Objective and Sensory Evaluation of Fresh Fruit of Day-neutral Strawberry Cultivars

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Abstract. Sensory and objective attributes of fresh fruit of five locally grown day-neutral strawberry (Fragaria × ananassa Duch.) cultivars (Tristar, Tribute, Mrak, Yolo, and Selva) were compared to those of California-grown strawberries available in the Iowa markets. ‘Tristar’ and ‘Tribute’ fruit were redder and more sour than fruit of other day-neutral cultivars, and ‘Tristar’ fruit were the most juicy of the berries evaluated. ‘Tristar’ and ‘Tribute’ fruit had higher titratable acidity and lower Hunter L. (lightness) values than those of other evaluated fruit. Sensory panelists rated the California-grown berries as the least red.

Day-neutral strawberry cultivars have been introduced as strawberries capable of producing high quality fruit throughout the growing season (Draper et al., 1981). A longer season of production would benefit growers because of higher yields and higher out-of-season prices. Consumers may benefit from locally grown fruit that may be higher quality and more flavorful than those grown elsewhere. Preliminary marketing analysis of day-neutral strawberries indicated that Iowa consumers preferred the flavor of locally available day-neutral cultivars compared with berries transported from out-of-state regions (Nonnecke and Hayenga, 1989).

The objectives of our study were to 1) compare the sensory characteristics of five day-neutral strawberry cultivars with strawberries available in a supermarket during late summer, and 2) determine the physical and chemical characteristics of the day-neutral cultivars.

Five day-neutral strawberry cultivars (Tristar, Tribute, Mrak, Yolo, Selva) were grown following standard horticultural practices at the Iowa State Univ. Horticulture Station, Ames, during the 1989 season. Harvest dates and frequency of harvest are listed in Table 1. California-grown strawberries (Driscoll Strawberry Assocs., Watsonville, Calif.) were purchased from a commercial establishment at each of the seven harvest dates. The California-grown fruit represents the strawberries available locally in August and September, and was not the same cultivar as any of the Iowa-grown cultivars.

Table 1. Harvest dates for day-neutral strawberry cultivars.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tristar</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tribute</td>
<td>0</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mrak</td>
<td>X</td>
<td>X</td>
<td>0</td>
<td>X</td>
<td>0</td>
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<td>X</td>
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<tr>
<td>Yolo</td>
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<td>X</td>
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<td>X</td>
<td>0</td>
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<td>X</td>
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<tr>
<td>Selva</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

*Harvest dates 1, 2, 3, 4, 5, 6, and 7 were 28 July, 2, 7, 11, and 15 Aug. and 13 and 19 Sept., 1989, respectively. X = harvest, and 0 = no harvest.
pressed in Newtons. A mean of 10 measurements of force (kgf) to break the skin of the probe moved through the entire berry. The amounts of force (kgf) to puncture the flesh and core were extracted from a commercial source; day-neutral cultivars were grown at Iowa State Univ., Horticulture Station, Ames.

Mean separation within columns, P < 0.05. Lack of letters = differences nonsignificant.

California-grown strawberries (cultivar unknown) were purchased from a commercial source; day-neutral cultivars were grown at Iowa State Univ., Horticulture Station, Ames.

Expressed as percent citric acid by titration of 5 g puree to pH 7 with 0.1 N NaOH.

Standardized with Hunter L = 34.2, a = 50.2 and b = 20.9; hue angle = tan⁻¹(b/a), saturation index = [(a+b)²]¹/₂.

Instron Universal Testing Machine (kgf x 9.8 = N).

7.0 with 0.1 N sodium hydroxide, and reported as percentage of citric acid.

SSC (percent) was determined by extruding a sample of puree through two layers of tissue paper onto the lens of a Reichert-Jung refractometer (0–50 °Brix). The pH of strawberry puree of each cultivar was measured with a Fisher (Model 640A) pH meter.

The color of strawberry puree of each cultivar was measured with a Hunter (Model 640A) phosphorimeter (Ourecky and Bourne, 1963). Each berry was selected from students, staff, and faculty at Iowa State Univ.

At each harvest date, washed ripe berries with attached sepals were used for evaluation of the local day-neutral cultivars and California-grown strawberries. Two randomly selected berries of each cultivar were placed into individual styrofoam cups and coded with randomly selected three-digit numbers. Panelists were in individual booths and were instructed to rinse their mouths with water between samples. Unsalted crackers were also provided.

Panelists received samples of each cultivar and were instructed to sample randomly. They were instructed to grasp the berry at the stem end and bite through the middle of the berry. A 17-cm line scale was used to evaluate color, firmness, juiciness, sourness, sweetness, and fruit flavor. Green, mushy, extremely dry, no sourness, no sweetness, and no fruit flavor; 17 = deep red, extremely firm, extremely intense sourness, extremely intense sweetness, and extremely intense fruit flavor.

Sensory evaluation of strawberries was completed by a 12-member trained sensory panel according to procedures described by Heintz and Kader (1983). Panelists were present at several cultivars and a range of degrees of ripeness in six training sessions during June and July. Panel members were selected from students, staff, and faculty at Iowa State Univ.

Each panelist evaluated a cultivar, least significant differences (LSD) at P = 0.05 were calculated.

The pH of ‘Tristar’ and ‘Tribute’ fruit was lower than that of California-grown fruit or that of ‘Yolo’, ‘Selva’, and ‘Mrak’ Iowa fruit (Table 2). Titratable acidity of ‘Tristar’ and ‘Tribute’ cultivars was higher than that of California-grown or local ‘Mrak’, ‘Yolo’, and ‘Selva’ fruit. Fruit of ‘Mrak’ and ‘Yolo’ had a higher SSC than fruit of California-grown strawberries or Iowa-grown ‘Tribute’ and ‘Selva’ strawberries.

Hunter L values indicated that California-grown fruit was the lightest (L = 33.2) followed by ‘Selva’ and ‘Mrak’, ‘Yolo’, ‘Tribute’, and ‘Tristar’, respectively (Table 2). ‘Tristar’ and ‘Tribute’ fruit had the highest Hunter a values, indicating the most intense red color, while the California-grown fruit had the lowest ‘a’ value. The Hunter a value is a reliable test for redness among strawberry cultivars (Sistrunk and Morris, 1985). Sistrunk and Moore (1979) reported that strawberry selections containing 20% titratable acidity and high Color Difference Meter ‘a’ values were rated higher in quality attributes by a sensory panel. In a similar study, high acidity and low pH values were found to stabilize strawberry color in frozen fruit (Sistrunk and Morris, 1985).

and ‘Selva’ were similar in redness (Table 2). The California-grown fruit was the least red of all cultivars compared. Differences in redness by hue angle values were not as great as indicated by Hunter a values.

The saturation index (S.I.) or chroma for California-grown fruit was lower than the S.I. values for the Iowa-grown day-neutral cultivars (Table 2). The S.I. values for ‘Tristar’, ‘Tribute’, ‘Mrak’, and ‘Selva’ were similar.

The amount of force required to puncture the skin of the berries was similar among cultivars. The internal flesh and core, as a unit, of ‘Selva’ fruit was firmer than that of all berries but ‘Tribute’.

The sensory evaluation results for color, firmness, sourness, and sweetness correspond well with the color measurements, Instron firmness, titratable acidity, and SSC, respectively.

Sensory panelists judged ‘Tristar’ and ‘Tribute’ fruit to be the most intensely red cultivars (Table 3). California-grown fruit was the least red. Luby et al. (1987) reported that ‘Tribute’ and ‘Tristar’ fruit had higher sensory color scores (7.1 and 7.0, respectively) than did the reference California-grown strawberry (6.2). Draper et al. (1981) also described the skin color of ‘Tristar’ and ‘Tribute’ as a glossy deep red.

Sensory firmness values among berries were similar. Luby et al. (1987) reported that ‘Selva’ fruit were rated fair (5.8) and ‘Tristar’ and ‘Tribute’ were rated good (6.7 and 6.9, respectively) in texture 16 h after harvest, but ‘Tristar’ and ‘Tribute’ were not different from the reference California-grown sample (6.4).

Sensory panelists rated ‘Tristar’ and ‘Tribute’ fruit as the most juicy and the most sour (Table 3). Luby et al. (1987) also reported that ‘Tribute’ and ‘Tristar’ fruit were described as tart by sensory panelists.

Sweetness and flavor were perceived as similar among the strawberry cultivars, but California-grown and ‘Selva’ fruit had less fruit flavor than ‘Tristar’ or ‘Yolo’ (Table 3). Luby et al. (1987) reported lower flavor scores for ‘Selva’ (4.9) compared with a reference sample (6.0), ‘Tristar’ (6.7), and ‘Tribute’ (6.5). Strawberries with desirable redness and with a good balance of acidity and sugars usually are rated high in flavor quality by sensory panels (Sistrunk and Morris, 1985).

The quality of Iowa-grown day-neutral cultivars used in this study rated favorably when compared with the California-grown strawberries available in markets in August and September. The results of this study suggest that locally grown fruit should be able to compete in the market with California-grown strawberries. Additional research on day-neutral cultivars should consider storage quality and consumer attitudes about strawberries that are redder and tarter than California fruit available in the supermarket.

Literature Cited


