

*The Taste of Spring*

---

## LOW CHILL STONE FRUIT GROWER

No 6/04 – December 2004

---

*The official newsletter of Low Chill Australia Inc, the industry body representing the interests of low-chill stone fruit growers*

### **LCA Membership Subscriptions 2004/05**

**Your Association needs you!** – LCA membership subscriptions for 2004/05 are **\$110 for growers**, and **\$275 for corporate** membership.

**Advertising** rates in this newsletter are very reasonable and provide a cost effective way of informing members about your products and services.

Please contact the LCA Communications Manager Peter McFarlane on mobile 0418 839 836 or email [peter@mc.com.au](mailto:peter@mc.com.au) concerning your particular requirements.

**In this edition** – AGM report, End of 2004 season debrief, News items, Low-chill Breeding Program update, Production systems for low-chill stonefruit.

### **2004 Season Survey**

**Could you please complete the attached 2004 season survey form and return to:**

**Phillip Wilk NSW DPI, PO Box 72  
Alstonville 2477 or Fax 02 6628 5209**

### **Low Chill Australia Inc leads the way.**

Everyone recognises that the Australian Summerfruit Industry is centred on Victoria's Goulburn Valley and Swan Hill Regions, but is it a coincidence that all 4 National Industry Presidents (past and present) are financial members of Low Chill Australia Inc?

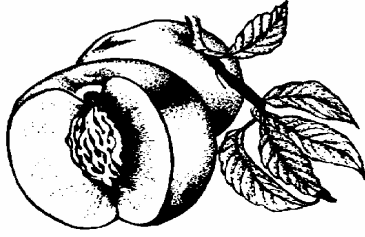


Attending the *Low Chill Australia Inc* 2004 AGM – **Cliff Riseborough** (Cherryhill) – past Chairman *Australian Fresh Stonefruit Growers Association Inc.*, and current member of *Horticulture Australia's Market Access Committee (HMAC)*, **Pat Wibaux** (Encore Fruit Marketing) – current Chairman *Summerfruit Australia Ltd*, **Bill Hatton** (Sherwood Park) – past Chairman *Australian Fresh Stonefruit Growers Association Inc.* and current President of *Low Chill Australia Inc.* (Absent - *Michael Trautwein (QFM)* – past Chairman *Australian Fresh Stonefruit Growers Association Inc.*)



**Seasons greetings from the Low Chill  
Australia Inc Committee**





### *The Taste of Spring*

#### **Low Chill Australia Inc AGM Report, Bangalow 26<sup>th</sup> November 2004**

##### **Management Committee Election:**

At the recent Low Chill Australia AGM, the following members were elected to form the Committee for 2005:

- President: Bill Hatton
- Vice-President: Ross Stuhmcke
- Secretary: Ray Hick
- Treasurer: Trevor Wilson
- Committee: Robin Wolf, Phil Stacey, Graham Francis, Ivan Dascombe, Dennis Dugdell, and Robert Clisdell.

##### **President's Report**

LCA President Bill Hatton reported on the activities of the Association over the past year, which included:

The appointment in April 2004 of Peter McFarlane as LCA Communications Manager, to assist the Secretary in the management of membership and publication of the newsletter.

LCA Membership has now increased to 114 (including 35 Corporate Members).

The LCA Newsletter continues to be issued regularly with editions published in September 2003 (2 editions), December 2003, April 2004, June 2004, July 2004, and September 2004. (plus the current December 2004 edition)

The LCA database now has 287 entries including 180 on email distribution. A recent survey indicated overwhelming support for the current newsletter content and format.

The LCA web site will also be developed in the New Year.

Six field days and seminars have been held for members since the 2003 AGM including:

- December 3<sup>rd</sup> 2003 – Season Debrief - Nambour
- April 21<sup>st</sup> 2004 Soils Seminar – Bangalow
- May 24<sup>th</sup> 2004 – Winter Pruning – Heavenly Valley Farms
- July 28<sup>th</sup> 2004 – Thinning & Water Management – Coopers Shoot Orchards
- August 11<sup>th</sup> 2004 – Spray Calibration – Coopers Shoot Orchards

- 27<sup>th</sup> October 2004 – Varietal Evaluation – Sherwood Park

The last Update Conference was held in Ballina in May 2003, with the committee to decide on the date for the next conference.

The LCA “Springfruit” strategy is proving difficult to implement with local grower groups still evolving and positioning themselves in the marketplace – so the concept may need to sit until such implementation is more appropriate.

##### **New Low Chill Varieties**

Discussions have been held between LCA, QDPIF and NSW Agriculture concerning:

- **Low Chill Breeding Program** – Funded by Horticulture Australia Ltd (HAL), Summerfruit Australia Ltd (LAL), LCA, Growcom (formerly QFVG). This project is overseen by a reference committee, which meets regularly.
- **LCA Varietal Evaluation Project** – Conducted by NSW Agriculture and QDPIF, funded by HAL and LCA, which is now in its final year of funding, and is being restructured from the single evaluation block to multiple grower sites, and it is proposed to integrate the project in the low chill breeding program.

**Commercialisation of Low Chill Varieties** – With the first new varieties anticipated to be released in 2-3 years, a commercialisation plan will need to be developed in consultation with the project financial partners. What is essential is that as many growers as possible have access to the new varieties from the QDPIF program, noting the concerns inherent in current closed loop marketing arrangements.



**Dr Bruce Topp (QDPIF), with Bill Hatton (LCA President), in the Maroochy Research Station stone fruit evaluation block.**

### ***New Packaging Systems & USA Import Risk Assessment (IRA) Update.***

Rob Clisdell has recently undertaken trialling of new packaging being proposed by Woolworths.



**Rob Clisdell**, Director Summerfruit Australia Ltd (SAL), and recently appointed Committee member of Low Chill Australia Inc.

Rob reported to the LCA Annual General Meeting that Woolworths are seeking to make \$500million savings in supply chain systems reform, including implementation of a “one touch” handling system. Summerfruit Australia Ltd has now met twice with Woolworths senior management, together with their suppliers Panda Ranch and Montague Fresh. The system involves a new “black box” with a pallet footprint of 6 units. Low-chill stonefruit will pack at 5 kg. Cartons are currently being stamped with red print, but are looking to move to stickers.

#### ***Returnable Plastic Crates (RPC's)***

Woolworths also looking at RPC's – only one size currently available – 155mm single layer 75mm depth. Counts will be different, with Montague Fresh and Panda Ranch looking to standardise with apples.

A major limitation is there is only one supplier – Chep, which only has 2 sterilisation plants – Melbourne and Sydney. It is therefore important that both the cardboard and RPC options be made available to growers to overcome a potential monopoly situation.

In answer to a question on temperature trials, it was reported that trials were undertaken this season through the Encore Group. It was found that temperature was well maintained, providing netting and not shrink wrap is used on the pallets.

In answer to a question on international trends it was reported that Walmart has implemented a similar system in the USA, and Tesco's in the UK, however their pallet size is different.

It was pointed at the central markets will have problem with any rejected black boxes and RPC's as it will be obvious to buyers that the lines have been rejected by the supermarkets.



Ancor's **George Ganzenmuller** (National Development Manager), and local representative **David McBride**, with the controversial “black box” and the standard P84 packaging.

It was emphasised that Summerfruit Australia Ltd is working with Woolworths to see that the proposed system works for growers, not as a standard for industry.

### ***Pacific North West USA Stonefruit Import Application***

Robert Duthie, Senior Plant Scientist, and John Wilson, Communications Manager, Biosecurity Australia (BA), attended the LCA Annual General Meeting. It was explained that Australia as a member of the World Trade Organisation is therefore governed by international trading rules, including market access protocols. All market access application must be considered by BA. The USA stone fruit application was first lodged in 1994. There are many other import applications including Canada, Chile, China, South Africa and Japan – See [www.daff.gov.au](http://www.daff.gov.au)

Because BA is currently going through a restructure, the USA – Pacific North West Import Risk Analysis (IRA) will not commence until the New Year. With a full risk assessment, it can be expected that this process may take something like 3 years to conclude, including months of mandatory notification / stakeholder response periods. Given USA Pacific North West cherries already have access to Australia BA has some relevant history to work on.

A consultative group has been established with Summerfruit Australia Ltd, to assist in industry consultation / communication. BA also has an official Stakeholder Register that anyone can join, and a web site link will be established. Reports will also be made available for

publication in industry newsletters, including Low Chill Australia News.

With respect to reciprocal trade, Cliff Riseborough advised that he sits on the Horticulture Market Access Committee (HMAC) – a committee of HAL. The next meeting of HMAC will consider a private application to export Australian summerfruit to the USA.

Cliff advised he is also a cherry grower, and asked what monitoring of pest condition was undertaken by BA – eg Powdery Mildew risk. To which Rob Duthie advised that all import systems are audited by BA

Ray Hick suggested industry needs to find out what it can expect from USA imports. Greg McPhee suggested a visit to NZ during the season would provide an insight into the anticipated quality of the imported fruit Australia could also expect to receive if access was approved. The LCA President advised that such an exercise had already been undertaken, and that the market observations will be made available when appropriate.

Greg McPhee also emphasised that imports in a national issue, and SAL have set up a biosecurity committee on which a position has been reserved for a low chill industry representative to communicate with sector. The committee positions are as follows:

- Pat Wibaux – SAL
- Greg McPhee - SAL
- Andrew Moore – Panda Ranch
- Richard Dow – Swan Hill
- Michael Barkley – NSW Agriculture
- Neil Mungall – Stanthorpe
- Low Chill - TBA

#### **Welcome to LCA Corporate Members**

A very warm welcome to our latest financial corporate members (new and renewed). Please support the companies that support your industry.

#### **Q-Pak**

John Stevenson  
93 Enterprise Street  
KUNDA PARK QLD 4556  
Bus: (07) 5456-1888  
Mobile: 0418 710 493  
Bus Fax: (07) 5456-1444  
E-mail: [john@qpac.org](mailto:john@qpac.org)

#### **NEWS - PHYTONOVA™ LICENSEES APPOINTED**

*Phytonova Pty Ltd* has appointed four companies as Production and Marketing Licensees in Australia:

- •Karragullen Coolstores (WA)
- •MM Fruit Management (WA)
- •Panda Ranch (east coast)
- •National Fruit Marketing (east coast).



**Michael Silm** (Panda Ranch) & **Mark Kelly** (National Fruit Marketing), at the *Phytonova* field day University of Western Sydney – Hawkesbury)

As well as these four, two nurseries have joined the *Phytonova* program. These nurseries are licensed to test the *Phytonova* varieties and produce trees for sale. The nurseries are:

- •Mike's Fruit Trees (WA)
- •Mossmont Nurseries (NSW).



**Mark Kelly** (National Fruit Marketing), **Robin Wolf** (Byron Bay Fruits), and **Graeme Richards** (*Phytonova*) in *Phytonova* test block at the University of Western Sydney – Hawkesbury)

**For further information** please contact:

Hugh Macintosh  
*Phytonova* Pty Ltd  
PO Box, 358  
WESTMEAD, NSW. 2145  
Tel: 0416 219 750.



NSW DEPARTMENT OF  
PRIMARY INDUSTRIES

**Low chill stone fruit end of 2004 season  
debriefing**

By Phillip Wilk, District horticulturist, NSW  
DPI Centre for Tropical Horticulture,  
Alstonville ph: 02 6626 2450

Email: [phillip.wilk@agric.nsw.gov.au](mailto:phillip.wilk@agric.nsw.gov.au)

At the 2004 AGM held at Bangalow Bowling club on 26<sup>th</sup> November, an informal discussion over lunch was held as how the season progressed for growers, what varieties produced well and any problems they encountered. This included transport issues, post harvest packing, handling, and issues relating to the casual labour shortage.

The main points are summarised below from grower comments on the day, feedback from market agents and my own observations over the season.

**Note: With a view to expanding on these preliminary findings, a survey form is attached to this newsletter – your cooperation and assistance in completing this survey form will be greatly appreciated.**

1. The volume of fruit produced this season was more than double that of last seasons and in many cases triple.
2. Growers and agents were unhappy with the quality of *White Satin* (90-3) nectarine this season. Fruit arrived at the markets with hard green shoulders and soft tips. This was mostly due to rain damage.
3. Agents reported large green fruit arriving in mid October. This is a management problem and the trees need to be opened up to colour fruit at least a few days before picking.
4. *86-10* peach is grown at Stuart's Point (Macksville NSW) and has proven to be an excellent reliable early season variety harvesting between *Floradaprince* and *Tropic Beauty*. The local growers would like to name this variety **SunGold**.
5. Growers in the Dunoon area reported major problems with *SunWright* nectarine this season. Fruit was misshapen and on opening the seed it was black inside. The fruit was at least size 30 at this stage and should probably have fallen off earlier but continued to develop right up to just before its normal harvest time. This was probably due to a frost at pollination time.

6. The problem of inking on the skin of some peach varieties this season was discussed. (see following article)
7. *UF Gold*, one of the first non melting flesh peaches, was reported to be a useful variety that is now showing up in many major outlets.

There have been a few quality issues with this variety this season. This is to do with internal breakdown and off flavours once it has been left on the tree to long. One observation from a few growers was that if the red colour begins to bleed into the flesh then it has passed its optimum picking time. The attachment end also will need to have a hint of green while the rest of the fruit has a bright orange/red colour. Size will not always be an indication of readiness to pick, especially if it is the second or third pick. It will be a matter of growers educating casual pickers before they begin picking on the special attributes of this and other non-melting flesh varieties.

**NB. This is a very important issue that needs to be addressed quickly as there are many non-melting peaches and nectarines that are now being released without proper grower information on picking and tree management.**

8. *Sunmist* white flesh nectarine has been a useful variety that ripens after *SunWright* but before *Sunblaze*. It is larger and has fewer problems with soft tip but has less blush than *White satin*. It has good eating characteristics but does have some problems with cracking if heavy rain occurs just before harvest.
9. *SunSnow* white fleshed nectarine is being grown by some growers for the late market in November. It is large, colourful and has good eating characteristics. In some years it is the only large white nectarine available at this time. Its downside is it harvests in the 3<sup>rd</sup> and 4<sup>th</sup> week in November.
10. Some growers reported problems with transport this season. Trucks were late and growers were not phoned and told that this would occur. Growers only wanted to be notified so they were not wasting their time waiting. They asked if the drivers could use mobile phones to alert them if they would be delayed. LCA will take up this issue with the transport company concerned.
11. There were also some reports of thrip damage on nectarines. It is unknown

wether they were Plague thrip or WFT. As yet no WFT has been identified in this area. Plague thrip often causes damage early in the season during flowering while WFT affects later varieties and often feeds on the mature fruit surface. Their chemical controls are different.

12. Finally the markets report that the eating quality of stone fruit was very good this season. The markets felt that a common brand and uniform packing helped to sell large volumes at higher prices. They also felt that central packing sheds will further help with improving uniform quality. Growers need to have sufficient infrastructure with coolrooms being able to cater for the volume of crop being harvested. Some crop did not have sufficient field heat removed before transporting.

### ***The Development of dark Skin Discolouration on Peach and Nectarine Varieties***

In the 2004 low chill stone fruit season there were a number of notable problems that occurred on fruit, the most notable being what is commonly called Inking, Inkstain or Dark Skin Discolouration (SD).



This disorder is an 'old friend' and tends to reappear or surface every few years. It has been an ongoing problem in high chill areas and overseas in California where considerable research has been conducted to solve this post harvest problem.

Inking is a post harvest disorder which is variety specific. Some varieties show the effect more than others and it tends to be varieties that develop a dark red blush such as Tropic Beauty peach and Sunblaze nectarine that are worse.

The symptoms of inking (SD) are cosmetic only and show up as a series of dark black or blue run marks, spots or stripes over the

surface of the fruit running from the shoulder downwards.

The internal flesh of fruit affected by inking remains sound but fruit having this effect is usually downgraded in the marketplace.

In almost all the research, (SD) abrasion has been found to be the major factor although not the only factor involved. This abrasion often occurs due to physical damage during handling at harvest or as vibration or physical rubbing of fruit in transit from the orchard to the pack house facilities. The physical rubbing of the harvested fruit is often associated with transporting it over rough tracks or ungraded roads in the orchard.

(SD) may also be exacerbated by having dirt or dust in picking bags, in picking crates or on the fruit surface.

In almost all cases, heavy rainfall occurred just before harvest, which started the first signs of inking.

Several chemicals including foliar nutrients, insecticides and fungicides applied as preharvest sprays all had an effect on SD development.

This largely depended on the amount of heavy metals such as Iron, Copper, Aluminium and Zinc present in the preharvest spray and the application time before harvest.

Post harvest waxes and dips if not maintained at the correct pH level of around 7 may also cause SD. This may be doubly the problem in the northern rivers area as growers may be using wash water that is notoriously high in iron. Iron is in abundance in most naturally occurring water in the northern rivers due to our iron rich red soils.

Unfortunately, it is almost impossible to eliminate physical injury during harvesting completely from your operation but there are a number of steps that growers can take that can minimise the occurrence of SD.

### ***Recommendations to minimise the effects of Fruit Skin Disorder***

- Handle fruit gently during picking
- Avoid carting fruit over rough roads
- Keep harvest crates free of dirt
- Morning picking is preferable to late picking
- Avoid pre harvest foliar sprays for at least 3-4 days (ICA21)
- Check for heavy metal contaminants in washer water
- Keep dip water below pH of 8 (preferably 7) during packing



***Report to Low Chill Australia Annual General Meeting on Low-chill Breeding Project SF02015, Bangalow 26<sup>th</sup> November 2004***

*By B.L Topp, A.P. George, D.M. Russell and R.J. Nissen, Queensland Department of Primary Industries & Fisheries*

At Maroochy Research Station the population of over 4,000 seedling peach, nectarine and plum trees fruited for the first time. Using management techniques developed by Dr Kenji Beppu (Kagawa University) we were able to fruit more than 90% of the two year old seedling trees.



***Dr Kenji Beppu (Kagawa University), and Dr Bruce Topp (QDPIF) in the Maroochy Research Station seedling evaluation block***

Approximately 20 selections have been identified that require propagation for either further testing or for use as parents for the next generation. Of particular interest were some nectarines with large fruit size; peach and nectarines with semi-dwarf growth habits; and some low-acid, high-sugar nectarines. Some of the fruit was available for tasting at the conclusion of the AGM.

The first crop of fruit was observed in 2004 on 8 grower test sites in NSW and QLD. Three nectarine, two peach and two plum selections are being observed at these test sites. One peach and one of the nectarine selections appear promising. We will require 3 years of cropping data before making a decision to release. It is planned for all the testers to meet in 2005 in order to review the 2004 season and standardise evaluation procedures for the next season.



***Embryo rescue techniques being applied in the Low Chill breeding project at Maroochy Research Station***

A major reason for the rapid progress in this breeding program (ie having selections out on grower test after only 3 years) is because of the great cooperation we have received from Dr Wayne Sherman at the University of Florida.

Inclusion of additional grower test sites for future evaluations will be discussed at the next industry steering committee meeting to be held in April 2005.



***Dr Dougal Russell (QDPIF) taste testing new low chill selections at the LCA Annual General Meeting***



Know-how for Horticulture™

*The Taste of Spring*

### **Low Chill Stone fruit Varietal Evaluations (NSW), December 2004**

By Phillip Wilk, District horticulturist, NSW DPI Centre for Tropical Horticulture, Alstonville ph: 02 6626 2450 Email: [phillip.wilk@agric.nsw.gov.au](mailto:phillip.wilk@agric.nsw.gov.au)

#### **Introduction**

All varieties are harvested from the Low Chill Australia evaluation block at Bangalow NSW. The varieties have come from a number of sources - University of Western Sydney, ANFIC or DPI Qld, although we are using a number of public domain varieties as reference trees.

Most ripening times of low chill varieties are taken or compared to *Flordaprince* peach.

We normally expect *Flordaprince* to be picked around the middle of September, followed by *Tropic Beauty* peach 1-3 weeks later. *Sunwright* nectarine (81-17), begins its pick around the second week in October and is usually the first nectarine on the market.

87-4 nectarine, (90-3) *White satin* nectarine are the next two reference varieties to be picked towards the middle to end of October followed by *Sunblaze* nectarine, beginning in the first week of November.

The fruit development period (FDP) is the time from full flower bloom to harvest. The longer this period, the more time fruit has to accumulate sugars. *Flordaprince* is usually around 78 days.

The information collected comes from a number of sources including release notices, grower's comments and evaluations by NSW Department of primary industries over the last season.

A large number of trees that had undergone testing were discarded and removed in February 2004.

#### **Seasonal conditions**

The varietal test site at Bangalow received over 700 hours of chill up to the end of August 2004. This is not beneficial in terms of setting

fruit on low chill peach and nectarine trees in the sub tropics. The main reason for this is that most of the varieties we now grow here have finished flowering by mid July and any further chill that is accumulated is not beneficial for fruit set.

Here at Bangalow we average 350 to 500 hours of chill annually, which was no different in the 2004 season. This is atypical of most of the sites on the North Coast and Southern Queensland and is at the extreme end in a low chill area. Most sites would average 100 to 300 chill hours normally.

At the Centre for Tropical Horticulture at Alstonville this year we averaged 200 to 225 hours of chill.

Shaun Reynolds and Mark Keen took over the management of the Bangalow test site in 2003 and have done a fantastic job. The trees look healthy and the fruit has sized up well.

They delayed pruning this season until mid to late April (2 weeks later than usual) as we were worried that due to the dry, clear, cold conditions we would receive a late frost which did not eventuate.

As a result most of the varieties are 7 to 10 days later than usual.

The trees were defoliated in April with 2 copper sprays as the very mild conditions did not allow a normal leaf drop pattern.

Disease pressure has been down this season due to the low rainfall, which resulted in a full flowering and excellent fruit set.

Many varieties that were near to bud burst in July flowered simultaneously when we received 10mm rainfall and mild conditions for a few days.

The whole area around Bangalow up unto the second week of October was in drought conditions and growers had only 6 hours of pumping in 24 hours allowed from creeks and streams. A cease to pump restriction was placed on all local streams at the end of the second week of October but most areas luckily received over 100mm of rainfall over the next few days.

This was a mixed blessing as a great amount of fruit began splitting due to the large water uptake by trees and soft tip problems were evident on many varieties.

#### **Performance of varieties in 2004**

Most growers were one to two weeks behind in their picking this season in Northern NSW. QLD growers reported being slightly ahead of their usual picking time by one to two weeks which was drought related.

This worked out well as markets in Brisbane and Sydney were able to cope with the volume of fruit which kept prices firm at around the \$20-\$25 for trays of 25-28 peaches.

Good sized fruit continued to receive above average prices in October as there was a large amount of smaller fruit bulked in 10 kg boxes.

This large quantity of small fruit resulted from the lack of rain in both NSW and QLD.

The chill received in all low chill areas was the best seen in many years. There were no pointed fruit in any district from a lack of chill and the fruit at thinning time was difficult to remove.

The large amount of rain that did eventually fall in October (125mm-150mm) caused a large amount of skin cracking on many nectarines. The high rainfall caused the fruit to lack sugars and flavour and if possible, fruit should be left for a few days before harvest.

White Satin nectarine was at the peak of harvest at this time and most of the fruit had water damage on the tip. This variety of nectarine, which although being a very sweet recognisable product has major post harvest handling problems. This does not occur in all years but when it does occur there is a huge amount of wastage such as has occurred this season.

We really need to concentrate on a replacement for this variety. Many growers still have Sunmist, which is the variety that was replaced by White Satin. It has better size and post harvest handling. Flavour is about equal but colour is not as good.

Growers in the Dunoon and Stuarts Point (Macksville) area have had problems with SunWright nectarine this season. The seed dies and the fruit is misshapen. Half the fruit has failed to fill out. This may be due to one or more things.

Poor pollination from a lack of bees, frost or cold damage during pollination or a lack of Boron in plants. The most likely cause is cold injury during pollination but there seems no definitive answer.

Stuart's Point growers have had some success with Flordaprince and they still grow quite a few and receive excellent prices for them.

In many microclimates Flordaprince are unsuitable to grow, are colourless, misshapen, hit the market too late and then compete alongside Tropic Beauty (Alstonville area).

#### **Varietal performance with public reference varieties**

##### **Nectarines**

- **White satin (90-3) white flesh** - If harvested before the second week in October, the fruit although small (28-30 tray size) was excellent sugar levels 11-12%. After the heavy rains in NSW in mid October the quality was poor. (uneven ripening, soft tip,)
- **SunWright (81-17) yellow flesh** - SunWright nectarine in most areas was superb. Very large colourful fruit. Some early cracking with the first pick but later fruit was excellent. Harvested late at Bangalow in the 3<sup>rd</sup> week in October (usually 2<sup>nd</sup> week). This variety has problems when grown at Dunoon with misshapen fruit.
- **Sunraycer (84-16) yellow flesh** - Harvested 3<sup>rd</sup> week in October. It had the typical oval shape but less so this year due to its larger sizes. Quite a deal of split stone which is typical of this variety. They need to be packed on their side, which means there is not a snug fit in tray liners. Colour was very good.
- **Sunmist white flesh** - Harvested after *SunWright* but overlaps the last harvest which is the last week in November. Good size 23-28 but colour not as good as White satin. It also had some cracking from rain, which occurred just before harvest.
- **Sunsnow white flesh** - Harvested 2<sup>nd</sup> week November. Sizes were all 20-25, good colour, taste and skin colour if trees pruned before harvest. Excellent quality but later than *Sunblaze*.
- **Sunblaze (9-15) yellow flesh** - Harvested the first week in November. Size and colour were excellent (23-28) but it had a few problems after rain with "inking" this season.

##### **Peaches**

- **Flordaprince** - Flordaprince had a very heavy crop this season. Shape was full and round. Harvested the 4th week in September which was a little later than usual and almost the same time as Fla. 86-10.
- **Fla. 86-10** - This harvested in the 2<sup>nd</sup> week of October but overlapped with some early Tropic Beauty and late Flordaprince. The colour was superb bright orange/yellow and sizes were 23-28. This variety grows well in the Stuart's Point area and colder sites at Bangalow. Sometimes it is difficult to harvest, pack and send if we get a few very hot days (over 30°C) as it will need to be picked almost daily.

- **Tropic Beauty** - The quality of fruit was excellent in almost all low chill areas this season. Some growers began harvest in the 2<sup>nd</sup> week of October, which continued into the 2<sup>nd</sup> week in November. Colour, size, shape and flavour were excellent this year. In many areas, size 18 to 25 was common. This variety will be difficult to replace. In some years there has been internal breakdown in the flesh when the trees have very little leaf early in the season and the fruit is very large. This disappears as soon as the leaf pushes through. This very early large fruit should be removed.
- **Flordagem yellow flesh** - Harvested at the beginning of the 2<sup>nd</sup> week in November. Excellent size and colour but it has the same small tip as other years. Had a very heavy crop this season.
- **Flordaglo white flesh** - This white flesh peach variety was harvested at the same time as *Flordagem* (2<sup>nd</sup> week in November). In some areas (Stuart's Point), this variety performs well but it ripens very quickly if we get high day temperatures (over 30°C). It lacks flavour but has a small niche market in Melbourne. It is generally difficult to manage post harvest.

#### Protected Varieties Being Tested

##### Peaches

- **Fla 94-32c** Non-melting yellow flesh peach. Fruit ripened very late this year in 2<sup>nd</sup> week in November. This variety was one of the first non-melting flesh peaches. It is usually small and there are much better varieties from ANFIC and QDPI. To be removed in 2004/2005.
- **UF Gold (ANFIC)** Non-melting yellow flesh peach. Fruit harvested in 3<sup>rd</sup> week of October or same time as *Tropic Beauty*. Moderate orange/yellow background colour with 50-70% bright red blush. Very firm with good transport and handling characteristics. Fruit is 63-67 mm diameter or 25-28. tray size. Management of the tree with Paclobutrazol is essential as it has long willowy laterals and this causes it to be more compact. Fruit on Austar® treated trees were one to two weeks earlier. This variety is better for colder sites as it needs at least 250 chill units. Fruit in all districts set well this season as we had sufficient chill.
- **Fla92-11c UF Charm (ANFIC)** yellow non-melting flesh peach. Fruit harvested in the 2<sup>nd</sup> week of November or same time as *Flordaglo and Flordagem*. Similar colour to UF gold 50% moderate red blush on a yellow/orange background. Size 63-67 mm diameter, 25-28 tray size but needs heavy thinning. Shape is square round with small tip. Has full flavour moderate juice, strong aroma and sugar levels 11-12%. No observable difference on Okinawa or Coastal rootstocks. \*Needs heavy pre harvest pruning to colour fruit otherwise it remains full yellow. Some off flavours develop with overripe fruit. In most low chill areas, it harvests too late.
- **Fla92-15c UF Delight (ANFIC)** yellow non-melting flesh peach. Fruit harvested 3<sup>rd</sup> and 4<sup>th</sup> week in November. Looks like a later version of UF Gold in colour. Produces a very heavy crop and needs heavy thinning. It has 75% full moderate red blush on a bright yellow/orange background. Size is 25-28 or 63-67 mm diameter. It has an excellent shape with no tip, a shallow suture moderate juice, full flavour and sugar levels 14-16%. The flesh shows some bleeding especially around the seed. There was no observable difference on Okinawa and Coastal peach rootstocks. Needs heavy pre harvest pruning to colour fruit. This variety harvests too late for most low chill areas.
- **N18-5 (QDPI)** peentu yellow non-melting flesh peach. Harvested the 1<sup>st</sup> week in November. It has 75% mottled red blush on a moderate yellow background. Shape is flat (China flat peach) with a sunken stylar end tip and size 28-30 or 60-63 mm diameter. It has a mild flavour, 11-12% sugars but very little juice. Has excellent post harvest handling characteristics but has a blemish if it is attached facing tip upwards on the tree. All fruit that were attached below or on the side of the branch were unblemished. Careful fruit and flower thinning may be able to solve this problem.
- **N17-20 (QDPI)** yellow non-melting flesh peach. Harvested the 2<sup>nd</sup> week in October or same time as *Tropic Beauty* and one week after *UF Gold*. It has 80% moderate red blush on a moderate yellow background. Excellent shape with a shallow suture and no tip. It has full flavour, juicy and sugar levels of 10-12%. Size is 67-73 mm diameter or 23-25 tray size. Some off flavours develop if it is overripe. It is now being tested on a number of orchards in Northern NSW and

QLD. Further testing will continue in 2005.

- **N52-48 (QDPI)** yellow non-melting flesh, sub acid peach. Harvested the 1st week in November. A young tree with only one piece to evaluate. It had 100% full red blush on moderate yellow background. Shape was excellent with no tip and shallow suture. It had full flavour, was very juicy and had sugar content of 14-16%. It had low acid and excellent post harvest handling characteristics. This variety needs further testing. It may be appropriate for an Asian export market.

#### Nectarines

- **N22-50 (QDPI)** white non-melting flesh nectarine. Harvested the 2nd week in November or *Sunblaze* timing. It has 100% full dark red blush with light green background colour. Size 63-67 mm diameter or 25-28 tray size. Shape is excellent with no tip and a shallow suture bulge. It has full flavour, moderate juice and 12-14% sugar. Its post harvest handling characteristics are excellent and it remains firm for up to five days. This variety will be tested on a number of sites in Northern NSW and Qld in 2005. It looks much like *Sunblaze*.
- **N21-8 (QDPI)** yellow non-melting flesh nectarine. Harvested mid October or *SunWright* timing. It has 100% full moderate red blush with a light green background. Shape is excellent with no tip and shallow suture. Size is 63-67 mm diameter or 25-28 tray size. It has full flavour with high juice levels and 14-16% sugar. It has excellent post harvest handling characteristics and firmness. This will be tested on a number of orchards in Northern NSW and Qld in 2005. This may be a replacement for *SunWright* in some districts.
- **N11-11 (QDPI)** white non-melting flesh nectarine. Harvested the last week in October and first week of November. It has 100% dark red blush with a light green background. Has some sugar speckling when ready to harvest. Shape is excellent with no tip and shallow suture. Size is 60-63 mm diameter or 28-30 tray size but if thinned well should increase at least one more count. It has full flavour with high juice levels and 11-12% sugars. There was some splitting this season but we received 125 mm rainfall before harvesting. This variety will be tested on a number of

orchards in Northern NSW and Qld in 2005.

#### Plums

- **PI 97-2B (UWS)** Blood plum. Harvested at the beginning of last week in November. Full dark red/black skin. Shape excellent. Size 57-63 mm diameter or 28-32 tray size if thinned hard. Full flavour and deep blood colour flesh. Excellent juice levels with sugar 12-13%. Produced very good fruit this season but it may be too late for low chill districts. This is the best early plum over the last two years. Okinawa rootstock produces a more vigorous tree than Coastal rootstock without improved yield.

#### Recommendations for the 2004 season

Phillip Wilk, District Horticulturist with NSW DPI conducted the fruit evaluations over the 2004 season of one to three year old peach, nectarine and plum trees. The following short listed selections need further testing and commercial evaluation by growers in their own microclimates.

#### Peaches

1. UF Gold
2. 98-1(Montague)
3. N17-20

#### Nectarines

1. N22-50
2. N11-11
3. N21-8
4. Sunsnow

#### Plums

1. PI 97-2b Blood Plum

#### Disclaimer

NSW Department of primary Industries recommends that all growers undertake their own evaluation trials to determine the suitability of these selections to their management situations, microclimate and marketing strategies. These varieties are available from ANFIC nurseries QDPI, Low Chill Australia, University of Western Sydney (Phytonova) and Ausbuds. The above assessments are preliminary and growers wishing to trial these selections do so at their own risk.



## **PRODUCTION SYSTEMS FOR LOW-CHILL STONEFRUIT**

*By Nissen, R.J., George A.P., Waite, G Department of Primary Industries & Fisheries, Horticulture & Forestry Sciences, Maroochy Research Station, Mayers Road, PO. Box 5083, SCMC, Nambour Qld 4560, Australia.*

### **INTRODUCTION**

Consumer satisfaction and purchasing patterns are directly related to fruit quality variables, such as fruit sweetness and firmness, with orchard management practices directly affecting these variables (Crisosto et al. 1997, 2003). Compared with high-chill varieties, early-season, low-chill stonefruit cultivars generally have poorer fruit quality (George and Hieke, 1996). New, improved management practices are urgently needed to improve fruit size and quality of early-season low-chill cultivars. Key factors affecting fruit quality include: light interception, orchard design, tree training, control of vegetative growth, excessive crop loading, pest and disease control, irrigation and nutrition. Jackson (1980) and Palmer et al. (1992) showed that internal tree shading severely reduced yield and fruit quality and that stonefruit needed a minimum of 20% full sunlight for optimum fruit quality.

Fruit flies (Tephritidae) cause substantial losses in terms of both quantity and quality and are recognised worldwide in tropical and temperate climates as major pests of horticultural crops (Bellas 1996). Countries in South-East Asia experience pre-harvest fruit and vegetable losses as high as 40 to 100% (Drew 2001). Good control of fruit flies is therefore essential to increase profitability. In addition, consumers now prefer to purchase fruit and vegetables grown using environmentally friendly, reduced chemical usage systems.

Due to increasing costs of production, new production systems are urgently needed to increase productivity and to improve economic viability.

### **ORCHARD DESIGN AND TRAINING SYSTEMS**

Traditional, vase-trained stonefruit trees, planted at <400 trees per hectare are highly inefficient in intercepting light (Jackson, 1980; 1985). Consequently, yields per hectare are low, ranging

from 15 to 25 tonne. As light interception and productivity in orchards are highly correlated (Jackson, 1980; 1985), new orchard training systems are designed to maximise the amount of light intercepted by tree canopy (Corelli and Sansavini, 1989). The best of these new designs is the Open Tatura training and trellising system (Van den Ende et al., 2001).



*Open Tatura trellis system planted at 2,222 tree per hectare.*

Compared with the traditional vase system, the Open Tatura system can produce double the cumulative yield during the first three years after planting and double the maximum yield (40 to 50 tonne per hectare), at full maturity (Van den Ende et al., 2001). The economic breakeven point is reduced from 12-17 years under the traditional vase system to 6-8 years for Open Tatura system. Besides tree design, light interception and yields can be increased through other management practices and these are discussed in the following sections.

### **CROP LOADING AND CULTURAL PRACTICES**

There are many commonly used indices for estimating yield efficiency such as fruit number per tree circumference or butt cross sectional. Our studies (Menzies et al., 2002) have shown for stonefruit trees under the age of five years, fruit number per butt circumference or butt cross sectional are the most appropriate measure, but for trees older than five years, other measures such as fruit number per canopy surface area and canopy volume may be more appropriate. Cultural practises also affect estimations of yield efficiency, e.g. growth retardant, paclobutrazol, increases butt circumference. For low-chill stonefruit cultivars, we currently recommend leaving 2 fruit per centimetre of butt circumference, or alternatively, either 20 fruit per square metre of canopy surface area or 50 fruit per cubic meter of canopy volume (Menzies et al., 2002). Fruit sugar concentrations for low-

chill stone fruit are low due to their short fruit development period (FDP). Menzies et al. (2002) showed that sugar concentrations of the fruit decrease by about 0.1° Brix for each increase of 10 fruit per tree.

Menzies et al. (2002) showed that gross returns for low-chill stonefruit trees, planted at 800 tree/ha, increased slightly with increasing crop loads up to double that of commercially-accepted levels despite loss in fruit quality. At higher crop loading levels returns were reduced due to smaller, lower quality fruit and increased costs associated with growing, harvesting and packaging. Their studies also showed that at crop load double the commercially-accepted level, trees went into biennial bearing due to a 30% reduction in starch accumulation during late autumn when reserves for next season's growth are normally accumulating.

### **GROWTH CONTROL**

The growth retardant, paclobutrazol has been shown to increase average fruit weight by one to two size grades, tree yields by 25% and economic returns of low-chill stonefruit. The mode of action of paclobutrazol is to reduce competition between the fruit and vegetative growth (George and Hieke 1996). Paclobutrazol also advances fruit maturity by about 10 days, a major advantage for low-chill stonefruit cultivars where exceptionally high prices are paid for early-season fruit. George and Nissen (2002) and Menzies, et al. (2002) showed that paclobutrazol, when combined with additional nitrogen, significantly ( $P < 0.05$ ) increased Brix levels by about 10-15% and reduced the rates of fruit size reduction with increasing crop load. In some studies, paclobutrazol significantly increased ( $P < 0.05$ ) fruit firmnesses due to better uptake and accumulation of calcium and boron, presumably as a result of reduction of vegetative growth (Menzies, et al., 2002).

### **IRRIGATION**

George and Nissen (1992) found that regulated deficit irrigation (RDI) at critical periods during fruit development and after harvest of low-chill stonefruit cultivars could control excessive vegetative vigour without loss of yield or fruit quality. In South-East Asia, soil water deficits occur in at least 4 months in each year (dry season) with the dry season coinciding with the flowering and FDP. In eastern Australia, RDI is difficult to implement as summer rainfall coincides with the FDP. Glasshouse studies, using container-grown trees, showed that RDI could be effectively used for low-chill cultivars with short FDP (80-120 days) (George and Nissen, 2002,

unpublished data). They found that mild to moderate soil water stress (up to -50 kPa) applied during Stage II of fruit growth, and up to 3 weeks prior to harvest increased fruit Brix by up to 20%. However, there are limits to how much soil moisture stress trees can stand without affecting yield. For example, on light clay soils in Thailand, drought (maximum soil water deficits of -200 kPa), applied during FDP of low-chill stonefruit, reduced yield and fruit firmness by about 20%. Fruit sugar concentrations were increased by 2 to 3° Brix (Noppakoonwong et al., 2002). RDI may have a greater application to control excessive growth after harvest of vigorous low-chill cultivars and this aspect requires further investigation.

### **NEW PEST CONTROL MEASURES**

The major pest of stonefruit in Australia and South-East Asia is fruit fly (Tephritidae). In Australia, cover sprays of persistent insecticides (fenthion and dimethoate) are used for control. In both Australia and South-East Asia, there has been a strong move to develop alternative treatments driven by consumer and environmental concerns to reduce pesticide usage and residues. Broad-spectrum insecticides are detrimental to beneficial insects and are therefore not compatible with Integrated Pest Management (IPM) programs. Various natural products such as neem oil and natural pyrethrum have been investigated as cover sprays but none has proven to be effective.

Bait sprays are used as an alternative to cover sprays and are applied to a small part of the tree, such as the trunk or foliage and not the fruit. Fruit fly bait sprays consist of a combination of an insecticide e.g. chlorpyrifos, trichlorfon, malathion plus an attractant eg yeast autolysate. DPI&F researchers have assessed two new commercial bait formulations, which include protein attractant mixed with Spinosad (Dow AgroSciences) or fipronil (BASF) and thickening agents that prolong their effective life. These new "soft" insecticides are used at lower concentrations and have a lower mammalian toxicity the organophosphate insecticides currently registered for use in Australia. Spinosad is a microbially produced insecticide that has obtained organic certification in the USA. They are applied at lower rates, 5-7 L/ha compared to standard baits which are applied at 15-30L/ha (Lloyd et al., 2003a).

### **SURROUND™**

Other alternative pest control measures include the use of biopesticides and particle film technologies e.g. kaolinite (Surround™) (Glenn

et al., 2002). Surround™ was developed in the USA for protecting crops from heat stress, sunburn and frost, but was found to improve photosynthesis, fruit set, fruit size and fruit colour due to transmission of diffuse light within the tree canopy (Glenn et al., 2002). Surround™ can deter insects via tiny particles attaching to the insect bodies, agitating and repelling them or coating the plant/fruit making it unsuitable for feeding and reproduction. Dufour (2001) and McBride (2000) found that kaolinite coats the trees in a reflective white coating making trees less recognizable as a host. In the USA, Surround™ was reported to control or suppress leafrollers, leafhoppers, mites, codling moth, plum curculio, apple sucker, stinkbugs, apple maggot and thrips. In Israel, Mazor and Erez (2004) showed that female Mediterranean fruit flies avoided landing on treated nectarine fruits giving a 100% protection. Similarly, Saour and Makee (2004) found kaolin film effectively controlled olive fruit fly (*Bactrocera oleae*) in olives where insecticide sprays of dimethoate failed. Surround™ is applied as a liquid spray, which dries, leaving a protective powdery film on the surfaces of leaves, stems, and fruit. Surround™ can be washed off by heavy rain and has to be reapplied; therefore its usefulness in high rainfall regions of Australia may be limited. In contrast, in South-East Asia, Surround™ may act as a highly effective protectant of temperate fruits because they develop and mature during the dry season.

#### **PHYSICAL BARRIERS**

Physical barriers, that exclude pests, can also provide non-chemical control and are highly suitable for both conventional and organic production systems, reducing or eliminating pesticide usage. A small mesh net fabric can be used to fully enclose individual trees or an orchard. In Israel, Erez et al. (1993) demonstrated the feasibility of producing pesticide free fruit using net covered orchards. Recent trials by DPI & F researchers using a 2mm mesh net made from long lasting, translucent fibre, that minimizes shading, excluded a variety of insect pests including fruit fly, macadamia nut borer, fruit spotting bug, fruit piercing moth, and yellow peach moth (Lloyd et al., 2003). Exclusion netting involves a high initial capital cost, however conventional hail/bird/bat netting is already extensively used on stone fruit orchards. Two years of trials comparing exclusion netting (with no additional fruit fly treatment) to an adjacent block under conventional bird and bat net showed zero infestation in peaches under exclusion netting

compared to a chemically treated bird and bat net block. Preliminary results have shown that exclusion netting can increase fruit quality, in particular, fruit sugar levels by 30% and yields by 10-15% (Lloyd et al., 2003). Fruit maturity is also advanced under exclusion netting by about 7-10 days due to higher heat units accumulated under the netting.



*Exclusion netted, open vase trained low-chill stonefruit trial trees with reflective mulch at Maroochy Research Station.*

#### **ECONOMIC EVALUATION**

In Queensland, we conducted an economic evaluation of the new innovative training, netting and trellising systems for low-chill stonefruit and compared these with non-trellised and bat-netted, vase trained trees, which are currently the industry standard (Lloyd et al., 2003). Fixed, variable and capital costs were adjusted for each training system and a discounted accumulated cash flow generated. Our findings show that non-netted orchards are not viable (Lloyd et al., 2003). We found that increasing tree density greatly increased returns and reduced the break-even point. The break-even point for trees trained to an Open Tatura system, under exclusion netting, was up to 6 years earlier than for vase- or palmette- trained trees, under bird-netting (Lloyd et al., 2003).

#### **CONCLUSIONS**

For long-term viability, farmers must adopt new training and management technologies to increase their orchard productivity. We have demonstrated that combinations of new netting and training systems eg exclusion netting and Open Tatura trellising systems, can significantly boost economic returns to the farmer and at the same time meet community expectation of delivering cleaner, greener fruit.

### **LITERATURE CITED**

- Bellas, T. 1996. The papaya fruit fly-a failure of quarantine. Canberra Parliamentary Research Service, Research Paper, No. 29: 1995-1996.
- Corelli, L., and Sansavinin, S. 1989. Light interception and photosynthesis related to planting density and canopy management. *Acta Hort.* 234:159-174.
- Crisosto C.H., Johnson R.S. and DeJong T.M. 1997. Orchard factors affecting postharvest stone fruit quality. *HortScience* 32: 820-823.
- Crisosto C., Crisosto G. and Bowerman E. 2003. Searching for consumer satisfaction: New trends in the California peach industry. Proceedings of the First Mediterranean Peach Symposium. Sept. 10, 2003, Arigento, Italy.
- Drew, D. 2001. Confronting Fruit Flies – Devastating pests. The Crawford Fund Highlights, July.
- Dufour, R. 2001. Insect IPM in Apples; Kaolin Clay; Reduce-risk pest control. Factsheet. Appropriate technology transfer for Rural Areas, [Online], 4 pages, Available: <http://attra.ncat.org/attra-pub/kaolin-clay-apples.html>. [2004, March 19].
- Erez, A., Wysoki, M., Yablowitz, Z. and Korczynski, R. 1993. High density plantings for protected cultivation of fruit crops: net to protect against insects. *Acta Hort.* 349: 89-93.
- George A.P. and Hieke S. 1996. Control of tree growth in temperate fruit with paclobutrazol: a synopsis of research findings over the past 5 years. In: "Challenges for horticulture in the tropics" Proceedings of the Australian Society of Horticultural Science Conference, Gold Coast. Ed. R.A. Stephenson and C.W. Winks, pp.283-288
- George, A.P. and Hieke, S. 1996. Control of tree growth in low-chill stonefruit using paclobutrazol: a synopsis of research findings over the past 5 years. *Acta Hort.* 436: 339-345.
- George, A.P., and Nissen, R.J. 1992. Effects of water stress, nitrogen, and paclobutrazol on flowering, yield, and fruit quality of the low chill peach cultivar 'Flordaprince'. *Scientia Hort.* 49: 197-209.
- Glenn, D. M., Prado, E., Erez, A., McFerson, J., and Puterka, G. J. 2002. A reflective, processed-kaolin particle film affects fruit temperature, radiation reflection, and solar injury in apple. *J. Amer. Soc. Hort. Sci.* 127:188-193.
- Jackson, J.E. 1980. Light interception and utilisation by orchard systems.. *Horticultural reviews* Vol2. (J. Janick ed.). p 208-267. The AVI Publishing Company Inc., Westpoint Connecticut.
- Jackson, J.E. 1985. Future fruit orchard design: economics and biology. In: MGR Cannell and J.E. Jackson (eds) *Trees as crop plants*. Inst. Terr. Ecol., Huntington, UK, pp. 441-459.
- Lloyd, A., Smith, D., Hamacek, E., Kopittke, R. and Pinese, B. 2003a. Improved protein baits for fruit fly control, *Horticulture Australia Final Report*, November 2003.
- Lloyd, A., George, A.P., Nissen, R.J., Hamacek, E., Waite, G., and Neal, C. 2003. Exclusion canopy netting of fruit crops for economically and environmentally sustainable production and non-chemical interstate/export market access protocols, *Horticulture Australia Limited, Final Report HG00018*, August 2003.
- Mazor, M. and Erez, A. 2004. Processed kaolin protects fruits from Mediterranean fruit fly infestations. *Crop Protection*, 23 (1): 47-51.
- Menzies, R., Nissen, R.J. and George, A.P. 2002. Crop regulation and blossom thinning to increase fruit size and market returns of low and medium chill stonefruit *Horticulture Australia Limited, SF 97007, Final Report*.
- McBride, J. 2000. Whitewashing Agriculture. Agriculture Research Services, [Online], 9 pages, Available: <http://www.ars.usda.gov/is/AR/archive/nov00/white1100.htm>. [2004, March 19].
- Nardi, D. 2001. Regional Reports, Victoria. *Australian Fresh Stone Fruit Quarterly*, 3: 21-22.
- Noppakoonwong, U., Sripinta, P., Pasopa, P. and Pichakum, A. 2002. Reports of the First International Workshop on Production Technologies for Low-chill temperate fruits. Chiang Mai, Thailand. Effects of water stress on shoot growth and fruit development of nectarine. pp. 236-243.
- Palmer, J. W., Avery, D.J. and Wertheim, S.J. 1992. Effects of apple tree spacing and summer pruning on leaf area distribution and light interception. *Sci. Hort.* 52:303-312.
- Saour, G., and Makee, H. 2004. A kaolin-based particle film for suppression of olive fruit fly *Bactrocera oleae* Gmein (Dip., Tephritidae) in olive groves. *J. Appl. Ent.* 128: 28-31.
- Van den Ende, B., Clippingdale, B., and Corboy, P. 2001. Effects of tree density and training systems for peaches, apricots and plums. *Horticulture Australia Limited Report*.

**ILLUSTRATIONS**

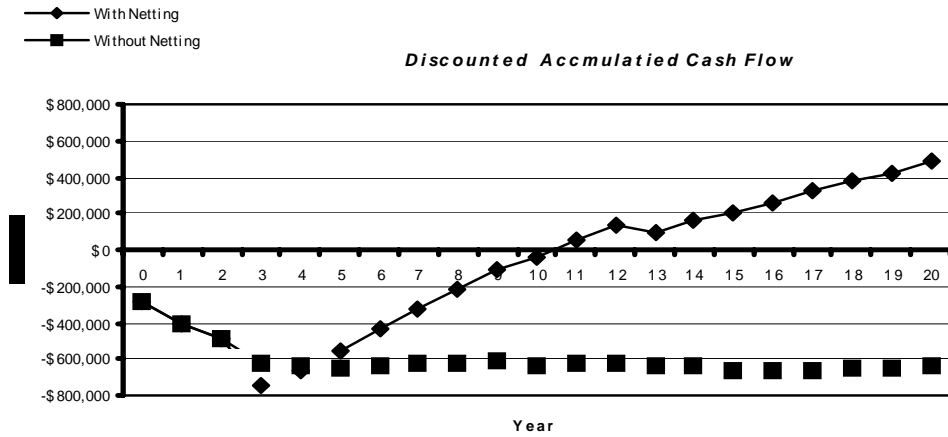


Figure 1. Discounted accumulated cash flow for a un-netted orchard vs a exclusion netted orchard trained to a tight open vase planted at 833 trees per hectare.

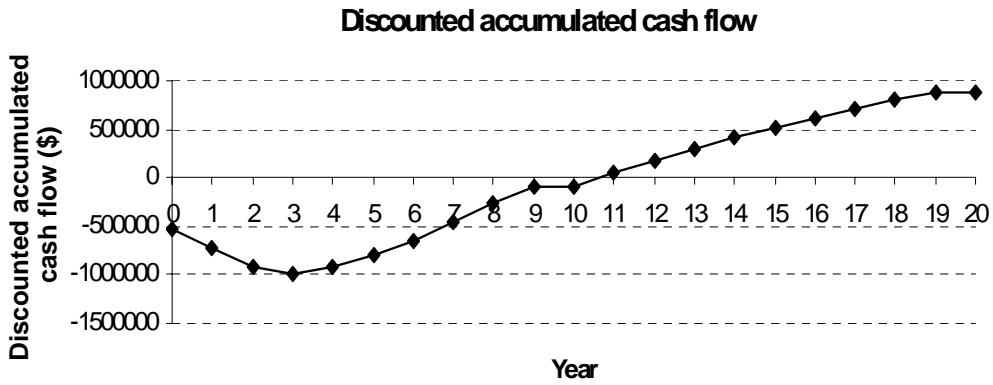


Figure 2. Discounted accumulated cash flow for a exclusion netted orchard trained to a palmette systems planted at 1111 trees per hectare.

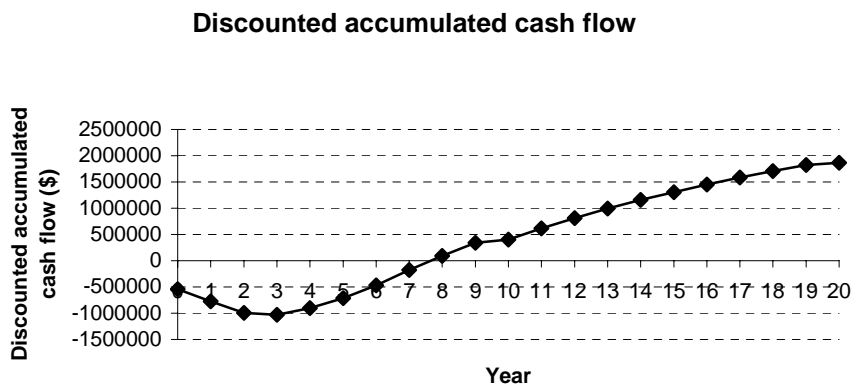


Figure 3. Discounted accumulated cash flow for a exclusion netted orchard trained to an Open Tatura systems planted at 2222 trees per hectare.