



# Talking Avocados

Australian Newsline

2 Number 1

March 2001



**"Goodwood Plantation" the Property of Ron Simpson  
in the Bundaberg Region**

- Risk Management
- Rots and Bruising Main Quality Problems
- Field Management of Postharvest Diseases
- Nutrient Replacement for Avocados

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## Calendar of Events

### March

- 19-20 **Australian Avocado Growers' Federation** - Half Yearly Meeting, Brisbane. Contact: Rob Donkin 07 3213 2477.
- 21 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable Growers' Office, Barolin St., Bundaberg, commencing 7.30 p.m.
- 30 **NSW Avocado Association**-AGM, Summerland House With No Steps, commencing 10 a.m. Guest Speakers - Rob Donkin (AAGF Industry Manager) and Wayne Prowse (HAL).

### April

- 3 **Avocado Growers' Association of WA** - Annual General Meeting, Conference Room, Market City, commencing 5.30 p.m.
- 18 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable Growers' Office, Barolin St., Bundaberg, commencing 7.30 p.m.

### May

- 9 **South Australian Avocado Growers' Association** - AGM and Seminar at Waikerie. Guest speaker will be Graeme Thomas. Contact Colin Fechner, 08 8541 281.
- 16 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable Growers' Office, Barolin St., Bundaberg, commencing 7.30 p.m.

### June

- 2-7 **2001 Australian & New Zealand Avocado Conference** - Bundaberg Qld. Contact - Rob Donkin Ph: 07 3213 2477, Fax: 07 3213 2480, E-mail: aagf@uq.net.au

### July

- 18 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable Growers' Office, Barolin St., Bundaberg, commencing 7.30 p.m.

### Front Cover:

*Aerial view of Ron Simpson's property, "Goodwood Plantation" in the Bundaberg region.*

### Back Cover:

*Top - Canopy management - initial prune of trees on the Childers property of Ivan Philpott.*

*Middle - The same trees six months later.*

# Editorial

- Orf Bartrop

This issue of Talking Avocados will be the last you will receive before the Bundaberg Conference in June. For those not contemplating going, previous attendees to this type of event consider it money well spent. Besides the knowledge to be gained, Bundaberg is a beautiful town, so why not combine work with pleasure—while you are there, have a holiday.

I will be in Bundaberg for the Conference. Please come and introduce yourself. I am always happy to meet my readers.

For those growers who are not using AVOMAN as a production tool, perhaps

you should read the AVOMAN Survey on page 14. It was compiled by an independent researcher, and therefore, should not show bias. It may help you make up your mind about getting into the 21<sup>st</sup> Century.

There are four articles from the NZ avocado magazine that should be of interest to Australian growers. I say Australian instead of all growers because Talking Avocados now goes to twenty-five addresses in New Zealand.

To satisfy the requests of many readers, I have included more than the normal number of technical reports in this issue. □

## Horticulture Australia Limited

Horticulture Australia began its journey into the future when the Board of Directors of the newly formed Horticulture Australia Limited met for the first time in February.

The Board started the process of reshaping the former Australian Horticultural Corporation (AHC) and Horticultural Research & Development Corporation (HRDC) into a new industry-owned service company ready to meet the challenges of the future.

The formation of the new company is the culmination of over two years of hard work by the horticultural industry in partnership with government. According to Horticulture Australia's new Chair, Dr Jane Wilson: "The aim is to create an organisation with closer links to industry which can deliver a more integrated and commercially-focused approach to marketing and R&D services.

"The company will be driven by industry priorities with strong accountability for performance to shareholders, levy payers and the Government, which will continue to provide matching R&D funds."

Senator Judith Troeth, Federal Parliamentary Secretary for Agriculture, Fisheries and Forestry, wished the new organisation well and expressing confidence in its ability to serve the industry.

The Board has met with representatives of the 28 industries that signed the Deed of Agreement underpinning the new organisation. The HAL shareholders presented the industry perspective on the factors

driving change within horticulture as well as its strategic issues, intentions and expectations regarding the new company.

Neil Eagle, Chair of Horticultural Industry Consultative Group, which coordinated industry responses to the restructuring process, said "We are extremely positive and enthusiastic about HAL and the role it can play in assisting us to meet the challenges of the future. We have worked hard to bring this new company into being as there is strong consensus market driven R&D is essential for positive industry development."

The first steps taken by the new Board were the election of Bob Seldon as its Deputy Chair and initiation of the process to select a new CEO for the company.

During the transition phase, an executive management team, made up of marketing and R&D representatives, is responsible for the day-to-day running of HAL.

A critical element of the new structure is the establishment of Industry Advisory Committees (IACs) with Horticulture Australia's shareholder industries. The company's Board and management are having preliminary discussions with industry to address the issues regarding the establishment of these committees.

According to Dr Wilson: "The key to the IACs is that they should be flexible to suit the circumstances of individual industries while enhancing and strengthening the relationship between the shareholders and the company. □

# President's Perspective

By Rod Dalton, President AAGF

## Avocado Production

The avocado production season for 2000 has drawn to a close and a number of issues are worthy of comment.

As discussed on page 7 of this edition, the levy receipts for the July/December period indicate production was up by some 62% over the same period in 1999. This dramatic increase in volume and the consequent effect on returns to growers again highlights the difficulties the industry, the AAGF and all sectors of the marketing chain, has due to the limited availability of accurate industry statistics.

There was general acknowledgment early in the season, that there was a good crop to be harvested. However there was no capacity to quantify that crop or to monitor volumes being marketed during the season. If our industry is to professionally manage the generic avocado marketing effort, more accurate and timely statistics are essential. The issue has been identified in the Industry Strategic Plan to be addressed in the medium term.

The challenge is to develop a system which is cost effective and acceptable to industry. Options might include individual crop estimates, estimates from sample orchards, packing groups/large growers providing estimates to an independent body or the Californian system where each packhouse provides the Californian Avocado Commission with data on stock, packouts and sales on, I believe, a daily basis. Anyone who has some ideas on how we might address this issue is welcome to contact this or her local Director, Rob Donkin or myself.

The fact that the Victorian and South NSW sections of our industry are not actively involved in AAGF activities was highlighted when it became apparent they were harvesting a very large crop which impacted on the marketplace and the AAGF had been largely unaware of it. Better communication, both ways, is needed within our industry.

## Age of Fruit

Another issue of concern remains the age of fruit at retail level. This becomes a serious problem during periods of heavy supply and late in the season when much of the fruit was "very" mature the problems were exacerbated, particularly if the "cool chain" was not effective. The AVOCARE project outcomes are helping address the problems; however, all sectors of our industry need to work to improve their performance.

## Horticulture Australia

Horticulture Australia Limited (HAL) officially started operations on 1 February although the staff of the two previous organisations, AHC and HRDC, had moved into the new offices prior to Christmas. The Board of HAL now has the challenge of establishing the company and the "culture" which will provide industry with the outcomes which the process has sought, whilst ensuring that the existing programs and commitments are not adversely affected. As there are a lot of issues to be covered, including the recruitment of the Managing Director of the new company, the process of change will be measured.

Rob Donkin and I, together with the Chairs of most horticultural grower peak

industry bodies, attended a workshop in Sydney on 15 February. This provided industry with the opportunity to brief the HAL Board on industry expectations of the new organisation. This was also an excellent opportunity for the Board to meet industry and become familiar with issues of concern. The outcomes were very positive and the Board impressed with their enthusiasm for the role of the new organisation and their understanding of the issues.

The manner in which the staff of the AHC and HRDC, particularly Wayne Prowse and Gerard McEvelly, have handled the change and the uncertainty associated with it over the last 2 years, has been excellent and I thank them for their commitment to our industry.

An issue the AAGF Board and industry will be addressing in the coming months is the role, structure and composition of the Industry Advisory Committee (IAC) which needs to be established to manage the relationship between HAL and the AAGF. There is considerable flexibility in the legislation as to the structure of IACs and the AAGF will be working closely with the HAL to establish a process that best suits the needs of the avocado industry and HAL.

## Avocado Conference

Planning for the conference in June is now well in hand. The program will provide a wide range of information and the opportunity to network with other growers and sectors of our industry will be an important part. I look forward to meeting many of you in Bundaberg in June. □

# From Your Federation

By Rob Donkin, Industry Manager

Hello, for my first time in what will be, I'm sure, many editions of Talking Avocados. My thanks go to those many growers who have made me feel very welcome. To those whom I have not yet met, I look forward to the opportunity in the near future.

It has been an interesting start to my time with AAGF getting my feet on the ground and getting a feel for the avocado industry issues. I have a background in Agriculture and a sincere empathy with farmers having grown up on a banana farm.

Of immediate concern is the Australian and New Zealand Avocado Growers Conference in Bundaberg from 3 to 7 June

2001. I understand it is the first international conference to be held in Bundaberg, certainly it is the first international **horticultural** conference to be held in Bundaberg. We look forward to an interesting and enjoyable conference.

I am putting the final touches to the Registration Package right now. You should have received a copy of the package by the time you receive this edition of Talking Avocados. It should be an excellent four days and good value for money with a very challenging business program with the extensive range and experience of the speakers your committee has been able to bring

together. The field days promise to be a valuable extension of the presentation with an opportunity to see first hand what other growers are doing and see the results of some of the latest horticultural practices.

Please get your bookings in early to ensure your attendance and to allow for our planning. Accommodation is also at a premium so please book this with your registration through the conference organizers.

Henry Kwaczynski has put together an exciting and interesting pre-conference tour through the Sunshine Coast to take in farms, wildlife parks and avocado nurseries.

It is an exciting and challenging time to be joining the industry; indeed it is a challenging time for the industry. Increasing production is already here, with nearly double the anticipated production for the period Jun to Dec 2000.

With production forecast to almost double again over the next five years, we must put ourselves on a footing to ensure the welfare of the industry as a whole and thereby the livelihood of the many growers that make up the industry.

I have joined the industry at the start of your recently developed Strategic Plan; I now have the challenge of assisting your Board to see the fulfilment of that plan. Above all else, the challenge is to see that you maintain your markets and develop new ones for your produce. Overseeing all that must be a strong and vibrant peak industry body that will need your input and support.

As I see your AAGF Board now, it is well structured and organised to meet the challenges. It has put itself in a good position to help in guiding the industry to move forward over the next four to five years. Prudent decisions and good structure have been the hallmark of its good standing. Your input and support will ensure that it stays that way. The advent of Horticulture Australia Ltd (effectively amalgamating AHC and HRDC) is a positive move for the organization of horticulture in Australia.

As a person new to the avocado industry, I believe we have a major challenge in presenting our fruit to our customers. I love avocados. However, like many, I have previously not been confident about choosing my fruit from the supermarket shelf. I am not the only customer with these concerns. Your Board has given me a principal task to work with retailers to address this issue.

We all have a role to play in addressing the quality of fruit that reaches the retail shelves. It is my opinion that there has never been a better time to produce and provide quality fresh fruit and vegetables to our customers. Any poor quality fruit that reaches our customers, for whatever reason and wherever the cause, has an impact on all our industry and its growth. But I am sure you know all that. It is how we deal with it that presents so many questions without any immediate answers. Any ideas you have or assistance you can provide will be most welcome.

That aside there are many other challenges for the industry, use of chemicals, taxation, workplace health and safety, environment. But more on these matters in the future.

In the meantime, I look forward to meeting as many of you as possible at the Conference in Bundaberg in June. □



## TALKING AVOCADOS - HAVE YOUR SAY

Dear Sir,

It is easy to be wise in hindsight, however, the clever people use foresight.

Some five years ago, the Federation was advising growers that the tree plantings would create a massive over supply in 4 to 5 years time. The wise people took note and got out of the industry. The game and confident growers simply expanded on the basis that you have to get larger to survive. True.

The market crunch has hit this year with big crops, saturated markets and poor prices. I believe this will be the end of small growers.

The Federation has a problem to find practical solutions. The industry has talked of export for years, but it never gets off the deck. The other panacea is for a large increase in domestic consumption, again a much-discussed solution.

Unfortunately, the consumption increase is less than that of production and until the industry can afford mass TV publicity and promotion the consumption solution will remain a will-o'-the-wisp.

Finally, some chickens are coming home to roost. For many years the Federation has been bending over backwards to reach some kind of accord with New Zealand. Discussions have taken place on earliest and latest dates into the market, quantities, quality etc. The North Queensland reps were activators, being vitally interested because of their early fruit in March/April. The Southern growers were likewise vitally interested in the late fruit in Nov/Dec.

The agreements reached are useless. The Kiwis send their fruit when they like in

quantities and quality that suits them. Unfortunately, the Federation made many statements about the late fruit from South Queensland (a tinge of jealousy) with the result that any fruit from anywhere in Queensland has been downgraded by four dollars a tray from the first of December. Not a good result.

One other problem a grower complained about was that the proceeds of sale, the cheques, are taking five to seven weeks to appear. This is something the Feds should look at.

*A very concerned grower.*

Dear Sir,

My congratulations on the last issue of TA, I thought it was excellent. Now, however, I would like to open Pandora's box.

The constitution of the AAGF was born out of political necessity and was aimed at creating a monopolistic control. To date it has been a success and greatly enhanced the progress of the industry; however, I believe it is now time for change (I must admit that I was instrumental in the creation of the current constitution—but it has done its job well).

As it is at present, the growers do not have any say or control over their industry. The only legal members of the AAGF are the Board Members. At the Annual General Meeting, growers do not approve of the policies, finances or decisions of the Board. No grower or growers may move a motion of censure or a motion of no confidence in the Board and the Board has no real responsibility to the growers, just to

the Government to account for levy monies.

Admittedly, the Board members are representatives of the various States and major growing districts which gives a semblance of a democratic organisation, but most growers never get a vote, many districts are not represented and it is not democratic.

The AAGF has now grown and matured to the position where this concentrated power and control is no longer required to ensure its existence and it has reached the stage where it is essential that the normal democratic checks and balances be inserted.

The Board must be made responsible to the growers. Change is required now, when it can be done smoothly and peacefully, rather than an unwanted change being forced upon us in uncharted waters ahead. There are major problems likely to arise that will greatly affect the industry. For example, QFVG having to reinvent itself without the support of Government regulations; the reorganisation of the AHC and HRDC with the increasing reliance on and influence from Government organisations and bureaucracy and the advent of sales by computer auction which must come.

The decline and demise of what was a strong and viable QFVG will be a severe blow to all Queensland growers.

I personally am retiring and leaving the industry, but I suggest that growers (and States) need to consider the structure of the industry and whether it safeguards their democratic rights and is suitable to meet future demands.

My best wishes to all growers and the hope for a good future for the industry.

*David Rankine  
Mount Tamborine*

# Avocado R&D Program Summary

By Gerard McEvelly, HAL

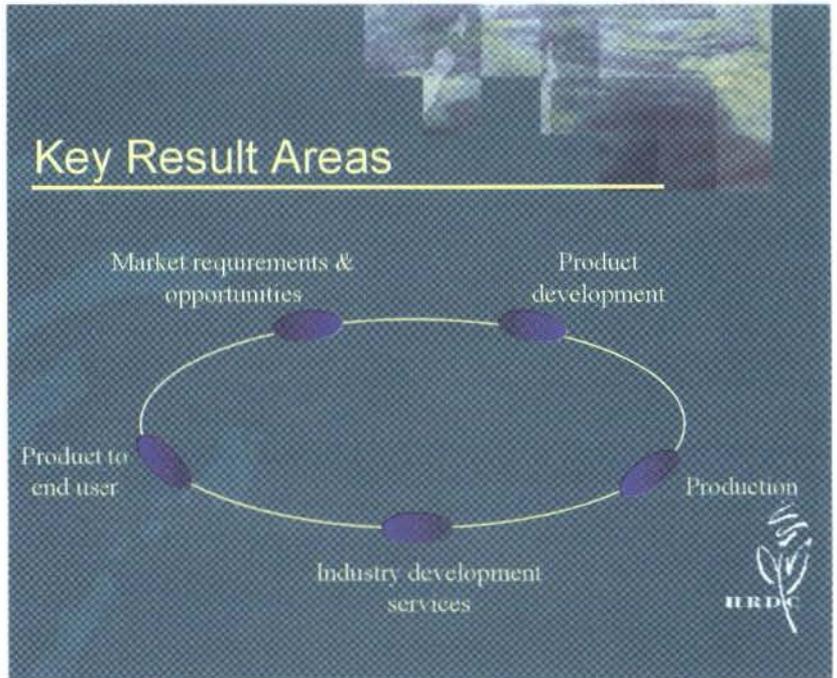
The strategic planning exercise undertaken in 2000 has provided some clear direction for the industry in its R&D and promotion activities. The plan was undertaken with the aim of identifying issues and then appropriate strategies to address these. The R&D committee will be meeting in early March to determine which of these should be initiated within the R&D program.

Some people still imagine that the R&D program only addresses "how to grow the crop better, or at lower cost". A quick glance at the diagram of Key Result Areas will show that the R&D program can encompass the whole marketing cycle, from research into market requirements, through to the production and delivery of the product.

It may be appropriate to give a brief overview of the current avocado R&D program, using the headings in the HRDC strategic plan. More details on some projects were provided in the AHC/HRDC report late last year.

## Market Requirements and Opportunities

At present, there is no R&D activity in this area. However, some ongoing domestic market monitoring



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is carried out as part of the promotion program. Given the focus in the new strategic plan on the need to develop new markets, there needs to be further consideration given to work in this area, in order to better understand the opportunities and challenges of potential markets.

### Product Development

This could encompass new varieties or value-added products developed to meet market needs. The avocado is unusual in having such a strong worldwide focus on a single variety, Hass, and there is currently little interest in developing new alternative varieties within the R&D program. With "value-added" products, the R&D committee has viewed these as being better developed by the processed food industry. At present, the R&D activity in this area is related to rootstock testing for effects on canopy growth, fruit quality and the many other factors governed by rootstock.

### Production

Much of the current R&D program concerns production issues. However in all

cases these issues have a market focus. The work on **disease control**, for example, is aimed at delivering fruit that is free of rot to the consumer. Research into **fruitspotting bug** and better pest monitoring is focussed on minimising pesticide use, as well as avoiding potentially heavy crop losses which would impact on consumer prices as well as grower profitability. **Irrigation** research is seeking to maximise production per megalitre, by better-targeted irrigation. This is part of demonstrating sustainable farming practices, which marketers worldwide are beginning to use as a message for consumers. **Canopy management** research addresses many issues, including productivity, but also fruit size and internal quality—both critical marketing issues.

### Product to End User

The key R&D in this area is the **Avocare** initiative, involving researchers, growers, wholesalers and retailers in better understanding fruit defects and how they are affected by growing and handling practices. The first year of Avocare has provided valuable insights into the causes of some

problems and a challenging "action plan" has been drawn up to enable these to be addressed.

### Industry Development

Always seen as a crucial area of the R&D program, with the focus on information delivery and assistance in better farm management through **AVOMAN** and the technical sections of **Talking Avocados**. The appointment of an **industry development manager**, part-funded through the R&D program will further develop this area and improve overall coordination of communication within the industry. The industry development program also includes the costs incurred by the R&D committee and by AAGF in planning and monitoring the R&D program.

This is a quick overview as a reminder of the current scope of the R&D program. If you have any comments or require further information, please contact myself, a member of the R&D Committee, its secretary, Rob Donkin, or your representative on AAGF. □

# Avocado Industry Marketing Report

## 50% Production Growth Expected This Year

According to levy collection statistics collections in 6 months to December 2000 were 62% higher than at the same period last season indicating a substantial increase in avocados marketed. On this trend production is likely to reach 36,000 tonnes in 12 months to June 2001. This increase, reinforced by market statistics, major retailers and AC Nielsen research has certainly taken its toll on individual grower returns per tray with relatively static production.

The new avocado promotion campaign designed to encourage consumers to have an avocado everyday for their good health sake has really turned out to be the right strategy and has been working hard in magazines, bill boards and in-store displays to make a difference. With increases like we have seen it is not realistic to be able to generate the increased demand necessary to hold prices at similar levels without substantially stronger promotion programs.

To that end the avocado industry marketing forum will consider a **TV strategy** at its meeting on 20 February. Our advertising agency has responded to develop an

exciting concept to promote avocados on TV. Funding an effective campaign to benefit all of industry will be the topic for wide industry consultation, as it will need funding contributions wider than the existing levy. This development follows outcomes of industry consultation during the strategic planning process last year.

Meanwhile the current promotion emphasis remains on in-store promotions, magazine advertising and public relations.

## Avocados In Europe

Under the banner of **Australia fresh** the Australian Horticultural Corporation represented a number of horticultural industries at the Fruit Logistica Berlin 17-20 January. Fruit Logistica is reputedly the largest exhibition in Europe dedicated to Fruit and Vegetable marketing. Although representing several industries, our small display of avocados drew considerable interest. Europe is a very large market for avocados and although widely available from areas like Spain, Italy and Israel, there are gaps in the market that can be filled from other areas that Australia is ideally suited to meet. One major challenge of course is the logistics to get them there; however

with improved CA containers and shipping services this can be overcome.

This and other export topics will be discussed at an export workshop being planned for April 2001. Australia exports less than 1% of avocado production.

*For more information contact Wayne Prowse at Horticulture Australia Limited [wayne.prowse@horticulture.com.au](mailto:wayne.prowse@horticulture.com.au)*

## Horticulture Australia Limited

Senator Troeth has announced that the assets and functions of the Horticultural Research and Development Corporation and the Australian Horticultural Corporation have been transferred to Horticulture Australia Limited from 1 February 2001. Contact details are:

**Horticulture Australia Limited  
Level 1, 50 Carrington Street  
SYDNEY NSW 2000**

**Ph 02 8295 2300  
Fax 02 8295 2399**

The new company is a grower owned organisation, limited by guarantee, to provide effective and efficient marketing and R&D services to Australian horticultural industries. □

## Australian & New Zealand Avocado Growers Conference

### “VISION 2020”

The Australian Avocado Growers' Federation and the New Zealand Avocado Growers' Association will be holding their Conference in Bundaberg from 3 to 7 June.

This is your opportunity to take a look into the future of your avocado industry. Presentations will be given on the latest approaches to Avocado growing from the heart of the biggest avocado growing area in Australia.

You will be able to develop your knowledge and understanding of the issues that are going to impact on the production and marketing of avocados in the future from an Australian, New Zealand and International perspective.

Over 400 delegates are anticipating to attend the four days of business sessions and field trips into the growing area. During the business sessions, local and international experts will deal with all aspects of the industry including the latest approaches to orchard management, research findings, packing and marketing.

During the two afternoon field trips to local industry leaders' farms and research sites you will be able to compare practical on-farm techniques and experience the farms in action.

The final day of the Conference will be a special field day on 'Canopy Management Options'.

With an innovative, forward thinking approach this is a Conference for everyone in the Avocado industry from growers to researchers, from suppliers to marketers.

#### About Bundaberg

Bundaberg is one of Queensland's most modern and progressive cities. The City, with a population of 46,000, is the commercial Centre of the Wide Bay Region. The city serves a district of 120,000. The region is situated at the Southern tip of the Great Barrier Reef, approximately four hours' drive north of Brisbane.

The district is a major sugar cane and horticultural producing region. Major horticulture crops are avocados, tomatoes melons and capsicums (see front cover).

The region is also a major tourism centre as a gateway to the Barrier Reef and as a whale watching venue from September to November. The City also serves as the home for the famous Bundaberg Rum Distillery. During the Conference the temperature is expected to range between 12°C and 22°C.



The city of Bundaberg and the Burnett river.

divided into two groups, visiting two farms each day allowing for everyone to be involved in discussions.

This will be an excellent opportunity to visit a number of very productive well managed orchards in the Bundaberg/Childers region which is now the prime avocado production region in Australia.

#### Social Functions

There will be several social events including a Welcome Function, a Gala Conference Dinner and a Casual Barbecue. Also for accompanying persons not attending the Conference, there will be tours in the area. These include trips to nearby beaches, visits to a wide variety of local attractions, fishing excursions or trips to the beautiful offshore Lady Elliot or Lady Musgrave Islands. Bundaberg is the gateway to the southern tip of the Great Barrier Reef.

#### Program Details

At the Conference, presentations will be given on:

- **Adoption of Field Practices to Assist in Expanding Avocado Markets.** *Dr Tony Whiley - Principal Horticulturist, Queensland Horticulture Institute.*
- **Structures, Relationships and Issues for Avocado Grower Organisations in 2020.** *Dr Jonathan Cutting - Chief Executive Officer, NZAIC.*

#### Marketing Avocados into the future.

- **Future Trends for the Sales, Marketing, Packaging and Consumption of Avocados.** *Avi Crane - Vice President, Calavo International.*
- **Horticultural Marketing in 2020.** *Lisa Cork - The Marketing Department, Auckland.*
- **New Directions in Promoting the Promised Fruit.** *Wayne Prowse - Industry Manager, Horticulture Australia Ltd.*

#### The challenge of quality at Retail Level

- **Avocado Quality at Retail Store: We have a role to play.** *Dr. Peter Hofman - Principal Horticulturist, Queensland Horticulture Institute.*

#### Pre Conference Tour

Prior to the Conference, there will be a pre-conference bus tour from Brisbane to Bundaberg. The tour takes in points of interest along the Sunshine Coast and including avocado farms, an avocado nursery and a local wildlife park.

#### Canopy Management Workshop

There will be three field visits to orchards in the Bundaberg/Childers area which are using a range of canopy management strategies. Trial sites being utilised in the QHI canopy management research project will be inspected. The opportunity will be taken at each site to review the approaches being used in a workshop/open forum approach.

#### Afternoon Orchard Visits

Four local orchards including a large packing shed operation will be visited. Topics such as orchard floor management, the use of growth regulators, irrigation management and harvesting equipment will be discussed. Delegates will be

## AVOCADO CONFERENCE

• **Quality in Distant Markets.** *Dr Henry Pak – Senior Technical Officer, NZAIC.*

• **Field and Post Harvest Management of Avocado Fruit Diseases.** *Dr Lindy Coates – Plant Pathologist, Queensland Horticulture Institute.*

**The Manipulation of plant growth to improve productivity**

• **Developments in Plant Growth Regulators and their use in the Manipulation of the Growth and Flowering of Avocados.** *Prof. Carol Lovatt - University of California, Riverside.*

• **Irrigation – Physiology of Turning Water into Oil.** *Dr David Turner - University of WA.*

• **Controlling Anthracnose in Avocado by Enhancing Natural Fruit Resistance: the Role of Rootstocks and Nutrition.** *Dr Sonia Willingham - Plant Pathologist, Queensland Horticulture Institute.*

• **The Management of Fruit Size in Hass.** *Prof. Nigel Wolstenholme - South Africa.*

**The future approaches for pest and disease management**

• **IPM and Avocados in Australia.** *Dan Papacek - Bugs for Bugs. A company specializing in IPM in the fruit industry particularly the citrus industry.*

• **Avogreen – NZ IPM program.** *Phillipa Stevens - HortResearch NZ.*

• **Future Management Strategies in Disease Control.** *Ken Pegg - Senior Plant Pathologist, Queensland Horticulture Institute.*

**Phytophthora management strategies for the future**

• **Use of Foliar Applications of Phosphonate to Control Phytophthora Root Rot in Avocados.** *Dr Tony Whiley - Principal Horticulturist, Queensland Horticulture Institute.*

• **The Benefits of Monitoring Phosphorous Acid in the Roots of Avocado.**

*Graeme Thomas - GLT Horticultural Services.*

• **Non-fungicidal Control Strategies of Phytophthora cinnamomi Root Rot of Avocado.** *Dr John Menge - University of California, Riverside.*

**Canopy Management**

• **Developments in canopy management:**

**in Australia** - *Dr John Leonardi, QHI.*  
**in South Africa** - *Jan Toerien - Consultant Australia/South Africa.*

**in New Zealand** - *Dr Grant Thorpe - HortResearch, NZ.*

**in the Bundaberg region** - *Dr Chris Searle – Development Extension Officer, Queensland Horticulture Institute.*

**Avocado Production in 2020**

• **Avocados and the “Information Age”.** *Simon Newett - Extension Officer, Queensland Horticulture Institute.*

• **Avocado Production in 2020.** *Prof Nigel Wolstenholme, South Africa. □*



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## Mother Nature Unleashes Her Fury On Northern NSW

By Frank Moore, Vice-President, AAGF

The 2000/2001 season will probably be remembered by avocado growers, and indeed, all other primary producers in northern NSW, as one of the most unpredictable, contrasting and extreme periods of weather patterns on record.

Consider the past five months, in October the north coast of NSW was threatened by bushfires, in November farmers copped the brunt of periodic storms that failed to produce any significant rain and for some growers resulted in hail damage.

In December and January, after coming off an already dry year growers were again disappointed by storm clouds that passed over without leaving any rain. Then searing temperatures caused sunburning on exposed fruit and threatened many trees that were already stressed by the dry times, with excessive fruit drop.

Mid January saw the town of Casino hit by a devastating storm with severe winds and large hailstones that battered all in its path, causing plenty of grief. Now, in very early February, the district has been hit with torrential rains causing major towns like Murwillumbah, Lismore and Grafton to flood along with dozens of rural communities and outlying regions. With global warming, the prediction is that these types of weather extremes will become the norm. (Sure to be a test of our Phytophthora management skills!)

Not to be content with the above, monolepta beetles caused further damage to crops. Growers deserve all they can salvage from such a wretched season.

This may sound like whingeing but it is not, it leads to the subject of Crop Risk Management and in particular, hail insurance.

It was once said that farming is "the only truly legal form of gambling known to man"—how very true.

However, like all shrewd gamblers, there are various ways and means to minimise the risk of loss caused by crop damage. There are many forms of damage that can cause loss to your crop, which can be managed by a competent grower. Without getting too bogged down, a few common and well-known means of damage with their antidote are: insect damage—by monitoring and spraying as required; anthracnose—by maintaining a regular

copper spray program and correct storage procedures; bruising—by careful handling during harvest and packing. Packaging also plays a very important role during transport.

Now to consider some more unexpected means of damage: fire damage—by maintaining fire breaks; frost damage—by adequately protecting the young tree (insulation paper), installing smudge pots or wind turbulence machines; hail damage, now this is what this article is all about.

The obvious answer is to install netting; however, until canopy management problems are sorted out (hopefully in the not too distant future), this option is not practicable.

Unfortunately, when it comes to hail, growers are at the mercy Mother Nature. The only safe answer to hail damage is through crop insurance.

That raises a few questions:

### What would growers in general think of hail insurance?

Probably 99% of growers would balk at the thought of spending money on insurance premiums each year, given the current climate in the market place. Especially if they are lucky enough not to have experienced hail damage.

There is no doubt that some regions are more prone to hail than others and, in fact, some areas that regularly receive hail are therefore classed by insurance companies as "exclusion zones". Most growers would claim to be in a reasonably safe area and prepared to take the risk. However, hail is unpredictable and can happen anywhere. One thing you can rely on, it usually only happens when you have a bumper crop.

### Why should growers insure against hail damage?

Obviously insurance is for financial protection against crop damage. Growers are able to plan and budget with a greater level of confidence knowing they have the security of crop insurance. The growers' equity in their orchard is protected by reducing the risk of an increased exposure to debt, which could arise as a result of crop loss, the interest on which could easily exceed the cost of insurance. Don't forget, crop insurance is tax deductible.

### Which growers would be most likely to insure their crop?

Many growers have more than one crop (eg: stonefruit, mangoes, bananas etc.) and are therefore not entirely dependent on their avocados. Many growers also have other means of income so once again they are not relying totally on their avocado production. These growers would probably be reluctant and hard to convince that hail insurance is a good management tool.

To be safe, most growers should insure against hail. However, in reality it is only used by growers in high-risk areas and those who can least afford a reduction in their crop revenue.

### How does crop insurance work?

Basically there are two policy types:

**Crop Income Policy** – based on actual, end of season income.

**Agreed Value Policy** – based on an agreed value per hectare, which may reflect estimated gross income, or a lower value.

### Which policy should growers pick?

The benefit of the **Crop Income Policy** is that growers are compensated for the actual financial loss caused by the hail damage. The actual income lost is the difference between the potential crop income that could have been achieved and the actual income received. This overcomes the problems associated with estimating income early in the season when crop yields and prices can be highly unpredictable and uncertain. This is especially important for larger growers where an inaccurate estimate of insured income could result in claims that could significantly over or understate their true financial position after a loss.

The **Agreed Value Policy**, on the other hand, provides growers with up front certainty in respect to the values insured and what compensation can be expected in the event of hail damage. This policy also covers trees not yet bearing, and provides optional cover for future loss of profit.

It is impossible to recommend a particular policy because there are so many variables that affect different growers in different ways.

## Weather Choices

By Keith Johnson, Alstonville

Do you use weather information as part of your farm management practice? You should, no good spraying only to have the spray wash off overnight.

You may not be able to choose the weather you will get but these days you can choose the weather forecast you will use. If you find the standard radio/TV forecast less than satisfying then you may wish to look at other, more informative, forecast providers.

There are Internet based forecast services available, there is also a weather channel on AUSTAR pay TV. AUSTAR is satellite broadcast and so is available in many areas that will never see cable based pay TV. Channel 22 (C22) provides a fairly comprehensive weather service that, in the writer's view, out-classes anything else available. So just what does C22 offer?

C22 provides, for Australia and by State, the full range of weather reporting and forecasting tools. You get the standard isobaric charts (animated), recent radar pictures (animated), satellite cloud pictures (animated), 24 hour, 4 and 7 day animated predictions, lightning strike patterns, marine and wind reports and forecasts, surf, and special reports covering medium and long range weather forecasts. Of course all the features are joined together by the usual talking head/s and presented in a set sequence.

The service is not perfect. For example, it is not interactive—you cannot pause the presentation while you study some feature, nor can you get it to focus down to a more detailed look at your locality. Even so, I have found it to be much more reliable for my purposes than the standard local radio prediction of "possibility of isolated showers later." Also, the

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This article is not intended to be an advertisement for any particular insurance company, nor does it imply that growers who do not insure are incompetent. What it is trying to achieve is to ensure growers are aware of what assistance is available.

Growers wanting any further information in regard to Crop Risk Management and do not know where to go, can contact Duncan Saville of Aon Risk Services Australia Limited. Phone: 02 6621 9833, Fax: 02 6621 8309. □

special reports do not always occur in the same spot in the sequence and so can be a little hard to access at times. Because the standard reports are in a set sequence you may have to wait 10 minutes for your area to come around in that sequence—still life is never perfect.

The feature that has proved very useful for getting a good fix on whether rain/showers will hit your locality is the animated radar picture. It shows the movement and intensity of the rain/showers/squalls that are occurring and have occurred in recent hours. You can see just how frequent, heavy, and scattered are the rain events buried in the cloud picture, and from this you can get a good idea of the likely pattern you can expect today.

Those same radar pictures, combined with the C22 prediction and cloud chart, can also give you a good fix on whether irrigation is warranted today. If you can see "rain/shower" coming in the next day or so you can soon tell if the "rain" is going to be a little or a lot. Obviously, if the "rain" is very little you continue your irrigation cycle until decent falls arrive or

are imminent. This same analysis is also handy in deciding whether you are going to spray or not and also whether to use a rainfast wetting agent in the mix.

Those of you who use Endosulfan would know that one of the questions you have to answer on that 2 page NRA required Spray Record is "Was rain officially forecast for the next 48 hours at beginning of application." If the radio forecast is "possibility of isolated showers" is that a forecast of rain? And is it official. With C22 you will have a better basis for answering that question. (It is difficult to not comment sarcastically about the NRA 2 page form and the information it requires.)

Now, the AUSTAR service is not cheap. You have to buy a package of channels and the cost is about \$50/month. However, it may be tax deductible (check with your accountant) and depending on how you use it and size of farm it may actually save you more than it costs.

The good news is that you can always cancel the service if it does not live up to your expectations and needs. □

## Weather on the Net

### Bureau of Meteorology

The Bureau of Meteorology has an Internet site that provides comprehensive meteorological data.

It provide the community with:

- warnings of dangerous weather such as severe thunderstorms and tropical cyclones, and weather conditions leading to floods or bush fires;
- weather forecasts for the land areas and for the coasts and oceans around Australia;
- seasonal outlooks of Australia's climate;
- data and information services on the weather and climate of Australia and surrounding areas; and
- scientific advisory and consultancy services in meteorology, hydrology and oceanography.

Weather data can be accessed through the Bureau's extensive World Wide Web site at <http://www.bom.gov.au/>

Also available are the current rain conditions provided by district radar sites. These pictures show rain areas and their movement over the last half hour. The pictures are available from: <http://mirror.bom.gov.au/weather/radar/>

### The Weather Company

The Weather Company is another good Internet site that delivers detailed weather reports including radar pictures of rain, lightning strikes, satellite cloud pictures, town and district forecasts, and many more services dealing with longer-range forecasts and records of rainfall etc.

The Web address for this site is: <http://www.theweather.com.au/>

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# Australian Round-up



The crop in NSW seems to be average to slightly above average. Some areas, such as the Alstonville Plateau, have

had a heavy set and maintained the crop while other areas are reporting a very light "off year" crop for Hass.

Early season hail had an effect in parts of the western boundaries of our region but was not extensive. Monolepta beetles have been particularly active this season, keeping those concerned on their toes throughout the summer, including the Christmas/New Year period. Time will tell how effective growers were at hitting the hot spot.

February started on a very wet note, weather stations recorded between 400-655mm of rain with most rain falling in a 36 hour period. This downpour followed a particularly hot and dry period. Rain was needed but I'm not sure that we needed quite that much in such a short time. Time will tell what effect it has on the trees.

Through all of the weather adversities and pest attacks fruit drop would appear normal.

Reports coming in would suggest that interest in growing Lamb on the North Coast is gaining momentum.

An earnest attempt is being made by all North Coast horticulture industries, through the North Coast Horticultural Sub Committee, to get the Drum Muster collection process up and running on a regular basis. The proposal is to approach councils on the North Coast with the intent of asking them to put aside one or maybe more days per year for the collection of chemical containers. The current ad hoc approach is not working with many farmers feeling uncertain that a Drum Muster collection day will eventuate. This is resulting in many containers ending up in the wrong place—private hideaways, public landfills etc.

Under the Drum Muster scheme the containers are recycled. Our responsibility is to triple rinse the containers and lids and store until the Drum Muster collection day. These days will be advertised through association newsletters etc. and councils hopefully will provide the collection base and manpower, with the assistance of Avcare. Here's hoping for success.

There is a proposal being worked on at the moment to form a State Horticultural Council. This would be an Agropolitical body to act collectively, representing hopefully all NSW Horticulture, to find solutions to problems that are common to all

Horticulture such as market chain dysfunction, improving the marketing of horticultural produce, importation of fresh produce, the Governments water reform agenda and restrictions on pesticide use. I'll keep you posted on progress.

A reminder that the annual membership subscription to the NSW Avocado Association of \$80 is now due.



By mid February, most growers in South Australia and Sunraysia have all but finished picking one of the largest crops of avocados for a long time. There is still a few Reed to be picked.

Even with a heavy Hass crop the fruit matured up to 3 weeks earlier than usual.

Growers who were still picking Hass in mid January lost a lot of their fruit due to the hot weather. We had numerous days of temperatures in excess of 40°C, a few days of 45°C and a Sunday when the temperature climbed to 48°C in the shade with a strong westerly wind. Even with water applied during the day the fruit still cooked on the tree. The excessive heat seemed to mainly affect the Hass but not the Reed, which still look good.

On Wednesday, 9 May, the South Australian Avocado Growers Association will hold its AGM and Seminar at Waikerie. The guest speaker for the day will be Graeme Thomas from Toowoomba. Graeme is a consultant to avocado growers and is on the R&D Committee. He is very knowledgeable as far as avocados are concerned. More details will be sent out to all our financial members before the day. All are welcome.



Bundaberg is expecting a good crop of Shepard and Hass this year and by the time you are reading this the district will be well into the 2001 harvest.

The year has been generally dry with the main rainfalls being 200 mm over 2 days at the end of October, 40 mm at the end of December, 50 mm mid January and 120 mm over 2 days end January. When we had rain it came and went quickly and to the writer's knowledge there has not been any hail in the area.

There has also been an announcement by the Beattie Labor Government to progress the construction of a new dam for the district. Welcome news indeed.

## Australia To Get New Avocado Oil Plant

Australia will get its first cold-pressed Avocado Oil production plant early next year.

Plans are under way to establish a large Avocado Oil processing plant near Brisbane, to accept fruit from growers throughout New South Wales and Queensland. Smaller plants may also be sited in other avocado growing regions to service growers in the rest of the country.

The venture is being planned by Olivado, which recently launched its premium Extra Virgin Avocado Oil to a very receptive market in New Zealand. Olivado established a purpose-built oil plant in Kerikeri in the north of New Zealand to process undersize and lower grade fruit that would otherwise have been left to rot in the orchards.

By turning unwanted avocado into oil, New Zealand growers have received an income not available to them in previous seasons and fruit disposal problems have disappeared. It has also kept smaller and lower grade fruit off the shelves, raising the overall quality of avocado in retail outlets and has helped to maintain good prices for growers for its better fruit.

Now Olivado aims to provide similar benefits to Australian growers by setting up a plant to take their unwanted avocado. The new plant is expected to be up and running by March 2002.

The plant will be twice the size of the one in New Zealand, to cater for the larger crop in Australia, but it will feature the same sophisticated oil production technology.

Olivado has been in discussions with the Australian Avocado Growers Federation to draw up guidelines for working alongside growers and pack houses to everyone's benefit. Olivado expects to have the first detailed information and supply contracts for local avocado growers and pack houses to view within a few weeks. □



## Eleven Producers' Views of AVOMAN

By Teresa Lynch, School of Computing & Information Systems, Faculty of Informatics & Communication, University of Central Queensland, Rockhampton, Queensland

The information presented below is a summary of the results of interviews conducted by Teresa Lynch, PhD student, University of Central Queensland, as part of her study into the adoption and use of decision support systems and expert systems within Australian agriculture.

AVOMAN was one of several software programs she investigated as part of her research. On behalf of the AVOMAN Team and the AAGF, I would like to thank Teresa Lynch for making this information available and allowing it to be published in "Talking Avocados".[Ed.]

### Background

A survey of eleven producers who were either users or non-users of AVOMAN was undertaken in May 2000. Seven current users were interviewed and four non-users were interviewed by telephone. Users of the system were asked if they used AVOMAN for decision making, record keeping, and how they rated AVOMAN in term of ease of use and usefulness. The results are given in the Table on the next page.

### Users

All seven users stated that they found the system both useful and easy to use. The level of computer skills was not an issue. Even new users who had purchased a computer to use AVOMAN still found it easy to use. The following comment by one of the users was given:

*"Never had used a computer before, needed to buy a computer. Bought a computer, got a copy of AVOMAN and away we went. No trouble from the first minute—it is so simple to use. It was no problem to use—very simple."*

All users used it for record keeping. The spray diary was very popular especially now that detailed recording of spraying regimes are required by industry. Most users mentioned quality assurance issues. Users liked the quality of the reports produced by AVOMAN and found them easy to generate

The use of the decision aid aspect of AVOMAN revealed some interesting issues.

One user was not using the decision aid aspect of AVOMAN. This was a new user who had not entered enough data at this stage to make use of the decision aid section. Five of the seven users still used consultants and compared the consultants'

recommendations with AVOMAN. All found AVOMAN to be in agreement with the consultants' recommendations within grams of fertiliser. One user said:

*"We use AVOMAN primarily as a recording tool. Use the decision aspect to check against the recommendation of the consultant."*

Only one user was relying solely on AVOMAN for recommendations. The users seemed reluctant to discontinue using their consultant and appeared happy to be able to check the consultant's recommendations against AVOMAN and as well, to check AVOMAN against the consultant. As one user stated:

*"We use a horticulturist but cross-reference AVOMAN with the horticulturist's recommendations. AVOMAN is generally very similar to horticulturist's recommendations. We did a test once—ask horticulturist and AVOMAN for recommendations for a whole year. Only one thing that the horticulturist did more than AVOMAN and that was because he knew the property personally. That convinced me that AVOMAN wasn't just a game program but was a serious thing."*

Users have a high opinion of AVOMAN. As one user commented:

*"If upgrades were on a user pay basis I would still use it. Feel it is our (producers') product—because of involvement. It was a team effort. Producers put a lot of effort into it as well. There is joint ownership."*

One user saw it as a 'must get' tool. Another user stated:

*"There are two good tools for the farm—four wheel bikes and AVOMAN."*

For some users it has impacted on decision making.

*"Makes it easier—especially in relation to fertiliser applications—knows when it is*

*the best time to apply fertiliser applications. Now apply fertiliser applications differently than I used to. It has refined our farming practice rather than changed it dramatically—especially in relation to fertiliser application."*

One user felt that the program would be better if it was structured differently so that it would be more useful for producers who grow more than one crop. This user suggested that there should be a basic module that links to other modules—one for each crop. The user liked AVOMAN so much that he wanted to use it for all the crops that he grew.

### Non-users

Four producers who had interacted with AVOMAN during the development phase but who no longer use it were interviewed.

Only one user did not use AVOMAN because they were critical of it.

*"Used the system when prototype testing was occurring but no longer use it. Thought that the data that is used to interpret results was not fine enough—too broad. Never interacted with full release version. Use a horticulturist to interpret leaf and soil analysis."*

This producer uses a computer for record keeping. However, he does not use AVOMAN.

One user indicated that their farm was too small and did not warrant the use of AVOMAN.

*"Wasn't worth it as it is not our primary source of income. Decided to keep going without it. Only have 270 trees. Too much effort for the benefit."*

One user did not use it because he was not computer literate.

*"It is harder to use the program than it is to record the data manually. I am not a*

## AVOMAN SURVEY

Id	User	Age	Computer skills	Uses a consultant	Uses AVOMAN for decision making	Rate AVOMAN in terms of ease of use	Uses AVOMAN for record keeping	Involved in testing/data collecting	Number of avocado trees	Rate AVOMAN in terms of usefulness	Why do you not use AVOMAN?
1	yes	60	skilled	yes	Comparison with consultant	strongly agree	yes	yes	1000	strongly agree	NA
2	yes	38	limited	?	not yet	strongly agree	yes	no	1500	agree	NA
3	yes	65	limited	yes	Comparison with consultant	strongly agree	yes	yes	1000	strongly agree	NA
4	yes	?	limited	yes	Comparison with consultant	strongly agree	yes	no	?	strongly agree	NA
5	yes	60	limited	yes	Comparison with consultant	strongly agree	yes	minimal	1250	strongly agree	NA
6	yes	22 & 53	?	not mentioned	yes	agree	yes	yes	1500	strongly agree	NA
7	yes	60s	?	yes	Comparison with consultant	strongly agree	yes	yes	400	agree	NA
8	no	?	?	?	NA	NA	NA	yes	270	NA	Not worth it for size of orchard
9	no	50	none	?	NA	NA	NA	minimal	1000	thinks program useful	Not computer literate and too much hassle
10	no	?	skilled	yes	NA	NA	NA	yes	?	?	Thought underlying data too broad
11	no	73	none	?	NA	NA	NA	minimal	700	NA	Not computer literate and small farm

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good example as I am not very good with computers. *Using the program is too much hassle. The program is good for new growers who know nothing. I recommend AVOMAN to people who are new to the industry.*"

The fourth non-user was interested in the software when he did the prototype testing and thought it was quite good. However, he indicated that his farm was small (700 trees).

*"If I had a big farm it would be wonderful."*



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## Success In Leafroller Control Will Come Naturally

From *AvoScene*, December 2000

After extensive evaluation over three seasons, Success Naturalyte\* has gained registration in New Zealand for control of leafroller in avocados. **[Australian growers please note that Success Naturalyte is not registered for use on avocados in Australia. Ed]**

In 1998, Dow AgroSciences launched the product for use in vegetable brassicas and field tomatoes where it has rapidly become established as a leading product for control of diamond back moth, white butterfly and tomato fruit worm.

A naturally derived product, based on metabolites produced by fermentation of a naturally occurring soil organism, Success Naturalyte combines the high efficacy level of synthetic products with the safety and environment profiles associated with biological products.

The product enters the pest by either contact or ingestion. Knockdown is fast with feeding ceasing almost immediately after exposure. It is safe to most beneficial insects, so it's a powerful tool for IPM programs. Its unique mode of action and ability to control pest species resistant to conventional insecticides means it can also be used in appropriate resistance management strategies.

It is safe to applicators because it has a very favourable toxicological profile. It also has a very favourable environmental

profile, being practically non-toxic to birds and earthworms. These features were instrumental in Success Naturalyte winning the Presidential Green Chemistry Award in 1999. This award was presented by the USA Environmental Protection Agency for incorporation of green chemistry into its design, manufacturing and use. This award also encompasses chemical processes that reduce negative impacts on human health and the environment.

Compatible with most other commonly used pesticides, Success Naturalyte is rain-fast six hours after application.

### Success Naturalyte on Avocados

Dow AgroSciences, HortResearch and independent research organisations conducted trials on avocados in New Zealand.

"The results were very conclusive," states Bernard Harris, technical specialist for Dow AgroSciences, "Success Naturalyte gave leafroller control that was fully equivalent to standard spray programs. We believe it has a big future for leafroller control not only in avocados but also in kiwifruit and pipfruit."

Features of Success Naturalyte that provide benefits to all fruit growers are:

- Naturally derived—a positive image and strong customer acceptance of fruit treated with natural products.

- Wide safety margins for applicators and the environment—use with confidence.
- Short residuality—satisfies increasing consumer demands for high quality fruit with minimal residues.
- OK on beneficial insects—compatible with Avo-Green programs.
- Unique mode of action—an excellent rotation partner in resistance management programs designed to ensure pest control can be maintained in the long term.
- Orchards can be re-entered once the spray is dry—orchard personnel can "get on with the job."
- Easy to measure and pour liquid formulation—no dust and low odour means it is pleasant to use.

Features of Success Naturalyte that provide specific benefits to avocado growers are:

- Safe to bees—can be applied during flowering.
- Highly active against leafroller, plus suppression of thrips, thereby ensuring high quality fruit at harvest.
- Short withholding period (three days) means greater flexibility in spraying immediately before and during harvest. □

\* Trademark of Dow AgroSciences

## Update On Lenticel Damage - NZ

### Researchers' report on a first look at a problem that caused heavy fruit losses last Season

By Kerry Everett, Ian Hallett, Chris Yearsley, Nagin Lallu, of HortResearch and Henry Pak, AIC - from *AvoScene*, December 2000

Last year, upon arrival in the American market, New Zealand fruit was prone to the development of black spots and patches on the skin of green fruit. These symptoms appeared to be worse in fruit harvested following a period of rain, and appeared to be associated mostly with lenticels. Therefore, this year research projects were initiated by the AIC to determine how long after being wet lenticels become damaged, how long after being wet fruit becomes less susceptible to damage, and whether there is an identifiable morphological change in the lenticel

itself that correlates with susceptibility to damage. Some of the progress made within the projects is described below.

As a first step it was necessary to develop a technique for fruit to take up water in a way that could be measured. In order to do this, we inserted the cut stem of the fruit into a flask that was sealed to make sure that any water loss was through the fruit alone.

Water gain and loss were measured by measuring change in fruit and water weight. We found that the best way to ensure there was an overall gain of water into

the fruit was to cover the fruit with a plastic bag and to place it in a high air flow in a chamber fitted with a row of fans.

The second step was to be able to simulate damage to lenticels in a quantifiable and repeatable way. We achieved this by rolling, or jostling, fruit 10 times from one side to another of a F40 container. Spots with diffusible blackening were counted after leaving fruit overnight in a coolstore (6°C).

When the two processes were combined, we found that after 120 minutes of water uptake, the number of lesions caused by

## TECHNOLOGY EXCHANGE



Photo 1. Magnification of swollen cells under the lenticel 2 hours after damage (top) and severe symptoms 24 hours after damage (bottom).

jostling increased from an average of 15 per fruit to an average of 20-25 lesions per fruit.

When fruit was taken out of the water and placed in the air stream, the fruit became less susceptible to damage after 120 minutes. There was more variation in the response of individual fruit to water loss than to water uptake, and individual fruit could take up to 24 hours to return to their original weight (water content).

There was also an identifiable morphological change in lenticels that equated to water uptake. Lenticels in avocados are identified as spots on the fruit surface. They function as water and gas exchange pores for the fruit. In normal fruit, there was a lot of space between cells under the lenticels, but when the fruit had taken up water, the cells became swollen (or turgid) and took up the space (Photo 1). It seemed that swollen cells in the lenticels were also more susceptible to damage, and responded by turning brown. These cells turned brown faster than other fruit cells. In other words, lenticels were more susceptible to damage than other fruit cells. The cells under the lenticels could be thought of as over inflated balloons which "popped" when rubbed only slightly.

In conclusion, fruit become more susceptible to lenticel damage after 2 hours of taking up water, hydrated fruit become less susceptible to lenticel damage after two hours of losing water, and cells in hydrated fruit become more turgid and more susceptible to damage. □

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# Don't Let Your Quality Effort Ease Off

By Henry Pak, from *AvoScene*, December 2000

The American season has drawn to a close and with much improved outturns compared to last year, we can all derive some satisfaction from a job well done. The reward for our efforts is reflected in the premium that our fruit has attracted over Chilean fruit and above all, the rebuilding of the reputation of the New Zealand brand.

Although the season is nearly over, we have only just commenced the daunting task of unravelling those factors that have contributed to this success. The sheer number of changes that were implemented this season will make this exercise difficult.

There is a temptation to point towards the most apparent cause as being the decisive factor. The reality is somewhat different and even something as apparently straightforward as how the weather pattern has influenced the outcome this season is impossible to quantify at this stage. Clearly, there was less rain over the harvest period and this would have resulted in less infection. Counteracting this, however, were the mild winter temperatures that increased the potential for disease to develop at the start of the season.

Until we can resolve the effect of this and a range of other factors we can ill afford to become complacent about quality issues for next season. The future of the industry is still reliant on providing high quality fruit into the USA market. While outturn quality has improved, there is still more work to be done. The outturn data and the library trays being collected by the sheds will prove invaluable in attempting to pinpoint those factors which have contributed to our success this year, and where we need to concentrate our efforts next season. The outturn data being collected by Jonathan Dixon has already highlighted some problem areas that will need to be addressed.

## Reefer shipping

A highlight for the industry this season has been the introduction of reefer shipments. Fruit quality of these arrivals has been closely monitored, and it is pleasing to report that fruit quality has been consistently high. The success of reefer shipments points the way to the future, as an economical way of handling the increasing export volumes.

The outturn results in the USA have confirmed the success of the compulsory maturity testing program run by AgriQuality.

Checkerboard arrivals were at very low levels compared with last year. This has positioned us well in the market relative to Chile, which had major problems this season with poor fruit quality due to fruit being immature.

Checkerboarding is a result of uneven rates of ripening and is indicative of fruit harvested at low maturity. Immature fruit not only has a greater incidence of checkerboarding but is also more prone to chilling injury, the flesh adheres to the stone, and vascular browning may be prevalent. Other symptoms include red colouration of the peel on ripening, stringiness of vascular strands, and in extreme cases the fruit may shrivel. The eating quality is also inferior with a distinctly watery taste. Fruit exhibiting these characteristics are unlikely to create a favourable impression on the consumer!

## Maturity testing

AgriQuality set up testing laboratories in Kaitaia, Whangarei and the Bay of Plenty. A total of 245 maturity samples were processed over the eight-week period of compulsory testing during August and September, with a peak of 72 samples processed in a single week.

Samples were processed and the results faxed back to the packhouse within 24 hours of the samples being collected. Of the samples processed, almost 20% failed to meet the minimum maturity standard. A further 10% were given marginal passes, with a clearance being received one week after the samples were processed.

The failure rate varied widely over the course of the season, but generally decreased over September. The large increase in failure rate that occurred at the end of September was influenced by the small number of clearance requests received in the final week of the program.

## Quality issues for Australia

With the beginning of the Australian season, it is timely to reflect on the quality problems that we have experienced in this market in the past. It is easy to be lulled into a false sense of security with Australia being just a three-day voyage away.

The reality is that, as with the USA market, rots are our biggest challenge, specifically ripe rots and stem-end rots. Although

the nature of the rots that develop in the two markets can be different, the principles behind their control are the same. Our success in the USA market should form the basis for quality improvements in the Australian market.

The Australian market provides some distinct advantages with shorter transport times and the ability to treat fruit with a postharvest fungicide treatment (Sportak). However, there are also disadvantages with the fruit being more mature with a consequently shorter storage life.

The fruit are also harvested during the peak of summer, with high fruit temperatures at the time of picking. Increased time on the tree also increases the length of time to which fruit are exposed to conditions favourable for infection, potentially leading to more rots. The fruit are also being exported into a hot climate, and can be exposed to very high temperatures resulting in potentially rapid deterioration in fruit quality.

The effect of fruit age on quality is the same, irrespective of market. Although there is an allowance for a maximum fruit age of 14 days, the sooner the fruit can be shipped after picking, the better the quality will be on outturn.

Sportak is most effective when applied within 24 hours of picking. Hence fruit should be treated as soon as possible after picking, but in any case no later than 24 hours. Fruit can be treated either by in-line spraying or dipping. If an in-line sprayer is used, take care to ensure that good coverage is obtained on the stem button. Sportak does not make the fruit bullet-proof. Some fungi are controlled better than others are and therefore it is important that the regular copper spray program is maintained for fruit harvested for Australia.

Another major issue for the Australian market can be the high temperatures to which the fruit are exposed over the harvest period. Avoid picking fruit in the middle of the day, especially when temperatures are high. Once the fruit are picked, keep the bins shaded when they are being held on the orchard.

Finally, it is important to handle fruit as carefully as possible to minimise peel damage. The update on lenticel damage (page 16) illustrates some of the reasons why wet fruit is more susceptible to damage. The results indicate why we have to be careful to avoid picking wet fruit. □

# Keeping Our Australian Customers Happy

By Sue Carter, FRESHCO, from AvoScene, December 2000

Higher Australian production is providing competition in our summer market across the Tasman.

In previous seasons when Australia was the main market for New Zealand avocados we took a "production led" approach to selling avocados. We had a certain quantity to sell, we had to find a way to keep selling more and more avocados in Australia. We did not have the benefit of targeting a certain percentage of our crop over there.

Developing the USA market has changed this situation and I think it is reasonable to say now that the US is where our growth potential lies. Having the benefit of the US market therefore allows us to change the way we look at the Australian market.

## Keeping our customers

Firstly it is important that we continue to recognise the benefit of having an established clientele in Australia—Australian wholesalers, retailers and consumers know our avocados. There is and will continue to be a place for New Zealand avocados on their retail shelves for quite some time.

However we all know that in any business you spend a lot less effort keeping a good customer than trying to find a new one. Our focus must therefore be on retaining our good customers, Australians, as every sale we make in this market will be very

important as the industry's production grows.

Australia's increased domestic production is also forcing us to refocus our business there. We are competing with them on a daily basis for the same share of retail shelf space from mid-November through till the middle of February. We must therefore be conscious of what the consumer is looking for when they buy an avocado and make sure we deliver on this.

The questions going through the consumer's mind are: Is it ready to eat, does it look good, is the price right, is it "safe" to eat?

Getting the price right will be critical to ensuring good sales momentum. Even though the summer months when we are in the market is when demand for avocados is at its highest, avocados are still a very price sensitive fruit.

Over the last few months Australian consumers have enjoyed prices of 65 to 79 cents per piece for 23/25 count fruit. The major retailers have put avocados "on ad" and given space to big instore displays. We can gain some real benefit from this exposure by entering the market with realistic price expectations.

## Presentation important

The need to focus on presentation will become increasingly important while we

as an industry strive to maintain our share of the avocado business in Australia. This is especially relevant in the wholesale market environment where we compete daily with avocados from Western Australian, South Australia and Queensland.

Presentation means focusing on getting the cosmetic detail right—good branding, well presented fruit within the trays, good packaging properly palletised. These things may not have been so critical in the past when we had the Hass market mostly to ourselves but now become important points of differentiation.

## Is it safe?

The buzzword in produce these days is food safety. The writing is on the wall—consumers want food they can trust and retailers need to be able to satisfy this demand. We already have an advantage in that in the international produce arena New Zealand is seen to be "clean and green".

Our challenge is to quantify that perception by implementing auditable food safety systems and continue to ensure that our Australian customers want to buy our products because they are the safest in the world.

Given the volume of fruit already shipped to the USA, New Zealand should leave about 650,000 trays for shipment to Australia this season. Last year there were 540,000 trays and the previous year just over 800,000 trays. So we will be up on last year's volume but not yet back to 1998/99 season when the majority of fruit was still being shipped to Australia. So we appear to have got the balance right between our two main markets.

This year we go into the season with great confidence in our ability to get the quality right. Our confidence is boosted by the excellent outturns we have had in the US to date. If we can add to this getting the price right, improving in-tray presentation, working with our retailers to improve instore quality plus meet food safety requirements we are on target to have a successful season in Australia.

Oh, one more thing—a good dose of hot weather over December and January will do great things for avocado sales! □

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# Rots and Bruising Main Quality Problems

By The Avocare Team

Surveys last season by the Avocare Project Team have found fruit rots and bruising to be the main defects reducing the quality of Hass avocados on display in retail stores.

The surveys were conducted in June and September 2000 in the Brisbane and the Sunshine Coast area, involving the three major retail chains. The aim was to identify practices in the supply chain contributing to quality loss.

Approximately 80% of the Hass fruit sampled had some level of defect, with 17% having at least 25% of the flesh affected. Practices at all steps in the supply chain can potentially contribute to the main defects observed; fruit rots and bruising.

## Methods Used

In the first survey, fruit were sampled from selected lines on arrival at the store and from the retail shelf in a representative Woolworths, Coles and Franklins store. The first sampling point provided an indication of fruit quality on arrival at the store, and the second provided an indication of the loss of quality due to store and consumer handling.

At the start of each day, before the shelves were re-stocked, the stickers on every fruit for each new delivery were colour coded. Fruit remaining in the cold room or preparation room and on the shelf were counted to track stock movement in the

store. Fruit movement prior to the retail store was traced by recording the packing date or code from the end of the tray and the handling conditions at the wholesaler.

The second survey focussed on the potential for quality loss between the wholesaler and the retail store. Fruit were sampled just before dispatch from the wholesaler to the retail distribution centres. Samples were also taken from the same lines at dispatch from the distribution centre and on arrival at the store, before being placed on the display shelf.

In both surveys, the sampled fruit were transported immediately to the postharvest laboratory at the Maroochy Research Station, Nambour. Skin colour and fruit firmness were assessed and a photograph taken. Fruit that were ripe were assessed immediately for internal quality, and the remainder placed at 20°C and assessed at the eating soft stage. The severity of the defects was recorded using a percentage rating scale, based on the avocado defects manual developed for the project.

A total of 3,400 fruit from 33 growers/packers were assessed over the two surveys.

## Fruit Quality Assessments

Figure 1 shows the average incidence of internal defects for all lines sampled across all sampling points in the two surveys. The percentage of fruit with at least 10% of the flesh affected is presented for each defect, and for all defects combined.

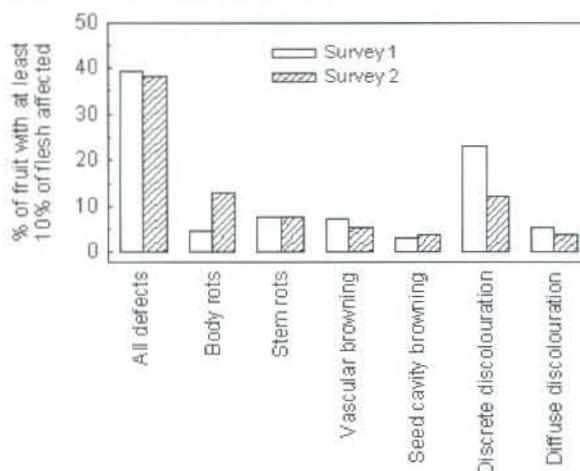
In both surveys, almost 40% of the fruit had at least 10% of the flesh affected by defects. Discrete discolouration, caused mainly by bruising, was the most common defect in survey 1, while discrete discolouration and body rots, caused mainly by anthracnose, were equally common in survey 2.

The level of stem rots was similar for both surveys. Vascular discolouration was often associated with stem rots, but can also be caused by physiological disorders. Seed cavity browning often appeared to be associated with mild impact damage from seed contact with the flesh, but may also be a physiological disorder. Diffuse discolouration of the flesh, typically caused by chilling injury during storage, was limited to a few specific lines.

## Where is Bruising Occurring?

In survey 1, we found significant bruising before the fruit were placed on the shelf. The damaged areas were often large with dark discolouration (see photo 1). There were also indications in some of the lines that damage was greater in fruit after several days on the retail shelf. We suspect that when consumers squeeze fruit they cause damage to soft fruit but little damage to firmer fruit. Therefore, firmer fruit showed little change in bruising damage with longer times on the shelf.

Figure 1. The average incidence of internal defects for all lines sampled across all sampling points in the two surveys. The percentage of fruit with at least 10% of the flesh affected is presented for each defect, and for all defects combined.





## Australian Native Bee

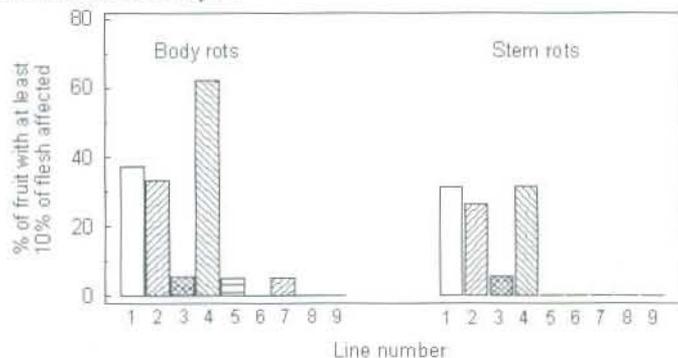
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## TECHNICAL REPORT

**Figure 2.** The incidence of fruit with at least 10% of the flesh affected by body and stem rots for lines sampled on arrival at one store in survey 2.



In survey 2, bruising was present at all the sampling points from wholesaler dispatch to arrival at retail store. The damage was often less severe with smaller areas affected (see photo 2). We think this may be partly caused by impact damage to firm fruit, as we have observed similar symptoms on fruit obtained directly from the end of the packing line.

These results indicate that bruising can occur at all steps in the chain, and that improvements are required by all fruit handlers. The softer the fruit, the more susceptible the fruit are to bruising.

### What Causes Rots?

Growing and packing practices and delays in the supply chain affected the level of rots in both surveys (see photo 3 for typical rots symptoms).

Figure 2 shows the incidence of fruit with at least 10% of the flesh affected by body and stem rots for lines sampled on arrival at one store in survey 2. There were large differences in both stem and body rots in fruit

**Photo 1.** Typical discrete discolouration symptoms observed in the first survey. These are usually caused by bruising, and were seen as fairly large areas of dark discolouration.



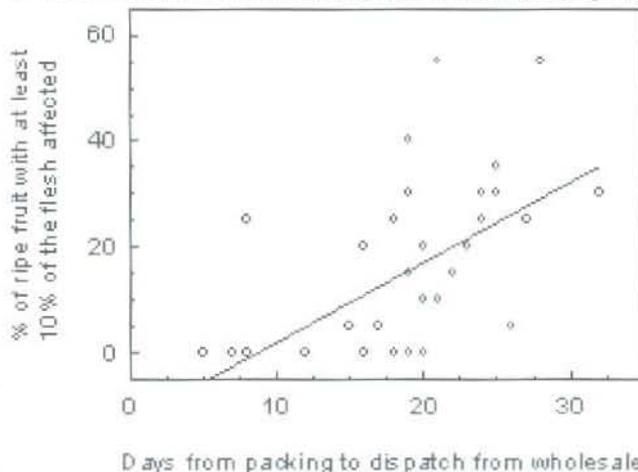
from different lines/growers. This would result from practices on the farm and in the packing shed, such as orchard spray programs, orchard age, nutrition, rootstock, and postharvest fungicide applications.

In addition, excessive delays between harvest and consumption can result in more rots. Figure 3 shows that as the time

from packing to dispatch from the wholesaler increased for survey 2, so did the level of body rots.

In survey 1, the average time from packing to retail sale was 22 days (Table 1), but the time at each step varied considerably between lines.

**Figure 3.** The relationship between the number of days from packing to dispatch from the wholesaler, and the percentage of the fruit with at least 10% of the flesh with body rots.



**Photo 2.** Discrete discolouration often observed in survey 2. The bruised areas were often smaller and less discoloured than in photo 1, and with small cracks in the flesh.



**Photo 3.** Body rots and stem rots observed in surveys 1 and 2.



On average, the fruit spent 6 days in the retail store, with some lines taking up to 11 days to sell. Delays were usually due to:

- poor stock rotation in the cold room, especially when sales were slow or when excess supplies were delivered to the store;
- over-supply of fruit to the store;
- reduced sales because of backward fruit on display;
- placing stock in parts of the display that are not frequently picked over by the consumer, especially when this is combined with poor stock rotation.

Previous studies have shown that the level of fruit rots increases rapidly with time once the fruit reached eating ripe. In one study, no body rots were present when fruit first reached eating ripe. After a further 3 days at 20°C, 16% of fruit had body rots while after another 2 days, the level increased to 60%.

The thick skin of Hass can sometimes make it difficult to determine if the fruit has reached the eating soft stage. Skin colour is not a good indicator of ripeness as fruit often reach eating ripe before the skin is completely black, particularly if the fruit are ripened at lower temperatures (about 15°C). This means that fruit rots can develop in the retail store if fruit is not rotated and sold quickly. The most effective way of alleviating this problem is to hold fruit at low temperatures (<4°C) once fruit are near-ripe.

**Packaging Effects**

During the surveys, we noted that there was less body rots and diffuse discolouration in the open top tray (usually the P84

tray) than the two-piece lidded tray. This may be due to better airflow with the open top tray, resulting in improved temperature control and ripening. It may also be a grower effect, as only a few growers were using this tray and they may produce better fruit.

Package collapse was noticeable in the two piece lidded tray, particularly towards the bottom of the pallet. The collapse was caused by misalignment of the trays on the pallet and insufficient stacking strength for the high humidity conditions during ripening. In the collapsed packages, compression damage to the top of fruit was obvious but it did not cause flesh discolouration.

From our observations, it appears that the lidded tray provides handlers with a false impression that the lid offers protection to the fruit. In contrast, the open top tray appears to be handled more carefully as it needs to be located correctly. The main constraint with the open top tray is that it is difficult to inter-stack with other produce packages when assembling pallets for dispatch to retail stores.

**Where to from here?**

The surveys have identified bruising and fruit rots as the main defects causing quality loss. Bruising can potentially occur at all steps in the supply chain. Growing and packing practices and delays in the chain affected the level of rots. To increase the quality of Hass avocados on the retail shelf, improvements need to occur at all steps in the chain.

Improved farm practices are needed to control rots. The avocado industry is investing heavily in this area already, with a multi-pronged approach involving improved fungicides and fruit nutrition.

Future articles in Talking Avocado will describe the current control strategies, and report on the current research in this area.

More careful handling is required at all steps to reduce bruising from impact damage. The effect of handling during harvesting and packing on internal bruising needs further investigation.

Improved understanding by wholesale and retail handlers of the interaction between the stage of ripeness and the risk of bruising and rots, is required. Stock rotation needs improving to reduce excessive delays in the chain.

Better coordination of supply and retail sales is required to improve product flow and reduce time in the supply chain. This involves the grower, packer/marketer, wholesaler and retailer working closer together.

A supply chain improvement group, with representatives from each step, has developed a list of possible follow-up activities to continue the drive to improving fruit quality for the consumer. The R&D Committee of the AAGF will shortly consider these suggestions and develop an action plan to achieve improved quality and consumer satisfaction. □

**Table 1. The time that Hass avocados were held at each step in the supply chain during survey 1.**

Step	Number of days at each step	
	Average	Range
Grower to wholesaler	4	1-12
Holding before ripening <sup>1</sup>	4	0-14
Ripening	4	2-6
Ripening to dispatch to retail DC	3	0-21
Retail distribution centre	1	1-5
Retail store cold / preparation room	2.5	1-7
Retail shelf	3.5	1-11
<b>Total time</b>	<b>22</b>	

<sup>1</sup>Ripening here means the period that the fruit are placed at the ripening temperature (often with ethylene) to start the ripening process.

**The Avocare Team**

This article was written by Peter Hofman and Scott Ledger (Queensland Horticulture Institute, Department of Primary Industries).

The project is the result of a concerted team effort. We wish to thank the project team members, Jason Cook, Barbara Stubbings, Matt Adkins, and Jenny Barker, for the long hours they put into sampling and assessing fruit.

Appreciation is also expressed to the management and staff of Woolworths, Coles, Franklins, and Murray Brothers for their commitment and cooperation during the project.

The avocado defects manual used to assess fruit quality was prepared by Allan Woolf and Anne White, HortResearch, New Zealand.

The Avocare project is a joint initiative of the AAGF, AIC and Horticulture Australia (formerly the Horticulture Research and Development Corporation).

# Field Management of Postharvest Diseases

By Dr. Sonia Willingham (QHI, Indooroopilly DPI)

The two major postharvest diseases of avocado are anthracnose, caused by the fungus *Colletotrichum gloeosporioides*, and stem-end rot, caused by a number of different fungi but predominantly *Dothiorella* spp. Avocado fruit quality can also be severely downgraded by the field diseases pepper spot (*Colletotrichum gloeosporioides*) and sooty blotch (*Stromiopeltis* sp.).

Like other fruit, anthracnose and stem-end rot disease symptoms don't usually start to appear until the avocado starts to ripen after harvest. This is because the infection structures are forced into dormancy on the fruit skin or in the fruit pedicel until the fruit reaches a certain stage of ripeness.

The objective of our research project was to firstly provide new short-term solutions to these disease problems by evaluating the new group of fungicides called strobilurins, and secondly, to develop new long-term disease control strategies that are based on increasing the fruits natural

resistance to disease, for example evaluating the effects of rootstocks.

## Strobilurin Fungicides: Setting fungus against fungus

For our first objective to look at new fungicides we have been focussing on the new group of 'natural' fungicides called strobilurins. This new group of fungicides is synthesised from a naturally occurring compound, called strobilurin A, which was isolated from a mushroom, found in the woodlands of Europe. The mushroom uses the strobilurin compound to protect its habitat from other invading fungi.

The strobilurin A compound was first discovered in 1960 by a Czech scientist and was used to treat skin diseases in humans. It wasn't until the early 1980's that the two big agrochemical companies Zeneca and BASF became interested in this unique compound for crop protection.

Because the original compound was sensitive to light and very volatile, a lot of research went into making it a more stable compound.

In 1997, after fifteen years of research, both companies simultaneously released their new fungicide products onto the market. Zeneca's is called Amistar and BASF's is called Strobry. Novartis also released their own formulation called Flint soon afterwards. These companies are currently working on further variants called 'second-generation' strobilurins. Amistar is now the most widely sold fungicide in the world.

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**WARNING:** Please note that the strobilurin fungicides and Bion are new experimental chemicals and as such are **not** registered by the NRA in Australia for use on avocados and under no circumstances should they be used in any way.

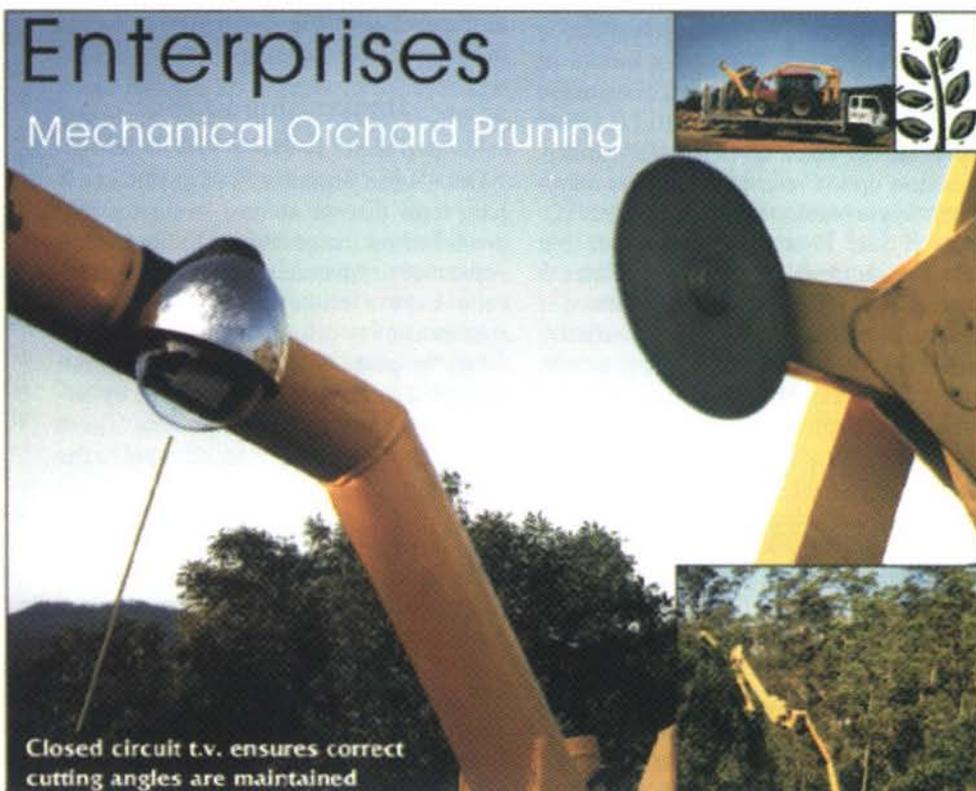
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New fungicides are released all the time, but what makes this a significant new class of fungicides is its unique properties.

The strobilurins have been described as 'environmentally benign' as they are active at low concentrations, have a low toxicity to mammals and bees (so can be used in IPM programs), are non-persistent in the environment and break down readily in the soil.

They have a broad spectrum of activity against all of the major fungal classes and against all developmental stages. This is due to their novel mode of action which is to inhibit energy production by the fungus which means the fungus is essentially starved to death and enables the fungicide to have preventative, curative and eradicator control properties. The strobilurins however, are best utilised as protectants.

These strobilurins belong to a new grouping of fungicides called 'reduced-risk' fungicides. To get onto this list, a fungicide must have at least one of the following characteristics: reduced exposure to humans; reduced toxicity to non-target organisms; reduced contamination of the environment; or facilitate integrated pest management adoption. So far, only seven new fungicides fall into this new category, include strobilurins.

The different strobilurin fungicides can be distinguished by their different modes of transport in the plant. Amistar is systemic so it moves from the base to the tip of the plant and is slowly taken up at the leaf surface. This slow uptake means some active ingredient stays to protect the surface of the leaf.

Stroby and Flint are not systemic but have translaminar movement, this means they can move from the top to the bottom of the leaf. These two also have a high affinity for waxy layers which means the plant can build up a reservoir of fungicide in its wax.

All of the strobilurins have some vapour phase activity when re-wet. This means that any active ingredients left at the leaf surface or embedded in the waxy layers can be re-activated when re-wet by heavy dew or rain.

This new group of fungicides has also been found to have another very interesting effect on the plant called a 'greening effect'. In avocado, we observed this 'greening effect' and found that trees sprayed with Amistar had greener and glossier leaves and a higher proportion of clean fruit. This 'greening effect' has been observed in other crops and has been attributed to the strobilurins ability to delay senescence and increase leaf photosynthesis. This means the leaves stay greener for

longer and thus have extra energy to fight off disease. Increasing the energy reserves of the plant also provides the potential for greater yields and improved quality.

Because these fungicides have a single-site mode of action, there is a real threat of fungal mutations occurring. This is a common problem for most modern fungicides, and special anti-resistance strategies have been put in place to prevent this from occurring to ensure that these fungicides stay around for as long as possible.

The first step in an anti-resistance strategy is to limit the use of the fungicide. For strobilurins, this means only one third of the total number of fungicides applied in one season should be strobilurins and you should block with other fungicides. It is also strongly recommended not to start and finish a spray program with a strobilurin.

The second step in an anti-resistance strategy is to monitor the fungal population for mutations by collecting baseline-sensitivity data. What this essentially is, is checking the existing pathogen populations for their sensitivity to the new fungicide before using strobilurins and then regularly checking for any shifts in the populations' sensitivity after the fungicide is registered and being used. The threat of resistance developing before these strategies can be put into place, is the reason why these fungicides should not be used until registered.

### Immunising Fruit: How plants defend themselves

Our second objective is to develop new long-term disease control strategies that are based on increasing the fruits natural resistance or immune system. Plants naturally have a range of highly effective mechanisms to defend themselves against attack by pests and pathogens. Plants can defend themselves biochemically, by accumulating antifungal compounds. These antifungals are usually concentrated in the outer layers of the fruit, such as its skin to help in the first line of defence. Fruit can also defend themselves physically. Upon attack, plants are able to strengthen and re-enforce their cell walls to try and limit or contain the spread of a pathogen.

Antifungal compounds have been identified for avocado and are called "dienes". These antifungal compounds are quite toxic and therefore naturally breakdown during fruit maturation and ripening. This decline in antifungals allows diseases, especially postharvest ones like anthracnose to develop.

One of our research activities is to develop an assay to detect the antifungal

dienes in the fruit and monitor its changes in concentration throughout the season and after harvest, to see if we can match up any particularly susceptible periods to changes in antifungal compounds.

Once we have identified these susceptible periods we will use commercially available plant activator compounds like Bion to switch on the plants defences and increase the concentration of antifungal compounds.

When plants are treated with plant activators, a whole series of reactions are switched on in the plant to make the plant think it is under attack—similar to how humans are immunised to create antibodies to defend the body. However, because there is a lag time between application and activation of defences, you need to use these plant activators as protectants. Because these products are not fungicidal and have no direct effect on pathogens, they act through the plant's defences. There is no risk of pathogen resistance occurring.

The impact of rootstock and nutrition on immunisation would also be investigated in these studies. So far our research team has found that rootstock can affect anthracnose susceptibility. When a 'Hass' avocado scion, which is of Guatemalan origin, is grafted on to a Guatemalan rootstock we have low levels of anthracnose. But if we graft the Guatemalan 'Hass' onto a Mexican rootstock we have high levels of anthracnose.

We found that the avocado rootstocks influenced the immunity of fruit as there were lower levels of antifungal compounds in the 'Hass' scion on the Mexican rootstock.

The different rootstocks also influenced the mineral nutrition of the fruit. We found that the Mexican rootstock, which had higher levels of disease, also accumulated more nitrogen in the tree.

### Field Trial Results

We have conducted three major field trials to investigate the strobilurins and plant activators and have had some very promising results so far.

In last season's field trial we evaluated different anti-resistance spray programs which blocked strobilurins during different periods of the growing season. Both programs tested were able to significantly reduce the incidence of anthracnose and stem-end rot compared with the untreated control. Program 2, however, appeared to be slightly better than program 1. Interestingly, when Bion was tank mixed with the Amistar fungicide disease control was slightly (but not significantly) reduced. □

# Crop Nutrient Replacement For Avocado

John Dirou, District Horticulturist, David Huett, Senior Research Scientist, Tropical Fruit Research Station, Alstonville

## Summary

In studies conducted on passionfruit and mango in northern NSW, fertiliser rates developed from crop nutrient removal data suggests that fertiliser recommendations for these crops have been too high. Previous fertiliser recommendations (kg/year) for avocados grown in NSW range from 60-250 nitrogen (N), 50-120 phosphorus (P) and 70-320 potassium (K).

In addition to nutrients that are 'exported' from the soil by the fruit, nutrients are also required for blossoming, leaf, shoot and root growth, and losses that occur from leaching, erosion and soil fixation. The total of these nutrients that are removed are called 'crop nutrient removal' and must be 'replaced' to maintain a sustainable fertiliser program. For a 10 tonne/ha avocado crop at Alstonville, the estimated crop nutrient removal figure (kg/ha) is 70 N, 16 P, 83 K, 34 Calcium (Ca) and 17 Magnesium (Mg).

## Introduction

In the 1960-70's, NSW Agriculture funded long-term research projects on management practices including nutrition. These projects were labour intensive and resource demanding and results often took years to come through.

Today, with limited State Government funding for horticultural research, industry levies are often the only way research can be carried out, and even then investigating nutritional problems does not rank highly on the industry's Research & Development priority list.

Consequently, a different approach has been taken by NSW Agriculture to provide information on crop nutrition. Called **crop nutrient replacement**, the process involves determining what nutrients are removed from the soil by the fruit crop, and then estimating the trees requirements for vegetative and root growth as well as estimating losses due to leaching, erosion and soil fixation.

This process reduces the likelihood of growers under or over-fertilising their trees. On a high fertility soil, replacing all the nutrients removed may not be necessary because of adequate soil reserves. Over-fertilisation is a major concern. Not

only is it a waste of money but it may lead to soil acidification, cause nutrient imbalances and soil salinity, and increase nitrate and phosphorus contamination of waterways which leads to eutrophication, algal blooms and aquatic weed growth.

NSW Agriculture aims to *promote and encourage grower adoption of sustainable fertiliser practices*. This policy includes the use of a crop nutrient replacement program aided by regular leaf and soil analyses. Monitoring soil and leaf levels ensures optimum nutrient availability and maximises productivity.

An examination of plant analysis records from NSW Agriculture (1957-1988) for 754 avocado samples showed that the proportion of nutritional deficiencies overall were quite low; 4% were deficient in N, 2% in K, 1% in Ca and zero deficiency in P. Toxicities were recorded in Chloride (Cl) 2% and Manganese (Mn) 3%.

## Fertiliser Practices

Fertiliser recommendations (kg/ha/yr) made by Weir and Cresswell for avocados grown in NSW range from 60-250 N, 50-120 P and 70-320 K depending upon the planting density, range 80-150 trees/ha.

Avocado fruit has been referred to as 'mineral cheap' and 'energy expensive'. This implies a lower fertiliser requirement than for other fruit crops such as oranges, apples and pineapples that produce much higher yields per hectare. 'Energy expensive' means developing fruits take a lot of

'energy' from the tree particularly the photosynthesizing leaf and carbohydrate reserves are required for the fruits' high oil content.

## Study Methodology

The study site was at Barry Daley's property near Alstonville on a deep red krasnozem soil.

Fruit were from the Hass variety harvested on 10 October 1999 and 20 September 2000. Fruit for analysis were selected at random from graded and packed trays. The whole fruit including the skin, pulp and seed were cut into 10 mm cubes. Two methods were used to extract the oil. With the cold extraction method, the cubes were hammer-milled then heated in a water bath and finally centrifuged. The solvent extraction method used the Soxhlet procedure that removes all the oil from the pulp. To determine the percentage moisture, the fruit sample was dried for 2 days at 90°C.

Nutrient analyses of the fruit were conducted at a NATA approved laboratory.

## Results

Nutrient analyses of the fruit components is presented in Table 1.

The amount of nutrient removed from the soil to produce 1 tonne of fresh fruit has been calculated and is shown in Table 2.

Results from similar studies in Israel, Venezuela, Cuba and New Zealand are shown for comparison.

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**Table 1. Nutrient analyses for Hass avocado (skin, pulp and seed).**

	% dry weight			mg/kg dry weight	
	1999	2000		1999	2000
Nitrogen	1.12	0.89	Zinc	26	20
Phosphorus	0.21	0.14	Copper	13	14
Potassium	1.66	1.36	Manganese	13	9
Calcium	0.20	0.06	Aluminium	20	13
Magnesium	0.21	0.08	Iron	58	110
Sulphur	0.11	0.13			
Sodium	0.04	0.02			
Chloride	0.09	0.04			

To calculate nutrient removal, the % dry matter must first be determined. The % dry weight was 36.5% in 1999 and 39.5% in 2000. As an example, the calculation for nitrogen in 1999 at 1.12% DW would be:

$$1 \text{ tonne fresh fruit} \times \frac{\text{DM}\%}{100} \times \frac{\text{N}\%}{100}$$

$$1000 \text{ kg} \times 0.365 \times 0.0112$$

$$= 4.09 \text{ kg/N/tonne of fresh fruit}$$

Table 2 gives nutrient removal for fruit only. The nutrients used by woody tissue, leaves, blossoms and roots to sustain tree health and to allow for its normal phenological development must also be considered.

Large amounts of nutrients may have to be taken up to support growth of roots, trunk, framework branches, leaves, flowers and fruits. But once trees mature, vegetative growth and nutrient demands stabilises. Minerals are recycled when leaves, twigs and roots die and breakdown. The major nutrient demand is for fruit and this is 'exported' from the orchard when they are harvested.

A study where a seven-year-old Mexican seedling was excavated, sampled, weighed, dried and analysed, showed that more than half of the total nutrients were concentrated in the leaves which constituted only one-quarter of the tree dry weight. The tree N content (930 g) for example, was allocated between leaves 57%, woody tissue 27%, roots 10% and blossoms 6%. Hence leaves constitute the largest reservoir of stored nutrients in an avocado tree.

Another study on thirteen-year-old Fuerte trees gave two results. Firstly, a substantial proportion of nutrients are returned to the tree from leaves before abscission; N 50%, P 57%, K 25%, Ca 4%, Mg 10% and S 33%. Secondly, nutrient losses from fallen leaves and shed blossoms over a 2 year period averaged 163 grams N, 13 g P, 123 g K, 262 g Ca and 80 g Mg tree/year. This loss is equivalent to 40% of the trees' N, P & K, and 60% of its Ca, and 75% of the tree's Mg. Extrapolating these figures to 100 trees/ha, nutrient losses in kg/ha/yr would approach 16 N, 1 P, 12 K, 26 Ca and 8 Mg.

The high loss of Ca is worth noting. Ca is readily transported upwards in the plant but there is little downward movement, and once Ca is fixed it is relatively immobile unlike N, P and K that move around the plant.

The nutrient requirement to sustain growth of woody tissue and roots can't be quantified as no published data could be found.

One researcher recommended increasing fertiliser rates to compensate for soil type, weather conditions, leaching by heavy rains or excessive irrigation, soil fixation of phosphorus and losses due to soil erosion. As a 'rule by thumb' guide, the following losses could be expected:

- N: 30 to 50% lost by leaching, higher levels occur on sandy soils, and with the conversion of ammonium fertilisers to gaseous nitrogen;
- P: 50 to 100% lost by fixation and erosion, the higher levels occurring in red krasnozems soils;

- K & Mg: 20 to 30% lost by leaching, higher levels occur in sandy soils;
- Ca & S: 5 to 20% lost by soil erosion in runoff. Sulphur is temporarily immobilised during the breakdown of crop residues.

Table 3 shows the estimated nutrient removal for a 10 t/ha yield. The Australian average production is less than 8t/ha.

### Discussion

Fruit nutrient analyses were lower in 2000 compared to 1999. Rainfall may have contributed to the low Ca (down 70%) and Mg (down 60%)—one very wet year and one dry year. In 1999, from February until harvest, 2249 mm of rain was recorded, while for the same period in 2000 only

**Table 2. Avocado nutrient removal (kg/ha) for 1 tonne fresh fruit.**

	N	P	K	Ca	Mg	S	Na	Cl
Alstonville <sup>1</sup>	3.81	0.66	5.72	0.48	0.55	0.47	0.12	0.25
Israel <sup>2</sup>	1.13	0.17	1.95	0.21	0.50	0.80	0.08	
Venezuela <sup>3</sup>	2.78	0.76	3.46	0.56	0.39			
Cuba <sup>4</sup>	6.11	0.96	9.61					
New Zealand <sup>5</sup>			13.82	0.38	1.00			
Trace elements (g/ha)								
	Zn	Cu	Mn	Al	Fe			
Alstonville <sup>1</sup>	9	5	4	6	32			

<sup>1</sup> averaged for 2 years, 1999 and 2000. Hass variety.

<sup>2</sup> variety not specified

<sup>3</sup> average of 9 varieties

<sup>4</sup> average of 3 varieties

<sup>5</sup> 11 orchards 1993, 3 orchards 1994. Hass variety.

**Table 3. Estimated nutrient removal (kg/ha/yr) for 10 tonnes/ha avocado yield.**

Nutrient	Fruit only	Estimated		
		Fallen leaves and Shed blossom <sup>1</sup>	Leaching Erosion Fixation of fertiliser	Crop Replacement Rate <sup>2</sup>
Nitrogen	38	16	+30%	70
Phosphorus	7	1	+100%	16
Potassium	57	12	+20%	83
Calcium	5	26	+10%	34
Magnesium	6	8	+20%	17

<sup>1</sup> Overseas results for Fuerte variety. Nutrient recycling occurs with the decomposition of fallen leaves and shed blossom.

<sup>2</sup> Nutrient requirements for woody tissue and root growth have not been quantified and have not been included.

766 mm was registered, that is two-thirds less rain. In the 42-day period prior to the 2000 harvest, only 5 mm were recorded, with 25 mm of irrigation applied. The long-term rainfall for this period is 1175 mm.

Nutrient removal by the Hass cultivar at Alstonville was lower than that reported from New Zealand for two of the three elements tested. K and Mg were about half while Ca was similar.

The closest figures to Alstonville for nutrient removal were from Venezuela. Israel was significantly lower, while Cuba was around 60% more for N and K. The Hass cultivar was not tested in these countries.

In Table 3, no allowance has been made for nutrient uptake by root or woody tissue,

while losses from leaching, erosion and soil fixation are influenced by location, soil type, tree management practices and seasonal conditions. However, on the credit side, the decomposition of leaf litter and shed blossoms helps replenish the soil nutrient reservoir.

Not unexpectedly, K is the nutrient most in demand both in fruit tissue analysis and in total crop replacement. This is the case for many horticultural crops—bananas, passionfruit, mango and low chill stonefruits.

The other nutrient worthy of comment is Ca. With only 4% Ca returned to the tree from the leaf before abscission, the crop replacement rate for Ca is inflated by the relatively high levels lost in

abscised leaf and to a lesser degree blossom, estimated to be 75% of the tree's Ca balance. The crop replacement rate of Ca to Mg in this study is 2 to 1. This would indicate that repeated applications of lime without a Mg amendment may not meet the crops' Mg demand and will cause a soil Ca:Mg imbalance over time.

When comparing the nutrient crop replacement rate from Table 3 for N, P & K to the recommendations of Weir and Cresswell, it would appear that for an above average crop of 10t/ha, the calculated crop replacement rate is at the lower end of their recommendation. This would suggest that their recommended fertiliser rates are high. □

# PK Nutrition of Avocados

## Summary of Two 25 Years Experiments

*By Simon Newett, Extension Horticulturist, QDPI, Nambour*

A 27 year nutrition research project has been conducted in Spain to look at different application levels (including nil) of phosphorus (P) and Potassium (K) on both poor and good soil.

Information about the project was included on a poster by J.M. Hermoso, S. Jaime, M.D. Torres and J.M. Farre (from Estacion Experimental La Mayora, Malaga, Spain) at the World Congress in Mexico last year.

The results of the experiments indicate that applications of P had no effect on yield even though the unfertilised plots had P leaf levels below 0.1% (optimum in Australia is given as 0.08-0.25%).

Leaf K levels decreased steadily in the unfertilised plots, especially in the poor soil, reaching 0.3-0.4% in some years (optimum in Australia is given as 0.75-2%). Yield slightly decreased under those conditions. K levels averaged 0.35% and went as low as 0.25%.

The soil is described as "neutral shale soil", and probably unlike our acidic P-fixing red soils, however the leaf levels in this experiment got pretty low.

Dr Tony Whitley (DPI, Nambour, Queensland) did a nutrition literature review recently and found that with all of the research work that he reviewed in the literature there was no yield response from applying P and K to trees.

Growers are warned not to rush out and change their fertiliser program based on this information. The results pertain to

Spain and may not be applicable to Australian conditions.

The following is an extract from the poster presented at the World Congress.

Two field experiments on neutral shale soil, a PK and a K, were started in 1973. The PK experiment was on a poor soil while the K one was on a richer soil. The PK experiment compared P0K0, P0K1, P1K0 and P1K1 while the K experiment included P1K0, P1K1, P1K2 and P1K3. P0 treatments received no P and K0 no K fertilisers.

Nitrogen application were adjusted to maintain leaf levels above 2%. P applications had no effect on yield even though the unfertilised plots had P leaf levels below 0.1% for the last three years of the experiment. Leaf K levels decreased steadily in the unfertilised plots, especially in the poor soil (PK experiment), reaching 0.30-0.40% in some years. Yield slightly decreased under those conditions.

In the K experiment, set in the richer soil, no yield differences were recorded with leaf K levels covering the range 0.4 to 1.0%.

In both experiments leaf K levels increased very markedly and stayed high for several years when the drip irrigation system was changed to micro sprinklers or spitters. This was probably due to the exploration of a larger soil volume by the root system. Along the experiment, available soil P and K increased in areas with high root density, even without fertilisation. P and K fertilisation affected fruit extraction differently. P extraction was only slightly

increased while K extraction was increased very markedly. □

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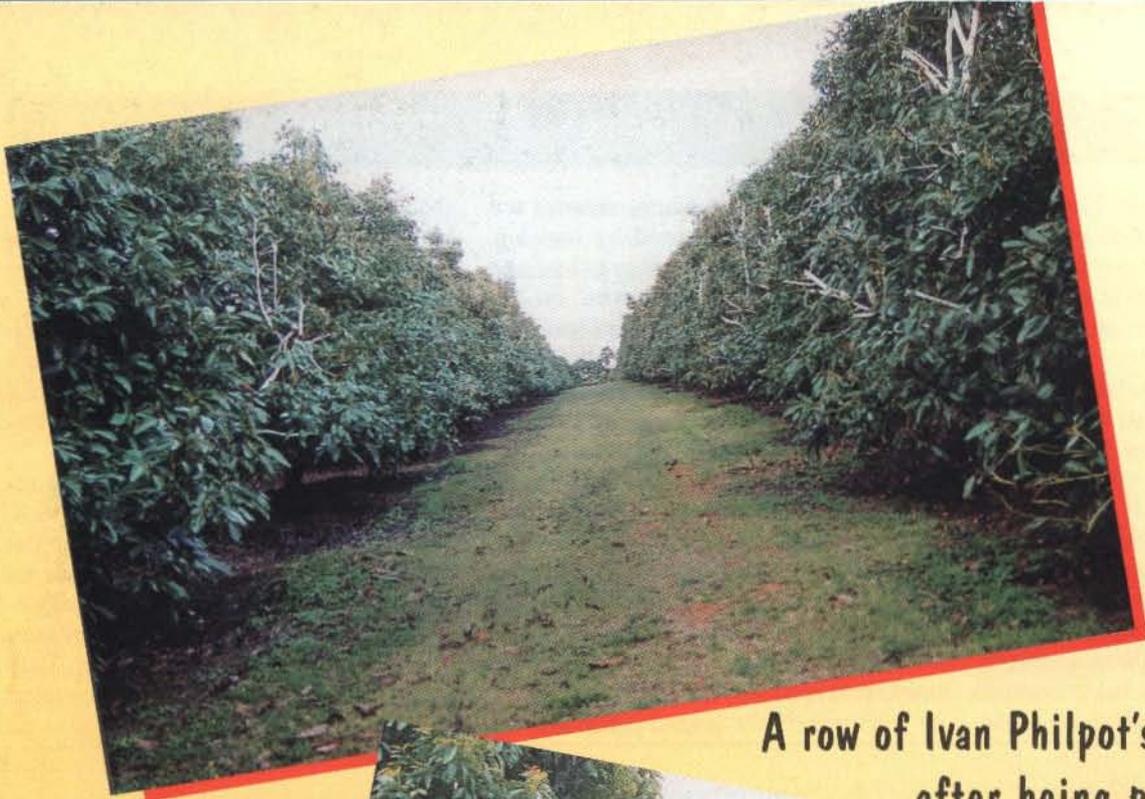
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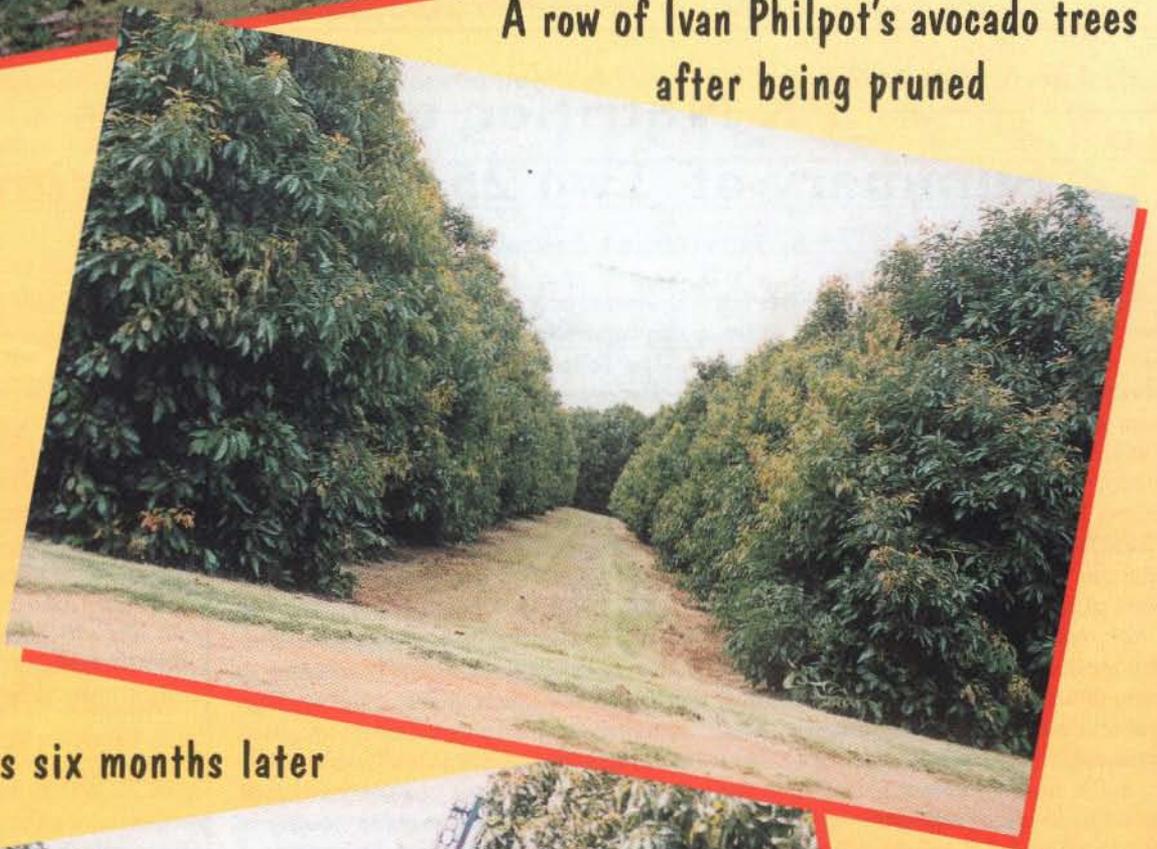
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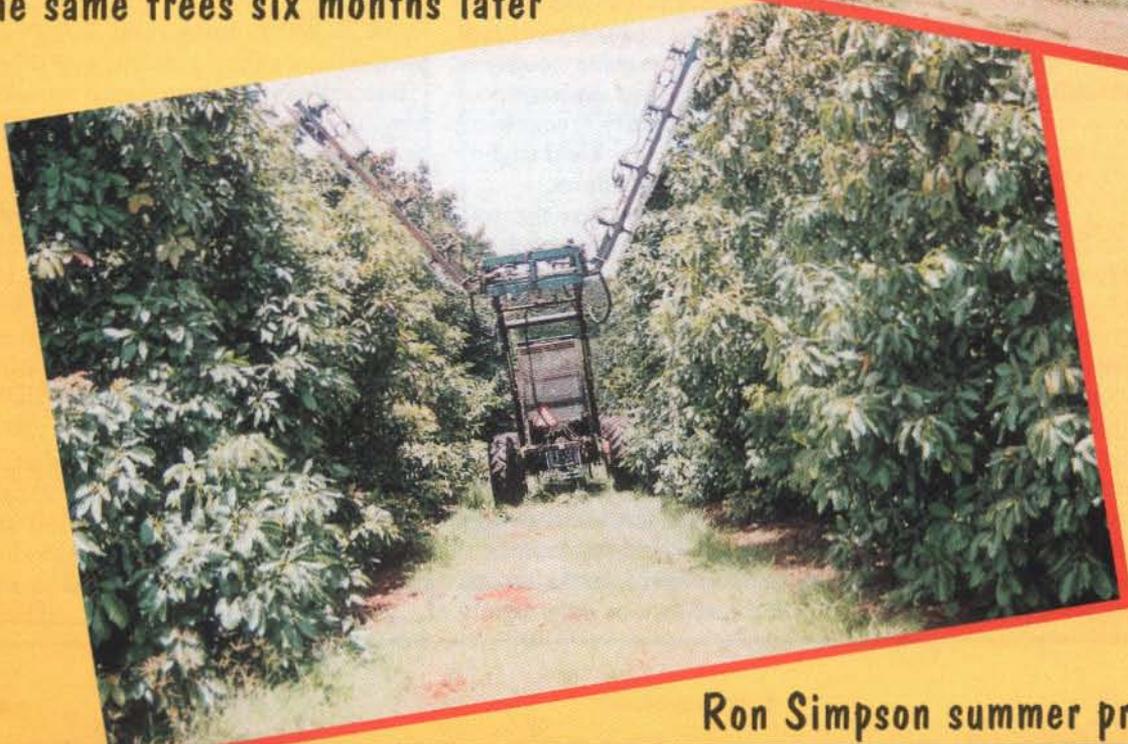
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**A row of Ivan Philpot's avocado trees  
after being pruned**



**The same trees six months later**



**Ron Simpson summer pruning**