

Mango Packaging

The Big Picture:

There are hundreds of growers, packers, and exporters from various countries who are involved in shipping mangos to the U.S. and numerous variations exist within the industry. While consumers may like the fact that mangos come in a variety of shapes, sizes and varieties, industry leaders have continued to struggle with the logistics of how the fruit can safely travel from places as far away as South America to the U.S. markets. Most shippers use corrugated fiberboard trays to ship mangos to the U.S. but currently there are no standards for mango packaging. In fact, the type of corrugated board used, the style of the tray, its size (length, width and height), the number of vent holes, interlocking tabs, the methods of stacking trays, and the type of wood pallets used for transport vary widely from growers to shippers, and region to region.

To address this concern the National Mango Board (NMB) commissioned a research study to design a new uniformed packaging tray to fit into a 40 x 48 Grocery Manufacturers Association (GMA) pallet. This study was led by researchers, Dr. Jay Singh, Professor & Packaging Program Director, Dr. Koushik Saha, Assistant Professor, Packaging Program Cal Poly State University, and Dr. Paul Singh, Professor Emeritus, College of Agriculture & Natural Sciences, Michigan State University. The objective of the study was to specifically design a package tray that is affordable but yet strong, has protective qualities and delivers improved cooling to increase mango quality.

The study included evaluating mango trays currently being used by packinghouses in Mexico, Peru, Guatemala and Brazil. The researchers visited a total of 15 mango packinghouses to understand the mango packing process which helped the researchers identify critical design elements for the mango tray. In addition, the researchers conducted a survey of the retailers and buyers associated with purchasing mango trays in palletized loads, to assess the impact of the proposed tray design on the mango industry.

Key Findings:

- **Current Variations in Mango Industry-Used Trays:** Trays used to ship mangos come in a range of different designs and shapes, varying sizes and different strengths in materials used.
 - Mangos shipped from longer distances (Brazil and Peru) were in mango trays that consisted of a double-wall interior design to strengthen the boxes to protect mangos for the longer shipping time.
 - The various designs of trays were either designed with interlocking or nesting tabs; however, these features provide very little pallet stability during transit.
 - Current tray designs used in the industry are shipped in various configurations on non-GMA pallets with a minimum weight of 4 kg (8.8 lbs.) per tray.
- **Mango Packaging Process:**
 - The size of imported mangos varied throughout the industry and the efficiency of the packing tray was compromised.

- Larger sized mangos created a low pack density in a 15 down footprint mango tray and were under the 4 kg (8.8 lbs.) weight requirement.
 - Smaller sized mango varieties resulted in higher pack density, meaning more fruit were packed in the tray.
 - Very few wood pallets used to ship mangos are designed to meet U.S. GMA pallet standards.
- Recommended Packaging Footprint for Mangos: Tray designs with a 14 and 12-15 down footprints were tested to fit a 40 x 48 GMA pallet footprint. The tray designs were required to be able to stack at least 18 rows high and should use forced air cooling to save energy and reduce pre-cooling time.
 - Designing an efficient pallet pattern that would provide both strength and allow efficient cooling while keeping the 4 kg fruit/tray was not able to be created.
 - A 14 down footprint is not recommended when using the standard GMA pallet for the following reasons:
 - **It does not fit** into a 40 X 48 GMA pallet.
 - The tray does not hold the required 4 kg (8.8 lbs.) of mangos when packing mango varieties with a 5-18 count.
 - When packing mango varieties with 12-18 count, it exceeded the minimum weight required with 5 kg (11 lbs.) of fruit per tray. The same applied with smaller varieties, such as Ataulfo.
 - Force air cooling is not as effective.
 - Common footprints of **12 and 15 down** are recommended which both designs are capable of holding 5 and 3.75 kg (8.3 lbs.) of mangos respectively, without affecting their cooling efficiency.
 - Specified tray dimensions are as follows:
 - 12 down tray design: 12.875 x 11.75 x 4 inches
 - Weight capacity: 5 kg (11 lbs.)
 - 15 down tray design: 13.2 x 9.5 x 4 inches
 - Weight capacity: 3.75 kg (8.3 lbs.)
 - These designs create a pallet pattern which makes clear channels for air flow through the mango trays, compared to a 14 down pallet pattern.
- Packaging Materials:
 - The materials for the recommended tray designs will not cost more than the trays currently being used to ship mangos from Mexico, Guatemala, Peru and Brazil.
 - However, a one-time cost for the equipment setup to transition to the new tray configuration may apply, which ranges between \$1,000-5,000.
 - Manufacturing the new designed tray will also not be difficult as manufactures in Mexico and Peru will be able to design it with their current equipment.
 - The minimum requirement for the packaging material is a C-flute corrugated board with a 200 lb. burst strength.
- Retailer Survey Results:
 - A total of 88 retailers who purchased mango trays in palletized loads were contacted to participate in the packaging survey.

- The retailers were contacted via email and phone.
- A total of 49 retailers responded and of those 49, 29 participated in the survey.
- The survey results revealed the majority of the survey respondents (84%) preferred mango trays to be shipped on a standard GMA (40 X 48) pallet.
 - About 73% are also willing to consider a tray design which can hold more than 4 kg/tray and prefers the 12 down mango tray design compared to the 15 down tray design.
 - Only 12% of the survey respondents did not want to make any changes to their current mango tray design.

Looking ahead:

This research helped identify the best common footprint and weight of mango trays for merchandising in the U.S. and how it will impact the mango industry at the different levels of the mango supply chain (producers, packers, exporters, importers, and retailers) regarding volume, equipment, cost, environmental issues, sanitation and safety, etc. Research findings indicate positive impacts for the industry in using the two proposed new tray designs of a 12 down (specified tray dimensions: 12.875 x 11.75 x 4 inches) and/or 15 down (specified tray dimensions: 13.2 x 9.5 x 4 inches). If the mango industry begins to incorporate the new tray designs, this may help improve the efficiency of shipping, environmental consideration for reduced corrugated material usage per weight of mango fruit for a 15 down configuration, and to deliver quality fruit to consumers.