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Fruit Characteristics of Asian Peaches Grown Under New Zealand Conditions

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Abstract

The physical properties of the fruit of 14 Asian peach cultivars were measured at eating maturity and compared with 4 commercial American cultivars. Asian peaches had lower percent overcolour and lower pH values. Differences in texture and firmness were found for the Asian cultivars. Sugar levels as measured by soluble solids ranged between 9 and 14% and were similar to the American cultivars.

Introduction

Approximately 30 white fleshed peaches have been introduced into New Zealand from Japan, Korea and China. Several of these cultivars have been evaluated for their potential for the New Zealand summerfruit industry. Some characteristics of these cultivars growing under New Zealand conditions have been described previously (1,2,4). Major differences between the appearance of white-fleshed peaches from Asia and those from America peaches were noted, with Asian peaches being typically large with a bright red blush and having very low pH values. Flesh texture was fine and melting.

A list of these peaches and their attributes when grown under New Zealand conditions has not been previously published. In this article, measurements of the physical properties of 14 Asian peach cultivars grown under New Zealand conditions are presented and compared with 4 commercial yellow-fleshed and white-fleshed cultivars originating in California, U.S.A.

Materials and Methods

Observations of 18 peach cultivars listed in Table 1 were made on 5 year old trees growing on Hastings silt loam at the Havelock North Research Centre orchard during the 1992/93 growing sea-

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son. Havelock North is situated on the east coast of the North Island of New Zealand (39°40' S and 176°53' E). Cultivars were grown on 'Golden Queen' rootstock, spaced at 5m x 2.5m and trained to a free form multi-leader system. ('Golden Queen', the major canning peach in New Zealand is also used as the standard seedling rootstock for peaches and nectarines.) Tree management including pruning and irrigation was carried out according to local standard commercial practices. Fruit were hand-thinned to 15cm apart. When fruit reached local market maturity, a 15-fruit sample was harvested from 2 or 3 trees and ripened at 20°C for 3–4 days before being evaluated. The external and internal characteristics of 10 individual fruit selected at random were then measured and treated as replicates.

Fresh fruit weight was measured to the nearest gram. Skin colour and percentage overcolour were visually estimated and percentage overcolour recorded using the scale 0–25%, 26–50%, 51–75% and 76–100%. Skin ground colour was classified as green, green-yellow, or yellow. Flesh firmness was measured on opposite sides of the fruit, using an Effegi penetrometer equipped with an 8mm tip. Kg-f were then converted to Newtons. A thin slice of skin was removed prior to measurement of firmness. Soluble solids concentration (%SS) was measured with a hand held Atago refractometer, using juice expressed from the penetrometer. Cultivars were grouped according to their origin and means of soluble solids concentrations compared. pH was measured with an Orion meter, by positioning the tip of the probe (Schott Geráte) in the hole made by the penetrometer. Cultivars were grouped according to country of origin and means of pH values compared.

Peach cultivars were classified according to whether they had melting or non-melting texture, by evaluating fruit firmness and texture. Non-melting peaches have a firm "rubbery" texture that remains firm at eating maturity, while melting peaches are much softer, particularly at eating maturity. Stone adherence characteristics were recorded as clingstone, semi-clingstone or freestone. The perceived levels of acidity and sweetness of fruit were also recorded when fruit was tasted. Fruit sweetness and acidity was recorded as low, medium or high by one person.

Results and Discussion

The Japanese peaches had white or cream flesh colour, (Table 1) which is a characteristic favoured for fresh market dessert peaches in Japan (10). The Korean peaches and the Chinese peach were also white-fleshed.

Asian peaches differed from the American peaches in skin colour. Asian peaches tended to have a pink to light red overcolour where American peaches had a much darker overcolour. Asian peaches had low percentage overcolour (0–25%) except 'Matsumori Wase' and 'Chiyohime' which had 26–50% overcolour. 'Yumyeong' had a higher percentage overcolour (51–75%) (Table 1) similar to 'Giant Babcock'. The other American cultivars had percentage skin overcolour of 76–100%.

The two earliest maturing cultivars 'Baekmi Josaeng' from Korea and 'Chiyohime' had the smallest sized fruit (Table 2). The Japanese cultivar 'Okubo' and Korean cultivar 'Yumyeong' had large fruit (200g) which was similar to the standard American cultivar 'Flamecrest'.

With peaches, flesh firmness is directly related to fruit texture. Peaches are generally classified as melting or non-melting with non-melting being recessive to melting (3). Non-melting peaches are generally used for processing while melting peaches are used as fresh market, dessert peaches. All the Japanese peaches were categorised as melting and classified as dessert peaches. Of the two Korean cultivars, 'Baekmi Josaeng' was classified as melting and 'Yumyeong' as non-melting. The Chinese cultivar 'Imperial Jade' was classified as non-melting. Wang and Lu

(8) referred to this cultivar as having hard melting flesh.

Firmness measurements were similar for all melting-flesh cultivars at eating maturity. The two non-melting cultivars., 'Yumyeong' and 'Imperial Jade' had flesh firmness of 98.1 N and 44.1 N respectively, while of the 16 cultivars with melting flesh, the maximum firmness was 24.5 N.

All the Japanese cultivars were classified as clingstone with strong adherence of the flesh to the stone at eating maturity. The American peaches, 'Flamecrest' and 'Giant Babcock' were freestone peaches with 'Tasty Zee' noted as semi-cling type, where some flesh adhered to the stone at maturity. Of the Asian peaches, 'Imperial Jade' was also noted as semi-cling while 'Yumyeong' was recorded as clingstone. Peaches with non-melting texture are almost without exception clingstone types, since expression of the freestone gene is suppressed by the presence of the homozygous recessive non-melting gene (7).

Soluble solids concentrations of individual cultivars ranged from 8.0% Brix to 14% (Table 2) but are unlikely to be significantly different. Similar results were found by Robertson et al. (6) who reported soluble solids ranging from 9–15% for yellow-fleshed peaches and 9–14% for white-fleshed peaches. The Japanese cultivars were perceived to have medium sweetness except for 'Nakatsu Wase' which had low sweetness (Table 4). 'Yumyeong' was perceived as having low sweetness as was the American cultivar 'Tasty Zee'.

The Korean cultivars tended to have lower soluble solids than the cultivars from China and the United States when cultivars were grouped according to country of origin and compared (Table 3). The Japanese cultivars had intermediate levels of soluble solids. Asian peaches have been previously cited for their low acidity (1,5) which is a simply inherited character (5). Peaches with pH $\geq$ 4.2 have been considered low acid (5,9). In this study, however, pH values for the Asian peach cultivars ranged from 3.5 to 4.3 (Table 2). All except 'Miyako Hakuto' were below pH 4.2. Asian peaches in this study had higher acidity levels as measured by pH than those quoted in another study (9).

The pH of the American peaches ranged from pH 3.3 to 3.6 (Table 2).

Table 1. Origin of Asian peaches, maturity and external characteristics.

Cultivar	Origin	Flesh Colour	Harvest Date	Ground Colour	Over-colour	% Over-colour	Stone Adherence	Texture
Chiyohime	Japan	white	16-Dec-92	green-yellow	red	26-50	cling	melting
Kahhoh	Japan	white	30-Dec-92	green-yellow	pink	0-25	cling	melting
Tsukuba 88	Japan	white	05-Jan-93	green-yellow	pink	0-25	cling	melting
Akatsuki	Japan	cream	08-Jan-93	yellow	red	0-25	cling	melting
Matsumori Wase	Japan	white	10-Jan-93	green-yellow	red	26-50	cling	soft melting
Miyako Hakuto	Japan	white	10-Jan-93	green-yellow	red	0-25	cling	melting
Okubo	Japan	white	15-Jan-93	green-yellow	red	0-25	cling	melting
Hakuto	Japan	white	15-Jan-93	green-yellow	red	0-25	cling	soft melting
Nakatsu Wase	Japan	cream	22-Jan-93	green-yellow	pink	0-25	cling	melting
Kozo Hakuto	Japan	cream	22-Jan-93	green-yellow	pink	0-25	cling	melting
Tsukuba 92	Japan	cream	12-Feb-93	green-yellow	pink	0-25	cling	melting
Baekmi Josaeng	Korea	white	08-Dec-92	green-yellow	pink	0-25	cling	melting
Yumyeong	Korea	white	02-Feb-93	yellow	pink	51-75	cling	non-melting
Imperial Jade	China	green/white	28-Jan-93	green	red	0-25	semi-cling	non-melting
Flamecrest	USA	yellow	20-Jan-93	yellow	red	75-100	freestone	melting
Tasty Zee	USA	cream	25-Jan-93	yellow	purple	75-100	semi-cling	melting
Giant Babcock	USA	cream	28-Jan-93	yellow	red	50-75	freestone	melting
53 GA 1070	USA	green/white	02-Feb-93	green/yellow	dark red	75-100	cling	firm melting

Table 2. Fruit measurements with standard deviations (S.D.) for each factor.

Cultivar	[1]Origin	Weight (g)		Soluble Solids (%)		pH		Firmness (N)	
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Chiyohime	J	80	6.0	9.0	1.0	4.0	0.2	15.7	3.9
Kahhoh	J	120	18.0	10.0	0.9	3.9	0.1	23.6	5.9
Tsukuba 88	J	120	9.0	13.0	1.0	4.0	0.2	12.7	2.0
Akatsuki	J	170	9.0	14.0	1.5	3.6	0.1	14.7	4.9
Matsumori Wase	J	160	12.0	12.0	1.0	4.0	0.1	19.6	2.9
Miyako Hakuto	J	140	15.0	9.0	0.9	4.3	0.1	19.6	2.9
Okubo	J	200	10.0	11.0	0.5	3.6	0.4	14.7	3.9
Hakuto	J	150	10.0	9.0	0.5	3.8	0.1	14.7	3.9
Nakatsu Wase	J	180	12.0	11.5	1.0	3.6	0.2	16.7	8.8
Kozo Hakuto	J	180	14.0	11.0	0.5	3.8	0.1	14.7	4.9
Tsukuba 92	J	145	10.0	14.0	1.5	3.6	0.1	9.8	1.0
Baekmi Josaeng	K	97	8.0	8.0	1.0	3.7	0.1	14.6	3.9
Yumyeong	K	200	10.0	10.0	1.0	3.5	0.3	98.1	29.4
Imperial Jade	C	190	5.0	14.0	2.0	3.5	0.4	44.1	4.9
Flamecrest	A	200	12.0	13.5	0.4	3.5	0.4	24.5	2.9
Tasty Zee	A	160	10.0	12.0	1.0	3.3	0.2	19.6	4.9
Giant Babcock	A	165	4.0	13.5	1.0	3.6	0.5	9.8	3.9
53 GA 1070	A	130	11.0	13.0	1.0	3.3	0.2	14.7	4.9

Origin J = Japan K = Korea C = China A = USA

'Flamecrest', a standard yellow-fleshed peach had pH 3.5 while 'Tasty Zee', a new white-fleshed American peach had pH 3.3. Two of the American white-fleshed peaches evaluated in this study were bred from low acid lines. 'Tasty Zee' was derived from 'Giant Babcock' which originated from 'Babcock', an old American low-acid cultivar (5). 'Gian Babcock' had pH 3.6, which was in the range of the Asian peaches. On tasting, 'Giant Babcock' was perceived to be low acid, similar to some of the Asian cultivars (Table 4). 'Tasty Zee', however, had pH 3.3 and was perceived to have medium levels of acidity (Table 4) indicating that the low acid factor was not expressed in this cultivar.

Table 3. Soluble solids (%SS) and acidity (pH) group means for country of origin of peaches.

Group	Cultivars (no.)	%SS	S.D.	pH	S.D.
Japanese	11	11.0	1.9	3.8	0.2
Korean	2	9.0	1.4	3.6	0.1
Chinese	1	14.0		3.5	
U.S.A.	4	13.0	0.7	3.4	0.2

The Japanese cultivars tended to have higher pH compared with American cultivars when country of origin group means were compared. The Korean and Chinese cultivars had intermediate levels of acidity. Low acidity of Asian peaches was detected by taste (Table 4) for 11 Asian cultivars, with 5 cultivars having medium acidity levels.

Conclusions

Japanese peaches were characterised by white flesh and melting texture. The Korean cultivar 'Yumyeong' was exceptionally firm at eating ripeness while the Chinese cultivar 'Imperial Jade' was also much firmer than the Japanese cultivars. The level of firmness exhibited by these cultivars would not be acceptable to all Asian palates as Japanese consumers prefer soft-melting peaches (10).

Soluble solids ranged within levels typical of peaches. However, cultivars with high soluble solids such as 'Akatsuki', 'Tsukuba 92' and 'Imperial Jade' (14% SS) rated similar to 'Chiyohime', 'Hakuto' and 'Baekmi Josaeng'

Table 4. Perceived taste of acidity and sweetness of 18 peach cultivars.

Group	Acidity	Sweetness
Chiyohime	low	medium
Kahhoh	low	medium
Tsukuba 88	low	medium
Akatsuki	low	medium
Matsumori Wase	medium	medium
Miyako Hakuto	low	medium
Okubo	low	medium
Hakuto	low	medium
Nakatsu Wase	medium	medium
Kozo Hakuto	medium	low
Tsukuba 92	medium	medium
Baekmi Josaeng	low	medium
Yumyeong	low	low
Imperial Jade	medium	medium
Flamecrest	high	medium
Tasty Zee	medium	low
Giant Babcock	low	high
53 GA 1070	medium	low

(≥9% SS) for perceived sweetness. 'Giant Babcock' was the only American cultivar to be rated as having high sweetness.

Acidity levels for the Asian peaches varied when measured by pH although all were perceived by taste to have low to medium acidity. Acidity levels for the American cultivars varied from low to high when tasted. pH measurements only, or taste only, did not always indicate whether Asian cultivars were carrying the low acidity factor.

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Water Relations of Grape Berries

The diurnal water budget of developing grape berries was measured with transducers. For well watered vines daytime contraction was less during post-veraision than pre-veraision. Contraction was reduced by restricting berry or shoot transpiration with the larger effect being shoot transpiration pre-veraision and berry transpiration post-veraision. A nearly exclusive role of xylem for water transport into the berry in pre-veraision where as the phloem is dominant in the post-veraision water budget. Daytime contraction was very sensitive to plant water status before veraision but insensitive after veraision. This transition is attributed to the increased phloem inflow during ripening and the partial discontinuity in berry xylem during this phase. Berries become drought tolerant during ripening. From Matthews and Greenspan. 1994. ISHS Hort Congress Abstracts O-16-3 p. 53.