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Analysis of External Coloration of the Low-Chill Peach 'Tropicbeauty' Grown in Puerto Rico.

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ABSTRACT.
Research was conducted in 2007 and 2008 to assess the external coloration components in fruits of the low–chill peach [*Prunus persica* (L.) Batsch] 'Tropicbeauty' grown in Adjuntas, Puerto Rico. Fruits were harvested at three apparent maturity stages (AMS) (50, 70, and 90% change in ground color) and external (peel) color was determined shortly after harvesting (fruits kept at 20°C) or after storage at 0°C for two weeks followed by ripening at 20°C. Peel color was determined with a Hunter Lab-MiniScan XE spectrocolorimeter calibrated with white and black standards (X=79.8, Y=84.6, Z=90.4) in the L* a* b* uniform color space, assessing values for L* (lightness of the color), a* (green to red), b* (blue to yellow), Chroma (color saturation or intensity), and hue (red, yellow, green, blue, purple, or intermediate colors between adjacent pairs of the basic colors). Chroma values increased as AMS was higher, whereas Hue values tended to decrease as AMS increased. L* values increased slightly as AMS was higher and after storage.

KEYWORDS: Fruit crops; low-chill requirement; post-harvest color.

INTRODUCTION

Fruit crops are an important crop group in Puerto Rico, worth $48.6 million in 2005 (Mejia, 2006). In many countries, peach [*Prunus persica* (L.) is a traditional and well established fruit crop; worldwide, peach was commercially grown in approximately 1.45 million hectares in 2006, with a global production of 17.2 million tons that year (FAO, 2008). In contrast, in Puerto Rico, peach is a relatively recent introduction. Peach varieties with low chill requirement developed by the University of Florida (Andersen et al., 2001) were introduced in Puerto Rico in January 2002, to assess their performance in the highlands of Adjuntas and Corozal, as a potential alternative for highland growers willing to diversify from more traditional crops such as citrus (*Citrus* spp.) and coffee (*Coffea* spp.).

So far, flowering and yield of low-chill peaches under normal conditions in Corozal (at 190 meters above sea level) has not been satisfactory. However, when grown with a relatively low input management in Adjuntas (at 594 meters above sea level), the low-chill peach varieties Tropicbeauty, Flordaglo, and Flordaprince have flowered and set fruits of adequate size and quality (Librán et al., 2006).

For commercial orchards, peach fruits for the fresh market should be harvested at an early stage in the fruit development process that allows the fruit to escape (or have significantly lower) damage by birds and fruit flies (*Anastrepha* spp.), provides a long

transit and shelf life, and when fully ripe still attains good quality at the consumer level. It is still unknown which is the earliest adequate maturity stage to harvest low-chill peaches grown in Puerto Rico. One of the easiest harvest indicators available to growers is the change in fruit peel color, usually from green (ground color) to yellow or orange. The objective of this research was to assess the external coloration components in fruits of the low–chill peach 'Tropicbeauty' grown in Adjuntas as a factor in the relationship between apparent maturity stages (as ascertained by peel color) and fruit quality after short-term postharvest time and after cold storage of fruits.

MATERIALS AND METHODS

'Tropicbeauty' fruits were harvested in 2007 from orchards at the Research Substation of the University of Puerto Rico-Mayaguez located in Adjuntas, Puerto Rico. Fruits deemed marketable as fresh fruit (adequate size and blemish-free) were collected at three apparent maturity stages (AMS) based on external (peel) ground coloration: 90% ground color change (= 10% of the peel was still green), 70% ground color change (= 30% of the peel was still green), and 50 % ground color change (= 50% of the peel was still green).

Color was analyzed with a HunterLab - MiniScan XE spectrocolorimeter (Hunter Associate Laboratory, Inc., Reston, Virginia, USA) calibrated with white and black standards (X=79.8, Y=84.6, Z=90.4) in the L* a* b* uniform color space, assessing values for L* (lightness of the color, where black =0 and white =100), a* (green to red), b* (blue to yellow), Chroma (color saturation or intensity), and hue (red, yellow, green, blue, purple, or intermediate colors between adjacent pairs of the basic colors). L*, a*, and b* were measured on the fruit cheeks. Chroma (C*) and Hue (H*) were derived from the resulting data with the statistical software SAS. The results were submitted to analysis of variance and separation of means with the Tukey test at the 5% level (SAS). Peel color was analyzed the same day the fruits were harvested and then again 5 days after harvest having kept the fruit at 20ºC (no cold storage) or having placed the fruit in cold storage (14 days at 0ºC) followed and then allowing 5 days at 20ºC. Results were expressed as values of L*, C*, and H* (McGuire, 1992).

RESULTS AND DISCUSSION

L* values determined 5 days after harvest (stored 20°C) or 19 days after harvest (stored at 0°C for 2 weeks and then at 20°C for 5 additional days) tended to be slightly higher than L* values taken at harvest (Tables 1 and 2). Cold storage had little additional effect on L* values (Table 2). In fruits harvested at the 90% AMS and then kept at 20°C for 5 days, L* values tended to decline after harvest, which was associated with fruit deterioration due to pathogens, injury, and/or excessive ripening (Kader, 2002; Lurie and Crisosto, 2005).

Chroma values tended to be higher as fruits were harvested at more mature stages (Table 1), and increased between 10 and 14% when fruits were kept for 5 days at 20°C. After cold storage followed by ripening at 20°C, fruit peel chroma values were 16-19% higher than right-after-harvest values (Table 2).

Hue values also tended to be higher (more in the green-yellow range) as AMS was lower. When fruits were harvested at the 90% AMS, hue values were closer to those indicative of the reddish-yellowish range, with H* values approximating 64 (Table 1).

Regardless of the AMS at fruit removal from the trees, hue values decreased after harvest. However, there was a tendency of lower hue reduction as fruits were harvested in more mature stages, with 11, 9, and 5% reductions in hue values for fruits harvested at 50, 70, and 90% AMS, respectively, for fruits kept at 20°C for 5 days without cold storage (Table 1), as well as 14, 11, and 7% reductions in hue values for fruits harvested at the 50, 70, and 90% AMS, kept in cold storage and then ripened at 20°C (Table 2).

'Tropicbeauty' is a low-chill peach variety with good yield performance in the highlands of a tropical island such as Puerto Rico. Our findings helped establish values for the peel color components of 'Tropicbeauty' harvested at three AMS based on peel coloration and their changes in postharvest in two different storage regimes. Having quantified L*, H*, and C* values, we aim at determining possible correlations between peel coloration components and fruit quality that may be useful to better determine adequate harvesting time for low-chill peaches in Puerto Rico and similar locations, as has been done with other fruits (Berger & Galleti, 2005).

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Table 1. Influence of apparent maturity stage (based on percentage of ground color change) of 'Tropicbeauty' peach on lightness, chroma y hue values at harvest and in fruit kept at 20°C for 5 days after harvest.

Apparent maturity stage at harvest	Time of evaluation	L* (Lightness)	C* (Chroma)	H* (Hue)
50%	At harvest	63.1	42.4	78.4
50%	After storage	65.4	48.1	70.4
70%	At harvest	64.3	45.1	71.5
70%	After storage	66.2	50.2	66.3
90%	At harvest	65.0	46.3	65.2
90%	After storage	64.5	51.0	62.2

Table 2. Influence of apparent maturity stage (based on percentage of ground color change) of 'Tropicbeauty' peach on lightness, chroma y hue values at harvest and in fruit kept at 0°C for 14 days followed by 5 days at 20°C.

Apparent maturity stage at harvest	Time of evaluation	L* (Lightness)	C* (Chroma)	H* (Hue)
50%	At harvest	66.3	45.0	79.8
50%	After storage at 0°C followed by 5 days at 20°C	70.3	46.9	78.5
50%	After storage at 0°C	71.1	55.3	69.5
70%	At harvest	65.9	46.1	72.3
70%	After storage at 0°C	68.1	48.3	69.6
70%	After storage at 0°C followed by 5 days at 20°C	68.7	56.5	64.7
90%	At harvest	63.6	46.5	65.2
90%	After storage at 0°C	67.1	49.0	64.7
90%	After storage at 0°C followed by 5 days at 20°C	66.3	54.6	63.5