Control of Cavities in the Flesh of Ataulfo Mango During Ripening

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Summary

A research study was carried out with the support of the National Mango Board. The objective was to determine the causes of the physiological disorder that leads to the formation of cavities in the flesh of the 'Ataulfo' mango during ripening, as well as developing treatments or methodologies to prevent their occurrence.

It was determined that turgid or freshly harvested fruit has a high content of intracellular air (gases). When subjected to hot-water quarantine treatment, the epicultural waxes on the skin surface become amorphous, which causes the gas to become trapped in the form of intracellular bubbles. As the fruit ripens and its epicultural waxes regain their crystalline form, cellular integrity is lost and the bubbles burst. When they merge, they form internal cavities, which become visible when the fruit is cut.

1. Importance of the problem and its impact on the mango industry

The negative perception among consumers generated by this physiological disorder has shown an increasing trend. As a result, a significant proportion of the fruit is discarded, and the likelihood of repurchase by the final consumer is practically nil. The problem has worsened due to the market pressure for quick fruit supply, which causes the harvest and quarantine treatment processes to be carried out hastily. In some cases, the percentage of fruit with visible damage exceeds 60%. Although the fruit retains its organoleptic

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characteristics (taste, smell, and color) and is safe for consumption, its visual appearance negatively affects its market acceptance.

2. Description of the methodology (treatments)

To eliminate the internal gases accumulated in the fruit, it was conditioned under packinghouse conditions (32–36°C/90–97°F) for 24 or 48 hours (1–2 days) after arrival at the facility. This conditioning period took place after washing and weight grading, prior to the corresponding quarantine treatment (46°C/115°F for 75 minutes).

Three main treatments were evaluated:

- **Lot 1:** Fruit was subjected to the standard quarantine treatment (46.1°C/115°F for 75 minutes) and subsequently kept under packinghouse conditions (32–36°C/90–97°F).
- **Lot 2:** Fruit received the same quarantine treatment and was left to rest for 30 minutes under packinghouse conditions before being cooled at 21°C/70°F.
- **Lot 3:** Fruit was treated at 46.1°C/115°F for 85 minutes (10 minutes longer than the standard treatment) and then cooled to 21°C/70°F.

Untreated fruit (no hot-water treatment) was used as the absolute control.

All treatments were applied to conditioned fruit (24 or 48 hours) and to unconditioned fruit. Subsequently, the fruits were packed in commercial boxes and stored under simulated marketing conditions (20–25°C/68–77°F) for ripening. During the storage period, fruits were cut open every third day to visually evaluate the presence of physiological disorders and assess quality characteristics.

The fruit that did not receive quarantine treatment (46.1°C/115°F for 75 minutes) **did not develop** the physiological disorder of internal cavities. Hot-water treatment appears to be one of the **factors responsible** for the onset of this disorder. The presence of internal cavities was evident in nearly 100% of the fruit that **were not conditioned** and did undergo quarantine treatment. These cavities worsened as ripening progressed.

In contrast, the physiological disorder was **insignificant** in fruit that had been conditioned for 24 to 48 hours, with no significant differences observed between the two conditioning times, or between resting and immediate cooling strategies. It was also observed that fruit takes between 3 and 4 hours to stabilize its internal temperature after hot-water treatment (46.1°C/115°F) until reaching the packinghouse ambient temperature (32–36°C/90–97°F).

Regarding the quality characteristics (color, texture, flavor, aroma), **no differences were detected** between treatments. Ripening progressed normally in all cases.

Recommendations

- **Do not carry out the quarantine treatment (46.1°C/115°F for 75 minutes) on fruit** unless it has first been conditioned for at least 24 hours under packinghouse conditions.
- **Avoid treating turgid fruit or fruit with high osmotic pressure.**
- **Allow sufficient resting time** after the hydrothermal treatment so that the fruit reaches room temperature before being graded and packed. This prevents handling fruit while it is still hot.

It is important to highlight that this is a physiological disorder, not associated with the presence of pests or diseases. It does not affect the flavor of the fruit, nor does it represent a risk to the consumer.

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Sequence of the development of cavities in the mango flesh.