

# Follow the fruit, find the answers

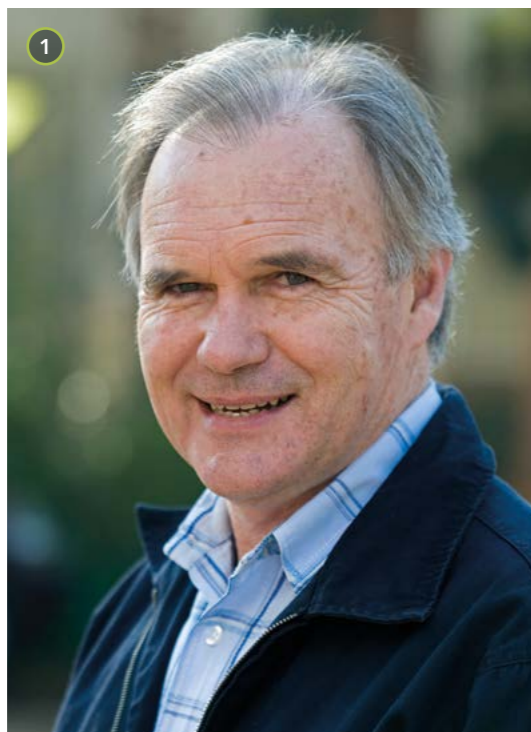
In ancient times sailors believed ships disappeared off the edge of the world when they reached the horizon. The fate of South African fruit exports was pretty similar until international research cooperation illuminated the black hole.



Based on the study's findings, roughly 32 000 fruit shipments per year do not adhere to the PPECB protocols for temperature and humidity control.

**THE SOUTH AFRICAN** fresh fruit export chain is long. It takes up to 40 days for an apple to travel from an orchard in the Western Cape to a Sainsbury's shelf in the United Kingdom. Of that time, the fruit spends between 14 and 20 days on a ship at sea. This is, incidentally, the only part of the journey that is legally monitored.

In terms of the Perishable Products Export Control (PPEC) Act, vessels have to supply the Perishable Products Export Control Board (PPECB) with storage air temperature data for the duration of the voyage.



Once the fruit arrives at the destination port, however, it disappears off the legal radar and, for all practical purposes, off the quality radar in general. What happens to our fruit when it arrives overseas and is sent to distribution centres, repacking facilities and later distributed to retailers? Up to a year ago, we simply did not know.

One of the biggest problems with this lack of insight into the final segment of the cold chain was who to blame when a consignment of fruit arrived in poor condition, especially when the fruit had no inherent quality issues on departure and the shipping records were satisfactory. Without answers, the cost and loss invariably ended up on the grower's account.

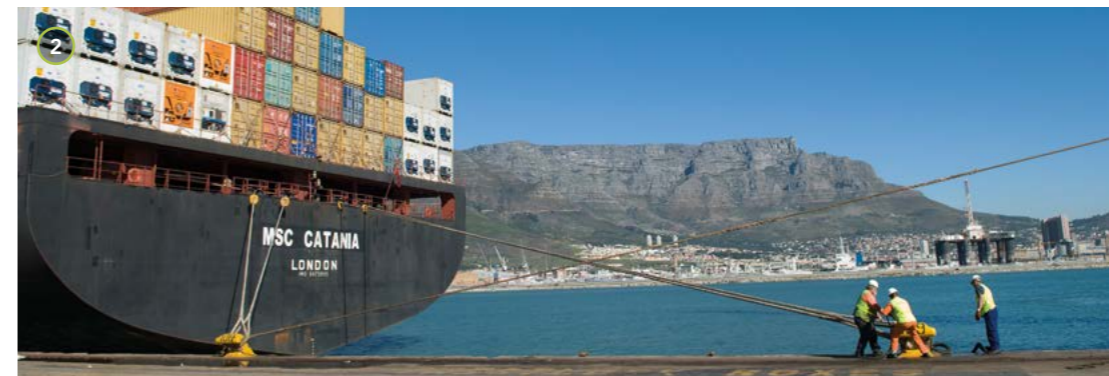
In 2011, cold chain expert, Prof. Malcolm Dodd, decided that the time was ripe for answers. The result was a research project made possible by unprecedented international cooperation.

### THREE PLAYERS, ONE GOAL

Prof. Dodd persuaded two international partners, BT-9 Tech in Israel and Sainsbury's in the United Kingdom, to participate in a project with the Department of Horticultural Science at Stellenbosch University to scientifically monitor fruit quality throughout the supply chain.

The Post-Harvest Innovation Programme, HORTGRO<sup>Science</sup> and Citrus Research International financed the South African part of the study. BT-9 Tech and Sainsbury's contributed their participation at no cost.

The aim of the project was to shed light on the 'hidden' parts of the supply chain – from when the fruit arrives at the overseas port to where it is sold. This involved gathering information on the relative humidity and the fruit pulp and storage temperatures in fruit export containers. Radio frequency identification (RFID)



technology, consisting of data recorders, radio receivers and hand-held scanners, supplied by BT-9 Tech, made the study possible.

### THE METHODOLOGY

The data recorders, known as tags, were inserted into two fruit pallets per shipment at the start of the journey. This was either in the pack house or the cold store, depending on the kind of fruit. The temperature and humidity information recorded by the tags was transferred by the radio receivers, via satellite, to a central server from where it could be accessed through the Internet.

The crucial overseas leg of the study was conducted by Sainsbury's staff. When the South African containers arrived at the distribution centre, the Sainsbury's team retrieved the cartons containing the tags from the pallets and made sure that these cartons were distributed to the supermarket.

In addition to the electronic tracking, two fruit quality control checks were part of the project design. The first samples were drawn by researchers from Stellenbosch University when the container left the farm.

The second quality control point was at the end of the supply chain where Sainsbury's staff collected samples in the stores. The fruit quality results were compared to the temperature and relative humidity data gathered by the RFID technology.

The study was conducted over two seasons, from December 2011 to December 2013, and examined plums, pears, apples and soft citrus as its test subjects.

### THE RESULTS

The study successfully followed 22 shipments of fruit from pack house to point of sale. The data recorded showed that 14 shipments adhered to the export protocols. The soft citrus cold chain was largely up to standard, while the plum data revealed considerable room for improvement.

The study found that the weak links in the supply chain, from a temperature and relative humidity management perspective, were the container loading facilities, shipping containers, the receiving distribution centres (DCs) and the Sainsbury DC.

The good news is that no quality issues were recorded with any of the fruit from the shipments.



### PROJECT TITLE

Radio Frequency Identification Technology (RFID) promotes understanding of the storage air, fruit pulp temperatures and relative humidity in a typical South African fruit export supply chain

### PRINCIPAL INVESTIGATOR

Prof. Malcolm Dodd

### CONTACT DETAILS

+27 21 674 4413  
+27 82 566 1150  
malcolm@alaceraer.co.za  
Skype: malcolm.c.dodd

### DURATION

Two years

### PHI-2 CONTRIBUTION

R254 933

### LEAD INSTITUTIONS

Stellenbosch University (Department of Horticultural Science), BT-9 Tech and Sainsbury's

### BENEFICIARY

The entire fresh fruit industry

### FOCUS AREA

Supply chain logistics and information

### PRESENTATIONS AND PAPERS DELIVERED

Two



- 1 Prof. Malcolm Dodd.  
2 Refrigerated containers on a vessel in Cape Town harbour.

“Simple attention to good cold chain practice by packing/loading operators and receiving distribution centres would improve the cold chain considerably.”  
Prof. Malcolm Dodd

The bad news is that the cold chain appears to be riddled with variations.

“Our findings can be summarised in two words: consistent inconsistency,” says Prof. Dodd. “And that is not good for delivering good quality product into the international market.” For example, the team was left puzzled by these unanswered questions:

- Why do pallets in the same container experience vastly different temperatures?
- Why do some of the distribution centres not place the fruit in the correct temperature store?
- Why does relative humidity vary so much between the different kinds of fruit?

**TOWARDS TRANSPARENCY**

The benefits of this study extend far beyond the recorded data. Its contribution towards bringing transparency to the supply chain, particularly as far as

addressing quality problems are concerned, cannot be overstated.

The data gathered gave the exporters and Sainsbury's a level of insight into their supply chain that they did not have before. Thanks to the project, companies such as Mack Multiples have started placing temperature data recorders in loads leaving their distribution centre.

Claims for losses can now be backed up with hard facts. As a result, innocent parties are protected and the culprits forced to take responsibility. The benefits for the insurance industry are self-evident.

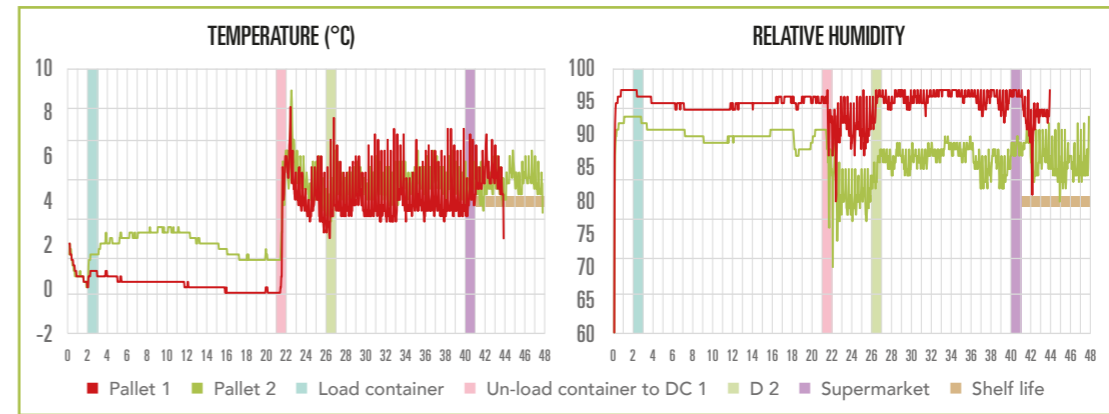
By using the radio technology that was proven in this study, fruit retailers can measure their service providers' contract specifications against facts and address any shortcomings. Sainsbury's has already used the research data to identify and rectify poor practices on the part of its service providers across the UK.

Arguably the most important benefit of the work done by Prof. Dodd and his team, is that the quality of fruit being offered to the export market can only improve as a result of better monitoring and management. The spin-off is a boost for 'Brand South Africa'.

“Our hope and intent is to use the results constructively,” concludes Prof. Dodd. “We want to protect farmers by determining where the final responsibility lies when product losses are incurred, and want to establish who is legally accountable. Moreover, this international project should bring great value to the South African fresh fruit export industry.”



“Sainsbury's is delighted with the information that has brought transparency and allowed the identification of areas for improvement.”  
Dr Theresa Huxley, apple and pear technologist, Sainsbury's



The graphs show the temperature (left) and relative humidity (right) of two pallets of 'Angelino' plums shipped in the same container from a pack house in Ceres to a supermarket in the United Kingdom. The plums should be stored at 0°C and a relative humidity of >90% right throughout the 48-day supply chain. The vertical lines show the different stages (segments) of the cold chain.

1 BT-9 Tech radio-enabled fruit pulp temperature and relative humidity recorders in a carton of pears.

2 A container vessel, laden with refrigerated containers of fruit, on its way to distant markets.



FRESH PRODUCE VALUE/ LOGISTICS/COLD CHAIN

Source: Prof. Malcolm Dodd

