

Textural Quality of Fresh-cut Tommy Atkins and Kent Mangos

The Big Picture:

A wide variety of fresh-cut fruits and vegetables are available in today's marketplace for consumers to choose. What appeals to consumers, in addition to convenience, is the availability of fresh, flavorful and ready-to-eat fruit pieces they can take home and enjoy without any preparation. However, fresh-cut fruits are susceptible to several quality issues within the fruit; affecting the fruit's texture, color, shelf-life and much more.

To increase the quality of fresh-cut mangos, the National Mango Board (NMB) commissioned a research study to evaluate the textural quality of fresh-cut mangos and identify the optimal ripeness stage for fresh-cut processing. The study was conducted by Dr. Diane M. Barrett, Dept. Food Science & Technology, Dr. Elizabeth J. Mitcham, Dept. Plant Sciences from University of California – Davis and Panita Ngamchuachit, Food Science & Technology- PhD student. The researchers first conducted a preliminary study on Tommy Atkins to assess whether there are normal qualitative differences in color, texture and composition in different positions within a single mango. Each mango was sliced into 2 slabs and a 5 mm diameter section of the peel was removed. Inner and outer color and firmness were evaluated in 2 different positions in the outer flesh (just under the peel) and in 4 different positions on the inner flesh (near seed side) to examine level of firmness, color, soluble solids content, titratable acidity, sugar:acid ratio and pH.

Second, Tommy Atkins mangos with 4 different firmness levels, from soft to firm (e.g. 0.5, 7.5, 10 and 12 lbs) were then put through the fresh-cut process (cubes) and evaluated for visual quality, color, firmness, soluble solid content, titratable acidity and pH on days 1, 3, 5, 7 and 9 of storage at 5°C (41°F). Third, researchers then examined the influence of ripeness stage (6, 8, and 10 lbs) at the time of fresh-cut processing of 'Kent' and 'Tommy Atkins' mangos on sensory and textural quality of fresh-cut mangos.

Results from the researchers' consumer test revealed nearly half (47%) of those surveyed (140 participants) preferred Kent mango cubes prepared from all ripeness stages (6, 8 and 10 lbs.), followed by 39% who preferred Tommy Atkins mango cubes with initial firmness of either 6 or 8 lbs. This indicates the Kent mango cultivar is particularly desirable for production of fresh-cut mangos, since consumers did not discriminate between the three tested ripeness stages. Even firmer (10 lbs. initial firmness), Kent mangos were desirable; which are better for shipping. For fresh-cut Tommy Atkins, the mango industry should be more concerned with the initial ripeness stage at the time of cutting in order to meet consumer needs.

Overall Findings:

- **Preliminary test results on Tommy Atkins variety for variability in texture, color, soluble solids content, titratable acidity and pH within a single mango.** The following results should be considered when mangos are used for fresh-cut products.
 - **Firmness-** Inner flesh (near the seed) has a softer texture with an average of 5.5-6 lbs. versus the outer flesh (near the peel) with 5-7.5 lbs.
 - Outer flesh firmness was higher at the blossom end than the stem scar end by 1.5 lbs.

- **Color**- Specific color values were measured on different positions of mango slabs (blossom end, stem scar end, inner and outer flesh).
 - Tommy Atkins mangos are more yellow along the stem scar to blossom ends of the mango slab. Along the side positions of the mango slabs they are greener, as well as at the blossom end of the outer flesh.
- Results from firmness and color testing indicate ripening initiates from the center (near the seed area) and then spreads out to the outer part of the flesh (near the peel) in mangos.
- **Soluble solids, Titratable acidity, Sugar:acid ratio and pH**
 - There was no significant effect of position in the mango slab on soluble solids content.
 - Acidity was higher along with a correspondingly lower pH in the stem scar and blossom ends of the mango slab.
 - Sugar:acid ratio was higher at the positions along the sides of the mango than in the stem scar and blossom ends.
- **Fresh-cut processing of Tommy Atkins, quality evaluation and observation of quality changes during storage at 5°C (41°F).**
 - **Visual quality** of mango cubes declined faster in mangos with lower firmness at the time of cutting.
 - The ripest mango (0.5 lbs. outer flesh firmness at the time of cutting) rapidly reached the limit of usability stage, which is less likely to be used and marketed because of poor visual quality, in less than 2 days, with very high levels of translucency.
 - Whole mangos that were 7.5, 10 and 12 lbs. at the time of cutting were equally marketable until day 5, at which time the 12 lbs. mangos had higher quality until day 9 of storage.
 - **Firmness**- Mangos with an initial firmness of 7.5 lbs. or greater will have **no significant change** in quality of fresh-cut mango cubes during storage.
 - The firmness of cubes taken from the outer-side slab was higher than those from the inner-side slab, except for the ripest fruit (0.5 lbs.), which had about the same low level of firmness throughout the 9 days of storage.
 - There were few significant changes in mango cube firmness during the 9 day storage period as well, but there was an insignificant decrease in outer-side cube firmness during the last few days of storage.
 - **Color**- Tommy Atkins mangos with an initial firmness of 7.5 – 12 lbs. **will retain** color in fresh-cut stored products.
 - Firmer mangos showed a slower browning rate, yellow color reduction rate and color saturation reduction rate, as compared to cubes cut from mangos that were initially softer (.5 lbs.).
 - **Soluble solids content, Titratable acidity and pH**- There was no significant change in Tommy Atkins mango cubes stored at 5°C (41°F) in all ripeness stages (0, 7.5, 10 and 12 lbs.).
 - Mango cubes prepared from the ripest mangos (0.5 lbs.) showed significantly lower soluble solids content, titratable acidity and pH during storage.
 - This may resulted from dissimilarity of harvest maturities of the mangos from the same initial firmness.
- **Consumer tests were conducted to evaluate the influence of ripeness stage at the time of fresh-cut processing of Kent and Tommy Atkins mangos on sensory and textural quality of fresh-cut mangos.** Firmness measurements of whole mango fruit can be used as an indicator for sorting mangos preferable for fresh-cut processing.

- Compared to other groups, fresh-cut Tommy Atkins mangos with an initial firmness of **10 lbs.** and **8 lbs.** were:
 - More acidic and green aroma
 - Appeared sharper at the cut edge
 - Felt more fibrous and had a starchy aftertaste
 - Greater tartness, bitterness and astringency
- Mangos cut from Tommy Atkins at **6 lbs.** tended to have a glossier and moist appearance, with fibrousness at the cut edge than other groups. Their texture was easily disintegrated and also had slipperier and juicier character. Based on their results, consumers preferred this ripeness level.
- Kent mangos from **all ripeness stages** tended to have riper characters than Tommy Atkins, **except** for fresh-cut mangos from the **10 lbs.** stage stored for 1 day, which were less ripe.
 - Kent cubes had a more intense, honey, fruity and piney aroma.
 - Consumers also preferred this ripeness level used for fresh-cut processing.

Looking ahead:

Building on to the initial fresh-cut mango research program in 2008, members of the NMB believe the future of the fresh mango industry will depend on the sales of new value-added fresh mango products. More research is being conducted to evaluate the effects of hot water quarantine treatment on gaseous 1-methylcyclopropene (1-MCP; SmartFresh™) on whole mango fruit during ripening. In addition, investigate the effect of the 1-MCP treatment on the quality of fresh-cut mango during refrigerated storage and evaluate the effects of calcium treatment on textural quality after cutting and during refrigerated storage using sensory and instrumental methods. Ensuring good flavor for fresh-cut mangos is important because it will affect how consumers perceive the fruit overall. Driving demand for fresh-cut mangos through retail and foodservice outlets should help to boost overall sales of the fruit as more consumers add mangos to their plates.