

CHEMICAL AND ORGANOLEPTIC DESCRIPTION OF WHITE FLESH NECTARINES AND PEACHES

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Additional index words : Stone fruit, quality, sensory evaluation, internal breakdown, ripening

Abstract

A large variability in titratable acidity (TA), soluble solids concentration (SSC), SSC/TA, and market life was found for several white flesh peach and white flesh nectarine cultivars growing under San Joaquin Valley, California conditions. This suggests that in order to avoid consumer confusion, a new classification of white flesh stone fruit based on acidity should be attempted. In general, white flesh nectarines were more flavorful, sweeter and more sour than white flesh peaches. Trained judges were able to detect differences in sweetness, sourness and peach or nectarine flavor intensity among cultivars. During ripening of white flesh peaches and nectarines, SSC did not increase nor did acidity decrease, thus, the SSC/TA remained the same. Because of this unique characteristic, most of the white flesh stone fruit can be eaten when still firm. A ripening treatment at the retailer or shipping point is not advised due to fast softening. In general, a longer market life (at least 5 weeks), based on mealiness, was measured on white flesh nectarine than on white flesh peach cultivars. In both cases, market life was longer than for most of the yellow flesh peach and nectarine cultivars. Because of their fast softening, careful postharvest temperature management is recommended.

Résumé

Une grande diversité dans l'acidité titrable (AT), la concentration en solides solubles (CSS), le rapport CSS/AT, a été trouvée chez plusieurs cultivars de pêches et nectarines à chair blanche cultivés dans les conditions de la vallée de San Joaquin en Californie. Ceci suggère qu'en vue d'éviter aux consommateurs des confusions, une nouvelle classification des fruits à noyau à chair blanche, basée sur l'acidité, doit être faite. En général les nectarines à chair blanche sont plus parfumées, plus douces et moins acides que les pêches à chair blanche. Des dégustateurs entraînés sont capables de détecter parmi les cultivars les différences de douceur, d'acidité et l'intensité de l'arôme des pêches ou nectarines. Pendant la maturation des pêches blanches et nectarines, la CSS ne s'accroît pas plus que l'acidité ne décroît ainsi CSS/AT reste le même. Du fait de cette unique caractéristique, la plupart des fruits à noyau à chair blanche peuvent être consommés alors que encore fermes. Un traitement de maturation chez le détaillant ou sur le lieu de

transport n'est pas recommandé du fait du ramollissement rapide. Sur les bases de l'apparition de la texture cotonneuse, on a constaté en général une plus longue vie des nectarines à chair blanche que des pêches à chair blanche au cours de la commercialisation (au moins de 5 semaines). Dans chaque cas, la vie commerciale est plus longue que celle de la plupart des cultivars de pêches et nectarines à chair jaune. Du fait de leur ramollissement rapide, des températures appropriées de conservation en post récolte sont recommandées.

1. Introduction

In recent years, total production of white flesh peaches and nectarines has increased rapidly. In general, these cultivars have low acidity although these acidity levels vary significantly among them. Consumer acceptance of low acidity fruit may vary according to individual consumer preference. Ethnic background may play an important factor in consumer acceptance in the search for new markets. In general, these new cultivars appear to be very popular among consumers with an Asian ethnic background. However, these cultivars are not well known by other American consumer ethnic groups and fruit acceptance by these groups remains to be seen. Information on the organoleptic description of these new cultivars and a better understanding of the relationship between ethnic background and fruit acceptance are fundamental to increasing white flesh peach and nectarine consumption.

To achieve this objective, we developed a data base on the chemical composition and organoleptic features of white flesh peach and nectarine cultivars to describe them.

2. Materials and Methods

During the 1995 and 1996 seasons, an evaluation of the chemical composition and market life of several white flesh peach and nectarine cultivars was carried out at the F. Gordon Mitchell Postharvest Laboratory (University of California, Kearney Agricultural Center). In addition, during the 1996 season, sensory evaluation was conducted with a trained taste panel.

2. 1. Quality evaluation

Fruit chemical composition of California-well mature (CA-well mature) fruit at harvest was evaluated for several white flesh peach and nectarine cultivars. Soluble solids concentration (SSC), titratable acidity (TA), and firmness were measured according to our quality evaluation protocol. Market life based on mealiness and internal browning development was evaluated for different white flesh peach and nectarine cultivars. Market life was calculated after 0°C and 5°C storage. In both cases, the end of market life was determined when more than 25% of the fruit were mealy and/or 15% of the fruit had at least 25% flesh browning.

2. 2. Sensory Evaluation

During the 1996 season, sensory perception of sweetness, sourness and peach or nectarine flavor intensity was conducted using a trained taste panel of 19 judges for 'Arctic Queen' and 'Arctic Rose' white flesh nectarines; 'Snow Brite', 'Sugar Giant', 'Sugar Lady', 'Summer Sweet', and 'White Lady' white flesh peaches; and 'O'Henry', a yellow flesh peach.

Each judge tasted 3 replicates of each cultivar. A sample consisted of a whole, ripened fruit at room temperature (20°C) presented in a dish labeled with a three digit random number. Samples were presented in random order in individual booths illuminated by fluorescent lighting. The judges were instructed to cut a longitudinal slice from the stem end to the blossom end from a cheek, then to taste it. Judges scored a sample by circling a hatch mark placed at increments of 0.5 cm on a 10-cm horizontal line anchored 1 cm from both ends of the line by "less" and "more". After tasting a sample, the judges placed the remainder of the whole fruit (approx. 3/4) back in the labeled dish for further chemical analysis of the individual fruit. Firmness, SSC, TA and pH were measured on each sample.

3. Results

3. 1. Quality Evaluation

3. 1. 1. Initial Quality

During the 1995 season, white flesh peach firmness measured on the cheeks varied from 49.8 to 65.8 N. The weakest position on the fruit also varied according to cultivar. Fruit firmness differences up to approximately 26.7 N were determined between the cheek and the weakest point on 'Snow Brite', 'Sugar Lady', and 'Snow Giant' cultivars. Fruit firmness within the fruit was more evenly distributed on 'Summer Sweet' and 'White Lady' peaches. A large variability in SSC, TA and SSC/TA was measured. Coefficients of variability of 13, 24, 2.8 and 410 were calculated for cheek firmness, SSC, TA and SSC/TA, respectively. 'Arctic Rose' nectarine had higher SSC and TA compared to the five tested peach cultivars (Table 1).

During the 1996 season, white flesh peach firmness measured on the cheeks varied from 41.8 to 75.1 N. The weakest position on the fruit also varied according to cultivar. Fruit firmness differences up to approximately 8.9-22.2 N between the cheek and the weakest point were determined in the different peach cultivars (Table 1). Coefficients of variability of 40, 66, 0.8 and 126 were calculated for cheek firmness, SSC, TA and SSC/TA, respectively. Levels of SSC (9.8-12.8%), TA (0.24-0.41%) and SSC/TA (25-47) varied among cultivars (Table 1). For all of the white flesh peach cultivars tested, they averaged approximately 53 N flesh firmness, 11.0% SSC, 0.31% TA, and 30 SSC/TA.

White flesh nectarine firmness measured on the cheeks varied from 42.2 to 80.5 N. The weakest position on the fruit also varied according to cultivar. Fruit firmness differences up to approximately 4.5-17.8 N between the cheek and the weakest point were determined in the different nectarine cultivars (Table 1). Coefficients of variability of 55,

54, 18, and 405 were calculated for cheek firmness, SSC, TA and SSC/TA, respectively. The level of SSC (10.0-17.4%), TA (0.33-1.45) and SSC/TA (10-45) varied among cultivars. For all of the white flesh nectarine cultivars tested, they averaged approximately 58 N flesh firmness, 14.0% SSC, 0.61% TA, and 26 SSC/TA.

Fruit acidity showed the least variability among fruit quality characteristics when harvested at the CA-well mature stage. Seasonal conditions (1995 vs. 1996) may slightly affect acidity levels in the white flesh stone fruit. We found that among the cultivars reported as low acid by the nurseries, there was a large variability in acidity and SSC/TA ratios. This suggests that in order to avoid consumer confusion, a new classification of white flesh stone fruit based on acidity should be attempted.

3. 1. 2. Quality after Ripening

During the last two seasons, ripening "off the tree" white flesh peaches and nectarines did not increase SSC nor decrease acidity, thus the SSC/TA remained the same (Table 2). This lack of acidity loss during ripening "off the tree" is a unique characteristic of these low acid white flesh stone fruit cultivars. In general, yellow flesh peaches and nectarines lose approximately 30-40% of the acidity measured at harvest after ripening, thus, their SSC/TA increases.

Also, a rapid rate of softening was observed in most of these white flesh cultivars. This very rapid softening rate may induce fast deterioration and potential decay. Because of this rapid softening and lack of acidity changes during ripening characteristics, we do not recommend that white flesh stone fruit be ripened at the shipping or retail points. Also, fruit temperature should be kept near 0°C during postharvest handling. This lack of acidity loss during ripening "off" the tree suggests that the climacteric may have occurred when the fruit were hanging on the tree.

3. 1. 3. Market Life

All of the white flesh nectarine cultivars tested had a market life of at least 5 weeks when stored at 0°C (Table 3). Market life was reduced to at least 3 weeks only on 'Arctic Queen', 'Bright Pearl', and 'Fire Pearl' when stored at 5°C. A market life of 3 weeks at 5°C is considered to be moderately susceptible to internal breakdown. Maximum market life was shorter for most of the white flesh peach cultivars than the nectarine cultivars. 'Snow Ball', 'Snow Giant', 'Snow Flame', 'Snow King', and 'Champagne' cultivars had at least 5 weeks of maximum market life. Market life at 0°C was 4.5 weeks for 'Snow Brite', 'Sugar Lady', and 'Summer Sweet' cultivars. 'White Lady' and 'September Snow' cultivars had the shortest maximum market life (4 weeks). Market life was reduced to 1.5 - 3 weeks at 5°C in most of these cultivars. 'Snow Flame', 'Snow Brite' and 'Champagne' cultivars had a minimum market life of approximately 5, 4.5 and 4 weeks, respectively. Higher decay incidence was observed in these white flesh cultivars than in the yellow flesh cultivars. *Botrytis cinerea* was identified in some of these cases.

3. 2. Sensory evaluation

For 'Arctic Queen' and 'Arctic Rose' white flesh nectarines; 'Snow Brite', 'Sugar Giant', 'Sugar Lady', 'Summer Sweet', and 'White Lady' white flesh peaches; and the standard yellow flesh peach, 'O'Henry', trained judges were able to detect differences in sweetness, sourness and peach or nectarine flavor intensity. Some of the tested cultivars were scored low (Table 4). Sweetness perception was highest in 'Arctic Queen' and 'Arctic Rose', intermediate in 'O'Henry', 'Sugar Lady', 'Sugar Giant', and 'Summer Sweet' and low in 'White Lady'. Peach or nectarine flavor perception was highest in 'Arctic Queen', 'O'Henry' and 'Arctic Rose', intermediate in 'Snow Brite' and 'Sugar Giant', and low in 'Sugar Lady', 'White Lady', and 'Summer Sweet'. Sourness perception was low in 'Summer Sweet', 'Sugar Lady', 'Snow Brite' and 'Sugar Giant', intermediate in 'Arctic Rose' and 'White Lady', and highest in 'Arctic Queen' and 'O'Henry' (Table 4).

4. Conclusions

A large variability in soluble solids concentration (SSC), titratable acidity (TA), SSC/TA, and market life was found for several white flesh peach and white flesh nectarine cultivars growing under San Joaquin Valley, California conditions. We found that among the cultivars reported as low acid, there was a large variability in acidity and SSC/TA ratios.

The white flesh peach cultivars tested, averaged approximately 53 N flesh firmness, 11.0% SSC, 0.31% TA, and 30 SSC/TA while the white flesh nectarine cultivars tested, averaged approximately 58 N flesh firmness, 14.0% SSC, 0.61% TA, and 26 SSC/TA.

During "off" the tree ripening of white flesh peach and nectarine cultivars SSC did not increase nor did acidity decrease, as occurs in most of the yellow flesh cultivars. Because of this unique characteristic, most of the white flesh stone fruit can be eaten when still firm (crunchy).

Trained judges were able to detect differences in sweetness, sourness and peach or nectarine flavor intensity perception among cultivars. In general, white flesh nectarines were more flavorful, sweeter and more sour than white flesh peaches among the tested cultivars. Some of the cultivars were scored low. It appears that flavor perception did not change after ripening because of the lack of acidity changes. Thus, fruit acceptance of relatively firm fruit should be high.

In general, a longer market life (at least 5 weeks), based on mealiness, was measured on white flesh nectarine than white flesh peach cultivars. In both cases, market life was longer than for most of the yellow flesh peach and nectarine cultivars.

Acknowledgements

We would like to thank the California Tree Fruit Agreement Promotion Committee for their financial support.

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Table 1 - Stone fruit quality measured at harvest, 1995 and 1996.

Cultivar	Date	Firmness (N)		SSC (%)	Acidity (%)	SSC/ Acidity
		Cheek	Weakest Point			
1995						
PEACH (white flesh)						
Snow Brite	13 Jun	49.8	6.6 (suture)	10.3	0.43	24
White Lady	26 Jun	61.8	11.7 (suture)	10.7	0.53	21
Sugar Lady	5 Jul	52.5	7.6 (suture)	11.5	0.34	34
Summer Sweet	10 Jul	65.8	12.0 (shoulder)	13.0	0.55	24
Snow Giant	4 Aug	51.6	6.7 (shoulder)	14.3	0.30	48
NECTARINE (white flesh)						
Arctic Rose	6 Jul	56.5	8.7 (suture)	18.7	0.62	30
1996						
PEACH (white flesh)						
Snow Brite	5 Jun	53.4	40.9 (tip)	10.8	0.30	36
Sweet Scarlet	7 Jun	44.0	36.9 (shoulder)	11.0	0.27	41
White Lady	19 Jun	60.0	37.4 (tip)	11.0	0.34	32
Sugar Lady	25 Jun	55.6	46.7 (suture)	12.6	0.27	47
Snow Ball	3 Jul	57.8	44.0 (shoulder)	10.6	0.32	33
Sugar Giant	8 Jul	47.6	36.9 (shoulder)	9.8	0.28	35
Summer Sweet	16 Jul	46.3	37.4 (shoulder)	11.8	0.34	35
Snow Giant	26 Jul	44.5	23.6 (shoulder)	11.6	0.37	31
Champagne	22 Jul	71.6	45.4 (shoulder)	12.0	0.41	29
Snow King	31 Jul	59.6	46.7 (shoulder)	11.6	0.27	43
September Snow	14 Aug	75.2	50.3 (shoulder)	10.8	0.31	35
NECTARINE (white flesh)						
Arctic Star	5 Jun	44.9	38.3 (shoulder)	11.3	0.42	26
Arctic King	13 Jun	42.3	34.7 (tip)	10.8	0.97	11
Arctic Glo	14 Jun	60.9	39.6 (tip)	14.4	1.45	10
Honey Kist*	18 Jun	65.8	44.5 (shoulder)	13.2	0.51	26
June Pearl	19 Jun	59.6	52.5 (suture)	10.0	0.39	26
Arctic Rose	3 Jul	75.6	62.3 (suture)	15.2	0.61	25
Arctic Queen	16 Jul	68.9	51.2 (shoulder)	17.4	0.59	30
Bright Pearl	22 Jul	56.5	41.8 (shoulder)	14.8	0.33	45
Fire Pearl	24 Jul	58.3	49.4 (shoulder)	15.8	0.37	41

* Yellow flesh, low acid.

Table 2 - Stone fruit titratable acidity (TA) changes during ripening "off" the tree, 1995 and 1996.

Cultivar	Harvest		Ripe	
	(%) Acidity	SSC/Acidity	(%) Acidity	SSC/Acidity
1995				
PEACH (white flesh)				
Snow Flame	0.70	16	0.73	15
Snow Brite	0.39	27	0.30	26
White Lady	0.53	20	0.38	30
Sugar Lady	0.34	34	0.36	32
Summer Sweet	0.55	24	0.58	22
Snow Giant	0.24	57	0.20	69
NECTARINE (white flesh)				
Arctic Rose	0.62	30	N.A.	N.A.
1996				
PEACH (white flesh)				
Snow Brite	0.29	41	0.31	38
Sweet Scarlet	0.25	44	0.24	47
White Lady	0.34	32	0.24	56
Sugar Lady	0.27	47	0.36	35
Snow Ball	0.32	33	0.39	27
Sugar Giant	0.28	35	0.31	32
Summer Sweet	0.34	35	0.40	30
Champagne	0.41	29	0.43	28
Snow Giant	0.37	31	0.31	37
Snow King	0.27	43	0.37	32
September Snow	0.31	35	0.33	33
NECTARINE (white flesh)				
Arctic Star	0.42	25	0.46	24
Arctic King	0.97	11	0.82	13
Arctic Glo	1.45	10	1.20	12
Honey Kist*	0.51	26	0.56	24
June Pearl	0.39	26	0.30	33
Arctic Rose	0.61	25	0.63	24
Arctic Queen	0.59	30	0.63	28
Bright Pearl	0.33	45	0.32	46
Fire Pearl	0.37	41	0.42	36

* Yellow flesh, low acid.

Table 3 - White flesh peach and nectarine market life based on flesh mealiness and browning.

	Harvest date	Market Life ^z (weeks)	
		Maximum 0°C	Minimum 5°C
PEACHES (white flesh)			
Snow Flame	1 Jun	5	5
Snow Brite	4 Jun	4.5	4.5
White Lady	18 Jun	4	2
Sugar Lady	24 Jun	4.5	3
Snow Ball	2 Jul	5+	4
Summer Sweet	14 Jul	4.5	2
Snow Giant	26 Jul	5+	3
Snow King	30 Jul	5+	1.5
Champagne	22 Jul	5	4
September Snow	12 Aug	4	3
NECTARINES (white flesh)			
Arctic Star	4 Jun	5+	5+
Arctic Glo	10 Jun	5+	5+
June Pearl	18 Jun	5+	5+
Arctic Rose	2 Jul	5	5+
Arctic Queen	7 Jul	5+	3
Bright Pearl	22 Jul	5+	3
Fire Pearl	24 Jul	5	3

^zThe end of market life was determined when more than 25% of the fruit were mealy or 15% of the fruit had at least 25% flesh browning.

Table 4 - Sensory evaluation for new stone fruit cultivars, 1996.

	Arctic Queen	Arctic Rose	Snow Brite	Sugar Giant	Sugar Lady	White Lady	Summer Sweet	O'Henry
Sweetness	4.5 ^z	4.6	3.2	3.4	3.2	2.4	3.7	4.0
Sourness	2.5	1.9	1.6	1.7	1.6	2.2	1.2	3.0
Flavor Intensity	3.9	3.8	2.8	2.9	2.6	2.2	2.6	4.3
SSC (%)	15.1	13.8	10.0	9.4	10.3	8.6	11.2	10.7
TA (%)	0.57	0.48	0.34	0.29	0.31	0.40	0.30	0.52
SSC/TA	26.9	29.5	29.6	33.7	35.1	22.2	38.8	20.7

^z Score: 0 = low, 10 = high