What do consumers really care about in fresh citrus?

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What are consumers looking for in fresh fruit like citrus

- Color
- Freedom from defects or decay
- Size (depends on intended use)
- Anticipated flavor
- Good texture (not too tough, not too soft)
- Perceived health benefits

External characteristics determine initial purchase

- Color (internal & external)
- Shape
- Size
- Decay
- Visible defects
- Peel luster
- Citrus type

Color

- Orange color increases over the season for early-mid fruits due to cold night temperatures
- This causes chlorophyll (green pigment) to degrade and the carotenoids (orange pigments) to increase
- Early fruit may require degreening with ethylene gas, which promotes chlorophyll breakdown
- Sometimes a color like CR#2 can be added

Use of waxes

- Add gloss or shine to fruit; shiny fruit sell better
- Reduce water loss that leads to shriveling of fruit (visible defect) and reduces fruit weight loss
- Reduces appearance of defects

Citrus waxes

- Shellac coatings – shiniest, but can cause anaerobic off-flavors; impart some water loss control
- Carnauba wax – some shine, good water loss control, more permeable to oxygen
- Most packers are using coating mixtures of these 2 compounds to get benefits of both
- Mix fungicides imazalil or thiabendazole (TBZ) in waxes to control PH decay
Decay

- Visual defect
- “Ick” factor
- Grey mold (*Botrytis cinerea*)
- Green mold (*Penicillium digitatum*)
- Blue mold (*Penicillium italicum*)
- Stem end rot (*Diplodia natalensis*)

Internal and secondary characteristics

- Flavor
- Texture
- Juiciness
- Anticipated health benefits
- Number of seeds
- Ease of peeling

Flavor

- Sweetness due to sugars (sucrose, glucose and fructose) often measured as soluble solids or Brix
- Acidity due to acids (citric and malic) often measured as titratable acidity (citric acid equivalents)
- Sweet/sour due to solids/acids ratio
- Aroma due to a delicate balance of 30-40 aroma volatiles including esters, aldehydes, ketones, sesquiterpenes and terpenes
- Bitterness due to limonin and nomilin
- Astringency due to flavonoids

Health benefits

- Potassium
- Ascorbic acid
- Folate
- Flavonoids, (such as naringin, hesperidin, neohesperidin, citronin, narirutin)
- Polymethoxylated flavones (such as tangeritin, nobilitin, sinensetin and others)
- Carotenoids (such as β-cryptoxanthin, α- and β-carotene, lutein, and zeaxanthin in general, and lycopene (blood oranges and red grapefruit)

Storage disorders affecting appearance or eating quality

- Chilling injury (CI) resulting in long term storage below 12°C results in visible defects like pitting
- Preconditioning with hot water or air can help prevent CI
- Stem end (styler end) breakdown
- Granulation of juice vesicles
- Peel pitting due to humidity/warm temperature and possibly in conjunction with coatings

Study on tangerines

Mall intercept interviews conducted by Ipsos-Reid
153 conducted January 22-29, 2008 (6 varieties)
154 conducted April 3-10, 2008 (4 varieties)
158 conducted October 22-30, 2008 (5 varieties)

Each set contained interviews in Chicago, Baltimore, and Tampa

Collected data on:
- Demographics of participants
- Sensory characteristics of tangerines
- Purchase usage and habits
- Perception of general attributes of citrus
Sensory ratings

• Analyzed which sensory characteristics statistically influence the rating of each tangerine
• Sweetness, Shape, Acidity, Overall Flavor and Juiciness were most influential
• Size (for adults only), color, and amount of seeds were influential, but to a smaller degree
• Only overall appearance was not significantly related for both adults and children
• Size was not significantly related for children

Flavor preferences for tangerine

• The most important sensory characteristics were: Sweetness, Shape, Acidity, Overall Flavor and Juiciness
• Ease of peel was excluded due to collection issues
• The most important general attributes were freshness, overall flavor, overall appearance, and juiciness

Importance of general attributes

Conclusions

• Freshness, flavor, appearance and price appear to be important features consumers are looking for in tangerine and likely can extrapolate to other citrus types
• Size, ease of peeling and seediness were surprisingly less important

Questions?