

MOVING TO A CIRCULAR ECONOMY

The current flow of plastics — and many other materials — is based on a linear economy. New plastics are manufactured to replace that which is lost. "The majority of plastic ends up either being landfilled or leaks into the environment. Very little goes back into a closed loop," said De Kock.

Shifting from a linear to a circular economy would keep plastic out of the environment and retain the value within the material stream. This requires a new emphasis on design for reuse and recyclability in addition to visual appeal. "WWF is committed to support the adoption of a circular plastics economy in South Africa," stated De Kock. "One of our interventions at industry level is the South African Plastics Pact."

Examples of the targets set by the Plastics Pact are that all plastic packaging should be reusable, recyclable or compostable by 2025, and that problematic plastics should be addressed by 2021. Organisations that want more information on sustainable packaging design can consult the Design for Recycling guidelines available online from PackagingSA.

"Organisations that are signatories to the various Plastic Pacts internationally are sending their fruit exporters and suppliers guidelines on the materials to be used for their packaging," said De Kock. Materials are classified as red, amber or green. Red materials — including polystyrene, oxo-degradable and black plastics — will be phased out this year. Amber materials are those where use is discouraged and include flow wrap. Green materials are preferred. Plastics in the green category include high- and low-density polyethylene.

De Kock presented some general principles to consider when making choices around packaging. "Look at your material combinations and separability. Multilayers are not recycled currently so try to move away from them if possible." Labels, printing inks and adhesives used on packaging can also affect recyclability. Packaging with food residues that are difficult to remove may be impossible to recycle.

De Kock believes that the challenges of plastic pollution can be met. "We need to keep in mind the trade-offs between extending shelf life, what the consumer wants, versatility and affordability, and the waste that is generated. Let's design smartly and not take the easy route — which will just generate more waste. The packaging landscape is changing and the sooner you get on board the better for your product." **FQ**



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Minimising Moisture Loss in Pears During Storage

What is in the producer's toolbox?

By Anna Mouton

Frank van de Geijn is a senior consultant and post-harvest researcher at Wageningen University and Research. He is with the Agrotechnology and Food Sciences Group which focusses on all questions relating to post-harvest: processing, packing, energy, and fruit quality.

Consumers demand pears year-round but long-term storage leads to moisture loss and associated quality issues like shrivelled necks and sensitivity to damage. Humidity control during storage aims to limit moisture loss. "We set a goal of 1.5%–1.8% weight loss for Conference pears over the storage period which can be for nine months or more," said Van de Geijn.

The atmosphere of the storage room has a relative humidity of 90%–95% compared to almost 100% for the fruit. This leads to a vapour pressure deficit that drives moisture from the pear to the air. Moisture in the air of the storage room is removed as part of the cooling process.

Van de Geijn outlined the variables affecting moisture levels in storage room air. "The concrete floor can take up 0.1%–0.3% moisture. I hear that

some people in South Africa wet the floor — at least that will prevent this uptake."

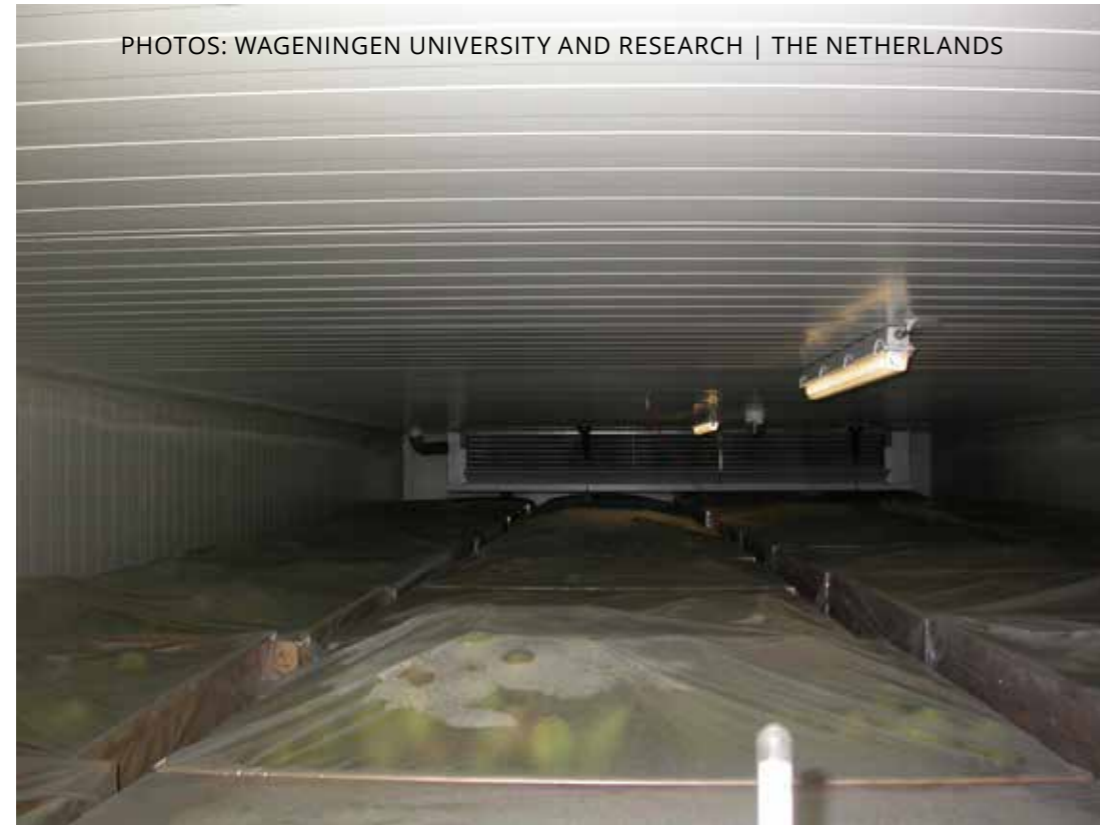
Wooden bins also absorb water but Van de Geijn has found them to have no impact on the total moisture balance compared to plastic bins. Most of the moisture added to the storage room atmosphere is contributed by the fruit. This effect is greatest during the initial cooling of the product.

The moisture balance in the storage room is not the only driver of water loss. "There's a huge product factor," said Van de Geijn. "Moisture loss drops as pears increase in size. And the same size fruit from different orchards can have different levels of moisture loss."

Van de Geijn's studies suggest that shrivelled necks are correlated with moisture loss of above 0.5%. He pointed out that some pears are more resistant to shrivel than others. Recent research suggests that dry matter content may explain some of this variation.

TOOLS TO MANAGE MOISTURE LOSS

There are four ways in which producers can manage moisture loss: protective packaging, humidification, optimisation of cooling equipment and putting ice on the bins. Van de Geijn doesn't



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“Covering the top of closed bins can reduce moisture loss by 30%–40%.”

recommend this last option. "It's effective but it's an enormous amount of work. It's not practical."

Van de Geijn has found packaging to be excellent for moisture loss control. Covering the top of closed bins can reduce moisture loss by 30%–40%. "That's enormous — you will never reach it with another technology," stated Van de Geijn. The Zeelandse method which uses foam on the bottom and sides of the bin combined with a top cover will reduce losses even further — by as much as 50%. Covering only the tops of bins will not work if they have open sides — like the standard South African plastic bins — through which moisture can escape.

There are several systems for humidification of storage rooms but Van de Geijn warned that all suffer from poor stability in operation. Humidification systems need to be checked regularly and installed to ensure that the moisture is evenly distributed throughout the room. "One of

the challenges of a humidification system is how do I balance moisture levels? It seems simple to measure but it's quite difficult because the volumes we add are low."

Van de Geijn believes that a solution to many humidification challenges can be found in installing ample cooling capacity.

The aim is to have as little cooling time during storage as possible to minimise condensation and water loss. "I define my evaporator capacity at minus 8 degrees Celsius," said Van de Geijn, "which is 8 degrees difference to the entrance temperature of the air in the coil."

Van de Geijn remarked on the difference in cooling strategies between the Netherlands and South Africa. In the Netherlands cooling occurs through short cooling actions characterised by large temperature drops. This minimises the impact on humidity. In South Africa, cooling is more moderate but creates an ongoing vapour pressure deficit that increases water loss.

Minimising moisture loss carries risk as well as rewards. A new pathogen of apples and pears called *Fibularhizoctonia psychrophila* has recently been identified in storage facilities in the Netherlands. It is associated with lenticel spot and can lead to



FAR LEFT Covering fruit is the most effective way to combat moisture loss during storage

LEFT Humidifications systems should be checked regularly to ensure that they are functioning correctly.

Best practices to combat moisture loss

- Invest in cooling equipment with high-capacity evaporators.
- Box-in-box cooling: cool the building as well as the storage rooms.
- Fast initial temperature pull-down: reach product temperatures of minus 0.5 degrees Celsius in less than 48 hours.
- Achieve maximum temperature stability over time and throughout room.
- Optimise air circulation and run fans only when needed.
- Measure defrost water: aim for moisture loss of 1.5–1.8 litres per tonne per month.
- Apply humidification to correct but not to solve problems.
- Use protective packaging in older or less efficient facilities.

total loss of the fruit in affected storage rooms. *Fibularhizoctonia* is a threat at high humidity levels and therefore bagging fruit for long-term storage is no longer advised. High humidity also increases the risk of internal browning and cavities.

Managing humidity during long-term storage is just one of the challenges facing pear producers. Fortunately, as Van de Geijn's presentation showed, improved technology has opened many more avenues to success. **FQ**



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