**Postharvest Handling of Manila Mangos**

**The Big Picture:**

The six main mango varieties exported to the United States are Tommy Atkins, Ataulfo, Tommy Atkins, Haden, Kent, Keitt and Francis. One mango variety that has minimal participation in the U.S. market, but is the second most produced variety in Mexico is the Manila mango. This tasty yellow mango has not yet made an impact in the U.S. market because of its weakness to the hot water treatment and limited postharvest shelf-life.

Research conducted on Manila mangos is widespread and includes the investigation of the fruit's physical characteristics, crop handling, postharvest technology and the effect of the ripening process on Manila mangos. To learn more and identify new areas of research for this mango variety, the National Mango Board (NMB) commissioned a literature review conducted by Dr. Edmundo Mercado Silva from the Autonomous University of Queretaro-College of Chemistry in Santiago de Querétaro, Mexico. Dr. Silva reviewed and examined the research results from 14 Mexican research centers that generated 64 published works, 13 projects presented in various forums, 17 thesis papers of different academic grades, and 13 websites.

The following are the key findings of his research about the current knowledge of Manila mangos.

**Key Findings:**

- General physical characteristics of Manila mangos:
    - Large strong tree, with open canopy; bright yellow fruit, occasionally with slightly pink cheeks, or very small reddish spots; it is long and flat, with a rounded base, with a round top, and occasionally with a small pointy tip.
    - On average, the Manila mangos are between 15 and 14 cm in length, 5.5 and 6 cm wide, and 5 to 5.5 cm thick, with a weight that varies between 180 and 260 g; thin and slightly hard skin that is easily removable; juicy flesh with medium firmness; with little or a lot of fiber.
    - When ripe, it has a deep yellow color, with a rich and pleasant flavor. Its ripening period is early to medium and it has a stable harvest.
    - Its seed is polyembryonic (a seed with multiple embryos), with medium thickness and woody appearance and texture.
- Manila mangos are highly vulnerable to decay, mechanical damages and attack from pathogens.
    - Manila mangos have a thinner skin and outer layer compared to other mango varieties.
    - Manila mangos' firmness also lessens during the ripening process.
- Harvest guides: The best harvest guide for Manila mangos is yet to be determined, however, the harvest guides used on other varieties are applied.
    - These guides and/or measurements are used to measure and predict the development of the fruit, as well as to separate immature fruit from mature ones.

        - Some signs used while harvesting include: the filling of the shoulders, color of lenticels (pore like skin tissue), etc.
        - Another method used to determine the volume of Manila mangos is called a “flotation separation process”, which is a mixture that has 1% salt in water.
            - If the mango piece placed in the mixture floats, it is unripe; if it sinks then it is ripe.
            - This process can be used at the beginning of the harvest season, and whenever it is difficult selecting the fruit based on their physical maturity.
- Ripening process for Manila mangos:
    - No reports were found on the description of the ripening process in Manila mangos or when the process begins.
    - Some studies only highlighted the use of sodium carbide during ripening. There are no reports that describe the use of ethylene to delay the process.
    - For a similar mango variety (Carabao mangos), its ripening process begins 10 days before reaching harvest maturity and during this time it shows high levels of ethylene production during its development.
        - This fact may be important as the ripening process for Manila mangos may be the same and it should be further researched.
- Refrigerated storage:
    - Manila mangos are sensitive to low temperatures and for that reason it must be stored at temperatures above 12° C.
- Reducing chilling injury:
    - Research shows that the below treatments used to reduce chilling injuries have not been proven effective in achieving a shelf-life that extends beyond three weeks.
        - Application of Methyl Jasmonate vapors (a substance used in plant defense)
        - Hot water treatments
        - Use of controlled atmospheres
- Controlled and modified atmospheres for storage:
    - No studies have been conducted on the use of controlled and modified atmospheres for storage.
    - There are only reports that refer to their use as an insect repellent treatment; however, this particular treatment requires an atmosphere that is low in oxygen and rich in carbon dioxide. Manila mangos are highly sensitive to this atmosphere.
- Control of anthracnose:
    - Research has been done on the organic control of the disease through the use of biofungicides specifically *Rhodotorula minuta* and *Bacillus subtilis.* These biofungicides are aggressive to the pathogen and have been able to reduce the rate of anthracnose by up to 8%.
    - The production of these specific biofungicides is currently at the pilot stage and the effectiveness on Manila mangos has not been determined yet.
- Irradiation quarantine treatment:
    - Gamma-ray irradiation treatment appears to be the most satisfactory option, one that is also accepted by USDA-APHIS.

- However, since Manila mangos are highly sensitive to decay, this needs to be resolved in order to achieve a more acceptable shelf-life.

**Looking ahead:**

Further research needs to be conducted in several areas to learn more how to improve the handling of Manila mangos. Areas include assessing the effects of using flowering inductors and paclobutrazol on the trees, how to extend shelf-life and decrease the problems of decay and susceptibility of anthracnose. The harvest indexes used currently for Manila mangos should also be evaluated to help better predict the development of the fruit, as well as a examining and describing the ripening process.

It is also necessary to assess ways to reduce chilling injury after the hot-water treatment and evaluate in greater detail the presence of lectins in the flesh of the fruit and accurately describe its functional properties.