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Evaluation of postharvest treatments for the control of bacterial soft rot in potatoes

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Background and Aim

Management of rots, both in the field and postharvest, is an ongoing challenge for potato producers. The issue is usually managed by minimising the time interval between harvesting and processing of potatoes.

In Canowindra the potatoes are harvested in early morning, washed shortly after harvest and bulk filled into trucks for transport to Sydney, Brisbane or Adelaide. The time interval between washing and arrival at final destinations does not exceed 24 hours, and the potatoes are processed soon after.

While the short transport period has previously provided satisfactory results, high temperatures during spring and early summer of 2019/2020 exacerbated the development of rots during transport, particularly to the Brisbane facility. This issue was likely made worse because the potatoes are packed wet.

The options available to producers to reduce transport rots include:

- Drying before transport **and/or**
- The addition of sanitisers (e.g. chlorine, Tsunami™) to the final wash step.

This trial was set up to explore the effect of sanitisers and/or drying on the development of rots in potatoes transported for 24 hours at high temperature and high humidity.

Trial Setup and Treatments

Location: The trial was conducted at Lachlan Valley Produce's premises in the Central West region of New South Wales:

1 Windowrie Road, Canowindra (Billimari) NSW 2804

https://goo.gl/maps/7FRgMTNKFYouY9u9A

Potato variety: Snowden

Treatments

The trial was commenced on 10 January 2020 around 9am, and all treatments were applied within three hours. The potatoes used in the trial were freshly harvested from surrounding paddocks on the same morning.

TREATMENT LIST

	TREATMENT	DESCRIPTION
T1	**Untreated**	Potatoes collected directly from the truck after harvest.
T2	**Washed + Wet**	Potatoes sampled from the end of the packing line, drained and packed wet into plastic tubs.
T3	**Washed + Dried**	Potatoes sampled from the end of the packing line, dried thoroughly with a fan before being packed into plastic tubs.
T4	**Washed + Sanitised + Wet**	Potatoes sampled just before the final wash step, immersed in a 200 ppm chlorine solution for 1 minute, drained and packed while wet into plastic tubs.
T5	**Washed + Sanitised + Dried**	Potatoes sampled just before the final wash step, immersed in a 200 ppm chlorine solution for 1 minute, thoroughly dried with a fan and packed dry into plastic tubs.

Before applying any treatments, the potatoes were washed using the commercial packing line (Figure 1). Bore water (21-22 °C) was used for all washing steps in the packing line, and the water was not recycled.

Figure 1. Commercial packing line.

Sanitising of potatoes: The sanitising treatment was to dip potatoes in a 200 ppm (mg/L) chlorine solution for at least 1 minute. The available chlorine dip was supplied using commercial bleach (active ingredient sodium hypochlorite 42 g/L or 4.2% available chlorine). The level of available chlorine remaining in the dip following treatment was checked using a commercial chlorine test kit.

Each treatment was replicated three times using different harvest loads.

Climate conditions were recorded during the trial using a Hobo temperature and humidity external datalogger placed in a tub containing dried potatoes (see Figure 2).

Figure 2. Recording of temperature and relative humidity in lidded tub containing dried potatoes.

Storage

Following the application of treatments, the potatoes were stored for 24 hours in 50 litre lidded plastic tubs, to mimic high humidity transport conditions.

The pulp temperature of the potatoes just before lidding averaged 23.5 °C (measurements ranging from 23.2 to 24.0 °C).

The air temperature measured in the tubs reached a maximum 40°C during the 24 hours of storage (Figure 3). Over this period, relative humidity (RH) inside the tub increased from 55% to 95%.

The spike in temperature around 1pm on 10 January 2020 was a result of brief exposure to direct sunlight during transfer from the packing shed into the shed for storage, but was unlikely to have had any significant effect on the results. The corresponding dip in relative humidity was due to the change in temperature.

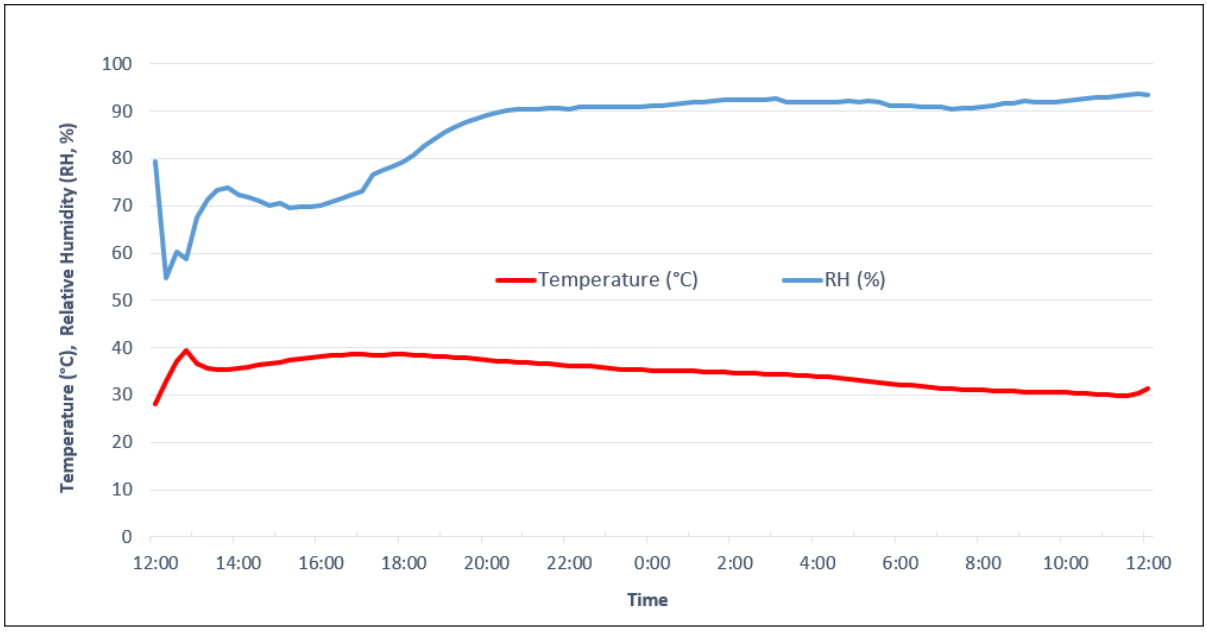

Figure 3. Temperature and RH measured in lidded tub throughout the 24 hour storage trial.

Assessment

After 24 hours in storage, the containers were opened, and the potatoes divided into the three categories listed below. The number of potatoes in each category was recorded. At least 600 potatoes in total were assessed for each treatment:

1. **None:** No rots detected on the tubers
2. **Slight:** Very slight soft rot, easily removable during peeling and cutting
3. **Severe:** Severe rot – tubers unusable

Figure 4. Assessment categories: No rots (right), slight rots (middle), severe rots (left).

Results and Discussion

After only 24 hours' storage in a high temperature, high RH environment, replicating the conditions likely to occur between the farm and processing facility, there were clear differences observed between treatments (Figure 5).

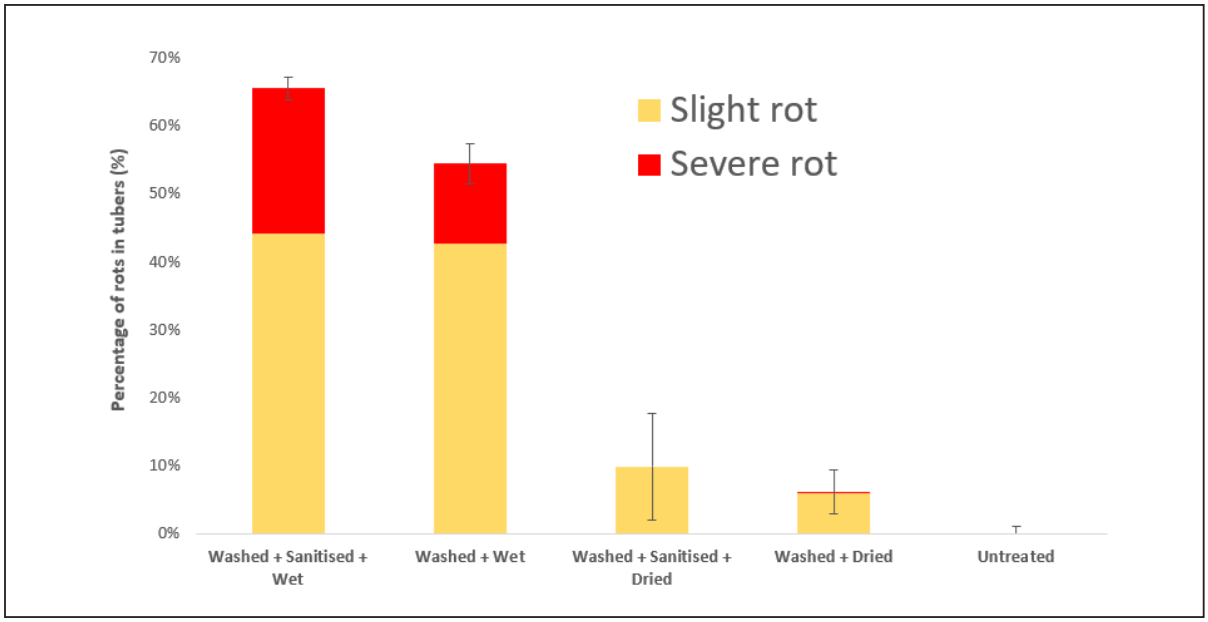

Figure 5. Assessment of postharvest bacterial soft rot in potatoes after 24 hour storage, simulating bulk transport. The vertical bars indicate SE of the total rots (n=3).

No washing: Unwashed potatoes did not develop rots (untreated control). It is likely that avoiding the additional handling during washing steps in the packing line reduces the level of damage (e.g. skin punctures/ peelings/slips), which favour bacterial infection.

Effectiveness of drying: After washing, the next best treatment was to dry the potatoes before transport, resulting in only 6% of tubers with slight rots and almost no tubers with severe rots. Adding a sanitiser step after washing and before drying made no significant difference.

Effectiveness of using a sanitiser after washing: Washing and leaving the potatoes wet before storage had a dramatic effect on the level of rots that developed over the following 24 hours. If the potatoes were washed and stored wet with no sanitiser, 55% of those tubers rotted (43% with slight rots plus 12% with severe rots). Adding a sanitiser step using 200 mg/L available chlorine after the wash step did not control the rots, and in this trial the level of rots was slightly higher than without sanitiser at 65% rots (44% with slight rots and 21% with severe rots).

The relative humidity used in this trial may have been higher than conditions inside a bulk transport truck during transport, with RH exceeding 90% after 9 hours storage. Consequently, more challenging storage conditions might have been created through stimulation of bacterial growth. Nonetheless, results of this trial reinforce the importance of drying potatoes before transport.

There are arguably more effective sanitisers available than chlorine, but given the complete lack of any benefit from using chlorine at the recommended concentration, it is highly unlikely that other sanitisers will be effective at controlling tuber rots in transport.

Conclusion

The most effective ways of reducing bacterial soft rots are either to transport potatoes without washing, or dry the tubers after washing and before transport.

Adding a sanitiser step after washing was not effective at controlling tuber rots.