Postharvest Sensory and Physicochemical Attributes of Honey Dew Melon Fruits

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Abstract. Physicochemical and sensory attributes of fully mature honey dew melon (*Cucumis melo* L. var. *inodorus* Naud.) fruits were evaluated 10 days after storage for eight commercial cultivars grown in two locations. Cultivars varied in degree of preference expressed by panelists' ratings for overall fruit preference, flavor, and shape and for physicochemical measurements of soluble solids concentration (SSC), flesh firmness, and fruit weight. The sensory attribute that correlated most strongly with overall fruit preference was fruit flavor ($r = 0.97$). The whiteness of epidermal tissue (rind L value) and SSC correlated more highly with overall fruit preference ($r = 0.54$ and $r = 0.52$, respectively) than other physicochemical attributes, such as fruit firmness ($r = -0.24$) and fruit weight ($r = -0.12$). Epidermal L value correlated more strongly with panelists' ratings for fruit shape ($r = 0.69$) than with fruit flavor ($r = 0.35$), but SSC correlated more strongly with fruit flavor ($r = 0.61$) than with fruit shape ($r = 0.30$). Superior honey dew melon quality at harvest was associated with high SSC, white epidermal tissue, and round fruit shape.

Attributes of smooth-skinned, green flesh honey dew melon cultivars associated with consumer perceived quality are poorly elucidated. Physicochemical and sensory attributes of netted, orange-fleshed muskmelon type cultivars (*Cucumis melo* L. var. *reticulatus* Naud.) have identified high-quality muskmelon cultivars (Lester and Turley, 1990). Such identification was possible because of extant variability for desirable postharvest fruit quality attributes. Variability for postharvest fruit quality traits has also been reported amongst netted muskmelon "fresh market" types (Evensen, 1983) and "western shipper" types (Davis et al., 1964; Lester and Turley, 1990; Yamaguchi et al., 1977).

The postharvest fruit quality of honey dew-type melons is more variable than that of netted muskmelons because honey dew melons do not develop an abscission zone after the fruit has obtained maximum sugar concentration (Ryall and Lipton, 1979; Webster, 1975). Melon fruit mesocarp tissue does not contain reserves of starch, so fruit maturity at harvest is positively correlated with postharvest mesocarp sugar concentration and consumer acceptability (Lester and Dunlap, 1985; Lester and Turley, 1990). Without a

visible maturity index, such as abscission zone development or exocarp color change, immature fruits likely will be harvested along with mature fruits.

Understanding which quality traits of honey dew fruits are strongly associated with consumer acceptance will permit identification of high-quality honey dew fruit. Identification of a nondestructive fruit harvest index for honey dew would assist melon growers in harvesting a fruit with high market quality. The objectives of this research were to 1) identify the postharvest quality attributes of honey dew fruits associated with consumer acceptance, 2) identify extant variability for these quality attributes, and 3) explore nondestructive maturity indices.

Eight honey dew type cultivars (TAM Dew,

HMX-8580, Greenflesh, Morning Ice, Morning Dew, Honey Cream, Honey Brew, and Moonshine), selected on the basis of good field trial performance, were planted at two commercial melon production sites (Sharyland Plantations and Rio Farms) in the Rio Grande Valley of southern Texas. Seed was acquired commercially and planted in 30.5 m rows. Standard commercial melon production practices were observed throughout the growing season. About 50 days postanthesis, 15 fruits of each cultivar were selected for harvest. Harvested melons met quality standards for grade U.S. no. 1 melons (mature, 8% SSC, firm, well formed, and free from defects; Code of Federal Regs., 1990). The melons were washed in tap water (21°C), dipped for 1 min in imazalil (528 µl-liter⁻¹) at 21°C, and stored at 18 ± 2°C and 90% ± 5% relative humidity for 10 days. Five fruits from each cultivar per location were evaluated for physical and chemical attributes in the laboratory, and three fruits from each cultivar per location were evaluated for sensory attributes.

The data were analyzed as a completely randomized design. Correlations between sensory and physicochemical attributes were based on cultivar means for each location. Data were subjected to an analysis of variance to identify cultivar differences for physicochemical and sensory attributes using SAS (1988). Duncan's multiple range test ($P \leq 0.05$) was used to ascertain differences when F values were significant.

The SSC of homogenized mesocarp tissue was measured with a tabletop, temperature-corrected refractometer. The dry weight of homogenized mesocarp tissue was determined according to AOAC (1984). Fruit firmness was measured as mean force (newtons) resistance of three 2-cm³ mesocarp tissue segments using an Accuforce Cadet force gage (Ametek, Largo, Fla.) equipped with a 6-mm-diameter, vee-head probe. The color of the equatorial epidermal and mesocarp tissue (excluding the ground spot) was measured in four areas with a Minolta Chromameter CR-200 (Minolta, Ramsey, N.J.) calibrated to a white tile under illu-

Table 1. Correlation of overall preference ratings for honey dew melon fruits with sensory and physicochemical attributes.¹

Attribute	Overall preference	Flavor rating	SSC harvest (%)	Rind ² L* value
Flavor rating	0.97**		0.61**	0.35
Sweetness rating	0.97**	0.99**	0.58*	0.47
Texture rating	0.95**	0.95**	0.63**	0.49
Fruit shape rating	0.75**	0.69**	0.30	0.69*
Flesh color rating	0.72**	0.68**	0.52*	0.37
Rind color rating	0.71**	0.64**	0.43	0.73*
Melon size rating	0.59**	0.51*	0.18	0.61
Rind L* value	0.54*	0.35	0.40	
SSC at harvest (%)	0.52*	0.61**		0.40
Cavity size rating	0.51*	0.44	0.41	0.79*
Firmness (N)	-0.24	-0.26	-0.30	-0.44
Fruit fresh wt (g)	-0.12	-0.14	-0.48*	0.24

¹Preference ratings based on a scale when 0 = dislike extremely, 9 = like extremely.

²Means of eight cultivars each at two locations (N = 16).

³Means of eight cultivars at one location (N = 8).

⁴**Significant at $P \leq 0.05$ or 0.01, respectively.

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Table 2. Honey dew melon cultivar mean values for selected sensory and physicochemical attributes of fruits following 10 days of storage at 18±2°C and 90% ± 5% relative humidity.^z

Cultivar	Consumer preference rating ^y			Physicochemical measurements			
	Overall	Flavor	Whole fruit shape	SSC at harvest (%)	Rind L* value	Fresh wt (kg)	Firmness (N)
TAM Dew	5.1 a*	5.8 a	6.0 ab	11.8 a	80.3	1.2 e	14.6 c
HMX-8580	5.5 ab	5.1 ab	6.3 a	9.4 c	81.5	1.9 b	14.6 c
Greenflesh	5.3 abc	4.1 abc	5.9 ab	8.7 f	78.6	2.0 b	15.7 bc
Morning Ice	4.9 abc	4.6 abc	6.1 ab	9.2 d	80.6	2.5 a	15.7 bc
Morning Dew	4.4 abc	4.6 abc	4.1 c	10.0 b	17.1	1.8 bc	18.2 ab
Honey Cream	4.3 bc	4.0 bc	5.8 ab	9.3 c	77.7	1.5 b	17.2 ab
Honey Brew	4.1 c	3.4 c	5.8 ab	8.5 g	79.6	1.6 cd	16.3 bc
Moonshine	3.9 c	3.5 c	4.8 bc	8.9 e	79.2	1.8 bc	19.3 a

^yMeans are based upon data from two locations.

^zSee Table 1 for scale description.

^xMean separation within columns by Duncan's multiple range test; $P \leq 0.05$.

minant condition C and expressed in the $L^*a^*b^*$ measurement mode. Hue angle ($\tan^{-1}b/a$) (Francis, 1975; Little, 1975) and saturation index $[(a^2 + b^2)^{1/2}]$ (Clydesdale, 1978) were calculated.

Preferences for external and internal fruit appearance, fruit eating quality, and overall fruit preference were measured for each of the eight honey dew melon cultivars at individual stations by an untrained, 13-member preference panel. Each station displayed a whole fruit, a fruit cut in half equatorially, and 2-cm-diameter melon balls of middle mesocarp tissue segments from the equatorial region (excluding the ground spot). The panelists were randomly selected from the local community through a mailing list from the Hidalgo County Extension office. A 9-cm line scale was used to rate external fruit color, shape, and size, and flesh color, cavity size, and overall fruit preference. The line scale was labeled dislike extremely at 0 cm and like extremely at 9 cm. Preferences were quantified by measuring the distance from 0 cm to the indicated preference mark.

Ratings for flavor, sweetness, and texture correlated strongly with overall fruit preference (Table 1). Sweetness ratings correlated more strongly with flavor ratings than with SSC. SSC at harvest correlated more strongly with flavor ratings than with overall fruit preference. Apparently, SSC is a better predictor of flavor than overall fruit preference. SSC at harvest correlated just as strongly with overall fruit preference as did the L^* value (rind whiteness) of the fruit exterior surface color. Aulenbach and Worthington (1974) reported a similar correlation between SSC and fruit acceptability in netted muskmelon fruit.

The decision to harvest a honey dew field is based on whether the SSC of an unspecified number of randomly selected fruits has reached the specified legal minimum SSC (Aulenbach and Worthington, 1974). Measurement of SSC with a hand-held refractometer is destructive and therefore precludes large sample sizes. The reliability of SSC per se as an index for consumer acceptability has been questioned (Aulenbach and Worthington, 1974; Currence and Larson, 1941). The SSC of a few individual fruits may be a poor indicator for a population because the number of fruits sampled in the field may not

adequately represent the amount of field variability for fruit maturity.

The skin L^* value had strong, significant correlations between preferences for cavity size, rind color, fruit shape, and fruit size (Table 1). All of these appearance-type traits were more strongly correlated with the rind L^* value than with SSC. Although Aulenbach and Worthington (1974) did not report the correlation between external color values (Gardner Color Difference Meter) and muskmelon fruit acceptability, they did note that external color characteristics were independent of SSC. The L^* value of the skin (non-destructive) and the SSC (destructive) at harvest are attributes that can be measured in the field and could serve as guidelines for melon harvest. This combination indicates a potential for better determination of fruit harvest maturity by measuring the skin L^* value in addition to measuring SSC.

Overall fruit preference ratings were more strongly correlated with fruit shape rating than with ratings for fruit size (Table 1). Fruit shape and size ratings were strongly correlated ($r = 0.84$). Panelists likely were influenced by the shape of the fruit when they rated the fruits for size. Fruit size preference was poorly correlated ($r = 0.02$) with measured fruit fresh weight (kilograms). Fruit fresh weight (kilograms) was also poorly correlated with overall fruit preference ($r = -0.12$). Since fruit shape ratings were more strongly correlated with overall fruit preference than were fruit size ratings, fruit shape probably influences overall quality more than fruit size.

Fruit cavity size ratings were poorly correlated with measured cavity size ($r = -0.22$). The ratio of fruit flesh thickness to fruit cavity diameter did not correspond to cavity size ratings or to overall fruit preference (data not shown). Cavity size ratings correlated strongly with overall fruit preference (Table 1), but the importance of cavity size per se to overall fruit quality remains undetermined. Measured sensory and physicochemical attributes not listed in Table 1 (fruit diameter and length, external a^* and b^* , internal L^* , a^* , and b^* , hue and saturation index, dry weight, fructose, glucose and sucrose) were not strongly correlated with overall fruit preference (data not shown).

Variability was apparent among honey dew

cultivars for three sensory and three physicochemical traits (Table 2). The fruits of 'TAM Dew' were most preferred and were significantly preferred over fruits of 'Honey Cream', 'Honey Brew', or 'Moonshine'. Fruit flavor ratings ranged between 3.5 cm on the line scale for 'Moonshine' and 5.8 cm for 'TAM Dew'. Fruit flavor ratings were nearly identical to the overall preference ratings for all cultivars ($r = 0.97$).

High SSC at harvest did not always correspond with high overall fruit quality. 'TAM Dew' had the highest SSC (11.8%) at harvest and was also the most preferred melon cultivar, but 'Morning Dew' was significantly less preferred than 'TAM Dew', despite a SSC of 10.0%. Attributes associated with fruit appearance may help explain why 'Morning Dew' was less preferred than 'TAM Dew'. The rind L^* value of 'Morning Dew' was the lowest (least white) of all the cultivars (Table 2). Fruit shape ratings for 'Morning Dew' melons were lower than for most of the cultivars and considerably lower than for 'TAM Dew'. The length : diameter ratio of 'TAM Dew' fruits indicated 'TAM Dew' fruits to be round (ratio 1.0), while 'Morning Dew' fruits were oblong (ratio 1.2). 'TAM Dew' fruits were also smaller than 'Morning Dew' fruits (1.2 vs. 1.8 kg, respectively). Fruit size did not appear to be as important as shape because the second most preferred cultivar, HMX-8580, was just as large as 'Morning Dew' (1.9 kg).

Fruit flavor was the best predictor of overall fruit quality following 10 days of storage. Since evaluation of flavor is time consuming and requires a sensory panel, SSC at harvest could be used to predict flavor. However, SSC at harvest appears to explain only ~50% of the variability in postharvest melon quality. We suggest use of rind L^* value and fruit shape, in conjunction with SSC at harvest, to predict optimum harvest maturity.

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