

When standards stack up

An innovative pallet testing device can save the South African fresh fruit industry millions of Rands and spur the development of stronger, cheaper pallets.



A pallet costs about R100, but can support a shipment of about R10 000 worth of fruit.

SOUTH AFRICA is a major player in the global fresh fruit market – in 2012, it was the second largest exporter of citrus in the world. The country's annual fresh fruit exports have averaged about R14 billion over the past five years.

Exporting such a large quantity of quality fresh fruit would not be possible without pallets – flat, usually wooden structures that can be forklifted into trucks and refrigerated containers. Fresh fruit destined for overseas markets are packaged in cartons that are then stacked on pallets.



A pallet's journey across the globe is a rough and bumpy ride. It must withstand cartons weighing more than a ton, forklifts flying in at different angles, being dragged across pack house floors and thrown around in moving trucks.

"A pallet costs only about R100, but it is entrusted to support thousands of Rands worth of fruit," says Koos Bouwer, an industrial engineer and independent engineering consultant. When a pallet breaks, the cartons buckle or collapse, damaging the content. Not only does the damaged fruit have to be sold at half price on the local market, but valuable time is wasted to repack the fruit.

Mr Bouwer estimates that only about 15% of South African fruit pallets are of a poor standard. "But 15% of three million fruit pallets exported each year is a large number."

Whenever pallets break the pack house and the pallet manufacturer point fingers at each other. The pack house claims poor quality, while the manufacturer blames rough handling in the pack house.

Up to now, this blame game could not be resolved. There were neither standards that a pallet had to conform to, nor a practical way to test such standards.

THE NEED FOR A TESTING DEVICE

Prior to October 1997, Outspan regulated the South African citrus export industry and Unifruco the deciduous fruit sector. The two exporters' packaging design departments coordinated the design and testing of fruit pallets.

Following deregulation, which allowed anyone to register as an export agent, no organisation fulfilled these functions. The design drawings of fruit pallets currently in circulation date back to the period of regulation and don't specify the forces a functioning pallet must withstand.

PALLETS IN THE PAST

Pallets evolved from skids – flat wooden boards with two runners like a sleigh – that were used to move cargo from shore to ship. The skids were carried by hand and loaded onto ships using a winch.

Pallets are first mentioned in documents dating back to 1931. However, the first known patent for a pallet was issued to two Americans, George Raymond Sr and Bill House, on 7 November 1939.

The patent for the modern-day forklift truck was issued on the same day. Allegedly, the pallet was invented specifically to promote the use of the forklift truck. Raymond's iron foundry would become the Raymond Corporation, a global provider of forklifts.

The logistical requirements of the Second World War led to the widespread use of pallets during the 1940s.

Since 1998, the height of the shipping containers in which pallets are transported have increased from 2,1m to 2,4m. As a result, pallets have to support up to 15% more weight than in the past, but the design drawings have not been adjusted to accommodate the extra load.

In 2008, a collaborative study between the Fresh Produce Exporters' Forum (FPEF) and the Commonwealth Secretariat (Comsec) made several recommendations for improving the logistics of the South African fresh fruit export industry. One of these recommendations stated that new packaging standards should be set and all packaging formats should be updated, including pallets.



In 2009, the Agricultural Research Council funded a project to develop pallet standards aimed at improving the quality of South African export pallets. With the pallet standards established, the next step was to build a practical testing device to test whether pallets conformed to these standards.

BOUWER TO THE RESCUE

In 2012, the Post-Harvest Innovation Programme tasked Koos Bouwer to design a pallet testing device to be used by pallet manufacturers and pack houses.



PROJECT TITLE
Pallet test equipment

PRINCIPAL INVESTIGATOR
Koos Bouwer

CONTACT DETAILS
+27 82 887 8425
bouweb@orangenet.co.za

DURATION
Nine months

PHI-2 CONTRIBUTION
R140 000

LEAD INSTITUTION
Koos Bouwer Consulting CC

BENEFICIARY
The entire fresh fruit industry

FOCUS AREA
Supply chain logistics

HUMAN CAPITAL DEVELOPMENT
One BEng student



1 Koos Bouwer.
2 The pallet testing device ensures that all South African export pallets adhere to the highest standards.



1654: The first orange and lemon trees in South Africa are planted in the gardens of the Dutch East India Company in Cape Town. The trees came from the island of St. Helena.

1925: South Africa exports more than a million boxes of citrus for the first time.



The device was designed with practicality in mind – it is compact, economical and easy to operate. Considering the amount of money it could save, it sells at an affordable R38 000. It is also cheap and easy to maintain. “The device only has two components you can’t buy at your local hardware store,” says Mr Bouwer.

The device is operated manually and uses no electrics, software, hydraulics or pneumatics. No more than two people are required to operate the device, which is easy to calibrate and, therefore, suited for semi-skilled workers.

Gert Coetzee, an engineering manager from the fruit packaging company, Kromco Ltd, says he is happy that a prototype proved that Kromco’s self-made pallets are of exceptional quality. “Pack houses should test the quality of their pallets, because the 15% rubbish that enters the market gives South African fruit exporters a bad name.”

LOOKING TO THE FUTURE

Now that the functional requirements of pallets are known and can be tested, pack houses cannot blame manufacturers for broken pallets if those pallets have passed the tests. Pack houses and farmers can also demand that manufacturers test their pallets before they are sold.

The testing device is also breaking new ground in pallet design. There is a growing trend towards plastic pallets, which can be cheaper, lighter and pose fewer health risks than wooden pallets. In 2010, for example, Pfizer had to recall several of its over-the-counter



products that had been contaminated by a chemical applied to the wooden pallets.

Despite these advantages, expensive tests slow down the development of new plastic pallet designs. According to Mr Bouwer, his pallet testing device paves the way for optimal pallet designs, including plastic, which could increase the competitiveness of South African fruit exports.

In 2014, Mr Bouwer will deliver several presentations at seminars and industry association meetings, and train staff at manufacturing facilities, pack houses and logistics depots on how to use the pallet testing device. He will also train industry players on how to use, interpret and update the functional pallet specifications for the five major fruit groups. 🍌

THE DEVICE AT WORK

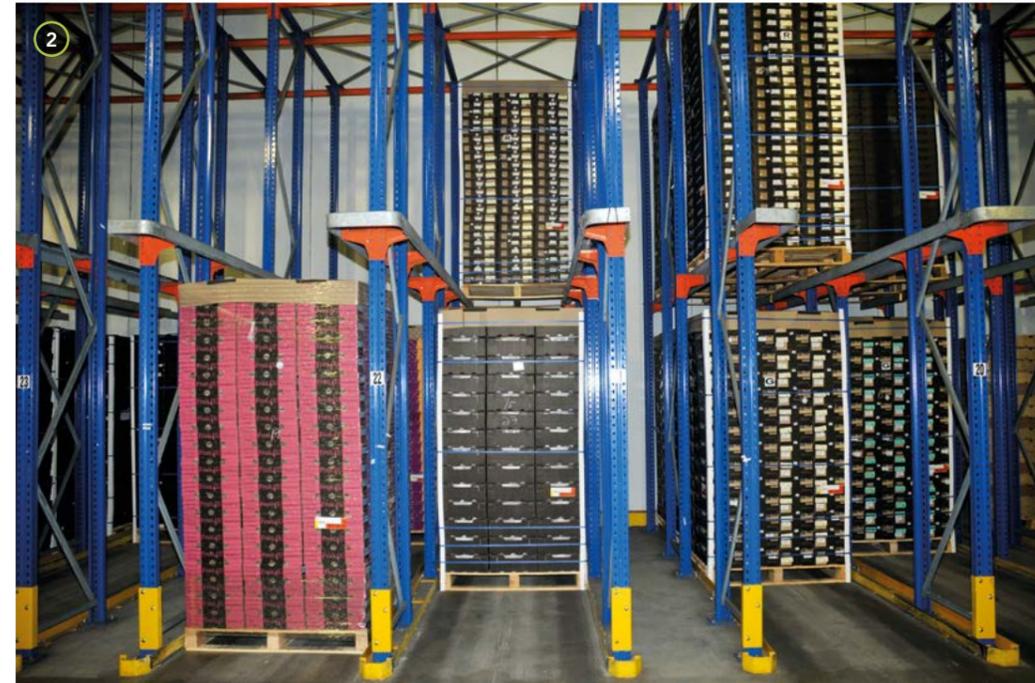
The pallet testing device, designed by Koos Bouwer, performs seven different tests to confirm that a pallet is up to standard. These tests are grouped into three categories.

LOAD-BEARING TESTS	IMPACT TESTS	DROP TEST
The bending stiffness test simulates the load a pallet carries while resting on a pallet rack in the cold store. If used for citrus, it must be able to resist 1 300kg without distorting by more than 20mm.	The impact tests mimic the force of a forklift hitting the pallet blocks at 1,27m per second. This simulation is achieved by forks attached to a pendulum that slams into the stationary pallet. The height at which the fork hits the pallet is adjustable, which makes it possible to test different types of impacts.	The final test drops the pallet on one of its corners from a height of one meter.
The vertical pull test pulls the top part of the pallet upwards and the bottom part down to test the resistance of the pallet joints.	There are three impact tests: <ul style="list-style-type: none"> • Block impact test • Top-edge impact test • Shear impact test 	
Forklift bending test		



Citrus: Oranges, grapefruit, lemons and limes. Naartjies and mandarins are soft citrus.

Deciduous fruit: Table grapes, apples, pears, peaches, plums, kiwifruit, nectarines, persimmons and apricots.



- 1 A pallet designed to hold citrus must be able to resist 1 300kg without distorting by more than 20mm.
- 2 Exporting large quantities of quality fresh fruit would not be possible without pallets.
- 3-6 It is estimated that only 15% of South African fruit pallets are of a poor standard. But 15% of the three million fruit pallets exported each year is a significant number.