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part 5:
Fruit protection with spray-on products, shade-netting or evaporative cooling can help reduce sunburn during heatwaves

In the first two articles in this series we considered the causes of different sunburn types along with orchard design and tree training options to reduce sunburn. This month, additional techniques to reduce fruit temperature and sunburn are examined.

Evaporative cooling
When heatwaves have occurred in SE Australia during the past five years, over-head sprinklers used in a small number of orchards have commonly been observed to contribute to reduced heat damage to fruit.

Evaporative cooling systems can lower apple surface temperatures in orchards by 10°C or more depending on conditions (Figure 2).

Sunburn protection

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Sunburn protection

In some overseas studies, this type of cooling has reduced sunburn by 25 to 45% (Parchomchuk & Meheriuk 1996; Gindaba & Wand 2005).

Rates of evaporation depend on radiation, wind-speed, temperature and humidity. Evaporative cooling is most effective in low humidity, windy situations but it is only effective when applied at the time of sunburn risk, which is usually the hottest part of the day.

**Pulsed application**

Cooling systems should operate to maximise evaporative efficiency while minimising the amount of water applied—and pulsed application typically achieves this.

Cycle ratios or feedback systems are set so that free water is almost continually present to evaporate from the fruit surface—evaporative cooling only works when water is present on fruit.

Once the fruit surface is dry, evaporation is no longer a source of cooling and surface temperature can rapidly increase.

Some pulsed cooling systems operate on the basis of time schedules (e.g. 20 min on, 20 min off) while others use air, fruit or simulated fruit temperatures as triggers to apply water.

The most effective cooling strategies are based on actual exposed fruit temperatures. Applications rates in the range of 2.3 to 4.5 mm/hour have worked overseas. However, while evaporative cooling is an effective way of decreasing apple fruit surface temperature, evaporative cooling does not filter out damaging ultraviolet-B rays.

**Other effects**

Other impacts of over-tree cooling on fruit quality depend on a number of factors.

In general, blush, firmness, weight and soluble solids concentrations tend to remain the same or show a slight increase.

Potential drawbacks associated with over-tree evaporative cooling systems include:

- capital expense of hardware
- water availability and price
- increased disease risk
- fungicides, foliar nutrient applications and herbicides applied to weeds can be washed off.

**Literature**


Solomakhin A.A., Blanke M.M. (2010) Coloured hailnets improve taste (sugar, sugar : acid ratio), consumer appeal (colouration) and nutritional value (anthocyanin, vitamin C) of apple fruit!. LWT - Food Science & Technology 43(8): 1277-1284.


Pesticide—including insecticides, fungicides and miticides—are still primarily used to ‘control’ insect and mite pest populations to prevent damage to the plant or fruit.

However, outbreaks of insect and mite pests following pesticide applications are also known.

continued from March 2015

Facts about two spotted mites

Hot conditions
Hot and dusty conditions favour two-spotted mite outbreaks. Mites develop and reproduce faster at higher temperatures.

Actually, temperatures above about 32°C are too hot even for mites, but mites live on the undersides of leaves in a micro-climate where temperatures are cooler.

Dry conditions
Mites are susceptible to outbreaks of certain fungal diseases that help keep their populations in check.

Epizootics of fungal disease often cause dramatic reductions in spider mite numbers during rainy periods when humidity is high.

Dry conditions interfere with the development of these fungi and allow spider mite populations to increase.

Dusty conditions
Current thoughts are that dusty conditions favour mite outbreaks because the dust that accumulates on plant leaves interferes with the searching ability of predatory mites and insects that prey on spider mites and help keep their numbers in check.

Very fast life cycle
Spider mites have a very fast life cycle. Under optimum conditions mites can complete a generation in as little as six or seven days.

This means that they can complete many generations in a year, and explains why they quickly develop resistance when repeatedly treated with the same miticide.

Eggs
Eggs are laid on the undersides of the leaves, where they hatch into 6-legged larvae.

These larvae molt into 8-legged nymphs, which quickly develop into adults that are able to mate and reproduce.

Mating—gender determination
Female mites are diploid (have one set of chromosomes). Male mites are haploid (have two sets of chromosomes).

When mated, females avoid the fertilisation of some eggs to produce males. Fertilized eggs produce diploid females.

Unmated, unfertilized females lay eggs that are exclusively haploid males.

Egg laying and hatching continued next month

Pesticides & pest population explosions (part 2)
Establishing a high-density orchard is costly. You must do it right the first time.

continued from March 2015

Once an orchard is established, it is difficult and costly to make corrections.

STEP 4. Hill up the surface soil
Most feeder roots grow in the surface soil, so when the surface soil is shallow, these roots are severely restricted.

Yet few roots grow in the compacted surface soil in the traffic-lines between rows of trees. If the land is also flat, the soil can easily be waterlogged when we get much rain.

To solve these problems, use a road grader to take the wasted surface soil from the traffic-lines, and hill-up the surface soil before you plant the trees.

This increases the volume of soil for the feeder roots to explore, and the sloping beds also allow excess rain water to run off. Surface drainage is as important as irrigation.

STEP 5. Sow ryegrass onto the beds or let voluntary weeds develop
This step must be carried out in early autumn to ensure that the ryegrass or weeds get established before the winter sets in. Use irrigation water to germinate and establish ryegrass or weeds.

STEP 6. Spray out ryegrass or weeds before you plant trees
Ryegrass or weeds are needed to keep the soil covered to avoid impact from heavy rain, and avoid impermeable crusts from forming and to stabilise the soil.

Once this has taken place, you must kill the ryegrass or weeds in spring, because ryegrass or weeds compete with trees for water and nutrients during the growing season.

Management
Many orchard soils are fragile and need careful management to sustain the production of fruit for a long time.

The six steps will help you to plan any new planting of fruit trees.
“Creditors have better memories than debtors. And creditors are a superstitious sect; great observers of set days and times”. Benjamin Franklin.

continued from March 2015

Managing cash flow difficulties

Agriculture being as volatile as it is, times will arise when a business can’t meet its suppliers’ credit terms because cash flow is adversely affected.

As noted before, this is not a light matter because there are legal consequences.

Again from experience, by far the best policy is to respect the customer/supplier relationship and talk things through with suppliers.

Where a business has demonstrated a good credit record in the past it would be a hard-hearted supplier who could not accommodate that business, although suppliers are not made of money either and the result of them not being paid is that they will not be able to pay their supplier accounts in turn. Some parts of the supply chain can handle payment delays better than others.

However, non-communication is rarely perceived as a positive way to do business when things get tough.

If balances are drifting out into the 60 or 90-day column the matter always becomes worse more quickly if nobody is talking to the other.

Talk also needs to be backed up. If possible, payments should be made to a creditor even if the balances being paid are old and outside terms. At least this shows a willingness to pay something, with the expectation that the account will be brought up to date when cash flow improves.

Agricultural product suppliers are fully aware that seasonal cash flows mean a customer may have difficulty in meeting credit terms at certain times of the year. Indeed, chemical and fertiliser sellers may offer crop terms for this reason. Regardless of the reason, the potential for exceeding credit terms should be discussed at an early stage with suppliers so that they can consider their own cash flow needs in order to support those of a customer.

Trading whilst insolvent

continued next month
It is as astonishing as it is sad to watch a ladybug turn into a zombie.

Understanding parasite mind control

Baculoviruses

In a handful of cases scientists have begun to pinpoint which of the parasite’s genes control their host’s behaviour.

Baculoviruses, for example, infect the caterpillars of gypsy moths and a number of other species of moths and butterflies.

The parasite invades its host’s cells, hijacking them to make new baculoviruses. On the outside the caterpillar appears normal, continuing to munch on leaves as before. But the food it eats is not becoming more caterpillar tissue. Instead it’s becoming more baculoviruses.

When the virus is ready to leave its host, the caterpillars undergo a radical change. They become agitated, feeding without rest.

And then they begin to climb. Instead of stopping in safe spots out of the way of predators, the infected caterpillars creep higher into the trees, remaining on top of leaves or on tree bark in daylight hours, when they are easily seen by predators.

The baculoviruses carry genes for several enzymes. When they’re ready to leave their host, certain genes become active in caterpillar cells, producing a torrent of enzymes that dissolve the animal into goo. As the caterpillars dissolve, clumps of viruses shower down onto the leaves below, to be ingested by new caterpillar hosts.

To Kelli Hoover and David Hughes of Penn State University and their colleagues, the climbing behaviour of the caterpillars seemed like an exquisite example of an extended phenotype.

By causing their hosts to move up in trees, the baculoviruses increased their chances of infecting a new host down below. To test Dawkins’s idea, they examined the genes in baculoviruses, to see if they could find one that controlled the climbing of caterpillars.

When the researchers shut down a single gene in the virus, called egt, it continued to infect caterpillar cells and replicate as before, even turning the caterpillars to goo as before. But baculoviruses without a working copy of egt could not cause the caterpillars to climb trees.

It’s unlikely that many other parasites control their hosts with a single gene; an animal’s behaviour is typically influenced by a number of its own genes, each contributing a small part to the sum. So it’s probable that many parasites control their hosts with a multitude of their own genes.

And what of D. coccinellae and its hapless ladybug host? While at the University of Montreal, Fanny Maure and her colleagues made a startling discovery: In turning its victim into a willing bodyguard, the wasp itself may only be acting as the extended phenotype of yet another organism.

The researchers found that when a wasp injects an egg into a ladybug victim, she also injects a cocktail of chemicals and other substances—including a virus that replicates in the wasp’s ovaries. Some evidence suggests it is this virus that immobilizes the ladybug, protecting the wasp’s cocoon from intruders.

The virus and the wasp have the same evolutionary interests; turning a ladybug into a bodyguard produces more wasps, and more wasps beget more viruses. And so their genes work together to make the ladybug their puppet.

The D. coccinellae wasp may not be the puppet master it once seemed. Instead it hides another puppet master within.
In earlier issues of Tree Fruit (May and June 2014), we reported the training of the cactus Pitaya, a native of Mexico, better known in Australia as Dragon Fruit, on a modified Open Tatura.

Succulent stem pieces were planted in early 2014. A specially-designed method of training allowed the plants to fill the canopy quickly and efficiently.

The canopy was fully developed approximately 11 months later with the first flowers appearing.

Of the many tropical and ultra-tropical fruits already growing on Open Tatura, Dragon Fruit has the potential to further expand and sustain a viable and profitable fruit industry in north Queensland where conventionally-planted trees were devastated by two cyclones (Larry in 2006 and Yasi in 2011).
Hydralada elevating work platforms save time and money

More and more orchardists are proving for themselves how efficient a Hydralada machine is by saving time when working the upper level of the tree.

Whether pruning, thinning, tree training, or harvesting, a Hydralada has the potential to more than double the output of one person working from a conventional step ladder.

It is also a far safer way to work at height and in some regions of the world, using mechanised elevating work platforms is endorsed as best practice.

Generally, labour is one of the biggest costs on today’s orchard, second only to spray.

Cost saving example
A Hydralada machine can be one of the most utilised pieces of machinery on the farm, clocking up to an average of 1000 hours per year.

It isn’t difficult to do the sums and calculate that if one person on a machine performs the equivalent to two people on ladders, the savings are significant!

For example, if the hourly labour rate was $14.50 (varies), over a period of 1000 hours the machine would be saving $14,500 every year—a very fast return on investment!

Minimal running costs
The direct running cost of a Hydralada on a per hour basis is minimal, with fuel consumption as low as half a litre an hour (depending on application).

Hydralada machines are renowned for their reliability, and maintenance requirements are minimal.

New features
With ongoing refinements to the design, the latest Generation II Compact Machine has many more new features to offer. These include:

• new-generation hydraulic control valve delivering a smoother drive
• electronic fuel injected 18 hp engine
• new sleek bonnet design with low tail profile allows the machine to manoeuvre in very intensive row spacings.

With the hydraulic fork lift for shifting bins and hydraulic power secateurs for pruning, this new model Hydralada is a truly versatile machine designed to increase your output all year round and increase your returns.

For further information phone Jason Smith
Freecall 1800 124 352
mobile +64 21 287 3008
e-mail jason@hydralada.co.nz
www.hydralada.com
Fruit Rights Australia Inc. (FRA) was formed in 2014 to help educate Australian fruit growers about the advantages and obligations associated with proprietary fruit varieties.

FRA would like to congratulate Steve and Ross Mammone, of Mammone Orchards, Woodwood, Victoria, for successfully completing FRA’s first field audit.

The Mammone field audit was based on on-the-ground counts of tree numbers, in the various blocks of their orchard and comparison of these counts with data previously supplied in a desk audit of the Mammone plantings.

“We are pleased to have been the first grower to successfully complete a field audit,” said Steve Mammone.

“Our position on proprietary varieties has changed over the years.

“We want the best varieties, at the right times and are prepared to pay for them”.

Desk audits
FRA has also completed a number of desk audits with leading growers in all Australian production regions.

The desk audits are based on a declaration from the grower covering the varieties they grow and the number of trees of each.

This data is matched with the records held by the nursery or rights holder.

Rocky Varapodio, a leading grower from Ardmona, said it only took a couple of hours to assemble the data required. After that, FRA did the rest.

FRA’s desk audit is designed to maintain the confidentiality of the data provided.

“Our desk audit process ensures that information about the grower’s varieties/trees from one FRA member is not seen or accessed by any other FRA member,” said Russell Soderlund, FRA’s Executive Officer.

“Growers who have been audited have been very positive about the audits and the role of FRA.

“Growers who pay their royalties don’t want to see others free riding via illegal propagation of proprietary trees or other means.”

Ian McAlister of SunFruit Orchards, a leading apricot grower at Lake Boga said, “I have to pay royalties for the varieties I grow.”

“I understand why and am happy to pay in exchange for access to the best varieties.

“But I don’t like the idea of other growers using the same varieties and getting away without paying anything.”

Ian added that with orchard acquisitions, tree removals and tree deaths, records can get out of date.

“It was reassuring to see that our records matched those of the various nurseries we deal with.”

Free desk audits
FRA aims to complete more, free, desk audits over the next few months.

Audits can be arranged by contacting the Executive Officer.

Contact Russell Soderlund, FRA Executive Officer

phone 0400 117 360
e-mail: russell.soderlund@bigpond.com
Low chill cherries

Whilst climate change will be debated, one thing that won’t be debated is the need to choose the best varieties that give us the best opportunity to succeed in the orchard industry.

That’s why a new range of low chill cherries out of the USA has caught the attention of the Australian grower.

The ‘Royal’ series by Zaiger Genetics is a new low chill series with most of the varieties requiring 500–750 chill hours.

These low chill varieties mean that you may now be able to plant cherries in areas you never thought possible—opening a world of possibility to the low chill region grower.

To find out more, contact Graham’s Factree phone 03 9999 1999 e-mail libby@factree.com.au

USA Northwest cherry crop coming on

Our regular contributor on all things cherry, Ken Gaudion, has forwarded a video link presented by Norm Gutzwiler of Northwest Cherries in the USA, about their cherry bloom.

According to Ken, Norm is a keynote speaker at one of the cherry industry conferences, and is well known to Australian cherry growers who visit the USA.

You can view the video by clicking on this link: Northwest cherry bloom

For information and professional advice, contact Ken phone 03 5721 9568 mobile 0400 652 258 e-mail k.gaudion@bigpond.com

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