Impact of Package Coating 'ZXT' on Postharvest Quality of Strawberries

'Driving ag-tech adoption across Australia (AS20007)'

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The trial tested if a new packaging technology can reduce disease and extend strawberry shelf life. Coated and non-coated standard 250g flat punnets were compared using *'Albion'* and *'Cabrillo'* strawberries grown in Stanthorpe. Fruit were harvested at early-to-mid and late season and stored at 4°C for up to 15 days.

Key findings

- Decay started 2–3 days later in coated compared to uncoated punnets for both cultivars and harvest times, with initial onset at 10—13 days (1st harvest) and 3—7 days (2nd harvest) after harvest.
- Packaging coating reduced disease incidence early in storage, especially for late-harvested '*Cabrillo*' fruit.
- Strawberry shelf life was mainly limited by physical damage and dehydration, not disease in early storage, so the effects of coating on overall shelf life were not clear.
- Cultivar affected disease development during storage.
- Results depended on the mixture of coating, harvest time, variety and storage conditions, and should be cautiously interpreted as the work was limited, including samples from a single farm and season, two harvest times, two varieties and one storage temperature.

The opportunity

Strawberry is a popular fruit, valued for its health benefits and convenience as a ready-to-eat snack. Due to its high moisture content, thin skin, soft texture and high respiration rate, fresh strawberry fruit is highly vulnerable to physical damage, dehydration, softening, decay and rapid deterioration.

Cultivar plays a major role in the postharvest performance of strawberries. It influences most fruit quality traits (except moisture loss), chemical composition and susceptibility to decay. Packaging also plays a vital role in protecting strawberry fruit from mechanical damage, moisture loss and microbial development through the supply chain.

In this article, we report how effective the packaging coating ZXT-724 ('ZXT') was in extending the postharvest quality of the strawberry cultivars '*Albion*' and '*Cabrillo*' packed in coated and uncoated punnets. ZXT supplied by OSY Group is a water-based packaging coating compliant with applicable food contact material (FCM) regulations. It is applied to package surfaces, forming a durable microscopic layer. This layer does not transfer to the fruit and is designed to physically disrupt microbes on contact, helping to reduce contamination and potentially extend shelf life.

What did we do?

Fruit sampling and handling

Strawberries of cultivars '*Albion*' and '*Cabrillo*' were harvested at Ashbern Farms in Stanthorpe on two harvest dates (Table 1).

Table 1. Harvest dates of *'Albion'* and *'Cabrillo'* strawberries from Stanthorpe

Harvest	Cultivar	Harvest date	Storage relative humidity (%)
First	*'Albion'*	03/12/2024	> 75
	'Cabrillo'	03/12/2024	> 75
Second*	*'Albion'*	04/05/2025	> 90
	'Cabrillo'	30/04/2025	> 90

* Fruit was collected during the final weeks of production for the Stanthorpe property.

Strawberries were commercially packed into standard 250g hinged-lid flat clamshell punnets. Half of the punnets had been pre-treated with ZXT coating to compare against untreated punnets. The punnets were then transported in coolers to our Department of Primary Industries (DPI) postharvest facilities at Gatton and held at 4°C to simulate typical retail display and domestic refrigerated conditions.

Fruit quality evaluation

Strawberry punnets were:

- Assessed daily for any visible decay up to 15 days after harvest
- Scored for overall visual quality every 2–3 days on a 5 to 1 scale, where 5 is excellent and 1 is very poor, which combined physical damage, dehydration, and disease (decay)
- Evaluated for shelf life every 2–3 days, which was defined as the time from harvest until a punnet would be considered unacceptable by a typical consumer (overall visual quality ≤ 2)

Data analysis

- Analysed changes in fruit quality over time using statistical models that account for differences between cultivars, harvest dates and punnet treatments
- Focused on the likelihood of loss of shelf life or disease development at each stage of storage

What did we find?

Overall visual quality

- Visual quality declined during storage, with a similar rate of decline in coated and uncoated punnets (Figure 1)
- Physical damage during harvest and packing, and dehydration were the leading causes of quality losses, with physical damage accounting for the greatest proportion of fruit failing to meet quality standards
- Symptoms became noticeable from 6 days after harvest and severity increased gradually over time at 4°C (Figure 2)
- Physical damage was more severe in the first (early-mid season) harvest, likely due to rainfall before harvest making fruit softer and more susceptible to handling damage
- Dehydration was less severe in the second harvest (late season) due to higher storage relative humidity (RH). This suggests storage under less than optimum RH (typically found in domestic refrigerators) will likely result in quicker quality loss

Shelf life

- Fruit quality remained high during the first few days of storage, with spoilage increasing rapidly after 7-10 days (Figure 3)
- The coating delayed shelf life loss but did not extend overall shelf life under the trial conditions, as physical damage and dehydration may have masked any benefits in reducing decay
- Shelf life varied between the two harvest dates. Fruit from the first harvest declined more rapidly and reached peak spoilage earlier, while fruit from the second harvest showed a slower, more gradual increase in spoilage. This indicates that storage performance can vary substantially depending on storage conditions
- The improved shelf life observed in the second harvest fruit may be due to the higher RH, harvest period, or a combination of both

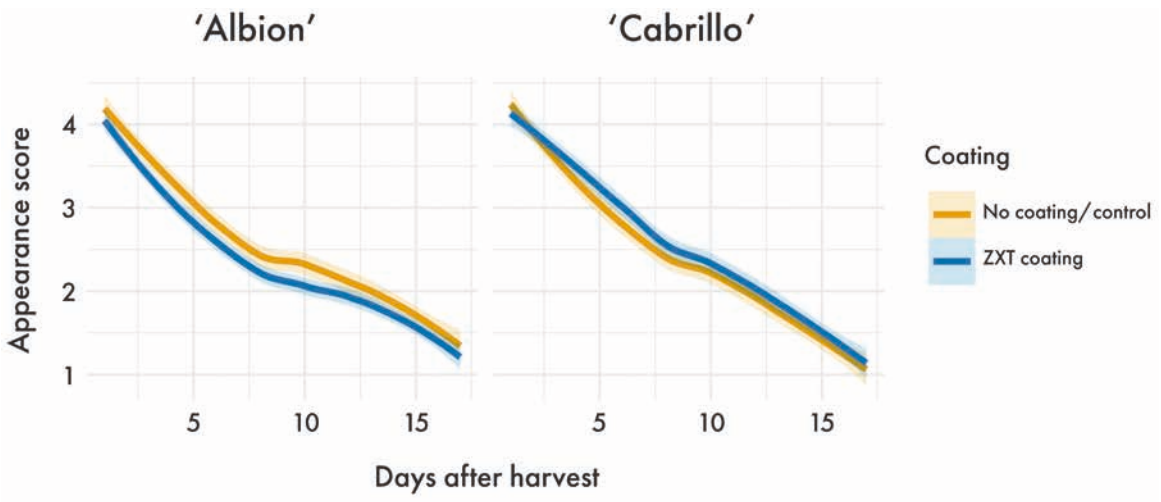

Figure 1. Decline in visual quality of *'Albion'* and *'Cabrillo'* strawberries over storage time at 4°C, comparing fruit stored in coated and uncoated punnets

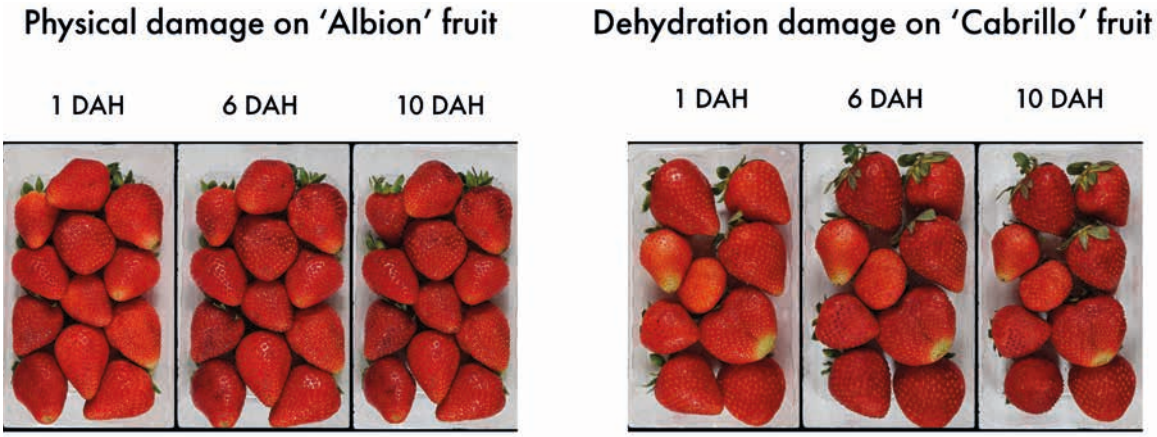

Figure 2. Examples of physical damage on *'Albion'* fruit and dehydration on *'Cabrillo'* fruit on the same punnets held at 4°C for 1, 6, and 10 days after harvest (DAH)

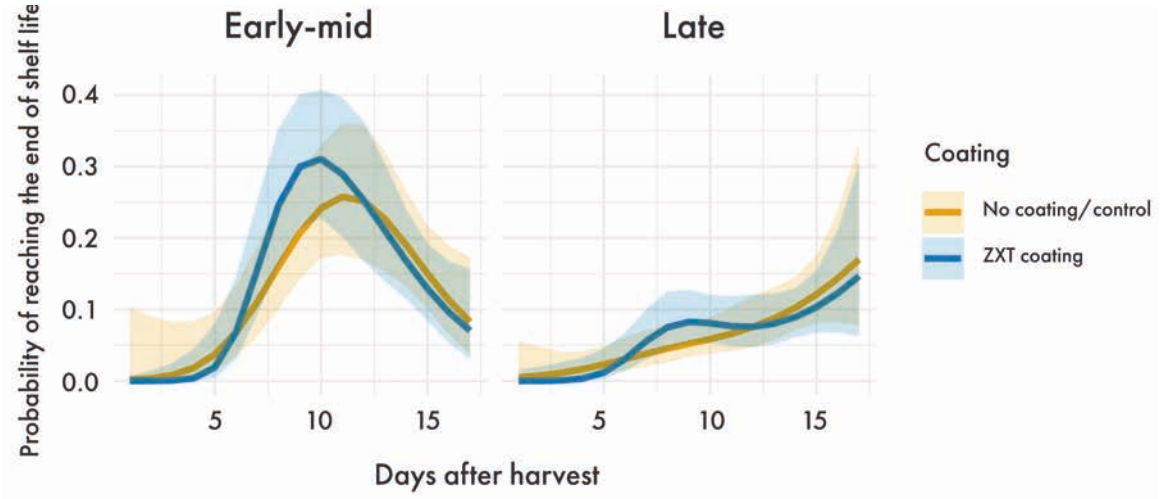

Figure 3. Probability of reaching the end of shelf life over time at 4°C for early-to-mid and late season strawberries

Disease development

- For both trials and varieties, the onset of disease was delayed by 2—3 days in treated compared to untreated punnets, starting at 10—13 and 3—7 DAH for the 1st and 2nd harvest times, respectively
- Disease remained low during the first week of storage but increased quickly as storage time extended (Figure 4)
- ZXT-coated punnets generally had similar or slightly lower disease levels up to 10–12 days after harvest) (Figure 5)
- Cultivars performed differently during late storage. '*Cabrillo*' developed disease more slowly, while '*Albion*' tended to have higher disease levels by the end of storage
- Fruit from the later harvest showed lower disease levels overall, although this may have been due to harvest period, higher storage RH, or both
- Storage time and cultivar had the biggest effects on disease development. Coating affected when disease developed but did not consistently reduce disease levels

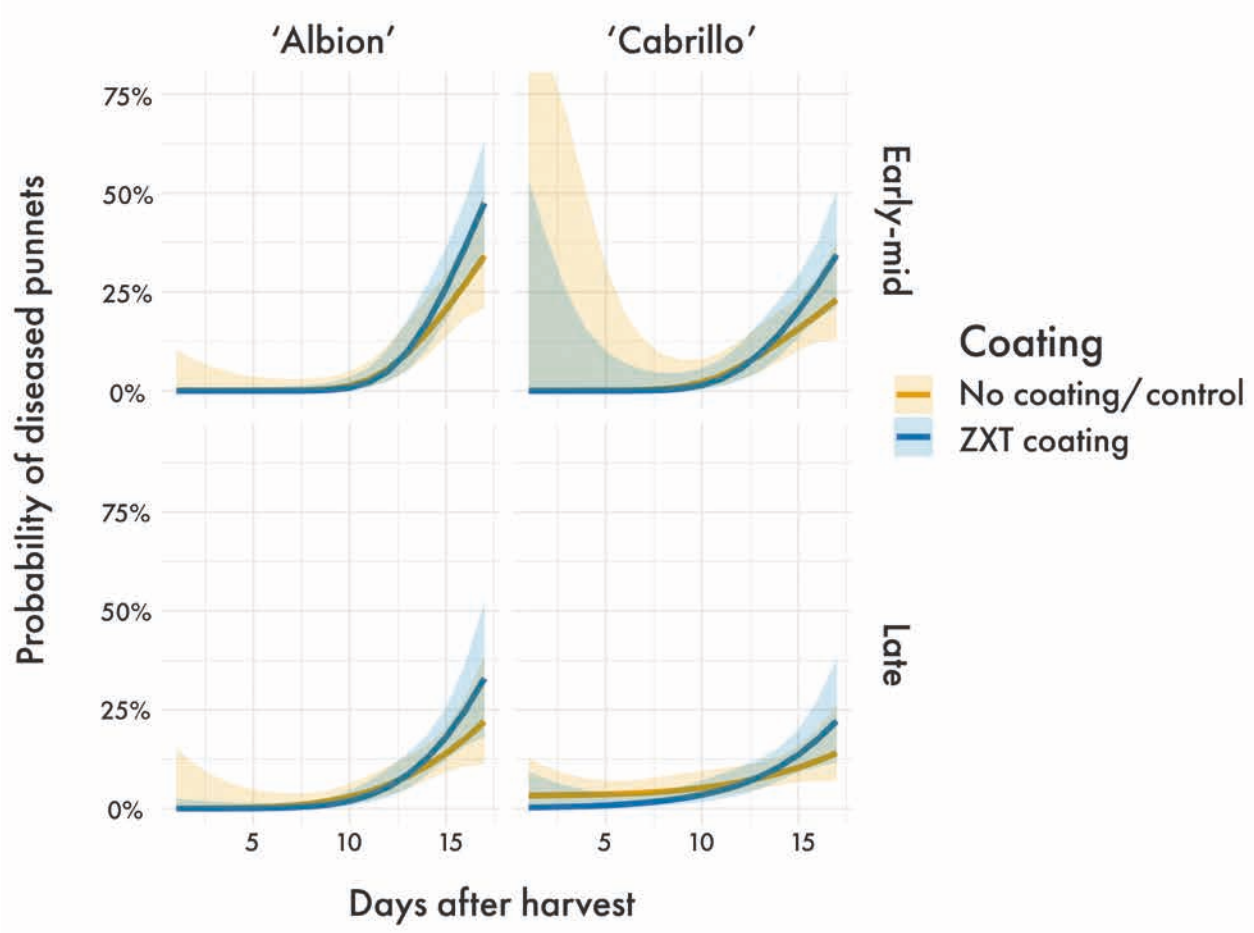

Figure 4. Increase in diseased punnets over time at 4°C for *'Albion'* and *'Cabrillo'* strawberries and two harvest times.

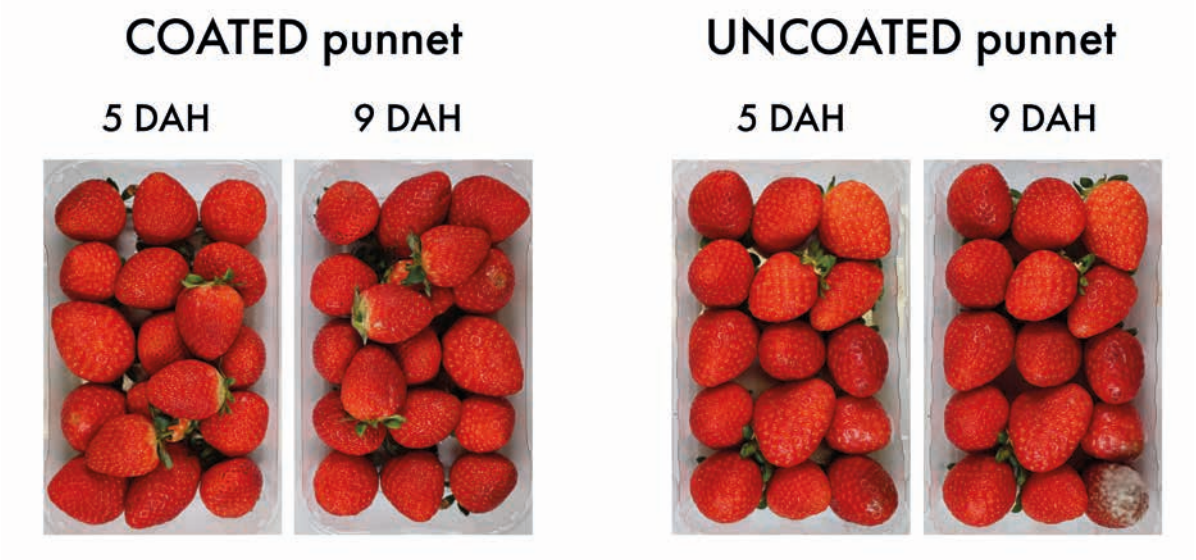

Figure 5. Examples of *'Cabrillo'* strawberries 5 and 9 days after harvest (DAH) held at 4°C in ZXT-coated (left) and uncoated (right) punnets. Differences were not always obvious.

Key actions for industry

- There is an opportunity to improve outcomes through improved handling practices
- Pre-cool fruit to below 10°C for packing as soon as possible after harvest and to less than 5°C before transport to market and maintain the cool chain
- Minimising physical damage during harvest and packing is critical to extend shelf life
- Even small amounts of damage can:
  - reduce visual quality
  - create entry points for pathogens
  - accelerate decay over time
- Overall, although postharvest treatments like ZXT may be useful additional tools, they do not replace best practices
- Maximising fruit integrity at harvest and packing along with rapid cooling and maintenance of the cool chain are still critical factors impacting on quality and shelf life of fresh strawberries

References

Berry good practice guide 2025, Version 1

Dong, W. et al. 2020. Effect of genotype and plastic film type on strawberry fruit quality and post-harvest shelf life. International Journal of Fruit Science

Acknowledgements

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Further information

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