fruits, with microbial metabolism of the sugars present.

COLOR

Prior to storage, freshly harvested fruits exhibited a bright red skin colour and during storage this was significantly affected by temperature ($P<0.05$). Color was determined through the measurement of Anthocyanins in the skin. Under ambient conditions, the intensity of anthocyanins increased from 0.243 um to 1.400 um after 6 days. But by the 8th day, the red color began fading thus giving a reduced intensity reading of 0.572 um for anthocyanins (Fig. 5). Fruits held at the 3 temperatures 15°C, 10°C and 5°C showed signs of color fading with time. At 15°C, the skin color went from a bright red to a faded pink/tan color after 15 days in storage. This was evident by the intensity reading which went from 0.243 um to 0.078 um (Fig. 5).

At 10°C, the skin color darkened from bright red to a dark red after 15 days in storage, but the colour began fading and eventually turned light pink by day 25 (Fig.5). The skin color of fruits held at 5°C went from bright red to faded light pink with traces of a tan color after 30 days in storage with an intensity reading of 0.092 um (Fig. 5).

This apparent color fading of the red pigment anthocyanin, maybe attributed to the breakdown of the red pigment when there is a change in the pH of the fruit. As the pH increases, the red pigment is altered to a blue pigment thus giving the faded blue pink colour (Asen, 1975; Paull, Deputy and 1985).

Pulp color was subjectively measured and appeared to be significantly affected by temperature ($P< 0.05$) and storage time ($P< 0.05$). When freshly harvested, the pulp of the Pomerac is white in color. At 10°C, the pulp went from white to a cream color after 25 days in storage. After 15 days,

those fruits stored at 15°C had a pulp color rating of 3.6, corresponding to a light cream color. Under ambient conditioned, the pulp was white with slight signs of cream after 8 days.

Those fruits stored under 5°C showed the least amount of discoloration to the pulp, with a rating of 2.3 (white with signs of cream) after 30 days in storage (Fig. 6).

SHRIVELLING

Shrivelling was seen to be significantly affected with time ($P < 0.01$) in storage. Fruits held at all the treatments showed some degree of shrivelling (Fig. 7). Fruits stored under ambient conditions showed severe shrivelling after 8 days. Fruits held at 15°C and 10°C showed moderate shrivelling in storage. After 30 days in storage, fruits held at 5°C showed moderate shrivelling. Shrivelling caused by moisture loss from the fruits can be related to the results from fresh weight loss (Fig.1). Excessive moisture loss at 28°C corresponds to the severe shrivelling that occurred. As the fruits lost moisture at the other three temperatures (15°C, 10°C and 5°C) the degree of shrivelling increased with time.

CONCLUSION

Pomerac held under ambient conditions (28°C) had a shelf-life of only 4-6 days. Fruits held at 10°C and15°C were shrivelled, decayed and showing color loss in the skin after 10-15 days in storage. At 5°C, fruits were acceptable in terms of color, firmness, and taste even after 20 days in storage.

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