Flavor and Consumer Science for Supply Security and Flexibility in the HLB Era

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Packinghouse Day

August 24, 2017
Citrus Supply Risks

Inclement Weather
- Freeze
- Hurricane

Diseases
- Cankar
- HLB
- CTV
- Black spot

Others
- Regulations
Flavor and Consumer Science for

- Raw Material Supply Security & Flexibility
- Signature & Quality

Solution for Extreme Supply Scenarios
The **consumer** is the key driver for product success in the contemporary marketplace.

Flavor is key to consumer preference ...
Consumer Acceptance

Sensory Attributes:
- flavor
- bitterness
- texture
- overall appearance
- sourness
- sweetness

Demographic Factors:
- age
- eating history
- race
- attitude
- education level
- genetics
- gender
Flavor... its origin and fade is complex.

Raw Materials

DNA → Ribose → Glucose

Protein → Amino Acid

Sugars

Maillard Reaction (High Heat)

New Flavors

Brown Color

Amino Acids
UF/CREC Sensory and Consumer Science

food and agricultural commodities

chemical stimuli

? study targets (variety, terroir, processing)

Instrumental characterization

GC-MS/MS
GC × GC
GC/O

UPLC-TOF/MS
UPLC-MS/MS
NMR

vaplates & non-volatiles

PLS regression

sensory profiles

relationships between analytical compounds & sensory attributes

selection of most significant variables

predictive models

sensory analysis

trained panel

flavor sensory attributes

UF/CREC Flavor Program

consumer preference
development of new variety
processing modification

UF/CREC Sensory and Consumer Science
Sugar Belle VS. Sunburst
Sugar Belle VS. Sunburst

overall acceptance

9-Point Hedonic Scale

<table>
<thead>
<tr>
<th>9</th>
<th>Like Extremely</th>
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<tbody>
<tr>
<td>8</td>
<td>Like Very Much</td>
</tr>
<tr>
<td>7</td>
<td>Like Moderately</td>
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<tr>
<td>6</td>
<td>Like Slightly</td>
</tr>
<tr>
<td>5</td>
<td>Neither Like nor Dislike</td>
</tr>
<tr>
<td>4</td>
<td>Dislike Slightly</td>
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<tr>
<td>3</td>
<td>Dislike Moderately</td>
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<tr>
<td>2</td>
<td>Dislike Very Much</td>
</tr>
<tr>
<td>1</td>
<td>Dislike Extremely</td>
</tr>
</tbody>
</table>
Sugar Belle VS. Sunburst

Overall Acceptance
Overall Flavor
Sweetness
Sourness
Bitterness

The Take-Home Message
UF914 VS. Ray Ruby
UF914 VS. Ray Ruby

Overall acceptance

The difference of overall acceptance between two varieties is statistically highly significant based on ANOVA analysis.
UF914 VS. Ray Ruby

- **Flavor intensity**
  - UF914: 6.26
  - Ray Ruby: 5.64
  - *P=0.073062, no significant difference*

- **Sourness intensity**
  - UF914: 4.13
  - Ray Ruby: 4.98
  - *P<0.05*

- **Sweetness intensity**
  - UF914: 5.2
  - Ray Ruby: 4.33
  - *P<0.05*

- **Bitterness intensity**
  - UF914: 4.49
  - Ray Ruby: 4.59
  - *P=0.807, no significant difference*
UF914 VS. Ray Ruby

Overall Acceptance
Overall Flavor
Sweetness
Sourness
Bitterness
950 VS Cuties

55 people
Age range: 22---65

Flavor
- Overall Flavor
- Sweetness
- Sourness
- Bitterness

Texture
- Melting
- Firm
- Chewy

Interior Color

Sample Preference
49 out of 55 people prefer 950

Overall Flavor

Melting
Color
Sweetness

Melting
950: 3
Cuties: 2

Good Interior Color
950: 5
Cuties: 4

Sweetness
950: 8
Cuties: 6

p<0.05
49 out of 55 people prefer 950

Sourness
Bitterness

Overall Flavor

Sourness
- 950
- Cuties

Bitterness
- 950
- Cuties

p < 0.05
**Bingo vs Halos**

**Database for Citrus Variety**

- **47 panelists**
- **Age:** 3 to 65

**Bar Chart**

- **Overall...**
- **Sweetness**
- **Sourness**
- **Bitterness**

- **Halos**
- **Bingo**

**Significant different**

**p<0.05**
Adult consumers tend to cluster into more groups than those of children.

The majority of adults and children are positively driven by sweetness, overall flavor, juiciness, and ease of peel while a distinct group of adult consumers show a strong preference for more acidic fruit.

The current maturity index used by citrus growers, Brix/Acid ratio, was not consistent in predicting consumer liking.

Fruit texture is an important driver for consumer liking.
Flavor and consumer Database for Citrus Variety

CREC Breeding Program
A Collection of 15,000 Varieties
Year 2017-2018

1. Flavor and consumer science study for HLB tolerant varieties

2. Support growers for choosing the right new varieties