



## Sustainability Assessment for the Mango Industry

### The Big Picture:

The concept of “going green” has been around for years. The idea of sustainability – generating what we need now without compromising our natural resources for future generations – is growing. While some may think that addressing sustainability is not “essential” to business, that simply is not true. Putting a sustainability action plan into place has been shown to reduce operating costs, extend product shelf life, enhance brand image, and attract and retain consumers. Customers who are able to identify “sustainable” products are more likely to increase the price they’re willing to pay for the product as well as the volume purchased. In fact, in a separate NMB study, the board found that 52% of mango buyers would pay more for exotic tropical fruits that have positive social benefit, and 55% of mango buyers would pay more for fruit grown using environmentally responsible methods.

In an extremely proactive measure, the National Mango Board commissioned this study as a first step in determining where the U.S. mango import industry stands with regard to sustainability. Using data collected in this report, the NMB hopes to develop goals for the mango industry that show its industry members are “good stewards of its human and environmental resources.”

The board used the Mexican mango industry as the basis for this research, an obvious choice given the fact that Mexico is the largest mango exporter in the world. As it relates to the United States, in 2008 the U.S. imported mangos with a value of \$210 million, and 61% of these mangos came from Mexico.

As the first part of the sustainability study, the NMB began to try to document the U.S. mango import industry’s carbon footprint. An organization’s carbon footprint is the amount of greenhouse gases (like carbon dioxide) it sends into the atmosphere during a given time period (often one year). Use of fossil fuels, electricity, fertilizer/agrochemicals, and refrigerant, among other things, all contribute to carbon footprint. In the case of the mango industry, orchards that contain a lot of perennial woody vegetation can also store a significant amount of carbon, thereby offsetting the environmental impact of any greenhouse gas emissions they may release. So, the NMB also researched “carbon sequestration” – the ability to remove carbon from the atmosphere.

Another portion of this study sought to determine where the mango industry stands with regard to sustainability as it relates to: **product integrity** (consistent fruit quality, food safety issues, etc.), **environmental aspects** (water and fuel usage, solid waste disposal, gas emissions, etc.), **biodiversity and ecological aspects** (availability of clean air and fresh water, habitat protection, etc.) and **social aspects** (workforce wages, health care, worker safety, etc.). For each of these areas, the NMB studied current performance and explored ideas to help determine what could be considered “best practices” in these areas.

The NMB partnered with Common Fields, a sustainability consulting service, to develop an online survey in both English and Spanish that was sent to mango producers, packinghouses, exporters, and importers their feedback. This survey was followed by on-site visits to operations in Mexico to verify and add to survey data.

As with any study, there were limitations to gathering data. Survey response rates were low, possibly due to the fact that harvests were occurring at the same time, so managers may not have had time to fill them out. Also, a limited understanding of sustainability and the reasons for this assessment may have prevented some owners/managers from making the survey a top

priority. Additionally, the NMB had hoped to gather greenhouse gas emissions data related to mango sales at the supermarket level, but unfortunately no retailer agreed to participate.

Nevertheless, this study did obtain interesting and useful data with results that provide a solid foundation from which to develop and prepare for future sustainability research.

## Overall Findings:

### CARBON FOOTPRINT

The mango industry's carbon footprint takes into account its greenhouse gas emissions as well as the potential for mango orchards to sequester carbon (remove it from the atmosphere). The ability to sequester carbon serves to offset the amount of greenhouse gas emissions, helping to lower the overall carbon footprint.

**Preliminary greenhouse gas emissions data suggest that mangos fare well in comparison to other fruit and vegetables like tomatoes and carrots.** Total greenhouse gas emissions from mangos (tracked from Mexican production to U.S. retail distribution centers) average .4556 kg of CO<sub>2</sub>e per kg of mango. Studies show that emissions from carrot production range from .3 to .6 kg CO<sub>2</sub>e/kg, while emissions from tomatoes fall between .8 to 5.6 kg CO<sub>2</sub>e/kg. In contrast, production of beef has been shown to emit an average of 14 kg CO<sub>2</sub>e/kg. (Nearly one-third of total mango emissions (32%) come from transport of fruit from Mexican packinghouses to U.S. retail distribution centers. Another significant portion (28.5%) comes from the use of agrochemicals.

**Greenhouse gas emissions come from a variety of sources throughout the production chain, including from farm operations, packinghouses, importers, and retailers.** Slightly more than 50% of all emissions come from the production of mangos, while 42% come from packing emissions – together contributing more than 92% of total emissions to the mango value chain. Emissions included fossil fuel consumption, refrigerants used within packinghouse cooling equipment, the energy used to manufacture agrochemicals and fertilizers, company business travel by employees on commercial airlines, and emissions associated with transportation.

- **The use of agrochemicals (including fertilizers) and transport of mangos together account for approximately 60% of the industry's greenhouse gas emissions.**
- **In Mexican farm/orchard operations, an average of .229 kg of CO<sub>2</sub> equivalents are produced for each kg of mango fruit produced.** The majority of these emissions (57%) come from the production and use of agrochemicals, notably fertilizers.
- **In packinghouses, an average of .192 kg of CO<sub>2</sub> equivalents are produced for each kg of mango fruit processed and transported to the Mexico/U.S. border.** Emissions in this group included fossil fuels used in vehicles for transport, electricity used to cool packinghouse cooling rooms, and fuel used to heat hot water tanks for the treatment of fruit fly larvae. The majority (66%) of total emissions for packinghouses were through transportation of mangos from the packinghouses to distribution centers at the border.
- **Emission data from importers was minimal, making it difficult to draw an industry-wide conclusion with regard to importer emissions.** The data that were gathered showed that importer emissions contributed .0258 kg of CO<sub>2</sub> equivalents to the

**mango value chain.** This figure is used in the analysis of the whole mango value chain to provide a more complete greenhouse gas emission assessment.

- **No retailers were able to provide direct data about emissions at the retail level. However, researchers were able to extrapolate data given industry parameters to determine that an average journey from an importer distribution center at the Mexican border to a U.S. retail distribution center would emit .008751 kg of CO<sub>2</sub> equivalents per kg of mango transported.**

**Researchers found that mango trees help to compensate for the greenhouse gas emissions given off during the production/distribution of mango fruit through carbon sequestration – the ability of the trees to remove carbon from the atmosphere.** Plants use the natural process of photosynthesis to pull CO<sub>2</sub> from the air and transform it into carbohydrates (in the form of sugars stored in the trunk, branches, roots, and leaves). Research shows that perennial woody vegetation, like that in mango orchards, can store significant amounts of carbon – this balance helps to reduce the mango industry's overall carbon footprint.

- **After much research and many calculations, researchers determined that an average mango tree in Sinaloa and Nayarit could sequester carbon at two to two-and-a-half times the rate of carbon emissions from mango production, based on data gathered.**
- **Researchers also determined that an average mango tree in Chiapas could sequester carbon up to seven times the rate of carbon emissions from mango production.**
- **Research shows that industries like the mango products industry can have a potentially positive overall impact on atmospheric CO<sub>2</sub> levels through carbon sequestration as a result of their growing operations.** These data are seen as a first phase attempt to understand carbon dynamics within the mango forestry system of Mexico, and this preliminary analysis lays the foundation for a more detailed study of greenhouse gas emissions and carbon sequestration in the future, researchers note.

#### OTHER SUSTAINABILITY FACTORS

Sustainability in business encompasses several factors, including product integrity, environmental issues, biodiversity and ecology, and social issues. While researchers were able to track some of these activities in the current mango industry, more research is necessary to develop a sustainability plan for the whole industry.

- **The mango industry reported zero food safety issues for 2009 throughout all components of the supply chain.**
- **Researchers recommend that all facilities across the mango supply chain create and use standard operating procedures that will align their operations with accepted good agricultural practices.** Data here reported that a little over half of producers use standard operating procedures as part of managing good agricultural practices; nearly 100% of packinghouses said they use standard operating procedures.

- **Mango companies that frequently provide worker hygiene training ensure that all employees are knowledgeable of good hygiene practices.** Good hygiene practices for food handlers are audited as a good agricultural practice. On average, hygiene training is five times higher in packing than it is in production, researchers found.
- **Producers reported an average fruit rejection rate of 27% by packinghouses, but the packinghouses reported only a 10% rejection rate on product received from production.** This discrepancy is likely due to small sample sizes, researchers say. Packers and importers reported a 2% rejection rate on product received from packing.
- **Average water usage for the production of mangos appears to be at the high end compared to other produce.** Research shows that mangos use 1,000 liters of water per 1 kg mango on average, while other crops use substantially less water (oranges use 330 liters/kg; watermelons use 378 liters/kg; tomatoes use 64 liters/kg). In addition to providing cost savings, water conservation is a foundational activity to sustainable agriculture.
- **Improving workforce efficiency can help reduce operational costs and eliminate waste in the mango value chain.** Further study of mango farms and facilities could be valuable in developing a list of best practices related to workforce efficiency. Currently, mango production uses two-and-a-half times more labor per unit than packing, and packing uses 23 times more labor per unit than importation.

#### **Looking Ahead:**

As the mango industry continues to grow and develop, creating a sustainability program will help position the industry as a pro-active entity that cares for its own members and is a good steward of natural resources. From a business perspective, implementing a sustainability program can help to reduce operating costs, increase mango sales, and mediate negative media attention.

As a result of this study, the National Mango Board identified several areas for improvement, specifically aimed at minimizing the risk on product integrity. This research has identified several Best Practices; these recommendations can be found here: [Sustainability Best Practices](#).

In the short term, the NMB will work to seek out good examples of mango companies that are currently having a positive impact on social and environmental factors. Promoting these stories to others within and outside the industry will further help to build a positive reputation for the mango industry.