

# fruitgrower

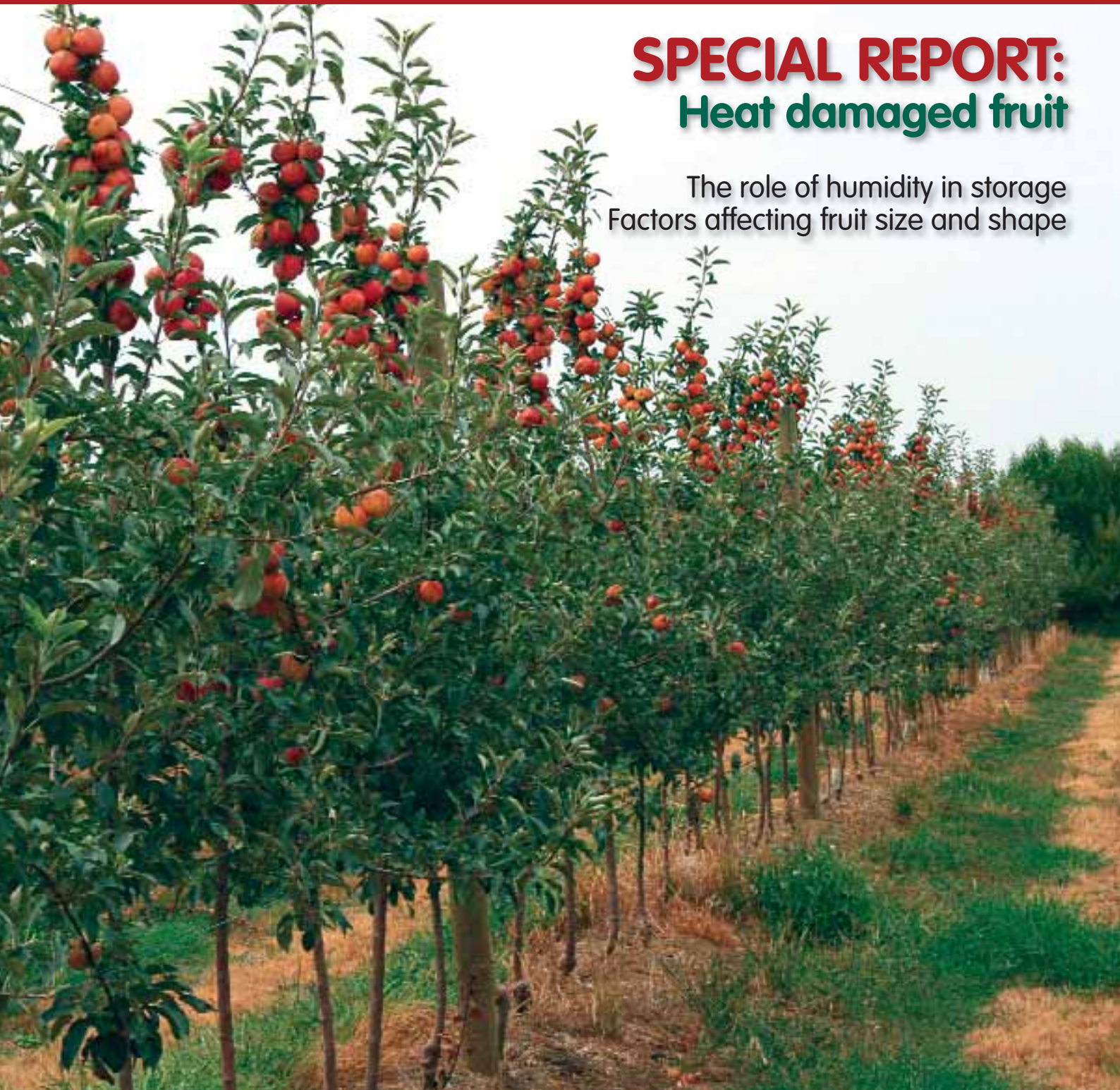
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## **SPECIAL REPORT:** Heat damaged fruit

The role of humidity in storage  
Factors affecting fruit size and shape



THE OFFICIAL MAGAZINE FOR APPLE, PEAR AND SUMMERFRUIT GROWERS IN AUSTRALIA



**Australian Fruitgrower**  
 Australian Apple and Pear Ltd (APAL) and Summerfruit Australia Ltd (SAL) are the peak industry bodies representing the interests of commercial apple, pear and Summerfruit growers in Australia in matters of national importance including regulation, legislation, marketing, research and development.

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## Editorial

Last issue we said "welcome back" but within days of Australian Fruitgrower arriving on your desks a significant part of the country was hit hard by either major fire or flood. In both cases the elements hit harder than past experience had recorded. In addition to a major loss of life, assets and communities, the fires also affected areas connected to our industry including Victoria's Yarra Valley, the North East and West Gippsland bordering on Melbourne's eastern fringe. Alleged human assistance notwithstanding, the fires roared out of a week of 45°C summer heat that set new records for parts of the state. Such extremes have been flagged by the climate change experts, implying that this will become the norm; heaven forbid. Personal safety aside, the recent weather events must prompt questions of just where, how, or even if, growers make future investments in these risk situations. Beyond our industry, headlines have already posed the core question "life or lifestyle?" We have been adapting to living with less water, competing in fierce global markets, burgeoning 'compliance', and the consumer's demand for fruit of ever-increasing quality and safety. Must we now question the very foundation of growing fruit in some of our most established industry strongholds? This is a medium-to-long term talking point. And we haven't even mentioned the 'GEC' (global economic crisis).

These recent events have prompted a special report in this issue on the causes and responses to heat affected fruit and, almost ironically, the little understood role of humidity in cool storage atmospheres – complemented by a report on thermography as a tool to better determine the costs and efficiencies of cool storage structures. Meanwhile 'back on the ranch' Martin Kneebone reports on just what matters most to different groups along the summerfruit supply chain, while Susanna Richards identifies some 'promising (new) pears' and Marcel Veens refreshes us on the factors affecting fruit size and shape. The business of growing and marketing fruit goes on.



John Fitzsimmons  
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*Cheers*  
**John Fitzsimmons**



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**OUR COVER:**  
 These 'Gala' trees in Victoria's Goulburn Valley were initially hit by frost and damaged earlier in the season, so at thinning, the damaged fruit was removed, emphasising the lack of fruit on the lower branches.

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April Edition Vol 3 No. 3	6th March	16th March	16th March
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July No. 6	8th June	15th June	6th July

## Thermography – Saving energy in the cold chain

By Dr Silvia Estrada-Flores\*

Heat leakage through the envelope of refrigerated equipment and air leakage through defective or damaged door seals have both consequences on heat load and refrigeration costs.

Unlike other heat loads, heat leakage and air infiltration are present during the entire working time of a cold store or container.

Thermography is a technique that enables engineers to determine why some insulated bodies fail in achieving the insulation effectiveness and air tightness standards required in the industry. Defects such as thermal bridges, airflow through gaps and insulated sections that have been damaged or that have aged at different rates from the rest of the panel can all be visualised through thermography.

We calculated the energy costs of heat leakage through the panels of a large cold store (58,500 m<sup>3</sup>) for frozen products as a function of the insulation effectiveness (*k* value) factor. Panels with low insulation effectiveness (*k* value = 2.98 m<sup>2</sup> kW) can lead to extra energy costs of \$32,000.00 per year, in comparison with panels with a *k* value of 7.1 m<sup>2</sup> kW.

Although ASHRAE recommends a *k* value ranging from 6.2 to 7 m<sup>2</sup> kW, it is well known that ageing and damage to panels can lower the insulation efficiency by 5- 12 per cent per year.

Additionally, we calculated the energy costs resulting from varying degrees of door sealing efficiency for the same cold store, assuming the existence of five sliding doors (2.3 x 2.7 metres) and two staff access doors (0.8 x 2m).

Our estimates indicate that even with a few gaps representing 10 per cent of the total door seal area per door, the annual energy costs due to air leakage are substantial (i.e. about \$5,000 per year).

We also estimated energy costs resulting from varying degrees of insulation efficiency in a 20ft ISO container at -18°C. An increase in *k* value from the optimum value of 0.4 W/m<sup>2</sup> k to 0.8 W/m<sup>2</sup> k would lead to an extra energy expenditure of US\$2,000 per year. If the *k* value increases to 1.2 W/m<sup>2</sup> k, the extra

energy costs would be US\$4,000 per container per year as compared with a new container with optimum insulation.

In regards to the effect of air infiltration through defective door seals, we estimate that gaps representing 10 per cent of the total door seal area lead to annual extra energy costs of about US\$4,480 per year.

In a global context, there are about 1,380,000 refrigerated containers in use. If only 3 per cent of these present a *k* value of 1.2 W/m<sup>2</sup> k and leaky door seals with gaps equivalent to 20 per cent of the total sealed area, the annual extra energy costs required to operate these containers (as opposed to containers in good conditions) would be US\$325.5m. Further, the use of these 41,400 containers would increase the carbon footprint of refrigerated shipping operations in 1.4 million tonnes of CO<sub>2</sub> equivalent per annum.

In our cold store and container case studies, the financial case for the use of annual thermographic surveys to detect uneven degradation of insulated panels and air leakages through door seals in cold stores and containers is strong.

The cost-benefit ratio of corrective and preventive maintenance (including an annual thermographic survey) in a cold store with an annual 10 per cent increase in door seal gaps and a 6 per cent decrease in *k* value (due to ageing and damage) is 1.56. In a container powered by marine diesel oil, for each \$1 invested in maintaining good seals and insulation values the return would be \$1.78.

Thermography is an attractive preventive maintenance solution for cold stores and containers.

**Editor's note:** Even though the examples and costs given in this article apply to cold rooms and refrigerated containers used for frozen food at -20°C, the same principles apply to the storage and shipping of chilled fresh fruit operating at about 0°C.

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