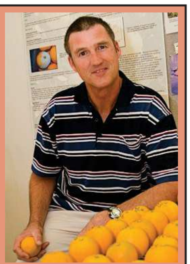
PACKER NEWSLETTER

VOLUME 111 JUNE 2014

EDITOR: PETER TAVERNER
Waite Research Precinct
GPO Box 397
Adelaide 5001
Phone 08-83039538
WEB ADDRESS:

http://www.sardi.sa.gov.au/foodsafety/publications/citrus_packer_newsletter



send me an e-mail :

peter.taverner@sa.gov.au

FUNGICIDE USE IS HEATING UP

I am aware of one citrus packer in the MIA that has been using heated fungicides successfully for over 20 years. Similarly, heating has been widespread for many years in a number of countries . At last, there is a new wave of interest in heated fungicides in Australia. Halleluiah! The 'secret' is out. I predict that, like high pressure washers, packers that investing in doing it properly will never go back. To fire more interest (pun intended), I have updated some information on heated fungicides. When I looked, I was amazed to find my previous article was in Packer Newsletter Vol. 72 in 2004.

Early research using heated solutions involved immersing fruit for several minutes, which is not a very appealing prospect for large commercial packers. However, enterprising researchers tried heating fungicides to lower, but safer, operating temperatures. It proved to have some very tangible benefits for decay control.

Mario Schirra's and Joe Smilanick's labs were major contributors to this work in the 1990's. During this period, it became apparent that higher fungicide residues are deposited in citrus fruit when applied in heated water. For example, increasing the temperature of dip solutions from 32^{0}C to 43^{0}C (by 11^{0}C) increased EC imazalil residues by 1.5 to 2 times (Smilinick et al., 1997). Heating lead to increased residue levels and improved decay control. Given this result, it is not surprising that many packers now use lower concentrations of fungicide in heated water compared to ambient water temperatures.

Much of the initial work was focussed of imazalil because the residue response was much higher than for thiabendazole. Smilanick et.al (1997) found that a fruit residue of 2-4ppm could be obtained with an EC imazalil rate of 350-400ppm, a solution temperature of ~38^{0}C , and 30 seconds exposure. This formed the basis for commercial application but requires adjustment due to the interdependence of imazalil dose, temperature and exposure time. Changing any one of those factors alters the outcome.

Recent work out of South Africa suggests other important factors were missing; pH and formulation type. Early residue work was conducted on the EC formulation of imazalil but imazalil sulphate (granular form) has become increasingly popular for aqueous application. Erasmus et. al. (2011) found that imazalil sulphate when buffered with sodium bicarbonate

(Continued on page 2)

INSIDE THIS ISSUE

Read the Packer Newsletter and stop the rot.

FLOCCULATING WATER USING ALUM

Many packers draw irrigation water from the river system for their packing needs. The quality of this water is more variable than town mains water. It is also likely to be much more turbid (cloudy). The cloudy appearance is due to suspended clay or silt. Fungicides added to this turbid water can be bound to the clay or silt rendering them less effective. Guazatine is particularly susceptible to being bound up, with up to 40% losses in very turbid water. Imazalil and thiabendazole are less susceptible but a significant amount can still be bound to clay particles. The clay and bound fungicide settle to the bottom of the tank, reducing the amount of fungicide deposited on the fruit. At the end of the day, the solution is drained and a sludge containing silt/clay and fungicide is washed out.

One way to reduce this loss is to remove the clay and silt. Flocculation is the removal of clay and silt. Basic instructions to use alum are below:

1. Move turbid water to settling tank
2. Adjust water to pH 7
3. Test if alum flocculation works in 10L bucket. Adjust rate/pH as necessary. A neutral pH is very important to get the alum to work properly.
4. Broadcast alum (aluminum sulphate) across water surface
5. Wait (12 hours+) for flocs to coalesce and fall to bottom
6. Carefully drain off clarified water and spray or splash (to aerate) into fungicide tank.

Detailed instructions for clearing turbid water can be obtained from the W.A. Dept. Agric. Farmnote No. 42/2004

Peter Taverner

(Continued from page 1)

(pH 8) had markedly increased fruit residues compared to unbuffered imazalil sulphate (pH 3). The pH of imazalil sulphate significantly changes the relationship between residues, time and temperature.

Another factor is application type. Immersion is preferable for efficacy but high volume flooding or drenching is generally preferred by packers. In deference to this, there has been considerable work in developing systems that flood or cascade heated water over fruit as it is transferred in-line. It is also theoretically possible to apply heated fungicides by low volume application. This has the advantage of only needing to heat a smaller, non-recirculating volume but the heat loss at application with the fine droplet size is drastic. To compensate, the solution could be superheated to ~30^{0}C above the target fruit temperature and pre-heating fruit in a short drying tunnel before fungicide application should help. An infra red thermometer is useful to measure the surface temperature of fruit. Measure the fruit surface after passing through the spray to avoid measuring the temperature of the liquid.

Imazalil's response has been well documented: But; what about heating other fungicides? Thiabendazole (TBZ) is considered less responsive to heat but there is a response. Smilalick et.al. (2006) looked at heated TBZ as a drench prior to degreening. They found that mild heating (41^{0}C) of TBZ significantly improved control. Adding sodium bicarbonate (3%) improved decay control even more. In their work, dipping gave better results than drenching. In addition, Palma et.al (2013) found that a 30 second dip in 300ppm TBZ at 56^{0}C was as effective as 1000ppm TBZ at 20^{0}C, and provide similar fruit residues.

What about the new fungicide, Scholar? Schirra et.al (2005) looked at residues and storage performance of citrus dipped in fludioxonil (FLU) in semi-commercial trials. They found higher residues (2.6-4x) in fruit treated at 50^{0}C compared to 20^{0}C. His work showed almost complete control of decay with FLU applications of 100ppm at 50^{0}C and 400ppm at 20^{0}C, both resulting in ~0.8ppm FLU fruit residues. Impressive, but difficult to translate directly to our commercial practices as they dipped fruit for 3 minutes.

The use of heated fungicide solutions can offer some additional benefits. The heated fruit dries quicker often resulting in a superior shine. Lower concentrations of fungicide are used, which means less fungicide is dumped with wastewater.

Higher temperatures can destroy surface pathogens (up to log 4 reduction) and temporarily inhibiting the growth of survivors. Sufficient heat melts the surface waxes sealing cracks that may serve as future entry points for pathogens. There are also very interesting reactions occurring beneath the surface of the fruit. Heat treatment can induce a 'natural' defence response against pathogens. Unfortunately, the response appears to be transient; providing relatively short-term protection. Another interesting benefit of heat appears to be an increased resistance to chilling injury.

<u>Key References</u>

Erasmus et.al. (2013) Imazalil residue loading and green mould control in citrus packhouses. Postharvest Biology and Technology. 62, 193

Palma et.al. (2013) Cold quarantine responses of 'Tarocco' oranges to short hot water and thiabendazole postharvest dip treatments. Postharvest Biology and Technology. 78, 24

Schirra et.al. (2005) Residue level, persistence and storage performance of citrus fruit treated with fludioxonil. J. Agric. Food Chem. 53, 6718

Smilinick et al. (1997) Improved control of green mould of citrus with imazalil in warm water compared with its use in wax. Plant Disease. 81, 1299

Smilinick et.al (2006) Pre– and postharvest treatments to control green mould of citrus fruit during ethylene degreening. Plant Disease 90, 89

Peter Taverner

WAX DEFECTS

There has been a lot of changes to waxes in recent times. In particular, the EU has banned morpholine from fruit coatings. Ammonia can perform the same function but it has some draw-backs. Ammonia is more volatile and the vapour is unpleasant. Formulating waxes with ammonia also requires some fine adjustment of other components (Hagenmaier 2004). Some packers are not happy with change but, don't always blame the manufacturer for wax problems. Wax defects can occur due to formulation, environmental conditions &/or poor fruit cleaning. Largely, defects show as whitening of the wax. Some of the terms used and the causes include:

Powdering. Usually occurs when is wax is applied during very low humidity, leading to wax particles drying before a smooth continuous coating is formed. Adjustment of plasticisers may be required.

Shattering. Flakes of wax separate because the wax coating is too brittle. Fruit may not be cleaned well enough or more plasticiser is needed.

Chalking. Condensation forms on fruit as moved in and out of refrigeration. Condensation can form between the fruit surface and wax. This results in whitening when the water dries and forms an air pocket . But, if the coating is sound the air will not enter. Chalking is exacerbated by poor fruit cleaning or insufficient drying prior to waxing.

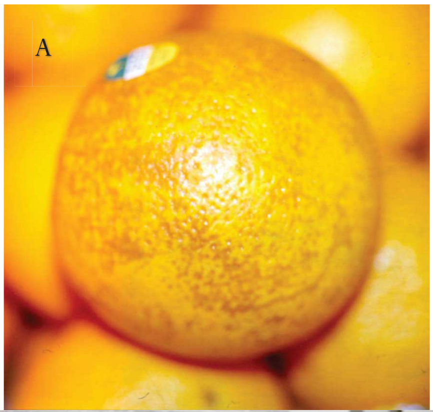
References

Hagenmaier R.D. (2004) Fruit coating containing ammonia instead of morpholine. Proc. Fla. State Hort. Soc. 117, 396 -402.

Hall & Sorenson. 2006. Washing, waxing and color-adding. In Fresh Citrus Fruits. Wardowski et.al. (editors). Florida Science Source Inc., Florida, USA.

Peter Taverner

CHILLING INJURY—IN ITS MANY FORMS



The introduction to the chapter on 'Physiological Peel Disorders' in 'Fresh Citrus Fruits' is a particular favorite of mine. It describes the 'elusive ' character of peel disorders. Anyone who's been sent an image with the plea 'What's this rind problem?' knows what I mean.

Chilling injury (CI) is a classic example of the elusive nature of peel disorder. It is unpredictable. The symptoms are highly variable and similar symptoms can occur with other disorders. To illustrate my point. Here's a test. Which image (left) is chilling injury ? A or B? I will give you a clue; the other one is brush-burn. Still not sure! The answer is on page 4.

Diagnosis of disorders is risky based on visual inspection alone. Some knowledge of the history of the fruit can certainly help but diagnosis is often still difficult.

Citrus fruits, especially grapefruit, limes and pomelos, are chilling-sensitive and can develop CI symptoms in storage and/or while in transit. There are preferred carriage temperatures for citrus to avoid CI but temperatures below optimum are often used for marketing advantage and as disinfestation requirements. Due to the sporadic nature of this disorder, fruit is often unaffected at these lower temperatures. But, when CI does appear, the symptoms in citrus fruit can vary from pitting, discoloured patches, superficial brown staining of the rind, browning of the albedo and watery breakdown (see images on page 4).

Why is CI sporadic? According to Grierson (2002), fruit susceptibility varies with stress at specific developmental stages, e.g., drought stressed trees are very resistant to CI. The mechanism conferring resistance is not clear. He thought that chilling injury might be associated with the balance of gibberellins (GA) and abscisic acid (ABA); high ABA levels correlate with drought and chilling injury resistance. Others link oxidative stress with CI development, and high levels of antioxidants, such as carotenoids, may provide protection (Alferez et al. 2005).

Generally, packers are less interested in why it happens and more interested in how to stop it happening. Chilling injury in citrus fruit can be alleviated by temperature conditioning, intermittent warming, residue lording of thiabendazole (TBZ) or imazalil and by film packaging or various wax coatings.

As mentioned earlier, curing or intermittent warming is not always an option. For Australian packers in fruit fly areas, the best options are probably TBZ residue loading, heated solutions and high quality shellac-based waxes.

Key references

Alferez et.al. (2005) A comparative study of the postharvest performance of an ABA-deficient mutant of oranges I. Physiological and quality aspects. Postharvest Biol. Technol. 37: 222-231.

Grierson W. (2002) A brief history of Florida chilling injury research. Proc. Fla. State Hort. Soc. 115: 41-43.

Petracek et.al. 2006. Physiological Peel Disorders. In Fresh Citrus Fruits. Wardowski et.al. (eds). Florida Science Source Inc., Florida, USA.

PETER TAVERNER

Acknowledgements

The National Citrus Postharvest Science Program, based at SARDI, has been facilitated by HAL in partnership with Citrus Australia for the period of June 2011–Mar 2015. It has been funded by citrus grower levies and voluntary contributions. The Australian Government provides matched funding for all HAL's R&D activities. Several citrus packers and service providers have also contributed funds for specific activities.

POSTHARVEST SNIPPETS!

DECCO EXPERT VISITS

E.E. Muir & Sons coordinated a visit by Mosen Sales, Technical Service, DECCO. Mosen gave a presentation in Mildura and Renmark on postharvest trends in the USA and specific details on new fungicides and waxes.

The Renmark presentation, was jointly organized with Citrus Australia SA, and held at Cant's Impi shed. Sam Rogers started with an overview. After Mosen, I presented on issues with water quality and fungicide stripout rates. Ben Cant then gave a very informative tour of his packing facilities.

Many thanks to Seamus Maloney (E.E. Muirs & Sons) and, Sam Rogers and Con Poulos (Citrus Australia SA region) for organizing a great day .

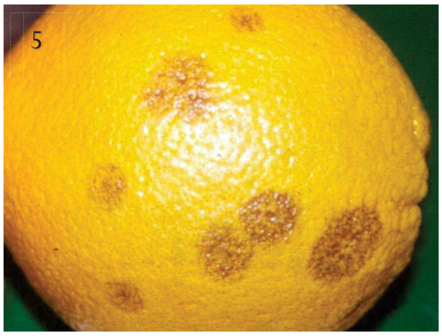
SAM ROGERS IS BACK

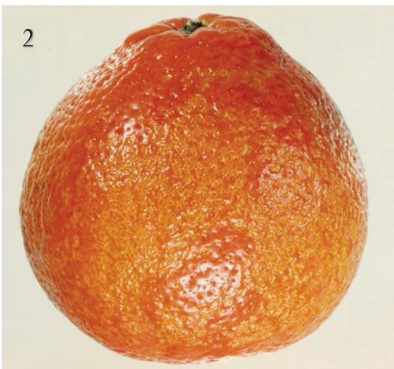
It is very pleasing to see Sam back working with citrus packers.

Sam has a wealth of practical knowledge and boundless energy. Congratulations to Citrus Australia SA region for an appointment that will undoubtedly provide great service to South Australian packers and the wider citrus industry.

SOME OF THE MANY FORMS OF CHILLING RELATED INJURY

1. Dark lesions. Irregular edges.
2. Light coloured surface scald
3. Distinct pits. Commonly referred to as Storage Spot (as distinct from non-chilling Postharvest Pitting).
4. Light lesions. Irregular edges.
5. Distinct pits. Brown Halo.





Answers: A. brush-burn; B. chilling injury (staining)