

## Improving Knowledge and Practices in Mango Supply Chains

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### THE NEED

Mangoes consigned to domestic markets suffered from fruit quality problems from 1997 to 2000. A high incidence of disease breakdown and green-ripe fruit resulted in loss of confidence by marketers, and reduced profits for everyone from grower to retailer. The 'Better Mangoes' project was initiated to identify where, and why quality was being lost, and to use this information to improve the knowledge and practices of supply chain businesses.

### OUR METHODOLOGY

The project, conducted in 3 phases, worked with specific supply chains to identify improved practices and then communicated this knowledge to the rest of the industry. In phase 1 (2000/01), the methods for monitoring quality and temperature were tested with collaborators for consignments from Queensland production districts to Brisbane wholesalers. The information generated stimulated the interest of further collaborators and in phase 2 (2001/02), monitoring was expanded to include Sydney, Melbourne and Adelaide. Improved handling practices identified in phase 1 were also tested during phase 2. In phase 3 (2002/03), we monitored performance for businesses that had changed practices.

Fruit and air temperatures were monitored in three positions on the pallet (top, outside, inside), from packing to wholesale dispatch, or receipt at retail distribution centres. Fruit samples, taken before postharvest fungicide treatment, after packing, before transport, on arrival at the market, and at the point of dispatch, were held at 20°C and assessed for disease breakdown, skin colour, and firmness as the fruit ripened.

A measure called the Saleable Life Index (SLI) was developed to compare consignment performance. The SLI is the time from when the average skin colour in a sample of fruit reaches 60% yellow, when the fruit is first saleable to retailers, to when 10% of the fruit show signs of fruit rots. Laboratory trials assessed the effect of different durations of high and low temperatures on quality and confirmed optimum ripening conditions.

The knowledge generated was communicated to collaborators and the industry in a number of ways. Sampled fruit was shown to collaborators to stimulate a self-assessment of the impact of handling on quality along with individual reports that were discussed in person. Growers, transporters, wholesalers, and retailers attended annual presentations in Queensland growing regions and wholesale markets. Articles were published in industry newsletters and magazines and the popular press. Collaborators were kept up-to-date through a project newsletter. Prototype guides on skin colour, defects, handling temperatures and ripening were pre-tested with collaborators and then widely distributed.

Bennett's Hierarchy (1975) was used to guide project evaluation. Data on activities, participation levels, reactions, changes in knowledge, attitudes, skills and aspirations, and practice change was collected. Qualitative data from both collaborators and non-collaborators was gathered from a survey of growers, wholesalers and retailers during phase 3.

## IMPROVEMENTS IDENTIFIED

A total of 93 consignments were monitored over the 3 seasons, involving 41 growers, 30 wholesalers, and 3 supermarket chains. Fruit temperature varied considerably, with many consignments fluctuating in temperature and often above 24°C. During 2001/02, only 29% of the Kensington Pride consignments monitored met supermarket expectations for a SLI of 7 days. Almost 20% of consignments had no saleable life. Monitoring showed that high ripening temperatures, mixed ripening, delays during handling, poor disease control in the orchard and ineffective postharvest fungicide treatment all reduced the SLI.

High ripening temperatures were caused by inadequate cooling before dispatch to market, fruit ripening during transport or inadequate temperature management during ripening at the market. The laboratory trials showed that high ripening temperature reduced degreening and increased disease development. The effect was noticeable after 3 days at 28°C and at constant 24°C.

Monitoring consistently showed that controlled ripening with ethylene improved the SLI. Treating mangoes with ethylene triggers ripening and results in faster and more even ripening in the tray. Without ethylene, ripening is mixed and it takes longer for a tray of mangoes to reach an average skin colour of 60% and be ready for sale. Often the more advanced fruit develop fruit rots while waiting for the other fruit to ripen and this reduces the saleable life.

Two handling systems delivered mangoes to retailers with good saleable life. Both used ripening with ethylene and careful control of fruit temperature. Good communication between supply chain members is essential to ensure that the systems work. In system 1 fruit is transported in a backward condition to the market and ethylene is used to control ripen the fruit for sale to retailers. In system 2 ethylene is used to control ripen on-farm, and fruit is transported in a forward condition ready for sale on arrival at the market.

## CHANGES IN KNOWLEDGE AND PRACTICE

There was a strong recall amongst the collaborators about project activities. They recalled the temperature monitoring of consignments, individual reports and feedback, meeting presentations, and the information guides. Non-collaborators recalled the meeting presentations and information guides. People were most surprised about the variability in temperature within pallets, how high the fruit temperature can rise during distribution, the extent of deterioration caused by poor temperature management, and the beneficial effect of ethylene. The things that were relevant to their business were the importance of managing temperature at each step through the supply chain and the need to control ripening using correct temperatures. Using ethylene was relevant to some businesses while others still have a fear of ethylene causing fruit to soften prematurely.

Many collaborators and non-collaborators changed their practices. Wholesalers have increased temperature monitoring, changed to the recommended temperatures for ripening and storage, upgraded facilities for cooling, ripening and storage, and have contracted specialist ripeners. One of the supermarkets changed their purchasing specification for skin colour from 80 to 60% yellow to give them more saleable life. Growers have changed to recommended temperatures for cooling and transport, to open top trays for better temperature management, upgraded facilities for cooling and ripening, shifted product quicker, and changed to wholesalers with ripening facilities.

The benefits gained from the changes have included better and more consistent product, less wastage and sorting costs, increased customer confidence and reputation, more control of business, improved relationships with supply chain partners, and for some an increase in price. The supermarket chains are yet to see benefits but they are expecting better quality product and less wastage, which will increase consumer satisfaction and lead to increase sales and profits.

## WHY CHANGES HAVE OCCURRED

For change to occur, the business must 'want' to improve, know 'how' to improve, and have the 'means' to improve. When asked what triggered or helped them to make the decision to change, both collaborators and non-collaborators responded that either they had already made the decision to improve or the information generated by the project stimulated a need to improve. Using the SLI as a measure of performance clearly demonstrated that improvement was needed.

Wholesalers had suffered substantial financial losses from handling mangoes and some were even considering withdrawing from trading in mangoes. Growers were driven by the want to reduce losses, increase returns, gain access to supermarket customers, and improve customer confidence and reputation. Those that did not change did not have a strong desire to improve. Some collaborated in the project only by request from their supply chain partner. No drive to improve, just a willingness to cooperate to maintain existing relationships.

Working 'with' businesses enabled them to see 'first-hand' what improvements were needed and gain knowledge on how to improve practices. Changes in practices by non-collaborators indicate that the communication strategy used was effective. Over 1 000 businesses across all sectors of the supply chain have received the guides.

Despite wanting to change some businesses are limited by lacking the 'means' or ability to change. For example they know the benefits of controlled ripening with ethylene, but are limited by a lack of facilities or the financial capacity to upgrade them. For growers in production districts that are long distances from markets, the use of on-farm ripening is limited by long transport times.

Most of the changes occurred at the individual business level. However, the greatest potential for improvement comes from all supply chain members working together to develop a system that manages product quality from farm to the retail shelf. The project showed that two supply chain systems work.

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## REFERENCES

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