

PACKER NEWSLETTER

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SANITATION SURVEY 2012

For many years, packers have used combinations of fungicides and sanitisers to minimise decay in export consignments. The limitation of chlorine products are well understood, but still cause monitoring problems due to the products' sensitivity to pH and organic matter. Packers regularly change practices with the expectation of improving their packout, including decay control. However, the interactions are complex and objective measurements are rarely made to assess the effectiveness of packingline operations.

We recently conducted a survey of 3 major exporters to determine whether they are achieving a reduction in fungal spores (and total microbe levels) on fruit as it progresses through packingline. To assess this, we measured the levels of spores on oranges as they passed through different processing points in the packingline. We conducted a similar survey in 2004 and it is interesting to compare the results.

POSTHARVEST DECAY IMPLICATIONS

In this recent survey, there were ~20,000,000 viable spores for every tonne of oranges, which represents a significant challenge to the packingline over an extended period of packing. The figures do not take into account diseased fruit, which can add millions more spores per fruit.

Most sheds have some form of sanitised high pressure (HP) washing early in the packing process. All fruit sampled after

the wash showed a large reduction in the surface spore load (~98% reduction). This is in stark contrast with the survey result in 2004, where the average spore count was reduced by 27% after a chlorinated wash. Sanitisers, at 50-200ppm free chlorine, are poor at inactivating spores on the surface of fruit: Best activity is on spores suspended in water. The survey improvement was most probably due to the change to HP washing, which physically removes the spores from the surface of the fruit. The spores washed off are much easier to neutralise in water and cleaner fruit moves further down the line.

After oranges pass through the chlorinated wash they may still carry some viable spores. It is important to minimise the number of spores as they are washed into the recirculating fungicide solution. The fungicides used for export markets control mould, but resistant mould spores and sour rot will gradually accumulate in the solution. For this survey, average spore levels remained low, presumably because fruit were carrying less spores after HP washing. The best results occurred when compatible sanitisers were added to the fungicide tank.

In 2004, adding sanitisers in fungicide tanks was not recommended because chlorine was incompatible with imazalil. Good packers still kept spore levels low by frequently changing the solution (at least daily). This is still good practice.

(Continued on page 2)

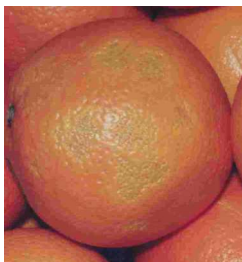
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Read the Packer Newsletter
and stop the rot.





OLEOCELLOSIS

This season there has been a lot of cold and wet weather, which makes fruit more susceptible to rind injury. Oleocellosis is caused by oil release from ruptured glands in the rind. The oil glands are easily ruptured when the rind is firm, and then harvested. This is why harvesting is often delayed as late as possible on wet, cold days.

The damage doesn't show quickly, but after a few days the injured areas start to collapse. The damaged area will not colour normally and browns with age.

When is it safe to pick? Growers can use fruit pressure testers (penetrometers) to measure the firmness of the rind. The fruit is tested by placing a tissue against the fruit and applying pressure with the tester until oil shows on the tissue. If the pressure is less than 2.75kg, harvest should be delayed.

If you are unsure, harvest fruit extremely carefully. Start picking trees off the highest and driest area of the orchard. Fruit on the northern side of the tree above waist height are less susceptible. Check picking bags and bins for sand and remove to avoid any abrasion. Don't squash fruit in bags or bins. **Peter Taverner**

(Continued from page 1)

Smaller packinglines can run without topping up and dump after the concentration runs down to half strength. Initially, solutions should be analysed to determine the rate of fungicide strip-out. This can be used to calculate top up &/or dump times. Quality assurance requires documentation of fungicide residues on fruit and these measurement can be useful in determining top up rates. The advantages of high volume systems are that they maintain the good contact of fungicides on fruit, which increases fungicide uptake.

Another option used by packers is to apply the fungicide in low volume non-recovery systems. This system has the advantage that the solution is fresh, ie. no recirculation to accumulate spores. Non-recovery systems rely heavily on the brushes to both wet fruit and distribute the fungicide evenly. An important hygiene consideration with a non-recovery system is the accumulation of spores in the brushes themselves. Although fresh solution is used, the brushes will be carrying an accumulated spore load. Low solution volumes may actually increase the concentration of spores in the brushes compared to flooding systems. Regular cleaning of the brushes will be required to maintain low microbe levels.

In this survey, swabs of wax brushes demonstrated that low levels of spores are present. Again, this is an improvement on the results of the 2004 survey. High-pressure washes minimised contamination by removing spores from the surface of fruit but there is no substitution for thorough cleaning of wax brushes using hot water under pressure. A proprietary chlorinated detergent may provide greater reduction of microbe levels when cleaning brushes and packingline surfaces.

Overall, the packing lines surveyed shows that spore levels decline as fruit was carried through the system. The accumulation of spores in fungicide solutions and wax brushes have been addressed since earlier surveys but vigilance must be maintained.

PUBLIC SAFETY IMPLICATIONS

Sanitation surveys are often associated with food safety risks and measure specific groups of bacteria, such as salmonella or shiga-toxin

producing *Escherichia coli* (*E. coli*). The majority of microbes on fresh fruit are harmless soil-dwelling bacteria. As a consequence, high microbe numbers in this survey do not necessarily constitute a public health risk but are indicative of a potential area of risk. We suggested that packers could use this survey to identify areas where potential problems may occur.

The total microbes levels are much higher than the fungal counts on pre-dump fruit. The HP wash significantly reduced levels of all microbes, but, because there were very high levels the potential for accumulation down the line is higher. Unsanitised fungicide solutions had high levels of bacteria even when fungal spore counts were low. As the fungicide did not control the bacteria they could proliferate. This situation also carried over to the wax brushes where high total microbe numbers were found, probably resident deep in the brush-beds. It is important to note that the levels of fruit remained relatively low compared to 2004 surveys. The reasons for this were not determined in this study, but packers indicated that cleaning and sanitation measures are being applied more frequently in these areas.

SUMMARY

General sanitation in citrus packinglines has improved considerably in the 8 years since the last surveys. Much of the credit for improvement must go to packers who have placed sanitation as a high priority. The selection of appropriate sanitiser rates, compatible chemicals, monitoring and 'after shift' sanitation has vastly improved the general cleanliness of packing operations.

HP washes may have been the major change effecting sanitation because they effectively wash dirt and microbes off. However, if you wash lots of spores off fruit into your tanks, make sure you have a good sanitiser or you may end up contaminating subsequent fruit and your line.

Sanitation and hygiene is an integral part of a successful commercial citrus packing shed. It can also play a role in fungicide resistance management. As you will see, in the article on page 4.

Peter Taverner

FUNGICIDE RESISTANCE SURVEY 2012

Agar media plates are routinely employed by fungicide manufacturers to assess the sensitivity of commercial fungicides. This season we placed plates amended with thiabendazole (TBZ), imazalil (IMZ) and fludioxonil (FLU) into a number of packingsheds.

The results varied between sheds, and even locations in the same packingshed. However, we usually recorded some growth on TBZ-amended plates. In some places, similar numbers grew on TBZ- and un-amended plates.

The images below show plates from this survey. Many fungi, yeast and bacteria grow but our concern is with the mould spore colonies only, which show as dark circles.

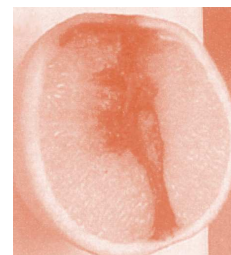
As you can see, there is considerable mould (dark) growth on the TBZ plates exposed by

the packingline. The cool room is a cleaner environment and little growth is visible. The FLU amended plates exposed in the same areas show yeast but no mould (dark) growth.

These images show nicely the difference between a fungicide after constant use and selection pressure (TBZ) compared with a fungicide never used (FLU).

We are still evaluating the significance of these results, and need to establish regular monitoring. However, signs of TBZ fungicide resistance early in the season (after summer break and cleaning) is a concern because resistance is likely to increase during the season, with consistent use of TBZ and IMZ.

Peter Taverner



CITRUS BLACK ROT

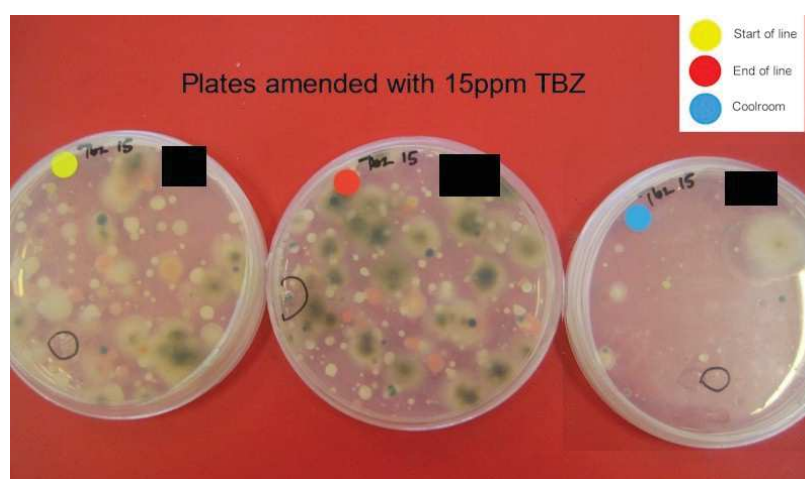
There are several diseases of citrus caused by the fungus *Alternaria*. This season citrus black rot has been reported in orchards. This disease can occur in the orchard and postharvest. Orchard expression is more commonly associated with navel oranges because of weaknesses and cracks in the navel. The infection lays 'quiet' until after adverse conditions (drought, frost or over maturity). The fungus invades the orange core producing a black rot. The fruit often looks sound until cut open (see image above).

As symptoms are internal, delayed harvest to allow diseased fruit to fall to the ground is the best method to prevent inclusion, especially to avoid tainting juice.

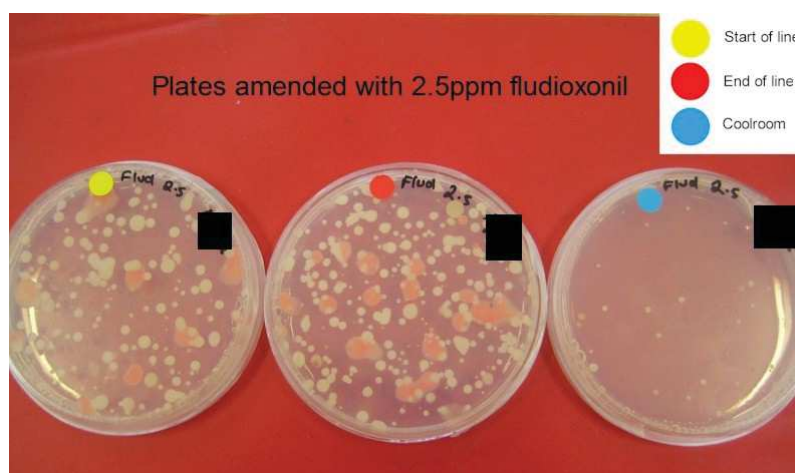
Postharvest expression is usually associated with senescence of the button. As such, it is often associated with long-term storage. The common postharvest fungicides used do not control this disease. However, the use of 2,4-D to delay button senescence can delay expression.

Peter Taverner

THIABENDAZOLE AMENDED PLATE



FLUDIOXONIL AMENDED PLATE



Acknowledgements

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Major voluntary contributors:



POSTHARVEST SNIPPETS!

EU FOCUS ON QUAT RESIDUES

European laboratories have recently detected the following QACs in several fruits and vegetables mainly originating from third countries but also from Europe: Didecyl Dimethyl Ammonium Chloride (DDAC) and Benzalkonium Chloride (BAC) [source: Freshfel]. The default EU MRL is 0.01 ppm for both DDAC and the QAC-family in general. In Australia, QAC's (Quats) are not used directly on fruit postharvest but equipment can be washed down at end of shift, followed by a fresh water rinse. It will be very important to avoid cross contamination, with these very low MRLs. Check your

market requirements, and review your use of QAC's accordingly.

NANCY'S HAVING A BABY

We wish Nancy and Tony a healthy happy baby; due in early August. Karolina and I will continue the work here in Nancy's absence. Nancy has started her maternity leave and will not return until March next year. She will probably be ready for a 'rest' back at work by then.



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PACKINGSHED DESIGNS TO REDUCE FUNGICIDE RESISTANT MOULDS

Strategies to minimise fungicide resistance place emphasis on the rotation of fungicides with different modes of action &/or fungicide combinations. The use of carbonates salts mixed with fungicides has also been successfully used. Great advice but not always possible with so few fungicides available, and not the whole picture.

Packingshed design and sanitation also contribute greatly to the build-up of resistant strains. Packingsheds are usually designed based principally on equipment and labour efficiency. Resistance management was not the priority at the time of design. However, some modest changes may make significant differences in resistance build-up.

The more spores floating around in the packingshed, the greater the risk of resistance developing. One approach is to introduce fewer spores into the shed and reduce the remaining

spores movement throughout the shed. The basic principles listed below are from a paper written in 1977 but still very relevant. It describes the spore movement in two Florida packinghouses, and the subsequent changes in design that reduced decay. It is very practical and can be found on the link supplied in the reference (right).

Some of the lesson they learnt have already become common good practice;

- Remove air-borne spores at dumps/rot sorting with strong exhaust hoods.
- Regularly sanitise surfaces susceptible to contamination.
- Take extra care during degreening. Separate degreening rooms from other operations as much as possible. Use a fungicide in the packingline with a different mode of action from the pre

-drench before degreening.

However, we may have forgotten this one;

- Place rot sort operations and decayed fruit downwind. Check the prevailing winds during packing season.

Significant reductions in the movement of spores into accumulators and packing areas were made by closing doorways, erecting partitions or altering air flows in other ways.

Spore movement before and after changes, and subsequent reductions in spore loads were measured directly by spore plates assays. Hum! Good idea!

Finally, if you want to monitor your situation and assess when to rotate fungicides;

- Assay airborne spores in the packinghouse regularly for resistant moulds.

Peter Taverner



Reference

D.J. Hall and J.R. Bice. (1977). Packinghouse strategies for the control of fungicide resistant moulds. Proceedings of the Florida State Horticultural Society. 90:138-141.

[http://www.fshs.org/Proceedings/PasswordProtected/1977Vol.90/138-141\(HALL\).pdf](http://www.fshs.org/Proceedings/PasswordProtected/1977Vol.90/138-141(HALL).pdf)