Philosophical Approach to Tomato Breeding - Is There Flavor Out There?

Jay Scott
University of Florida
LET’S TAKE A LOOK AT FRESH MARKET TOMATOES!
TYPES OF TOMATOES TYPICALLY IN THE USA SUPERMARKET 2011

- LARGE ROUND - Field grown
- LARGE ROUND - Greenhouse grown
- TOMATOES ON THE VINE (TOV) - Greenhouse grown
- PLUM TOMATOES - Field grown
- COCKTAIL TOMATOES - Compari, Amarosa etc. - Greenhouse grown
- GRAPE TOMATOES - Field grown
- HEIRLOOMS - Ugly Ripe
## Relative Importance of Tomato Quality Attributes

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>JUDGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRODUCER</td>
</tr>
<tr>
<td>APPEARANCE</td>
<td>XX</td>
</tr>
<tr>
<td>FIRMNESS</td>
<td>XX</td>
</tr>
<tr>
<td>SHELF LIFE</td>
<td>X</td>
</tr>
<tr>
<td>RIPENING BEHAVIOR</td>
<td>XX</td>
</tr>
<tr>
<td>TEXTURE</td>
<td></td>
</tr>
<tr>
<td>NUTRITION</td>
<td></td>
</tr>
<tr>
<td>FLAVOR</td>
<td></td>
</tr>
<tr>
<td>FRUIT SIZE</td>
<td>XX</td>
</tr>
<tr>
<td>YIELD</td>
<td>XXX</td>
</tr>
<tr>
<td>DISEASE RESISTANCE</td>
<td>XXX</td>
</tr>
<tr>
<td>EASE OF HARVEST</td>
<td>XX</td>
</tr>
</tbody>
</table>
TOMATO BREEDING DIRECTIONS (1998)

1. PREMIUM VARIETIES
2. GEMINIVIRUS RESISTANCE
3. BACTERIAL SPOT RESISTANCE
4. INTEGRATION OF ABOVE & OTHER PROJECTS
TOMATO FLAVOR COMPONENTS

I. ENVIRONMENTAL
   ▶ A. BEYOND CONTROL - SUNLIGHT, RAINFALL, SOIL TYPE
   ▶ B. WITHIN CONTROL - IRRIGATION, FERTILIZER

II. GENETIC
   ▶ A. SUGARS
   ▶ B. ACIDS
   ▶ C. VOLATILES
SOL. SOLIDS & TITRATABLE ACIDS

SS

TA

6.3

4.4

SSMG

RINBR

TOMATO CULTIGENS
<table>
<thead>
<tr>
<th>(F_2) PARENTS</th>
<th>PLANT NO</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>7060 x 7171</td>
<td>60</td>
<td>4</td>
<td>29 (55) (z)</td>
<td>16 (27) (y)</td>
<td>9</td>
<td>2 (18) (x)</td>
</tr>
<tr>
<td>7547 x 950042</td>
<td>85</td>
<td>6</td>
<td>35 (48) (z)</td>
<td>20 (24) (y)</td>
<td>16</td>
<td>8 (28) (x)</td>
</tr>
<tr>
<td>7692 x 964087</td>
<td>89</td>
<td>10</td>
<td>42 (58) (z)</td>
<td>19 (21) (y)</td>
<td>15</td>
<td>3 (20) (x)</td>
</tr>
</tbody>
</table>

\(z\) Numbers in parentheses in column are percentage of 1 + 2 over total number
\(y\) Numbers in parentheses in column are percentage of 3 over total number
\(x\) Numbers in parentheses in column are percentage of 4 + 5 over total number
TOMATO FLAVOR NOTES

1. BITTER
2. MUSTY (DIRTY SOCKS)
3. ASTRINGENT (DELTA)
4. ETHANOLIC (MTOH)
5. METALLIC
6. SOUR (OVERRIPE)
7. VEGETATIVE (GRASSY)
8. BLAND
9. SWEET
10. ACID
11. BALANCED
12. FRUITY/FLORAL
Parents of Tasti-Lee Hybrid

Tasti-Lee

Fla8059

Fla7907
Tasti-Lee™ (‘Fla. 8153’) Features

- Seed Available from Bejo Seeds
- Contact Greg Styers:
  - Email: G.styers@bejoseeds.com
  - Phone: 805-689-1627
- High Lycopene crimson \((og^c)\) gene
- Superior Flavor
- Heat-Tolerant
- Fusarium Wilt Race 1, 2, & 3 Resistant
- Candidate For Premium Tomato Market
Overall Flavor Sensory Panel Data
Fall 2004 (GCREC) and Winter 2005 (TREC)

Rated on a scale of 1-9 where higher numbers mean better flavor.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Overall Flavor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall '04</td>
</tr>
<tr>
<td>Fla. 8408</td>
<td>5.77 a</td>
</tr>
<tr>
<td>Tasti-Lee</td>
<td>5.35 a</td>
</tr>
<tr>
<td>Sanibel</td>
<td>-</td>
</tr>
<tr>
<td>Florida 47</td>
<td>4.43 b</td>
</tr>
<tr>
<td>Florida 91</td>
<td>4.35 b</td>
</tr>
<tr>
<td>Solar Fire</td>
<td>3.74 bc</td>
</tr>
<tr>
<td>Ugly Ripe</td>
<td>3.35 c</td>
</tr>
</tbody>
</table>

Z Ugly Ripe was store bought, all other harvested table ripe in Fall '04 and breaker in Winter '05.

Y Mean separation in columns by Duncan’s multiple range test at p < 0.1.
## Sensory Panel Data

**Balm, Spring 2005**

Rated on a scale of 1-9 where higher numbers mean better flavor or more sweetness or acidity

<table>
<thead>
<tr>
<th>Variety</th>
<th>Overall Flavor</th>
<th>Sweetness</th>
<th>Acidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fla. 8393</td>
<td>5.38 a&lt;sup&gt;y&lt;/sup&gt;</td>
<td>4.52 ab</td>
<td>5.28 a</td>
</tr>
<tr>
<td>Tasti-Lee</td>
<td>5.35 a</td>
<td>4.62 a</td>
<td>4.41 b</td>
</tr>
<tr>
<td>Fla. 8408</td>
<td>5.17 a</td>
<td>4.83 a</td>
<td>3.79 b</td>
</tr>
<tr>
<td>Florida 47</td>
<td>4.00 b</td>
<td>3.93 bc</td>
<td>3.76 b</td>
</tr>
<tr>
<td>Store-F</td>
<td>3.59 b</td>
<td>3.66 c</td>
<td>2.74 c</td>
</tr>
<tr>
<td>Ugly Ripe</td>
<td>3.35 b</td>
<td>3.55 c</td>
<td>3.90 b</td>
</tr>
</tbody>
</table>

<sup>Z</sup> All harvested at table ripe stage except Store F and Ugly Ripe were store bought

<sup>Y</sup> Mean separation in columns by Duncan’s multiple range test at p < 0.1
Flavor Summary for ‘Tasti-Lee’ at Release in 2006

Sensory panel:

- Consistent performance, always in most preferred group, significantly better than Florida 47 and any other commercial variety in 6 of 7 panels, always more preferred than store-bought samples.

- Chemistry: Tendency to be higher in soluble solids but especially sugars, good acid balance, nothing clear on volatiles yet (need to analyze further).
Marketable yield, fruit size, and culls for tomato hybrids grown at Pine Island Farms, Dade County, Florida. Winter 2010.

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Marketable yield (25 lb box/A)</th>
<th>Fruit size (g)</th>
<th>Culls (% by wt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fla. 8314</td>
<td>1806 a²</td>
<td>144 e</td>
<td>29 d</td>
</tr>
<tr>
<td>Fla. 8455</td>
<td>1538 ab</td>
<td>183 ab</td>
<td>32 cd</td>
</tr>
<tr>
<td>Tasti-Lee</td>
<td>1529 ab</td>
<td>154 de</td>
<td>33 b-d</td>
</tr>
<tr>
<td>Sanibel</td>
<td>1478 ab</td>
<td>175 bc</td>
<td>43 ab</td>
</tr>
<tr>
<td>Fla. 8787</td>
<td>1301 ab</td>
<td>187 ab</td>
<td>41 a-c</td>
</tr>
<tr>
<td>Florida 47</td>
<td>1267 ab</td>
<td>195 a</td>
<td>41 a-c</td>
</tr>
<tr>
<td>Tribeca</td>
<td>1242 b</td>
<td>162 cd</td>
<td>48 a</td>
</tr>
</tbody>
</table>

² Mean separation in columns by DMRT at P ≤ 0.05.
TBRT ’06: Why Tasti-Lee Will Not Succeed

1) There is no category for such a tomato and it will not get shelf space
2) No one is interested in such a tomato, it is a threat to present business practices
3) The flavor is not good enough to make a difference
4) Etc.
TBRT ’06: Why Tasti-Lee Will Succeed, Change the Entire Fresh Market Tomato Industry and Usher in World Peace

1) Good Marketing Strategy Employed
2) Good Field Production, Reliability
3) Consistent Superior Flavor and Color Quality
4) Health Aspects
The next best thing: Does Jay Scott hold the future of decent store-bought tomatoes in his hands?

By Barry Estabrook
Special to The Washington Post
Wednesday, May 5, 2010
J. Scott’s Vision for the Florida Tomato Industry of the Future

- **Food Service:** Mature green tomato varieties, will be jointless, CGH types that will not be staked and harvested by machine.
- **Supermarket:** Vine–ripe tomato varieties of the Tasti-Lee type will be staked and hand harvested.
Tasti-Lee: The Present

1. There is supermarket demand-expanding
2. Overall the fruit quality has been very good—will it continue?
3. Selling at $2.49/lb, growers get $1.25/lb.
4. Three growers “all in”, most growers business as usual.
TOMATOLAND

How Modern Industrial Agriculture Destroyed Our Most Alluring Fruit

BARRY ESTABROOK
Building a better Florida tomato

It may not be a scientific breakthrough on the order of curing cancer, but a University of Florida horticulturist has proven if you build a better tomato, the world may well beat a path to your dinner table. The Tasti-Lee is the result of five years of experimenting, teamwork and patience paying off in a mass market tomato that actually tastes like a tomato. If those sorts of skills can produce a tastier tomato, surely Washington could rely on those values to produce more jobs and a tidier federal budget.

Working out of UF’s research laboratory in Hillsborough County, Jay Scott combined two strains of tomato to create the Tasti-Lee, a rich crimson variety that retains a juicy, flavorful sweetness. Think of the Tasti-Lee as the Gatorade of fruit. For this is not merely some idle culinary curiosity. It is enhanced economic development on the vine. Florida accounts for nearly one-third of all fresh tomatoes grown in the United States and almost all tomatoes harvested during the fall and winter.

With the recent publication of Barry Estabrook’s Tomatoland, a harsh criticism of an agricultural industry that too often grows a rock-hard, bland product engineered more for portability than flavor, Scott’s Tasti-Lee could go a long way toward revitalizing the state’s reputation for quality, consumer-friendly produce.

The Tasti-Lee raises expectations Americans should demand from the farmland and the homeland. A country with the innovation and determination to grow a tastier tomato ought to be able to come together to produce a more fertile economy and a more sustainable budget.
THE
END