

Understanding Consumer Acceptance of Peach, Nectarine, and Plum Cultivars

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Abstract

'In-store' consumer acceptance tests, as part of a four-step program to develop a minimum quality index, were performed to determine the relationship between ripe soluble solids concentration (RSSC) and/or ripe titratable acidity (RTA), and consumer acceptance of 'Elegant Lady' peach, 'Spring Bright' nectarine, and 'Blackamber' plum. For these peach and nectarine cultivars, consumer acceptance was significantly related to RSSC. For 'Blackamber', consumer acceptance was significantly related to RSSC and RTA. The results from our "in-store" consumer tests and our previous orchard surveys demonstrated that these RSSC levels could be exceeded by these cultivars if good production practices are used.

INTRODUCTION

The increase in production of stone fruit in recent years includes new cultivars with different flesh colors, flavors, soluble solids concentrations (SSC), and titratable acidities (TA). Studies have associated high consumer acceptance of fruit with high soluble solids concentration (SSC) in peaches (Parker et al., 1991; Robertson et al., 1988; Kader, 1994). The importance of TA and SSC-TA ratio in oranges (Pehrson and Ivans, 1988) and volatiles (Romani and Jennings, 1971) in other commodities have been pointed out. From our previous research working with 'Brooks' and 'Bing' sweet cherries (Crisosto et al., 2002, 2003), 'Hayward' kiwifruit (Crisosto and Crisosto, 2001), and 'Redglobe' table grapes (Crisosto and Crisosto, 2002) we concluded that consumer acceptance was more sensitive to the SSC-TA ratio than to the SSC, but it depends on the cultivar. Tree fruit acidity is determined by several factors such as cultivar, environmental conditions, canopy position, crop load, ripening, fruit maturity (Crisosto et al., 1995, 1997), and rootstock (DeJong et al., 2002). As fruit production is increasing, we believe that it is important to understand the role of fruit SSC and TA in consumer acceptance.

MATERIALS AND METHODS

'In-store' consumer acceptance tests were carried out on 'Elegant Lady' peach, 'Spring Bright' nectarine, and 'Blackamber' plum during the 2002 season as previously described by Crisosto and Crisosto (2002). Approximately 100 consumers at a major supermarket were interviewed for each cultivar. For each cultivar, each consumer was presented four fruit samples of the four ripe SSC classes. These classes were selected to include the historical SSC levels from previous industry-wide fruit quality surveys. On the day of the consumer test in the morning, all ripened fruit of the cultivar to be tested were placed at room temperature (20°C). On each fruit to be used for the consumer test, a dime-size piece of skin was removed from one cheek and the flesh firmness measured with a UC firmness tester equipped with an 8 mm tip. If the fruit was ripe, i.e. 4.4-17.8 N flesh firmness, a number code was written on the tip of the fruit and the flesh firmness recorded. Then a longitudinal wedge was removed from the same area as the flesh firmness, placed between two layers of cheesecloth and the juice expressed for subsequent soluble solids concentration (SSC) and titratable acidity (TA) measurements. The coded fruit was placed in one of four boxes of the correct SSC class (A, B, C, D) based on the SSC measurement. This single fruit RSSC and RTA measurement technique reduced the fruit to fruit variability within each SSC class. For each fruit sample, the consumer was asked to taste it, then to indicate if he/she "likes", "neither likes nor dislikes", or "dislikes" the sample. Then, the consumer was asked to indicate his/her degree of liking/disliking: slightly, moderately, very much, or extremely. The consumer's response was recorded using a 9-point hedonic scale (1-dislike extremely to 9-like extremely). Consumer acceptance was measured as both degree of liking (1-

9) and percentage acceptance. The percentage of consumers liking the fruit sample was calculated as the number of consumers liking the fruit sample (score >5.0) divided by the total number of consumers within that sample (Lawless and Heymann, 1998). In a similar way the percentage of consumers was calculated disliking the sample and indifferent to that sample. The degree of liking data was subjected to analysis of variance (ANOVA) prior to the LSD mean separation using the SAS program.

RESULTS AND DISCUSSION

‘Elegant Lady’ Peach

Degree of liking was significantly related to RSSC but not to RTA within the quality attribute ranges used for this test. In addition there was no significant interaction between RSSC and RTA on the degree of liking. For ‘Elegant Lady’, a high acid, melting, yellow flesh peach, RSSC varied from 9.0 to 15.0% with a mean of 12.4% and RTA ranged from 0.45 to 0.90% with a mean of 0.74% within the population of fruit used in this consumer test. In the previous five years, the average RSSC has ranged from 11.4 to 11.7% based on industry-wide fruit quality surveys. Within the tested range of quality attributes ‘Elegant Lady’ peaches were liked “slightly” to “moderately”, while consumer acceptance varied from about 30 to 75% (data not shown). There was a significant difference in degree of liking between peaches with RSSC <11.0% and \geq 11.0% RSSC (Table 1). Peaches with RSSC \geq 11.0% were liked “moderately” (7.1) by consumers while peaches with RSSC <11.0% were liked “slightly” (5.9) by consumers. For these peaches, consumer acceptance varied from 47.8 to 71.8%. The “neither like nor dislike” option was selected by several consumers, and it varied from 25.0 to 37.8% depending mainly on the RSSC range. For “Elegant Lady” peaches with RSSC \geq 11.0%, the percentage of consumers that chose the “neither like nor dislike” option was 25.0%, while only 3.2% of consumers disliked them.

‘Spring Bright’ Nectarine

Consumer acceptance of ‘Spring Bright’, a high acid, melting, yellow flesh nectarine, was significantly related to RSSC but not to RTA within the quality attribute ranges used for this test. Thus, there was no significant interaction between RSSC and RTA on the degree of liking. For ‘Spring Bright’, RSSC varied from 8.0 to 16.0% with a mean of 11.0% and RTA ranged from 0.60 to 1.20% with a mean of 0.92% within the population of fruit used in this consumer test. In the previous five years, the average RSSC has ranged from 12.2 to 14.2% based on industry-wide fruit quality surveys. Within this range of quality attributes, ‘Spring Bright’ nectarines were liked from “neither like nor dislike” to “very much”, while consumer acceptance varied from about 30 to 80% (data not shown). There was a significant difference in degree of liking between peaches with RSSC <10.0% and \geq 10.0% RSSC (Table 2). Nectarines with RSSC \geq 10.0% were liked “moderately” (6.9) by consumers while nectarines with RSSC <10% were “neither liked nor disliked” by consumers. ‘Spring Bright’ nectarines with RSSC <10.0% had a consumer acceptance of 34.9% while nectarines with RSSC \geq 10.0% had a consumer acceptance of 70.5%. The “neither like nor dislike” option was selected by several consumers, and it varied from 24.0 to 39.4% depending mainly on the RSSC level. For ‘Spring Bright’ nectarines with RSSC \geq 10.0%, the percentage of consumers that chose the “neither like nor dislike” option was 24.0%, while only 5.6% of consumers disliked them.

‘Blackamber’ Plum

Degree of liking was significantly related to RSSC, RTA and RSSC-RTA ratio. For ‘Blackamber’, a black, high acid plum, RSSC varied from 8.0 to 18.0% with a mean of 12.0% and RTA ranged from 0.15 to 1.21% with a mean of 0.62% within the population of fruit used in this consumer test. In the previous five years, the average RSSC has ranged from 10.8 to 11.7% based on industry-wide fruit quality surveys.

There was a significant interaction between RSSC and RTA degree of liking. For this reason, data were further analyzed using three levels of RTA (Table 3). Within this range of quality attributes ‘Blackamber’ plums were liked from dislike “moderately” (3.3) to like “very much” (7.8) and consumer acceptance varied from 8.3 to 88.6%. RTA did not affect degree of liking when plums had RSSC \geq 12.0% disregarding acidity. Plums with RSSC \geq 12.0% were always liked “slightly” (6.3) to “very much” (7.8) by

consumers. However, when plums had RSSC of 10.0-11.9%, RTA played a significant role in consumer acceptance. Plums with RSSC from 10.0 to 11.9%, combined with low ($\leq 0.60\%$) or moderate (0.61-0.99%) RTA, were liked “slightly” (6.2) to “neither liked nor disliked” (5.3) with an acceptance of 56.4% and 34.5%, respectively. ‘Blackamber’ plums with RSSC from 10.0 to 11.9% combined with a RTA $\leq 0.60\%$ had a degree of liking similar to plums within the RSSC between 12.0-13.9% disregarding acidity.

‘Blackamber’ plums within the RSSC between 10.0 to 11.9% range but with RTA $\geq 1.00\%$ had the lowest degree of liking, disliked “moderately” (3.3) and had a consumer acceptance similar to plums with $< 10.0\%$ RSSC and RTA $\geq 1.00\%$. In the case of plums with RSSC $< 10.0\%$, these plums had the lowest consumer acceptance disregarding their RTA (≤ 0.60 to $\geq 1.00\%$). The percentage of consumers that chose the “dislike” option varied from 1.3 to 66.7% and the response was also related to RSSC and RTA. The percentage of consumers that chose the “dislike” option is high in comparison to other commodities and it may be explained by a potential bias against dark color plums. For plums which had RSSC $\geq 12.0\%$, disregarding RTA, the percentage of consumers that chose the “neither like nor dislike” option was approximately 18%, but less than 7% disliked the fruit.

Fruit firmness significantly affected plum consumer acceptance (data not shown). Consumer acceptance or degree of liking was significantly higher on plums with firmness < 13.3 N than plums with firmness ≥ 13.3 N, but it was the lowest for plums that had firmness higher than 22.2 N.

CONCLUSIONS

Consumer acceptance is related to RSSC and/or RTA but it varies with cultivar. Based on this work, different companies can select a quality index based on a minimum RSSC within a RTA range for a tested cultivar according to the percentage of consumers that the companies would like to satisfy. Our stone fruit quality surveys (since 1994) show that most of the fruit of these cultivars produced fruit that exceed these proposed minimum quality indexes. The use of adequate cultural practices and the careful determination of the harvest date should be applied properly to assure that the majority of fruit would exceed these minimum quality indexes.

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Tables

Table 1. Consumer acceptance of 'Elegant Lady' peaches by American consumers at different levels of ripe soluble solids concentration (RSSC).

Quality Attributes	Degree of Liking (1-9) ¹	Acceptance (%)	Neither Like nor Dislike (%)	Dislike (%)
RSSC < 11.0%	5.9 b ²	47.8	37.8	14.4
RSSC ≥ 11.0%	7.1 a	71.8	25.0	3.2
LSD _{0.05}	0.4	–	–	–
P-value	0.0001			

¹ Degree of liking: 1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4 = dislike slightly, 5 = neither like nor dislike, 6 = like slightly, 7 = like moderately, 8 = like very much, 9 = like extremely.

² Same letters within the same column indicate no significant difference between means.

Table 2. Consumer acceptance of 'Spring Bright' nectarine by American consumers at different levels of ripe soluble solids concentration (RSSC).

Quality Attributes	Degree of Liking (1-9) ¹	Acceptance (%)	Neither Like nor Dislike (%)	Dislike (%)
RSSC < 10.0%	5.4 b ²	34.9	39.4	25.7
RSSC ≥ 10.0%	6.9 a	70.5	24.0	5.6
LSD _{0.05}	0.4	–	–	–
P-value	0.0001			

¹ Degree of liking: 1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4 = dislike slightly, 5 = neither like nor dislike, 6 = like slightly, 7 = like moderately, 8 = like very much, 9 = like extremely.

² Same letters within the same column indicate no significant difference between means.

Table 3. Consumer acceptance of 'Blackamber' plums by American consumers at different levels of ripe soluble solids concentration (RSSC) and titratable acidity (RTA) measured as percentage malic acid.

Quality Attributes	Degree of Liking (1-9) ¹	Acceptance (%)	Neither Like nor Dislike (%)	Dislike (%)
RTA ≤ 0.60%				
RSSC < 10.0%	4.7 de ²	32.3	29.0	38.7
RSSC 10.0-11.9%	6.2 bc	56.4	25.6	17.9
RSSC 12.0-13.9%	6.9 ab	68.9	26.2	4.9
RSSC ≥ 14.0%	7.8 a	88.6	10.1	1.3
RTA 0.61-0.99%				
RSSC < 10.0%	4.8 de	24.6	40.4	35.1
RSSC 10.0-11.9%	5.3 cd	34.5	36.5	28.8
RSSC 12.0-13.9%	6.3 bc	61.1	25.0	13.9
RSSC ≥ 14.0%	7.3 ab	85.7	9.5	4.8
RTA ≥ 1.00%				
RSSC < 10.0%	3.7 f	8.3	33.3	58.3
RSSC 10.0-11.9%	3.3 f	11.1	22.2	66.7
LSD _{0.05}	1.1	–	–	–
P-value	0.0001			

¹ Degree of liking: 1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4 = dislike slightly, 5 = neither like nor dislike, 6 = like slightly, 7 = like moderately, 8 = like very much, 9 = like extremely.

² Same letters within the same column indicate no significant difference between means.