



Postharvest research update:

Maintaining lime fruit quality during storage

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Key points

Better storage required to supply local limes year-round

Low ethylene levels can maintain green colour of limes

Future options may include UV-C and 1-MCP treatment

THERE is a need to improve the storage of limes due to the inconsistent supply of limes onto the local market and increasing volumes of limes being grown in Australia. Storing limes can assist growers to receive premium prices through managed supply of green limes. However yellowing of green peel is a major problem during lime storage. This can be minimised with the use of cold storage where the recommended storage temperature is 10°C.

However, other options to maintain fruit quality after harvest are limited. Some reports have used controlled atmosphere storage to maintain fruit quality, but this is often not commercial. The NSW Department of Primary Industries (DPI) and the University of Newcastle at Ourimbah conducted a series of postharvest storage trials with different postharvest technologies to maintain lime fruit quality during storage.

Ethylene

Ethylene is the natural ripening gas that can be used to de-green early season mandarins and navel oranges (*Australian Citrus News*, May 2017). The application of ethylene during de-greening breaks down the green chlorophyll in the peel of oranges and mandarins. Therefore, to maintain the green colour of limes, it is logical to keep the ethylene away from the mature green lime fruit. Ethylene gas is naturally produced by all fruit and vegetables (but at different levels and rates).

In our storage experiments, we controlled the level of ethylene around the fruit. As expected, higher levels of ethylene around the fruit resulted in de-greening (yellowing) of the fruit, and lower levels of ethylene maintained the green colour of the fruit. This shows the benefit of reducing the levels of ethylene in the storage room during the storage of limes. This can be achieved with different venting or ethylene scrubbing technologies, such as the use of potassium permanganate pouches within boxes or the use of ethylene scrubbers in storage rooms.

1-MCP technology

Another method to counter the effects of ethylene on fruit is the use of 1-methyl cyclopropene (1-MCP). 1-MCP is widely used for the maintenance of apple fruit quality during storage and is registered for use on many other horticultural products, but not currently for citrus. 1-MCP is safe to use and works in a non-toxic way by delaying the action of ethylene in fruit and vegetables.

In these storage trials, treatment with 1-MCP retained peel green colour, even in the presence of moderate levels of ethylene. However, the beneficial effect of the single 1-MCP treatment on peel colour lasted for a short period, and stored lime fruit will eventually go yellow. But this benefit in delaying yellowing may be sufficient to allow short term marketing. It should be noted that 1-MCP is not currently registered for citrus or limes.

Use of ultraviolet light

The postharvest use of ultra violet light is a new method to maintain fruit and vegetable quality during storage. In another series of different storage experiments at the NSW Department of Primary Industries and the University of Newcastle, ultraviolet (UV-C) light was used to retard senescence and aging of green lime fruit.

UV-C is part of the regular light spectrum constituting about 10% of the total light output of the sun and has shorter wavelengths (100-280nm) than that of visible light. UV-C light can be dangerous to human health through causing sunburn and skin cancer, but it is also necessary for the production of Vitamin D. However it is absolutely critical to reduce exposure to UV-C for humans. In these trials, the UV-C treatment was applied to the fruit in specialized treatment cabinets where there was no potential human exposure to harmful UV-C light. It is envisaged that this treatment cabinet could be integrated into commercial packing lines.

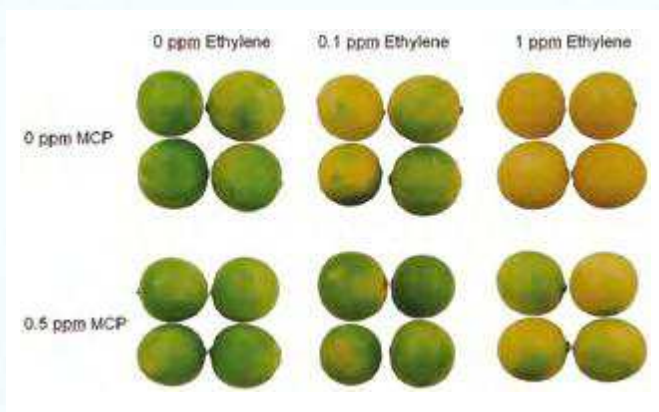


FIGURE 1 The effect of different ethylene levels and 1-MCP treatment on the peel colour of stored limes after 15 days at 20°C.

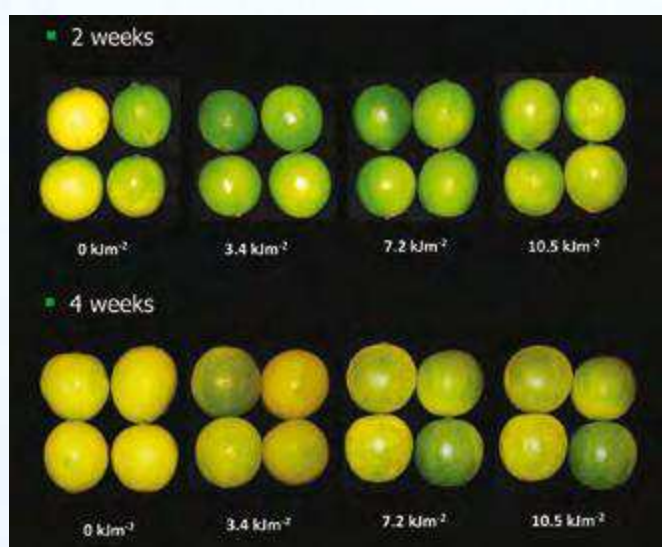


FIGURE 2 Effect of different treatment intensities of ultraviolet light on lime peel colour after two weeks (top row) and four weeks (bottom row) storage at 20°C.

We applied different intensities of UV-C light to lime fruit after harvest and stored this fruit at room temperature. The results showed that UV-C treatment delayed the yellowing of limes for two weeks but was less effective after four weeks storage. UV-C treatment did not affect internal fruit quality such as fruit sugar and acidity levels. A final series of storage trials showed the combination of UV-C and 1-MCP was the best treatment to maintain green peel colour of limes.

Summary

These storage trials showed there are potential options to maintain the green peel colour of lime fruit. Maintaining low ethylene levels around the fruit is a current option, but in the future the application of other postharvest treatments such as UV-C and 1-MCP may be commercialised to delay lime peel degreening. Further work is required to optimise these potential postharvest treatments for industry.

MORE INFORMATION

Full results from these research trials are available by contacting John Golding at NSW Department of Primary Industries (john.golding@dpi.nsw.gov.au / (02) 4348 1926).

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