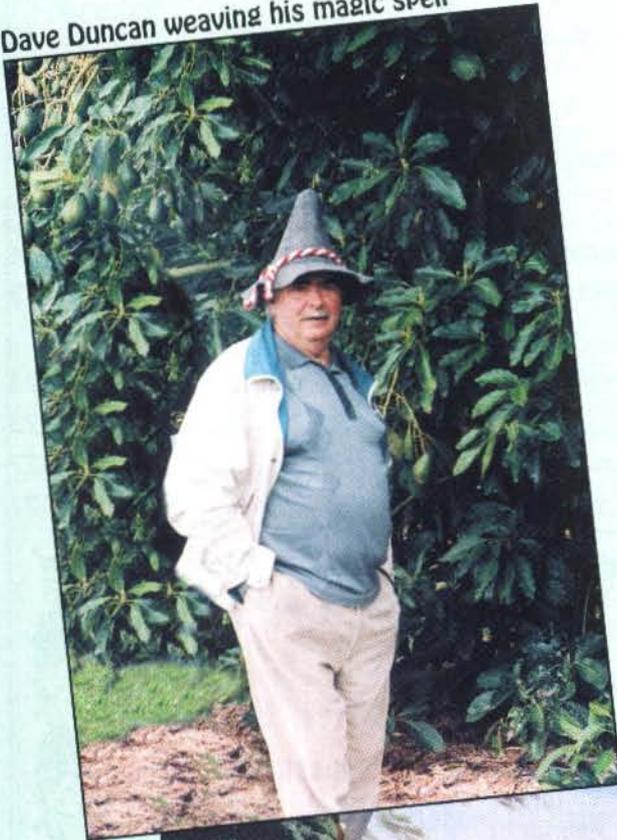


# Talking Avocados

December 1997

Dave Duncan weaving his magic spell



The tour group examining a packing shed



Rod Dalton presenting the Award of Honour to Orf Bartrop

- Annual Report
- Market Survey
- Influence of seedling rootstock
- From seed to tray - improving confidence

# AUSTRALIAN AVOCADO GROWERS' FEDERATION

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This publication is distributed upon the understanding that the publisher is not engaged in legal, cultural or other professional advice. The Editor, Directors and Executive Officers of the Australian Avocado Growers' Federation Inc (ACN Number IA 5122) do not accept any liability for and/or necessary enclose and/or concern and/or support any of the claims and/or statements made and/or views and/or opinions expressed anywhere in any edition of "Talking Avocados".

## Calendar of Events 1998

### January

- 20 **AVOMAN Training Session** - Community Centre, North Tamborine commencing at 10.00 a.m. Contact Simon Newett 07 5441 2211.
- 28-29 **AVOMAN Training Session** - Gatton College. Contact Simon Newett 07 5441 2211.

### February

- 3 **Avocado Growers Association of WA** - 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.

### March

- 3 **Avocado Growers Association of WA** - Annual General Meeting Conference Room, Market City commencing 5.30 p.m.
- 4 **Sunshine Coast Avocado Growers Association** - Annual General Meeting. Contact Barry Back 07 5478 9135.
- 18 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable Growers' Office, Barolin St. Bundaberg commencing 7.30 p.m.

### April

- 7 **Avocado Growers Association of WA** - meeting Conference Room, Market City commencing 5.30 p.m.
- 18 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable

### Front Cover:

**Top Left** - Dave Duncan with his witch's hat weaving a spell on NZ avocado trees.

**Top Right** - The Pre-Conference tour group inspecting a NZ packing shed facility.

**Bottom** - AAGF President Rod Dalton presenting Orf Bartrop, Editor Talking Avocados, with an Award of Honour for his work in publishing the magazine.

### Back Cover

**Top** - A general view of the Pre-Conference tour group.

**Middle** - Light entertainment at the Conference dinner.

**Bottom** - Delegates at the Conference dinner.



## TALKING AVOCADOS - HAVE YOUR SAY

Dear Sir,

I read with interest your article on Avocado Maturity Standards in the 1997 June issue of "Talking Avocados".

Starting in April of this year and through to July, I have conducted dry matter testing for the Hass variety and on a new variety which is very similar to Hass, but which matures 3 to 4 months earlier than Hass in Western Australia. The results of these tests are as listed:

	Hass	Llanos Hass
21 April	18%	21%
13 May	20%	23%
30 May	22%	25%
15 June	23%	26%
30 July	27%	30%

The above Hass would have been mature by the 30 May based on the 21% dry matter, whilst in fact Hass is only harvested in WA commencing around September. This, therefore, highlights the fact that 21% dry matter should not be used as the benchmark for all avocado varieties in Australia.

In California, there are different dry matter standards for the various avocado varieties, which brings into question the 21% standard in Australia.

As mentioned in your article, there are other factors to be considered in determining fruit maturity. Experience should now dictate at what time of the year various varieties mature. Timing of harvesting should be set, taking into consideration growing regions and climatic conditions.

Having a 21% dry matter for all varieties is really not an acceptable benchmark, as Hass does not reach an acceptable mature state until it has reached at least 23% to 25% dry matter.

Some of our readers may be asking what this new variety "Llanos Hass" is. Only an expert can tell the difference between this new variety and Hass. The skin, texture and colour are the same as Hass and the eating quality is as good as or even better than Hass, depending on one's tastes. Plant Breeder's Rights application of this new "Llanos Hass" has been accepted, and provisional protection received from the Department of Primary Industries & Energy, Canberra, Plant Breeder's Rights Australia.

*Anthony P. Llanos  
Llanos Enterprises  
Western Australia*

## Stabilising Phosphonic Acid Using Potassium Salts

*By Clive Kaiser, QDPI, Maroochy Research Station, Nambour*

For Australian conditions, once the spring and summer flushes have hardened off, avocado trees suffering from *Phytophthora cinnamomi* may be injected to control the disease. Injections consist of 15 ml of a 20% phosphonic (previously known as phosphorous) acid solution per metre of canopy diameter, adjusted to pH 5.6 using potassium hydroxide.

At the 1997 Aust/NZ Joint Avocado Conference, interest was generated regarding the use of different potassium salts for stabilising phosphonic acid. Apparently, the NZ industry used potassium carbonate instead of potassium hydroxide and as a result there is no leaf burn.

On examining the chemical reaction of potassium hydroxide, potassium carbonate and potassium bicarbonate to stabilise the pH of phosphonic acid, the end products of all the reactions are identical except that gaseous carbon dioxide is released when either of the latter two products is used. Therefore there is no advantage to be gained from adding either potassium carbonate or potassium bicarbonate in preference to potassium hydroxide.

The chemical manufacturers set the pH of commercial formulations of phosphonic

acid, so there is no point in being concerned with which product is used.

[A full chemical analysis is available from the author. Ed]

## ANVAS ACCREDITED NURSERIES

ANVAS accredited trees can be purchased from these nurseries:

### Rainforest Nursery

Ron and Joan Knowlton  
25 Reynolds Street  
Mareeba Qld 07 4092 1018

### Batson's Nursery

Merv and Pat Batson  
Schulz Road  
Woombye Qld 07 5442 1657

### Anderson's Nursery

Graham and Vivienne Anderson  
Duranbah Road  
Duranbah NSW 02 6677 7229

# From Your Federation

By Astrid Kennedy, Executive Officer

## 22nd Annual General Meeting

Your Federation held its Annual General Meeting in Rotorua, New Zealand, at the conclusion of Conference '97. It was disappointing that only 17 growers attended—deep sea fishing and local thermal attractions proved to be a more powerful magnet.

Notification of your Federation's Office Bearers, Committee Members and Directors' portfolios is presented on the next page. When you need information or want your views heard at National level these people are your first point of contact.

## AGM Adopts Levy Increase

The proposal to increase the Research and Development levy by 2 cents a tray was adopted unanimously at the Annual General Meeting of the AAGF. It is expected that the increase which raises the levy to 8 cents per tray/\$33.33 per tonne will take effect on 1 April 1998. This date will be confirmed in the March 1998 issue of Talking Avocados.

## Conference '97

"Searching for Quality", the 1997 Australia and New Zealand inaugural Avocado Conference, was a huge success. It must be remembered that successful events don't just happen—much planning, cooperating and hard work takes place behind the scenes and Directors of your Federation express their thanks to the organising Committees both local and across the Tasman. A full Conference report is published on page 8.

## Bilateral Discussions

The three day conference concluded with a final day of joint discussions between the Boards of your Federation, the New Zealand Association and other interested parties. The two Boards quickly agreed that generally they were serving the same avocado consumer and facing the same research needs.

Opportunities for joint research programs were identified in areas like packaging, quality management, exports, marketing and promotion, threats from exotic pest and disease and crop forecasting.

It was agreed that a representative from the Australian and New Zealand R & D Committees would attend the other's meetings to get a feeling of research priorities and look for issues on which the two industries can work together.

## Research

The R, D & E Subcommittee met on 1 November to consider funding applications and refresh the R & D strategic plan priorities. The Subcommittee will be issuing briefs to the research community calling for expressions of interest to conduct work or literature reviews on: Cloning methods, Harvest Handling, Post Harvest Humidity Management, Irrigation, Nutrition and Crop Forecasting. Dr Jonathan Cutting from the New Zealand R & D Committee attended the meeting.

## Congratulations Orf

Mr Orf Bartrop, Editor and Publisher of Talking Avocados, has received the AAGF 1997 Award of Merit. The AAGF recognises individuals associated with the industry who have given exceptional service to the industry. Mr Bartrop was nominated for the award for his voluntary contribution to the industry in editing and publishing the National magazine "Talking Avocados".

AAGF President, Rod Dalton, presented the award to Mr Bartrop at the conclusion of Conference '97 held in Rotorua, New Zealand, in September 1997. During the presentation Mr Dalton told the audience how Mr Bartrop had changed his vocation with the RAAF to the uncertainty of avocado growing. According to Mr Dalton, Orf is one of a rare breed, a survivor of a minor aircraft accident at 40,000 feet, who then settles down to grow avocados at Terranora just south of the Queensland border.

Mr Bartrop became involved with the NSW Avocado Growers Association in the early 1980s and held the position of secretary and editor of their magazine for many years. He accepted responsibility for Talking Avocados in May 1992 and under his control the magazine has become the industry's primary communications vehicle.

The Award of Merit recognises Mr Bartrop's efforts as a loyal and tireless worker for the avocado industry. Thank you Orf and congratulations.

## AAGF Disappointed with HRDC

The AAGF is disappointed with the HRDC on two accounts—both relating to the commercialisation of AVOMAN.

1. Your Federation has been under the impression and indeed has it in writing that other horticulture commodities could buy the AVOMAN "shell" and

adapt it for their needs. Proceeds from such sales would be

used to up-keep and upgrade AVOMAN. HRDC has handed down a ruling that precludes the AVOMAN shell from being sold.

2. The second point of dissatisfaction stems from a legal opinion which supposedly states that ownership of AVOMAN is retained by the major contributor. QDPI claims to be the major contributor.

This claim is based on the resources the Department contributed to the project. No one is disputing the department's contribution; however the equation is one-sided because the contribution of numerous avocado growers who provided input since the projects inception has not been accounted for.

Additionally, your Federation is unhappy with the lack of consultation during the decision making process and believes that HRDC did not act in the industry's best interests.

These matters were discussed with HRDC director Paul Zeibarth at the recent R, D & E Subcommittee meeting. Mr Zeibarth has since been provided with a copy of all relevant documents and a letter outlining the Federation's dissatisfaction—a copy of the letter has also been sent to Mrs Hyam, Executive Director, HRDC.

Your Federation is confident that now the matter is "on the table" it will be resolved satisfactorily.

## In Brief

### Get Well Soon

Three friends and supporters of the Avocado industry have been ill and are either convalescing or undergoing treatment. The Directors and Executive of your Federation sends best wishes for a speedy recovery to: John Dexter - Retired grower and Solicitor; James McGeogh - Chairman HRDC and Nurseryman; Orf Bartrop - TA Editor and recipient of the AAGF 1997 Award of Merit.

### Senator Brownhill "reshuffled"

In the recent cabinet reshuffle, Senator David Brownhill was replaced by Victorian Senator Judith Troeth as Parliamentary Secretary to the Minister for Primary Industries and Energy. Your Federation



extends its thanks to Senator Brownhill for his contribution to Horticulture and looks forward to working with Senator Troeth.

### Peak Industry Body for Horticulture

AAGF President, Rod Dalton, and Executive Officer, Astrid Kennedy, will participate in a two day seminar in late November to determine a better and more efficient way of managing the national horticulture industry. Further, the seminar will consider the need and possible structure for a Peak Horticulture Body.

The seminar was initiated by the Australian Apple and Pear Growers Association and is entitled "Titanic or Space Shuttle". The discussion promises to be lively and far reaching.

### Endosulfan Review

The National Registration Authority is systematically examining agricultural and veterinary chemicals registered in the past to determine whether they continue to meet current standards for registration.

Endosulfan is currently under review. A draft summary of the review findings had been released to chemical companies and State Departments of Agriculture/Primary Industries for input. Their comments will then be incorporated and a further draft released for comment, this time to industry and other interested parties.

If the restrictions on the use of endosulfan as proposed in the first draft are implemented then avocado growers in areas where Fruit Spotting Bug is a problem will be facing major losses.

Your Federation will receive a copy of the second draft of the report and distribute it to Directors (your representatives) as soon as possible. At time of writing, the response time frame is unknown.

### AHC - Consultation

The AHC held a second Chairman's Consultative Council Meeting on 19 November in Sydney. AAGF President, Rod Dalton, participated in the meeting with the new AHC Chairman, Arthur Charles, and leaders of other AHC member commodities.

A number of issues were progressed including:

- the effect of the currency instability in South East Asia on our horticultural industries and the need to raise awareness of the problem in Canberra,
- funding of industrywide programs within the AHC,
- AHC Board meeting locations, and
- AHC/HRDC interaction and coordination.

### Mexican Imports

Dr Cutting from the New Zealand Avocado Growers Association told the AAGF R, D & E Subcommittee meeting that Mexico lodges a new application every few months for entry to New Zealand.

### AAGF Board of Directors

Rod Dalton	President
Mary Ravanello	Vice-President
Geoff Betts	
Barry Daley	
Charlie Eden	
George Green	
Ron Hansen	
Henry Kwaczynski	
Frank Moore	
Ross Richards	

### Varieties Committee

Rod Dalton	Chairman
Mary Ravanello,	
Ross Richards,	
Graham Anderson	Nurseryman
Peter Young	Nurseryman
Alex Kidd,	Adviser
Tony Whiley	DPI Technical Adviser
Ken Pegg	DPI Technical Adviser
Registrar	AAGF Executive Officer

### Quality Project Management Committee

Rod Dalton	Chairman
Henry Kwaczynski	Director
Wayne Prowse	AHC Industry Manager
Scott Ledger	QDPI Post Harvest Specialists
Astrid Kennedy	AAGF Executive Officer

The committee will be disbanded at the conclusion of the project.

### Research, Development and Extension Subcommittee

George Green	Chairman
Phil Conner	Director
Graeme Thomas	Consultant/Grower
John Dorrian	Grower and processor
Alan Blight	Consultant/Grower
Astrid Kennedy	AAGF Executive Officer

### Conference '97

The Committee was disbanded at the finalisation of the Conference

### Research Champions

Ross Richards	Salt Tolerant Rootstock
Ron Hansen	Med Fly
Graeme Thomas	Dry Matter Maturity Test
	Boron Nutrition
	Anthraco-nose
	Spray Technology
John Dorrian	AVOMAN
	Canopy Management
Henry Kwaczynski	Fruit Spotting Bug
Alan Blight	Irrigation

### Marketing Forum

Mary Ravanello	Chairperson/Director
Ron Simpson	Grower/packer
	(1997 - 2000)
Garry Poole	Wholesaler Brisbane
	(1996 - 1999)
Lindsay Tillbrook	Wholesaler Sydney
	(1995 - 1998)
Barry Ross	National Retailer
	(1995 - 1998)

AAGF President  
Director of Domestic Marketing  
AAGF Executive Officer  
AHC Industry Manager

### Portfolios

Ross Richards	Export
	Californian Avocado Society
	World Council
Barry Daley	Market Research
	Statistics
	Industry Data
Frank Moore	Talking Avocados
Mary Ravanello	Industry Advertising & Domestic Marketing
Henry Kwaczynski	Product Handling
Geoff Betts	Farm Management Practices
Ron Hansen	Quality Assurance

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# Australian Round-up



## West Moreton

Following an unusually moist and mild spring most orchards are showing a good fruit set for next season. Along the Toowoomba range where most orchards had a light crop this season, a heavy flowering was observed with an above average crop expected. Obviously a lot can happen to reduce that crop between now and harvest time.

Some trees produced little or no spring flush growth after flowering and sunburn will be a concern. This lack of flush is often an indication of a tree under stress due to poor root health and it may be worth reviewing the root rot control program in orchards where spring flush development was disappointing.

Local growers are reminded that the AVOMAN '97 training sessions are planned for 28-29 January at Gatton College. Please advise Simon Newett if you are able to attend. From all reports the latest version is again a significant advancement on the previous version and the training will greatly assist in the understanding and utilisation of this excellent product.

## Bundaberg and District

In the main, growers are reporting a good fruit set. Most are hoping for a better crop than last season. At this stage we probably have the potential to produce 15-20% more fruit than last year, barring storms and pests.

The major concern will be water supplies, with the Monduran dam down to 7% of capacity and water allocations restricted to 15% for the year, most of which has already been used setting the crop.

Bundaberg will be hosting the first of a series of Spray Technology Workshops for advisers and growers on 8-9 December. The Workshops are jointly funded out of Avocado and Macadamia Nut R & D levy funds, and run by Robert Battaglia and Peter Hughes of QDPI Gatton.

The workshop will be designed to show, in a practical way, how to get the best spray performance from your particular spraying equipment. Anyone interested in attending should contact Diane Fullelove at the Bundaberg Fruit & Vegetable office on 07 4153 3007.

## Sunshine Coast

The December Quarterly Meeting of SCAGA was one of the best supported meetings in recent years. There appears to be two good reasons for this result.

First, growers were chafing at the bit to get the latest information on the new Interstate Certification Assurance (ICA) policy and first hand advice on how it affected them individually. Our guest speaker was Senior Plant Health Officer (ICA), Mr. Gino Russo JP. Gino was just the expert for the job and armed with reams of handouts he proceeded to explain the frill implications of certification and subsequent auditing.

The initial impression of what was required seemed daunting, but it soon became evident that growers who embrace 'best practice' techniques in their present operating procedures have little to fear from this new and comprehensive process. Moreover, they will find that they have a friend and mentor in Gino Russo who has as a primary objective, the successful certification of all growers who are motivated toward compliance with this and other quality assurance initiatives. To quote Gino: "My phone number is on my card and you can feel free to ring it any time twenty-four hours a day, seven days a week."

Any grower/packers who were not at the meeting could do themselves a major service by making contact on (07) 5441 2211 as soon as possible and asking for an application kit. With an expectation that some 500 growers will be seeking formal certification before 1 March 1998 it will be a case of first in best dressed. All fruit sent to Victoria, South Australia or West Australia will require certification either by the qualified grower at no further cost to himself or by a qualified QDPI Plant Health Inspector at the current inspection rates plus travel charge.

Second, the excellent barbecue and Christmas fellowship was enjoyed by all after the meeting. Our hosts, Brenda and Ralph Hoskin, spared no effort in ensuring that everyone had ample to eat and drink. While there was more than enough BYO conversation to go around, Simon Newett (QDPI) and Wayne Prowse (AHC) joined with Gino Russo to ensure that the quality of discussion remained focused.

Our President Ralph Hoskin and his wife Brenda extend their best wishes and Christmas greeting to fellow growers and

their families everywhere in general and to SCAGA members in particular.

## Tamborine Mountain

The past few months have seen a transformation on Tamborine Mountain. Most avocado growers have finished picking their Hass fruit, such as it was. As predicted, the harvest was well down on last year, by as much as ninety per cent in some cases.

On a brighter note, spring rainfall has been plentiful, coming in regular instalments.

The trees have blossomed profusely and on most of the orchards the fruit set has been phenomenal. No doubt there will be a heavy fruit drop in early January but there promises to be a bumper crop next year. Much of the bud fruit is high up in the trees and could be exposed to the sun but with the plentiful rain and warmer weather the leaf flush is vigorous and with any luck much of the fruit will be shielded before any damage is done.

Pests are sure to proliferate in the presence of such an abundant crop. Ivy Leaf Roller is already appearing in considerable numbers in some orchards and Spotting Bug is the next thing to watch out for.

Early spraying will be essential if full crop potential is to be achieved. Of course, the other old enemy will be lurking in the wings—Phytophthora will be waiting to attack the new root growth. So it will soon be a case of "all hands to the pump" to cope with the injection program.

Marketing continued to be of concern among growers, particularly the poor condition of avocados as they appear in ready-to-eat condition in many of the retailers' bins.

On the broader issues we were privileged to hear an address from the NZ Team Avocado marketing representative. He left us in no doubt that, 'Unity is Strength'.

Unity can also be pleasure, as our Local Producer Association members found when they gathered for their annual Christmas party, which was favoured by the presence of the local State Member of Parliament, Hon Kev Lingard, and his wife Allison. Spirits were definitely higher than they were at the same time last year.

Mountain growers look forward to a bumper crop next year and wish the same good fortune to all other growers.

## SQF 2000

West Australian avocado growers are developing a quality assurance scheme to cover avocado production from designing the orchard through to loading the packed produce on to a truck.

The SQF 2000 system developed by the Western Australian Department of Agriculture (AgWA) is based on the HACCP, which is used in many chain stores. SQF 2000 goes further to look at fruit quality and production issues as well as food safety. The basic idea is that once best practices for food quantity, quality and safety are identified, documentation methods are set up so that independent auditors can see that these best practices are actually occurring.

A generic plan has almost been completed for pre-production, production and packhouse. Once an auditor approves the generic HACCP plans, they can be taken in by individual growers/packers and modified to suit their situation. It is hoped that these generic HACCP plans will be approved early in the new year and that individual orchards in the Perth and Pemberton areas will have their accreditation by mid 1998.

## Promotion Activity

### Media Orchard Walk

Fresh Finesse coordinated an Orchard Walk for local media personalities to launch the 1997 avocado season. The event was held at Avowest, Carabooda, on Thursday, 23 October. Twelve media and industry people attended the walk. Ron Hansen, of the Avocado Growers Association of WA, welcomed the group. Alan Blight, manager of Avowest, led the group through the orchard and packing shed, explaining the procedures involved, and then presented an update on SQF 2000.

A light picnic-style lunch featuring avocados in every dish was served, after which Dietitian/Nutritionist Glenn Cardwell presented an entertaining and informative update on the nutritional aspects of avocados.

Outstanding media coverage was achieved for avocados from the Walk by Fresh Finesse. Calculations based on the advertising cost of the same print and radio coverage immediately following the Walk put the total value at almost \$22,000.

### In-Store Demonstrations

Fresh Finesse has just completed its in-store demonstration program for avocados. The demonstrators reported an excellent response from consumers to the avocado dip samples and distributed

hundreds of recipe leaflets to ensure consumers continue to use avocados in a variety of ways throughout the year. Consumers' confidence in being able to buy a ripe avocado should increase as a result of the information passed on by consumers.

With the avocado season in New South Wales drawing to a close, most growers will be by now nearing the end of their

Hass crop.

Those growers who were able to deliver quality produce should have been suitably rewarded. Returns for quality Hass were a welcome relief after the disappointing earlier prices of the green skins.

The New South Wales Avocado Association 1997 end-of-year dinner will be held at the Ballina Beach Resort on Friday 12 December. There will be two guest speakers of high quality. The first will be Ms Astrid Kennedy, Executive Officer Australian Avocado Growers Federation, whose topic will be "The Australian Avocado Growers Federation - the past year and upcoming issues."

Since taking up her position of Executive Officer in 1994, Astrid has been a valuable member of the Federation's team. Members at the dinner can raise any issues about administration of the Federation.

The second speaker will be Mr Barry Ross, Merchandising Manager, Woolworths. Barry's topic will be "An Overview of the Food Quality Network Program for Shepard Avocados." This program for Shepard Avocados was an enormous success and in fact, was respon-

sible for making Shepard avocados the highest selling variety of avocados in Woolworths.

With consumers demanding quality produce, it is imperative that there is a program to build a network involving all participants in the chain from grower to consumer.

The NSWAA Committee wish all growers and people associated with the avocado industry a Merry Christmas and a very Happy New Year.

## Royal Adelaide Show

We had another successful Royal Adelaide Show. We sold or gave away 458 trays of avocados to all the people who came to look and taste when it was rain-

ing. It rained on most days of the show.

It was noticeable that there were fewer comments about cholesterol this year. The message must be getting through. Young children were spending their own money to buy avocados—a good sign—and more older people were buying avocados.

Generally in South Australia and Sunraysia, the crops are very poor in all varieties, especially Hass. On top of a light crop, we had severe frosts during winter, the worst since 1982. Quite a few growers lost what Hass they did have as well as having their Reed trees severely frosted. Some large trees died back to the graft.

While there is a light crop, prices are quite good. Therefore, the fruit we do have should bring a reasonable return.

This spring has been more consistent with heavy flowering. It is to be hoped that this will result in a good to heavy crop next year—fingers crossed.



The avocado stand at the 1997 Royal Adelaide Show.

# Conference '97 – A Great Success

By Orf Bartrop, Peter Lyford (NZ) and Rosalie Smith, Editor Avocado Scene (NZ)

What started as a normal biennial Conference turned out to be a very successful international event. The Australian Avocado Growers Federation combined with the New Zealand avocado industry to hold a joint Conference where growers from both countries could benefit from an exchange of information.

By inviting speakers not only from Australia and New Zealand but also South Africa, Mexico and the United States, the Conference turned out to be a great international event. The world's top avocado scientists presented papers thus further enhancing the knowledge of attendees.

## Pre-Conference Tour

A united nations force of one Mexican, 18 Americans, 16 South Africans, 14 Kiwis and about 90 Australians assembled in Auckland on Friday 19 September and headed northwards.

The first very long day was via Mangawhai and Whangarei to Paihia. Murphy's law struck with some people left behind, the tour running two hours late, nametags lost and motel booking problems—for which the organisers apologise.

With Murphy's law satisfied, the tour proceeded to the Far North. This was a day to remember. The best lunch, a veritable feast, and the best dinner of lamb on the spit and fresh snapper—a banquet prepared by the Far North growers. Fine weather prevailed and everything ran to time.

By popular request the tour split into two groups on Sunday. Two buses travelled to Matakoho for lunch via the kauri forest on the West Coast. The others went south via Leone Batt's excellent orchard at Whangarei. The tour arrived in Auckland in enough time to get everyone to the Travelodge for a good dinner and relaxing evening.

On Monday the tour went via Katikati and Kauri Point to visit two more orchards before arriving at the Millennium Hotel in Rotorua. The lunch stop in downtown Tauranga proved profitable for one lucky Australian who managed to win a very rich "Scratchie" prize—well done Alan.

Thanks to all the hosts for the handouts and good talks and walks, they were much appreciated.

Visitors comments indicated NZ has an average production of 15 to 25 t/ha with extremely healthy, well-spaced trees!

It was obvious from visiting orchards that a few large avocado trees produced more fruit per hectare than many small trees. NZ growers are fortunate that the requirement to spray large trees is minimal. However, NZ growers do not get everything their own way. As can be seen in the photograph on the next page, young trees need plenty of protection from wind and hail.

Quote of the trip: A California grower was heard to say, "I can't wait to go home and get my chainsaw started."

## The Conference

After a get-to-know-you cocktail party on Monday night, the Conference started next morning. Mr Ron Bailey, Chairman of the NZ Avocado Growers Association, opened the proceedings and said that he hoped there would be more cooperation on the avocado front between Australia and New Zealand. In line with the Conference theme "Searching for quality," Mr Bailey said, "As an avocado industry there is a unique opportunity to exploit our geographical spread of growing. We should be able to produce high quality avocados and market them in a more coordinated way than we have done in the past.

"At grower level, we have tended to look at the growers across the ditch as competitors and that is fair enough. However, because there is only a small overlap in our two growing seasons, industry authorities should be identifying the areas where we can work more closely together. Let us create a climate that will allow commercial entities to expand every opportunity for marketing avocados, not only within our two countries but also in Asia."

Mr Rod Dalton, President of the Australian Avocado Growers Federation, then addressed the 260 delegates to the Conference. He said, "That from the Australian industry's point of view, the Australian consumer is, and has to be, our first priority. It is in our interest that our consumers, and they are New Zealand's as well, achieve maximum satisfaction and are happy with the product they buy twelve months of the year. If one sector of the industry lets us down, or we are not getting the supply at the right time of the year, then we all suffer. What we are looking to do is

to ensure that our consumer is satisfied and gets a continual supply of a good product."

Mr Dalton then went on to say that research is critical to both our industries and from the Pre-Conference Tour it was obvious that many of the issues out there are common to all of us. There seems little point in having a researcher in one country doing the same work as a researcher in the other country. Rod said, "Let's try to improve the communication between all sectors of our industry and this Conference is the first stage in doing this."

## The Conference Sessions

The Conference organisers only allowed speakers 20 or 30 minutes to present their papers. Although this sounds like an impossible task, what it did was to make speakers generalise and not get into too much detail. As a consequence, the sessions were more interesting because subjects changed rapidly and those parts of a talk that float about two feet above one's comprehension were missing. One drawback to the short time allowed for presentation was the shortness of the question time.

The quality and credentials of speakers was outstanding. One could be forgiven for thinking that they were attending a World Congress. It really paid dividends to invite international speakers.

## Day One

The first day was devoted to marketing and post harvest quality under the title, "Selling and Marketing—an International Perspective."

The presenters covered many subjects, some of which were:

- Alvin Snider (USA) - adapting to changing markets.
- Rob Robson (Aust) - the Shepard program.
- Bill Blandon (South Africa) - marketing to distant markets – promoting in the UK.
- Kevin Nalder (NZ) - international phytosanitary barriers.
- Dr Lindsay Milne (NZ) - Quality Assurance.
- Dr Allan Woolf (NZ) - variables in ripening fruit with ethylene.
- Prof Nigel Banks (NZ) - coating fruit to enhance storage life.
- Dr Kerry Everett (NZ) - managing latent infections.

- Anne White (NZ) - the electronic firmometer.
- Dr Peter Hofman (Aust) - fruit sampling procedures affect the accuracy of dry matter maturity tests.

From a grower's point of view, the subject matter was not as interesting as for Day Two. One grower was heard to say that he did not learn anything from the day's proceedings. On further questioning, it turned out that he did not pack or market his own fruit. Even so, he should have been interested for two reasons: First, quality starts in the orchard; and second, he could use the information as a benchmark to check on his packing company.

## Day Two

The second day consisted of technical sessions where distinguished scientists and other researchers had an opportunity to present research papers. The ranks of delegates swelled to 275 for these sessions to hear such subjects as:

- Dr Tony Whiley (Aust) - practices to improve consumer confidence in avocados (see article page 20).
- Prof Carol Lovatt (USA) - pollination and fruit set.
- Dr Samuel Salazar (Mexico) - flowering in Hass can be manipulated by gibberellic acid.
- Philippa Stevens (NZ) - control of insect pests with "green" sprays.
- Prof Nigel Wolstenholme (South Africa) - orchard mulching and its effect on avocado fruiting.
- Tim Smith (Aust) - boron deficiency and Hass fruit size.
- Graeme Thomas (Aust) - the influence of seedling rootstock on yield (see article page 24)
- Mary-Lu Arpaia (USA) - the Californian avocado-breeding program—what does it mean to Australian and New Zealand growers.
- Simon Newett (Aust) - the AVOMAN project.

## The Dinner

The Conference ended with a grand dinner held in a beautiful setting. Some 248 diners enjoyed a delightful meal as they sat round the Hotel Millennium's heated swimming pool. Speeches were kept to a minimum and some typical Maori entertainment topped the night off.

## Field Day

Three busloads of overseas visitors and many New Zealanders in cars turned out for the field day, a total of 190 souls. The Trevelyan's Te Puke packhouse was visited

where the avocado, kiwifruit and flower packing operation was described. The Australian growers, who mostly pack their own fruit, were particularly interested in the commercial nature of the packhouse. It was explained that if an efficient and competitive service was not forthcoming, growers would go elsewhere.

Ron Bailey's property was next. He had organised a line-up of machinery.

**Helicopter** A helicopter spray demonstration was of great interest. The helicopter made several low runs over tall avocado trees, spraying water on trees and watchers alike.

**Injector System** Geoff Aldridge (Aust) demonstrated his Sidewinder pressure tree injection system. As well as the trailer-mounted model he now has a backpack injector for the smaller orchard.

**Mowers** Trimax had its full range of orchard mowers on the job. Three were of particular interest:

1. The Richard Long mower/collector is a fully floating flail mower that throws mown material into a bin from where it can be tipped into a trailer or spread under trees as a mulch.
2. The Stealth is a multi-spindle wing mower consisting of three sections. The two outer blade spindles can be folded up to allow the mower through narrow openings. This gives three cutting width, ideal for orchards planted with different row widths.
3. The Warlord flail mower can cut grass perfectly, yet has the ability to turn prunings of up to seven centimetres in diameter into fine mulch.

**Cherrypickers** Four cherrypickers were on display:

1. Hydralada displayed a cherrypicker designed specifically for the avocado grower. Featuring a telescopic boom, it is 10 m to the floor of the cage. It uses proportional hydraulics controlled by electronics, which give it the ability to travel at low or high speeds. The telescopic boom makes it compact, the boom can be telescoped into a tree and the hinged cage slewed sideways to reach the target with ease.
2. Hydralada also showed a tandem drive machine. This system mounts two driving wheels on an oscillating beam,



Newly planted avocado trees in protected housing.

which enable the wheels to move over broken and uneven terrain with ease. The 6 x 4 driving system gives the six-metre lift model a certified ability to remain stable on slopes of 20 degrees both sideways and fore and aft.

3. The top of the line for rough terrain was a true four-wheel drive with an eight-metre fixed or telescopic boom. These models feature 20 or 30 HP diesel engines that give them the ability to move about an orchard quickly. They are claimed to be the most stable and safest models on the market today.
4. A small compact model that was on display was mainly for apple growers. It was equipped with a Hydrafork—a set of hydraulic forks between the driving wheels so bins can be moved round the orchard. The setup allows an operator to bypass full bins that may be in the way.



Some of NZ's tall avocado trees.



# Industry Manager's Say ...

By Wayne Prowse



It was a privilege to be able to attend the joint Australian and New Zealand Avocado Conference in Rotorua in September. Apart from the great wealth of information provided and available to attendees there was the social element of being able to meet so many people of similar interests. Congratulations to Astrid and Rod as well as everyone else involved in the organisation of the Conference. It really was a world class event.

One particularly memorable moment for me was chatting with a group of growers whilst looking at a world map. Each person was noting their part of the world where they were living and growing avocados. Chile, California, South Africa, Atherton Tablelands and the Sunshine Coast were proudly noted while we were all standing in an avocado packing shed at Te Puke, NZ. Suddenly the world seemed so much smaller!

On matters back home, it has been encouraging to see some excellent outcomes of the Public Relations programs. Well known nutritionist Rosemary Stanton featured AVOCADOS in a food segment of Burke's Backyard recently. Speaking with her last week she mentioned that some consumers had stopped her in the street to thank her for telling them that avocados are OK to eat!

Another respected nutritionist, Catherine Saxleby, has written several articles in her newspaper columns favouring avocados. It is good to see these strong opinion makers in the health and nutrition areas saying good things about avocados.

Australian Gourmet Traveller features an avocado recipe on the front cover of its October edition followed by a 4 page Avocado feature inside. Another magazine, "Australian Good Taste" produced a feature on Avocados followed up by a TV feature on the TV program of the same name.

These are just some examples of the good news about avocados that is hitting the media and helping to encourage more people to eat avocados. The good news is that so many are pleased to learn that they can enjoy an avocado without feeling

guilty! Even doctors at the Cardiologists conference (reported last issue) were pleased to know that they could commend avocados to patients instead of avoiding them.

## Your Levy at Work

(October - December 1997)

### In Store Demonstrations

NSW	38
Victoria	38
QLD	12
SA	24
WA	50

### Special Events

#### Western Australian

- Media Orchard Walk - October

#### NSW

- Folate awareness week (Avocado participation) - Martin Place Sydney - Parramatta

### Public Relations

- Rosemary Stanton (Nutritionist) avocado feature on Burke's Backyard in September. Avocado Recipe on Front Cover of Australian Gourmet Magazine - October Issue plus 4 pages of recipes and editorial.
- New recipe photography completed for next round of releases.
- Press release - focus on Hass September.
- Press release - focus on Reed November.

### Advertorials

- Bounty Magazines - to Maternity Hospitals - on going until May 98.

- HeartHealth Magazine - to HeartHealth Australia cholesterol testing clinics - ongoing.

## Varieties in Focus

The Public Relations program has introduced a varieties element to the series of press releases targeted at consumers.

To create more interest we are going to make a particular variety a "hero" in each press release and gradually work our way around all key varieties. In this way more interest can be generated in something different (which is what people like to read). After grabbing the interest with possibly a lesser known variety, its shape, taste and availability, the important generic message about the health and nutrition of avocados comes through with appropriate usage information.

We are responding to grower concerns that too much emphasis is placed on Hass whilst there are many other interesting varieties to promote. During November we will feature the REED variety and promote its large size as being ideal for serving a family. At the end of the day, which ever variety we promote it is still an avocado in much the same way that Camry, Corolla and Hi Lux all promote Toyota.

## Telephone Numbers

Telstra has now completed installing all the new area codes and eight digit phone numbers within Australia.

Readers are reminded to reset numbers in their Fax machines so that the correct number is automatically indicate to the receiver of a Fax message.



## BATSON FAMILY AVOCADO NURSERY



### ANVAS accredited Avocado Trees

Varieties Include: Fuerte, Hass, Sharwil, Wurtz, Pinkerton and Reed

Merv and Pat Batson have been growing avocados on their farm on the Sunshine Coast for 25 years and have operated the avocado nursery on a commercial basis for 20 years. They have a wealth of experience and knowledge and are more than happy to spend the time needed with customers to pass on this knowledge.

Place your order now! Phone/Fax 07 5442 1657

P.O. Box 105, Woombye Qld 4559

Or call at the nursery at Schulz Road Woombye near the Big Pineapple

# Annual Report To Industry For The Year 1996-97 By President Rod Dalton

Financial year 1996-97 has been a very busy one for the Federation, particularly the latter half when the base planning and groundwork was done for Conference '97.

It has become increasingly clear that the Federation needs to increase its resources. The current two days per week staffing arrangement is stretched to overflowing—a matter that must be addressed along with the industry's strategic plan which, after three years, is losing its relevance.

Despite these challenges the Federation continues to represent industry views to government whenever the opportunity presents itself and to attend industry forums and functions to keep in touch with and help mould the mood of our peers.

I have attempted to keep this report brief and focused whilst conveying to you the work being undertaken on your behalf. Always remember that the Federation is your organisation and that you elect the representative who brings your views to the decision making process.

## Committee Reports

### Varieties Committee

Chairman	Mr Rod Dalton
Members	Mrs Mary Ravanello Mr Ross Richards
Nursery Advisers	Mr Peter Young Mr Graham Anderson OAM
Technical Advisers	Dr Tony Whitley Mr Ken Pegg Mr Alec Kidd OAM
Registrar	Ms Astrid Kennedy

The committee contacted California Avocado Society to support the commercial release of BL122 (Lamb Hass) in Australia. At the date of writing this report, no response had been received.

The committee is aware of increasing interest in exporting avocados to New Zealand. As this fruit must be from registered trees increased demand for registered trees from ANVAS Nurseries is expected.

### ANVAS

During the year one nursery resigned from the scheme and one had its accreditation withheld. At 30 June 1997 three

nurseries were accredited under the scheme and two inquires from nurseries contemplating applying for accreditation have been processed.

### R, D & E Subcommittee

Chairman	Mr George Green
Members	Mr Alan Hartley Mr Phil Conner Mr John Dorrian Mr Graeme Thomas

Executive Officer Ms Astrid Kennedy

The committee welcomed a new member to its ranks, Mr Phil Conner, representative from NSW, and accepted with regret the resignation of Mr Alan Hartley. Currently one vacancy exists.

### Research activity

Two projects were completed during the year:

- Med fruit fly disinfection.
  - Avocado maturity standards.
- There are three ongoing projects:
- AVOMAN due for completion 1998.
  - Boron Nutrition (funded by voluntary contribution).
  - Salt Tolerant Rootstocks (funded by voluntary contribution).

Four new projects are underway:

- Avocado Canopy Health and Management.
- Managing Avocado irrigation for yield and fruit quality.
- Field management of avocado post-harvest diseases.
- Ecology and behaviour of fruit spotting bugs.

There are two projects funded awaiting acceptable proposals:

- Improving pesticide application in large canopy trees.
  - Exotic disease control strategies.
- We believe that this is a well balanced research portfolio, however there are still a number of areas that require work:

- Quality Assurance.
- Maturity Testing.
- Nutrition.
- Technology Transfer.
- Crop Forecasting

Unfortunately no further work can be commissioned until more funds are available.

### R & D Levy Increase

The subcommittee's recommendation to the March Board Meeting that the research and development levy be increased from 6 cents to 8 cents a tray was accepted. The avocado industry will be amongst the first to test the government's new guidelines for changing the rate of existing levies.

One of the key features in the guidelines is the requirement to ensure that the majority of levy payers understand the reasons for and support the proposed increase.

An information campaign has been underway since March. Articles have appeared in TA, and the matter has been discussed at local grower groups, field days and meetings. Growers have been asked to provide feedback to their local Federation Director or R, D & E Subcommittee member with their support or otherwise for this increase.

### Quality Project Management Committee

Chairman	Mr Rod Dalton
Members	Mr Henry Kwaczynski Mr Scott Ledger Mr Wayne Prowse

Executive Officer Ms Astrid Kennedy

At the beginning of the year under report, Agribusiness expressed concern that retailers were not supporting the training workshops and withheld final funding until the project was refocused and the budget revised. As a result of this intervention the project consultant, Mrs Story, and I met national produce manager/buyers from Woolworths, Coles and Franklins to progress the issue of retailer training. Our proposal was enthusiastically accepted resulting in workshops for Woolworths and Franklins being conducted during February in each State. Further, Mrs Story was invited to present a session on avocado handling at three Woolworths training sessions for managers at the University of Western Sydney.

The project is funding an International speaker for conference '97 to address the issue of quality and quality assurance.

The project concludes in October 1997 and the committee is currently considering possible follow-on projects to ensure the training momentum continues and that the information generated by the project is retained.

### Conference '97 Committee

Members Mrs Mary Ravello  
Mr George Green  
Mr Phil Conner  
Mr John Williams  
Ms Astrid Kennedy

The committee was formed to work in conjunction with the New Zealand organising committee to make Conference '97 a reality. Mrs Mary Ravello was responsible for obtaining sponsorship, Mr George Green took on the task of selecting R & D speakers and program coordination, Mr Phil Conner was responsible for transport arrangements, Mr John Williams for professional advice and Ms Astrid Kennedy for communications, registrations, general coordination and facilitation.

### Marketing Forum

Chairman **Mrs Mary Ravello** – Director in charge of domestic marketing.

Members **Mr Rod Dalton** – AAGF President and Grower.  
**Mr Barry Ross** – Retailer (Chain store).  
**Mr Lachlan Mutton** – Retailer (Independent).  
**Mr Gary Poole** – Wholesaler (Brisbane Markets).  
**Mr Lindsay Tillbrook** – Wholesaler (Sydney Markets).  
**Mr Ron Simpson** – Grower/exporter.  
**Mr Alan Glogoski** – Packer/marketer.  
**Ms Astrid Kennedy** – AAGF EO and Consumer.  
**Mr Wayne Prowse** – AHC Avocado Industry Manager.

Marketing forum members are selected for their expertise by the Federation and ratified by the AHC Board. The forum is responsible for evaluating and recommending marketing strategies and plans to the Federation Board.

During the past year the forum met twice, discussed and recommended that:

- In-Store Demonstrations continue as a key area of promotion activity. Demonstrators will be briefed to provide consumers with information covering the health benefits of avocados along with tips for selecting, storing and usage.
- Point-of-Sale material be revised and carry the theme "Avocados Really Make a Meal."
- Public Relations activity will focus on the health benefits of avocados.
- Bounty "Baby" Magazine will convey the benefits of avocados as an ideal first food for babies and also for the general health and nutrition for mothers particularly while breast-feeding. This publication reaches 95% of all new mothers via the hospital system.

### **Directors' Portfolios**

#### **Export – Mr R Richards**

Export activity funded and/or researched by the Federation was relegated to the back burner for the short term. Entrepreneurial sectors of the industry are encouraged to identify specific export markets and to follow through with appropriate action. It is worth noting that the Californians have had little penetration on the Japanese market (5000 tonnes) despite government assistance with promotional support.

#### **Market Research – Mr R Richards**

The Wilson consumer survey data are no longer available. The AHC had commissioned Wilson MLI to conduct consumer surveys on a monthly basis for a number of commodities thereby obtaining consumption statistics for each commodity at a reasonable cost.

Wilson's have been taken over by another organisation and the service is no longer affordable. A possible alternative source of consumption data is through the central markets and the AHC is currently collecting information from Flemington markets.

#### **World Avocado Society – Mr R Richards**

The World Avocado Society meets every four years, usually at the World Congress. The next meeting is scheduled for 1999 at Uruapan, Mexico. The principal objective of the Society is the preservation of avocado germplasm.

#### **Californian Avocado Society – Mr R Richards**

California has been forced to live with restricted imports of Mexican avocados into the eastern states. A suggested theme for their Annual General Meeting is, "can we get along with Mexico."

#### **Statistics/Industry Data – Mr B Daley**

In an attempt to estimate the funds available through levy collection for the Marketing and the Research & Development programs, the Federation has obtained avocado production statistics from the Australian Bureau of Statistics agricultural census 1995-96. The data was published in the June issue of Talking Avocados and the information will be updated annually.

#### **Talking Avocados – Mr P Conner**

**Survey** For the first time in a number of years the Federation conducted a grower survey through TA. The feedback received was valuable and has already been used to update TA and will be used in December during strategic planning for the industry. The results from the survey and some grower comments were published in the June edition of the magazine.

**Control** In the past TA was published under the auspices of the AHC using the marketing levy as the only funding source. This arrangement is no longer appropriate because in some editions the number of pages used for research updates and extension information exceeds those used for marketing information and articles. Further, during the year under report the editor Mr Orf Bartrop experienced some delay in his dealings with the AHC. Accordingly, it was deemed prudent for the Federation to reimburse Mr Bartrop first and to claim against the marketing and R & D levies at a later stage. The Federation assumed control of the TA advertising service from 1 July 1997.

**Funding** The Federation has been successful in an application to the HRDC to make R & D levy funds available to fund the Research component of the magazine. Funding has been granted for the next three years on the conditions that, first, a grower survey be conducted on an annual basis. The Federation plans to conduct a telephone poll in June 1998 and again in 1999 and a full survey in 2000. Second, that a publication contents plan is prepared.

## Marketing – Mrs M Ravello

This portfolio is closely linked to the Marketing Forum of which Mrs Ravello is chair.

## Product Handling – Mr H Kwaczynski

This portfolio is closely linked to the Quality project and Mr Kwaczynski is a member of the management committee for that project.

## Farm Management Practices – Mr F Moore

This portfolio is closely linked to the AVOMAN project.

## Quality Assurance – Mr R Hansen

Mr Hansen has been actively involved in evaluating, formulating and implementing a SQF 2000 quality assurance system in the West. Once tested the system will be available for other groups to use and adapt to suit local conditions.

## Service Providers

### Horticultural Research & Development Corporation (HRDC)

The relationship between the Federation, the R, D & E Subcommittee and the HRDC continues to be one of cooperation and respect. All elements of the equation recognise that each has been charged with a task, which needs the cooperation of the others to achieve. We hope that this standard will continue under the new regime.

The HRDC now has a new Chairman, Board of Directors and a new Managing Director. The new regime is in the process of evaluating and streamlining the systems and rewriting policy to ensure that its intent is clear and applicable. The Mortimer Report is the only cloud on the HRDC horizon.

### Australian Horticultural Corporation (AHC)

The Federation has a working relationship with the AHC. At its September 1996 meeting, the Board resolved to rescind the motion to withdraw from the AHC by 30 June 1997. A number of factors contributed to this decision:

- A stated willingness by the AHC to be responsive to the AAGF requirements particularly in relation to providing visible "Micro" financial reporting on a quarterly basis.
- A written intent to provide a more equitable funding arrangement for all the participating industries and upon their agreement to the new funding formula the Avocado Industry's contribution to

the AHC would be reduced from \$49,000 to \$18,000 per annum.

- The proposed merger of the HRDC and the AHC
- Growing doubt as to the ability of Federation members to collect levies by State legislation.
- The Prime Minister's intervention into why primary industries were using the Commonwealth taxation powers to collect levies.

De-coupling remains the AAGF's preferred option. However, this option was relegated to the back burner when Senator Brownhill advised publicly that government policy does not allow for industry levies to be passed back to industry bodies because of the need for accountability to all levy payers and the parliament.

The AHC now has a new Chairman and Board of Directors and the AAGF will endeavour to maintain and if possible improve the current working relationship.

### AQIS

Relations between the Federation and Officers at AQIS remain amicable.

### Horticultural 2000

There are a number of issues under discussion by the Horticultural 2000 group that, should they come to fruition, will affect the industry. Your Executive Committee is monitoring development on these issues:

- A Peak Industry Body for Horticulture.
- A Business Plan for Agriculture.
- Disinfestation Research Business Plan.
- Chemical Residue Management Plan.
- Taxation depreciation for the costs of establishing new horticultural plantings.
- SCARM incursion management strategy for exotic pest, weeds and diseases.

## Conclusion

The past year has seen a number of significant developments in the Australian Avocado Industry.

The organisation of an avocado conference in conjunction with the New Zealand industry reflects the maturity of our industries and their understanding that a closer working relationship will be of benefit to both industries in the medium and long term.

Australian production exceeded 20,000 tonnes this year for the first time and although prices were disappointing during some periods, the average return was better than might have been expected given

the increased volumes. This I believe reflects the value of our promotional campaigns and the success of the quality project training program for wholesalers and retailers. The success of the latter has been highlighted in the results of a recently conducted survey of fruit at retail level.

During the year the market place also provided the industry with the very clear message that we must provide the customers with the variety and quality they want or suffer the financial consequences. The reality is that at this time our customer is not the consumer and that scenario is unlikely to change in the future. Thus I would encourage all growers to critically review the quality and the varieties they are growing and if appropriate, change.

The AAGF has actively represented the interests of the avocado growers of Australia and will continue to do so with your support and input. I would like to thank sincerely the Board for their efforts and support over the last 12 months, particularly my Vice-President Mary and our R, D & E Chairman George for their wise counsel and commitment.

The contributions to our industry by members of the Marketing Forum, R, D & E Subcommittee, Varieties Committee and the Quality Project is also acknowledged with gratitude, particularly the non-grower members of those committees. Further, I must also acknowledge the efforts of Gerard and Wayne, our program managers from HRDC and AHC respectively.

Finally my sincere thanks go to our Executive Officer for her efforts over the past 12 months. The professionalism and enthusiasm with which Astrid handles her role is greatly appreciated.

## Conference Proceedings

Conference proceedings are now available from the AAGF Executive Officer, P.O. Box 19, Brisbane Markets, Qld. 4106.

The purchase price is:

Australia \$45 + \$5 postage  
Overseas \$65 + \$10 postage

All prices quoted are in Australian dollars.



## AVOMAN Tips

### Selecting preferred nutrient application intervals

Last year's prototype was a little inflexible when it came to timing. If for example you were farming on a loam type soil and you selected fertigation as the method for applying nitrogen, then (providing several other criteria were normal) 25 fortnightly applications starting from the end of summer fruit fall would have been recommended. While this recommendation was agronomically sound it did not give you any flexibility to alter your timing. The new prototype still has strict rules for the start time(s) of recommendations (tied to events in the growth cycle) but now it allows you to choose the interval between applications over the period when they are due.

Figure 1 shows the choices that are available for each element. To set the interval you simply click the desired cell.

Note that if you select "monthly" this doesn't mean that nitrogen will be recommended every month of the year but that for the specific period(s) when AVOMAN *does* recommend it, applications will be spaced at monthly intervals.

To get advice about which are the most appropriate intervals to choose for your situation you simply go to the on-line help file on this topic. You can be taken directly to this information by pressing the "help" button on this screen and you will be presented information to help you decide. For example the notes may advise you to select a short interval if your soil type is light or a longer interval if it is heavy.

### Working with more than one recommendation per week

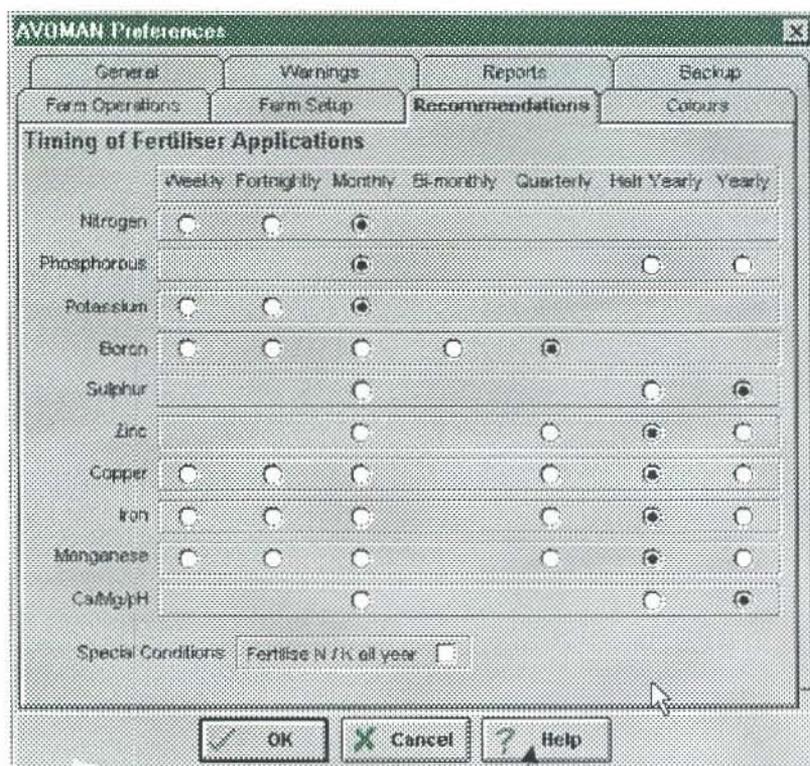
Often you will be doing more than one job each week. How do you enter a second job of the same category?

Once you have selected the appropriate cell in the recommendation grid (correct week for the element, pest or disease you are working with) simply press the add (+) button on the left-hand side and enter the required details (i.e. The same procedure as you would when entering the first job).

After saving the new job, if you already had one job recorded for that week the statement near the top of the left hand screen will now say "2 of 2" to tell you that you are looking at record number two out of a total of two. You can enter any number of jobs in a single week.

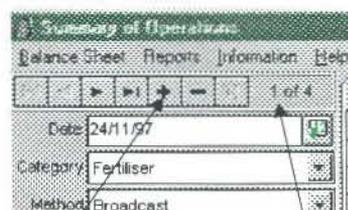
In the case where, within the same week, you have applied more than one fertiliser containing the same element (e.g. nitrogen where urea and potassium nitrate have both been applied) AVOMAN will add these amounts together to come up with the total for the week. The total will appear as the applied amount (blue number) in the recommendation grid and the balance (green number) will now reflect how this sum of nitrogen applications compares with the weekly amount recommended by AVOMAN (red

Figure 1. The AVOMAN screen allows you to select a preferred application interval for your nutrient applications.



Press this button to get advice about making your selections

Figure 2. The navigation keys (on the left side of the Operations screen) where you can add or delete jobs and the statement that tells you how many jobs have been recorded for the week.



Press this button to add another job

This tells you there are four jobs created for the week and you are currently displaying details of the first one

number). Thus you can see that more than one fertiliser can be applied to match a requirement.



# Features In The AVOMAN '97 Prototype

## Part 2

Reports and charts by Shane Mulo and Simon Newett

### Operations: AVOMAN's "Central Station"

A new buzzword has been bouncing around the AVOMAN team during the development of the 1997 AVOMAN prototype—Operations. It's the name given to the latest feature in AVOMAN and it will greatly simplify both the way you get recommendations and the way you can record your jobs. Those who currently use the 1996 AVOMAN prototype will know that the process of getting a recommendation is fairly simple; however, there is quite a bit more work involved in translating a recommended rate into a job record after the job is done.

The '96 prototype's planner simplified the process of recording repetitive jobs, particularly pesticide sprays, but since the rate and composition of each fertiliser application is usually different, a new job button has to be defined each time a new rate or fertiliser is used. While some users really liked the planner approach, it became obvious from the training sessions and the annual survey that many users found it difficult to use.

The AVOMAN team put their heads together and consulted a number of enthusiastic growers to come up with a system that would integrate the best aspects of both the planner and recommendations into a system that was both quick and easy to use. The following features were also added to the wish list:

- Display of more than one recommendation at a time.
- A method of balancing elemental requirements (particularly for NPK).
- Combining the N, P & K requirements so that the most appropriate blend can be suggested.
- A simple way to turn a recommendation into a record once carried out.
- A reminder facility (for future jobs).

The operations section in the '97 prototype does all of this and more. The development team refer to it as, "central station," with good reason as operations are now at the heart of most AVOMAN activities.

### How operations work

Figure 1 shows one of the screens from the new operations section. There are two

sections—details (on the left) and the recommendations grid (on the right).

Users of the '96 prototype will notice some familiar things in the details section which have come across from last year's version (e.g. method, product, rate and units). The right hand side of the screen however replaces the recommendations screen from last year's prototype and as you can see it is completely new.

The changes have been made with more integrated farm management in mind. In most cases, the logic behind the recommendations is the same; however many growers will appreciate the changes made to some of the recommendation rules, particularly those in West Australia whose needs are sometimes different from those on the East Coast. One of the biggest differences between the new recommendations compared with last year's is how the results, and in particular timing, are displayed. You may recall that last year's recommendations were based on a twelve month application schedule and the timing

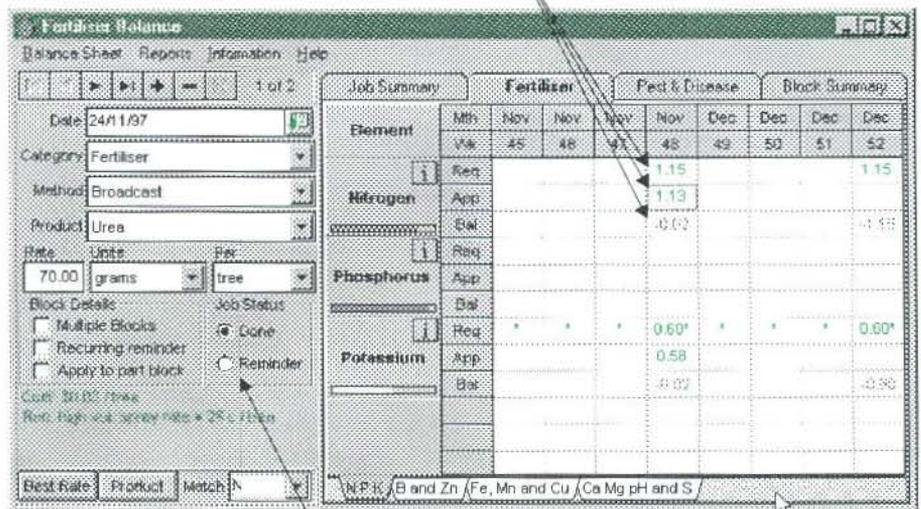
was referred to descriptively. This year recommendations are calculated on a *weekly* basis and the timing is obvious by the presence of an entry in the appropriate week cell in the recommendation grid. The timing of a recommendation (and thus when it appears in the grid) is governed by the logic of the recommendation and is linked to one or more growth events for that block. It is therefore important to keep the growth cycle up to date (refer to notes on the dynamic growth cycle on pages 12 and 13 in the September 1997 issue of Talking Avocados).

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All AVOMAN and other technical articles and reports published in this magazine are sponsored by the HRDC and the avocado industry.

Figure 1. The new Operations section in AVOMAN showing "details" on the left and the N, P & K "recommendation grid" of the Fertiliser page on the right.

Red, blue & green numbers reflect amount required, amount applied & the balance respectively



↑ Details  
Select "reminder" or "done" status here

↑ Recommendations grid



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Eight weeks of recommendations are visible on the screen at any one time but other weeks can be seen simply by changing the date in the display on the main toolbar or using the scrolling buttons on either side of it.

In order to present the recommendation results this way, all of last year's user defined parameters (e.g. root rot status, crop load, leaching) have been moved to the block information section of the program. You can enter and update the information as it changes there rather than each time you require a recommendation (see figure 2).

This new way of recording these parameters also allows this information to be retained as a historical record because it is linked to the date that appears here. Each weekly recommendation in the grid is therefore generated from its own set of parameters giving AVOMAN the ability to accurately match the requirement to the conditions existing on the farm for each week.

You can see the results of this when you look back and compare what you applied with what AVOMAN recommended for a given week—the weekly rate now adjusts automatically when parameters such as leaching, leaf analysis level or root rot status change from one week to another.

Fertiliser, pest and disease recommendations are organised on a number of pages. Up to four nutrients or up to six pests and diseases can be displayed on one page.

There are several benefits to this approach. First, it is obvious from Figure 1 that you can see collective requirements for more than one element or pest and can quickly identify overlapping requirements. In the case of N, P and K, AVOMAN can also pick a fertiliser blend which best suits all three elemental requirements in any given week. Second, as results are shown weekly, it's easy to see what jobs are due for the current week and plan them all in a coordinated way.

Figure 3 shows the job list for the week selected which is displayed when the "job summary" tab is selected. This information can be printed and now replaces the job sheet in the last prototype.

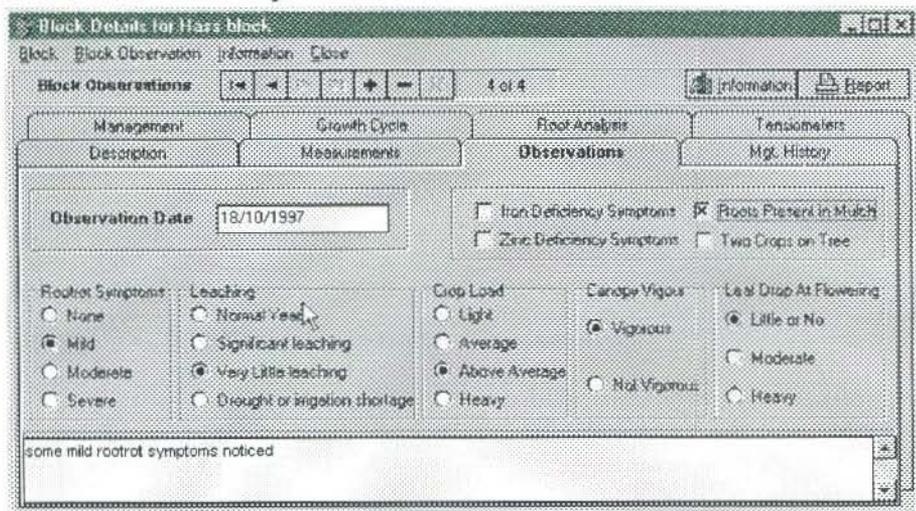
In the recommendation grid, a requirement that AVOMAN recommends will appear as a red number or symbol. To turn a requirement (red number) in the grid into a practical recommendation, you simply select the cell for the desired week and element, pest or disease in the grid, then move your mouse across to the left hand side of the screen and click the add (+) button.

As AVOMAN already knows most of what is required for that week, it will fill in most of the details for you such as job category (fertiliser, fungicide etc.) and rate once you have selected a method, product and units. In this version you also have the option of altering the date or rate yourself if you want to do something different from what AVOMAN is suggesting.

Once you are happy with the details of a recommendation all you need to do is select the "reminder" option and AVOMAN will automatically record all of your details as a reminder. This will also trigger a reference to it in the new planner (more about this in the next issue). Once the job has actually been done you have the opportunity to update the details (e.g. rate and date) before selecting the "done" button. This changes it from a reminder to a historical record, which means it will now show up when you produce one of the new reports available in AVOMAN such as the fertiliser application summary or the spray diary.

When a job has been recorded a blue and green number (or symbol) will appear in the recommendation grid. The blue number represents the rate you plan to apply or have applied for that week and the green number is simply a weekly balance which AVOMAN calculates by subtracting the tree requirement (red number)

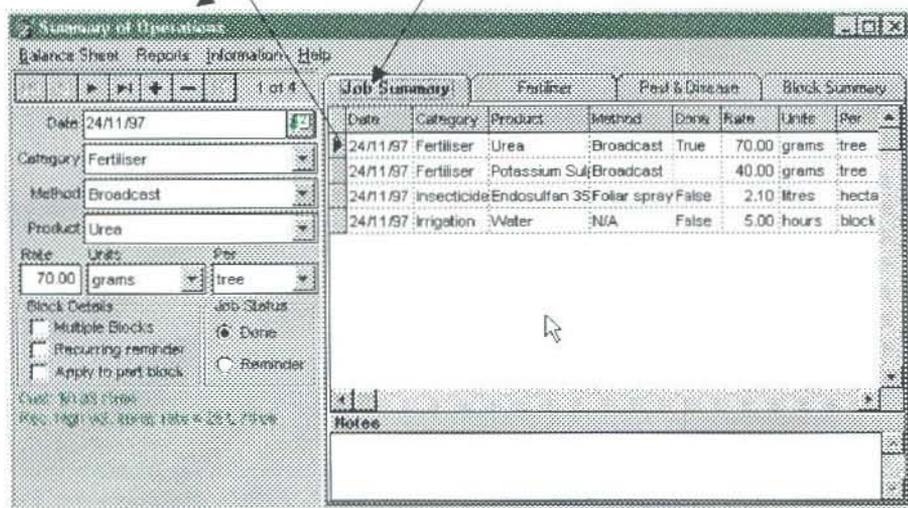
**Figure 2. One of the screens in the Block Information section where user defined parameters are now set.**



**Figure 3 The new Operations section in AVOMAN showing (on the right) the job list for the week selected.**

The details on the left are for the job selected with the small arrow on the right

Select the Job Summary tab to display the job list for the week



# Internal Quality Of Avocados In Brisbane And Sydney Retail Outlets

A. Story, *Story Horticultural Services Pty Ltd, Toowoomba*, and T. Rudge, *Rudge Produce Systems Pty Ltd, Melbourne*

## Introduction

A survey of retail outlets in Brisbane and Sydney was undertaken as the final activity in a three year project titled, "Improving the management of avocado quality during marketing." The project was funded

from the applied rate(s) (set by you) for that week. A negative green number therefore indicates an undersupply and a positive number an oversupply.

The units used for rates in the grid are universally expressed in grams of element per square metre of canopy area. Do not be concerned about this unit because it is the units you set yourself on the left of the screen that you will be using in the field. The units on the right are essentially to show you first if something is required and second how closely your choices on the left of the screen have matched the requirement. If you have elected to accept the rate that AVOMAN presents you with on the left it will match the requirement either very closely or exactly.

Although recommendations are calculated on a weekly basis, you may prefer to apply some fertilisers at different intervals. AVOMAN allows you to select a preferred application interval for all elements so that requirements can be expressed say monthly rather than weekly. This aspect is discussed further in the AVOMAN Tips section.

As a job is done, you may wish to record additional information. This may include notes, labour and machinery costs, wind speed and direction and employee details. You can set a preference to have AVOMAN display a screen to allow you to enter this information at the time of recording a job. You may also wish to record the same job on multiple blocks or set multiple recurring reminders for a single block. All of these functions can be done through this screen and will be explained further in the next issue.

The software training sessions on the new prototype which begin in early December and will of course cover all of these aspects.

The next article in this series will highlight the new planner.

by the Australian Avocado Growers Federation and the Department of Primary Industries and Energy Agribusiness Program.

The retailing of avocados has changed markedly over the duration of the project. The majority of outlets now present avocados for sale in a ripe or "sprung" condition rather than as a hard, green unripe fruit as in the past. This has major implications. Fruit handled ripe or sprung is extremely sensitive to bruising and could be likened to a strawberry in this regard. Retail outlets have needed to upgrade handling and display procedures to accommodate the increased susceptibility to bruising.

With the information collated from previous surveys, the avocado industry has been able to develop a profile of the internal quality of avocados at retail level (see next article). Market research undertaken during the project indicated that consumers viewed avocados as a high-risk purchase and were prepared to accept a proportion of unacceptable fruit in purchases.

Previous retail surveys have indicated a high level of internal quality defects in avocados. The defects noted included anthracnose, stem end rot, bruising, chilling injury, hard lumps or stones, dark streaking in the flesh and abnormal ripening.

## Procedure

A comprehensive survey of metropolitan retail outlets in Brisbane and Sydney was undertaken in August 1997 to monitor the nature and extent of internal quality problems in avocados.

Fruit was bought from each of the retail outlets and placed immediately into single layer trays with inserts to minimise further bruising. The suburbs in each city were selected on a socioeconomic basis and were the same suburbs sampled in the previous surveys. Where possible, three retail outlets were sampled in each suburb: a supermarket, a fruit barn and an independent fruiterer.

At each retail outlet, a sample of 20 ripe or sprung Hass avocados was purchased from the retail display. Fruit purchased was representative of what was on display, appeared sound and would likely be selected by a consumer. Information on the display position in the store, the fruit

history, the brand, packer and grower was noted if available. In addition the size of the fruit, its class and price were recorded.

Each avocado, when determined to be ripe (as indicated by the firmness of each fruit) was cut into thin wedges to assess its internal quality. The form, incidence and severity of defects were recorded. The severity was divided into 4 categories: slight, mild, moderate and severe, with category guidelines provided for each defect.

An overall rating of acceptability was recorded for each fruit. A fruit was rated as unacceptable if a moderate or severe defect was present.

## Results

In Brisbane, a total of 28 lots of Hass avocados were sampled from 25 retail outlets. In Sydney, 24 lots of Hass avocados were sampled from 24 retail outlets. Only the Hass variety was surveyed because this variety was available across multiple outlets. The number of fruit per lot varied from 7 to 20 (mean 18.5).

The stage of ripeness at which avocados are purchased from the wholesale market is an individual business decision. Only 30% of Sydney fruiterers routinely source control ripened fruit, yet 57% of the fruit barns and 100% of the supermarkets routinely use sprung or ripe fruit, which has been control ripened. There is still a strong preference by Sydney independent fruiterers to ripen avocados themselves. Fruiterers top up by purchasing small quantities of ripe or sprung fruit (from the markets) if demand for ripe fruit exceeds the rate of ripening in the green stock they rotate.

Brisbane retailers appear comfortable in routinely purchasing ripe or sprung fruit with 75% of greengrocers sourcing ripe or sprung avocados (approximately 50% in 1996), 67% of the fruit barns and 100% of the supermarkets. This is a marked increase on the previous surveys in Brisbane and reflects a response to the project's message to source control ripened fruit for the retail level.

This survey did not find any fruit lots totally free of internal quality defects in either Brisbane or Sydney. The number of defect free fruit per sample has improved in Sydney from 30% in 1993 to 50% in

1997, Brisbane showed that the proportion of defect free fruit per sample dropped from 48% in 1995 to 41% in 1997, at the time of sampling.

In Sydney, the number of avocados with unacceptable internal quality (major problems) was half of that found in 1993 whilst in Brisbane the incidence fell by 35%. However, the number of fruit with minor internal quality problems in Brisbane increased to 44% in 1997 (as compared with 29% in 1995). In Sydney, the incidence was the same.

The Brisbane survey showed that the level of Hass avocados with unacceptable internal quality is similar at each of the three types of retail outlets. In contrast to survey results in 1995, Hass fruit purchased from supermarkets were of lesser internal quality than fruit purchased from either fruit barns or independent fruiterers, with higher levels of minor problems and less fruit defect free. Purchases from fruiterers had the highest proportion of fruit free of any internal defects.

In Sydney, there was a higher incidence of unacceptable internal quality in purchases from a supermarket (26%) than either a fruit barn (19%) or a fruiterer (17%). Fruiterers provided consumers with the highest proportion of defect free fruit and less minor problems whilst the supermarket and fruit barn were on par in both areas.

When the incidence and severity of individual internal quality defects was analysed, it showed that bruising (34%) was the major quality problem in Brisbane. Minor bruising occurred in 20% of fruit whilst 14% of the sample had a major level of bruising that rendered fruit unacceptable. This is comparable in quantitative and qualitative terms with the survey's findings in 1995.

Of concern was the increased incidence of Anthracnose (up to 26% from 10% in 1995). Half of that was of slight or mild severity. Stem end rot (6.8%) was around the same level as in 1995 (7.0%), and was mainly present as a minor defect.

There was a significant increase in the incidence of lumps or stones in the flesh of avocados sampled. In 1995 this was recorded at 4.9% but in 1997 it rose to 12.5%.

Chilling injury was uncommon (0.8%) and at lower levels than observed in 1995 (5.5%). No incidence of dark flecking of the flesh was detected in Brisbane (as compared to 2.3% in 1995).

In Sydney, bruising was again the main cause of internal quality problems (40.2%). In the original surveys in 1993, flesh browning (including bruising) was found to be 26.4%. This was higher than

that found in Brisbane. Nearly half of the fruit had an unacceptable level of bruising.

### Discussion

The survey revealed that the extent of internal quality problems in avocados purchased from retail outlets in Brisbane and Sydney remains high.

Sydney consumers could expect 50% of Hass avocados purchased to have some form of defect (30% with minor defects and 21% with major defects) that render them unacceptable. Of greater risk were purchases in Brisbane where only 41% of purchases would be defect free with a high proportion of purchases being acceptable but with minor defects (44%) and 21% being unacceptable due to major internal quality defects.

In both cities, the traditional fruiterer was able to provide a higher proportion of defect free Hass avocados at the point of retail sale. This represents a turn around in Brisbane where the supermarkets were the most likely to present defect free fruit in 1995.

Bruising was the most common defect in both locations. Of particular concern was the high incidence of severe or major bruising which rendered the fruit unacceptable.

Much of the bruise volume was found in one large bruise located at the base of the fruit, on an angle, reflecting the fruits positioning in the tray insert. There were also examples of bruising at the stem end due to a more vertical orientation of fruit in the pack and subsequent lid compression due to insufficient depth in the tray. There is an urgent need to review the performance of the packaging used to distribute ripe and sprung avocados and to clearly identify where in the distribution chain this particular form of bruising is occurring.

Anthracnose is still a quality issue with Hass avocados. Whilst the incidence was reduced in Sydney, it had increased in Brisbane, although more frequently evident as a minor (rather than major) defect. Any fruit which showed advanced symptoms of anthracnose was not purchased for the purpose of the survey, but may have been present in the retail display.

Management strategies for this disease need to be ever vigilant as it is an ongoing and underlying quality defect with many fruit. When present, anthracnose tended to affect several fruit within the sample. There were many examples of grower lines where anthracnose was not evident in the sample.

Of surprise was the increase in the incidence of hard stones or lumps in the flesh of the fruit. A noticeable increase was

detected in Brisbane this year whilst Sydney's levels reflected a slight increase. Again there was a linkage between sample lots and this defect. Many fruit only had one or two stones (minor defect), but there were some samples which had several stones per fruit (5 or more) that classed them as unacceptable.

### Conclusion

Avocados continue to present a challenge to the industry to ensure that only sound fruit of acceptable internal quality reach the consumer. With an increasing proportion of retailers sourcing control ripened fruit, the management of bruising remains an ongoing concern.

The role of packaging in effectively protecting fruit when in a ripe or sprung condition, needs to be urgently reviewed. This is based on the high incidence of localised bruising observed in both Brisbane and Sydney.

Anthracnose continues to pose problems though it tends to be sample specific, reflecting the latent nature of the disease and its relationship to individual sources of supply. The increased presence of hard lumps or stones is another production-based issue.

There are still reasonably high levels of minor defects in Hass avocados purchased in Brisbane and Sydney. This presents an opportunity to improve the handling and distribution of the fruit so that this can be shifted to a defect-free status. Apparently there are still many areas for improvement, indicating the need for the industry to adopt a holistic approach from paddock to plate. Each step in the movement of avocados from the tree to the plate must be managed correctly for the industry to fully capitalise on the unique marketing position it holds with the consumer.

### Recommendations

- Review the effectiveness of existing packaging styles and packing methods in relation to protecting ripe and sprung avocados from bruising.
- Continue to provide information to anyone who is part of the "paddock to plate" continuum with a focus on best practice in handling at all times rather than at any one particular stage in the marketing system.
- Growers need to recognise their direct influence on the level of anthracnose and hard lumps/stones in avocados.
- Continue to monitor the internal quality of Hass avocados to maintain the industry's profile on quality reaching consumers.

## Wholesale/Retail Project Concludes

By Anne Story, Story Horticultural Services Pty Ltd, Toowoomba

With over 200 industry personnel passing through its national training workshops, the AAGF's, "Improving the Management of Avocado Quality During Marketing," project has now concluded.

The concerns about poor consumer confidence in avocados identified in the early '90s triggered this project. Now, some four years later, the avocado industry has experienced profound changes in the handling of avocados at wholesale and retail levels.

Consumers wanted ripe avocados and to deliver, the industry had to have a major change in attitude and handling practices. The challenge was to ensure that the consumers received ripe avocados of high (internal) quality.

The industry has moved from a tradition of handling and marketing hard green fruit to one where the majority of wholesalers now control ripen fruit to meet retail and consumer demand. This project has initially provided the awareness and subsequently the support necessary for this significant change in avocado handling to have occurred in such a short time frame.

The project proved very timely and increased the awareness of the consumer's requirements and the use of controlled ripening as a technique to deliver on these requirements.

After survey findings early in the '90s reported alarmingly high levels of internal quality problems in avocados, a series of monitoring surveys were included in the project design. The defects noted included anthracnose, stem end rot, bruising, chilling injury, hard lumps or stones, dark streaking in the flesh and abnormal ripening.

Scott Ledger in a 1993 report before the project started, found rots to be the major problem. At that time, controlled ripening was not a common practice in Sydney.

The 1995 Brisbane retail outlet survey identified that there were still significant internal quality problems but that the majority of these were related to physical injuries (bruising) as a result of handling practices during distribution rather than rots. Controlled ripening is recognised as an effective means of controlling rots in avocados and in 1995, Brisbane was the most advanced of all locations in using controlled ripening on avocados.

The retail survey results reflected that Brisbane was rapidly embracing the move to controlled ripening of avocados but that

the pace of change in handling practices for ripe fruit at retail level was slow. The 1995 survey showed the benefits of the reduced rot levels but identified the need to target retail display and handling procedures to reduce bruising in particular.

The final surveys in 1997 in Brisbane and Sydney indicated that there was still work to be done to reduce the level of bruising which remained the predominant internal quality defect. Of concern was a consistent major bruise that appeared in the same position on fruit sourced from different suppliers, different retailers and different States. This indicated there is a problem in the distribution of ripe avocados that may relate, independently or collectively, to packaging, transport and/or the stage of ripeness. This requires urgent attention.

Avocados remain a high-risk buy with 50-60% of consumer purchases displaying some form (minor or major) of internal quality defects. Sydney consumers could expect 50% of Hass avocados purchased to have some form of defect (30% with minor defects and 21% with major defects) that render them unacceptable. Of greater risk were purchases in Brisbane where only 41% of purchases would be defect free with a high proportion of purchases being acceptable but with minor defects (44%) and 21% being unacceptable due to major internal quality defects.

Although bruising is the most predominant defect, the levels of anthracnose present in the sample, merit attention in both Brisbane and Sydney. This further confirms rots remain a quality issue with avocados. Whilst the incidence was reduced in Sydney, it had increased in Brisbane, although more frequently evident as a minor (rather than major) defect. This is likely to be, in part, due to the positive effect controlled ripening has in relation to disease control.

Any fruit that showed advanced symptoms (external indications) of anthracnose were not purchased for the purpose of the survey, but may have been present in the retail display. Management strategies for disease control need to be ever vigilant, as it is an ongoing and underlying quality defect with many fruit. When found in the survey, anthracnose tended to affect several fruit within one sample. There were many examples of grower lines where anthracnose was not evident in the sample.

Of surprise was the increase in the incidence of hard stones or lumps in the flesh of the fruit. A noticeable increase was detected in Brisbane this year whilst Sydney's levels reflected a slight increase. Again, there was a linkage between sample lots and this defect. Many fruit only had one or two stones (minor defect), but there were some samples which had several stones per fruit (5 or more) that classed them as unacceptable.

There was little evidence of chilling injury or black streaking of avocado flesh compared with previous surveys.

Avocados continue to present a challenge to the industry to ensure that only sound fruit of acceptable internal quality reach the consumer. With an increasing proportion of retailers sourcing control ripened fruit, the management of bruising remains an ongoing concern.

The results from these surveys reflect how important it is to monitor at the retail level. They provide valuable feedback on the status of internal quality as well as identifying problems that may otherwise not be apparent without this type of cross-section analysis of avocados at the retail level.

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# From Seed To Tray - Some Field Practices To Improve Avocado Fruit Quality

*Edited version of a paper presented at Conference '97 by A.W. Whiley, P.J. Hofman and L.M. Coates, Queensland Horticulture Institute, Queensland Department of Primary Industries*

## Introduction

The avocado evolved in the highland subtropical to tropical areas of Mexico, Guatemala and Honduras, where it grows as a rainforest sub-story species. Three ecological races of avocado are recognised: Mexican, Guatemalan and West Indian. These races freely hybridise, giving rise to genotypes with adaptation from cool semiarid to hot, humid tropical lowland climates.

Commercialisation of the avocado has resulted in production across a range of environments, where cultivars have been selected to suit specific conditions. Our interest is in cultivars developed from the Mexican and Guatemalan races which are commercially important in Australia, Chile, Israel, South Africa and the USA (California).

Production in these countries occurs in two major climatic zones: cool and semiarid with winter-dominant rainfall, e.g. California, Chile, Israel and southern Australia, and subtropical with summer-dominant rainfall, e.g. eastern Australia, Mexico and South Africa.

Each of these climatic zones has both advantages and disadvantages for fruit production. For instance, fruit yields are generally lower and less reliable in the cool and semiarid areas compared with subtropical regions but pests and diseases are less prevalent and tree growth less vigorous. Possibly as a consequence, fruit from the cooler environments are generally of better quality at harvest and at the end of the marketing chain.

Most of Australia's avocado production is sold on the domestic market, but there is a growing realisation that export markets need to be developed to maintain profitability. The New Zealand industry also markets avocados in Australia, mainly in the summer months when local supplies are low.

The total number of avocado plantings in Australia has increased by 60% over the last six years. In addition there has been a similar trend in New Zealand with a subsequent increase in fruit from this country being marketed in Australia. Thus, increased production from a growing tree

population in both countries will put greater pressure on the Australian market over the next five years.

In Australia, fruit quality has been identified as a major factor limiting market development. For example, research has shown that over 40% of consumers were dissatisfied with avocados they had purchased, while 53% of consumers said avocados were unsatisfactory when served. Black or brown flesh was the most common cause for dissatisfaction.

Several extensive surveys on the quality of avocados presented for sale in major retail outlets in Sydney in 1993 found that 14-25% of ripe fruit were unacceptable, mainly due to anthracnose, stem-end rot, chilling injury, and flesh browning attributed to bruising. The problems were greatest with 'Hass', probably because this cultivar is often sold in an overripe condition, which allows greater expression of defects.

Chilling injury was most prevalent at the end of summer when New Zealand 'Hass' dominated the market. It has been suggested that retailers held these high-priced fruit too long.

Ongoing programs have been implemented to educate wholesalers and retailers on handling procedures to reduce spoilage of avocados; however, this is unlikely to eliminate the "abuse" that occurs to the fruit throughout the marketing chain.

A more holistic approach is required, and we believe that, strategically, the industry should be investigating methods of producing more robust fruit that are better able to handle stress beyond the farm gate.

This article discusses how this might be achieved. We have mainly confined our comments to 'Hass' because of its dominance in the Australasian market.

## In Pursuit of Quality

It is an accepted principle that fruit quality reaches its peak at the point of picking. There are no postharvest techniques that can improve the quality beyond that achieved at harvest. Thus, it is important that management strategies be used during production that will provide the quality of fruit that consumers demand.



**Tony Whiley presenting his paper at Conference '97**

For avocado, the main quality criteria are shape, size, colour, flavour, flesh texture, internal disorders, rots and skin blemishes (rubs, insect stings, etc.). Each sector of the consumer market has specific requirements for these characteristics, and will increasingly demand that the quality be consistently at the level they require. Lower quality, and especially inconsistency in quality, will negatively affect repeat purchase. Orchard management strategies should be implemented/developed to achieve these market requirements of specific quality and consistency.

## Fruit shape

Although fruit shape is not an important fruit quality parameter, nevertheless long-term exposure of consumers to a specific cultivar, especially one as dominant in the market as 'Hass', establishes a norm for fruit shape. Departures from this norm usually result in loss of recognition



*The articles on this page are sponsored by IIRDC and the avocado industry.*

leading to buyer resistance. While fruit shape is highly interactive with the environment, and hence generally beyond grower control, there are management factors which directly contribute to shape at harvest.

Deficiencies of boron and zinc, particularly during early fruit growth, cause fruit distortion that can result in a high rejection rate at harvest. Mature summer leaf concentrations of these micronutrients ideally should be 50-60 mg kg<sup>-1</sup> for boron and 40-50 mg kg<sup>-1</sup> for zinc.

Mid-bloom foliar sprays of paclobutrazol (Cultar®) in Australia and paclobutrazol and uniconazole (Sunny®) in Israel and South Africa are being used to increase fruit size and yield of 'Hass' avocados.

These plant growth regulators inhibit the biosynthesis of gibberellins and reduce the length:width ratio of fruit, thereby giving it a rounder shape. However, these changes in fruit shape are no greater than the variability typical of different environments, and would be unlikely to have any market impact.

### Fruit size

Fruit size continues to be a problem with 'Hass', particularly when grown in the warmer regions of the subtropics. Some management strategies that may alleviate the problem include:

- Manipulation by plant growth regulators such as Cultar® and Sunny®. These treatments have been shown to increase mean 'Hass' fruit size at harvest by about 13%.
- Early summer scoring of limbs has increased fruit size of 'Hass' but further studies investigating the long-term effects on tree health and productivity are required.
- Selective harvesting of larger fruit with a corresponding delay in harvest of smaller fruit has been shown to increase the overall size of 'Fuerte' and 'Hass' fruit grown in a cool, subtropical climate.
- Under-tree mulching can increase 'Hass' fruit size by about 12% in a cool subtropical climate. Mulching during the summer and autumn prolonged root growth and improved root health. This growth was considered a contributing factor to increased fruit size.
- Correction of boron deficiency through soil application of Solubor® has given an increase of 11-15% in 'Hass' fruit size in Australia. In South Africa, a 10% increase in fruit size was found following soil applications of

boron to 'Hass' trees. An increase in 'Hass' fruit size in trees grafted to 'Duke 7' was also reported when foliar nitrogen (4.5 g/tree) and boron (30 mg/tree) were applied when the first flowers opened. In these trees, leaf nitrogen (1.17%) and boron (23 mg kg<sup>-1</sup>) were sub-optimal prior to treatment.

- Cross-pollination has been suggested to increase avocado fruit size. However, studies found that 'Hass' outcrossed to 'Ettinger' produced larger seed but there was no increase in mean fruit size. This may have been due to the study being conducted on young trees (5-years-old) and fruit size benefits may occur as trees age and fruit size becomes a greater problem. Longer-term studies are required in this area.

### Colour

Consumers most easily identify 'Hass' with its change in colour from green to black as the fruit ripens. The consumer generally considers the fruit ready to eat when the skin is fully black. However, the black skin colour may be a negative feature of 'Hass', since it can mask fruit defects that remain undetected until the fruit is cut.

Large variations in the skin colour of ripe 'Hass' fruit have been reported, which have no apparent association with maturity at harvest. Light and crop nutrition, particularly nitrogen and calcium, are most commonly associated with skin colour of fruit. However, these factors generally influence the red, green and yellow colours, and there are no indication of their effect on ripe 'Hass' colour. Studies are required to investigate the causes of irregular skin colouration, followed by the development of strategies that promote more even colouring.

### Eating quality

Cultivar, growing conditions, and the stage of maturity at harvest determine eating quality in most fruits. Similar influences on avocado oil content have been identified and this is likely to have an impact on avocado flavour and texture because of the important effect of oil on these parameters.

Hard lumps in the flesh or firm, rubbery-textured flesh around the seed can occasionally affect texture. Information is scant on factors contributing to this uneven ripening. High rainfall immediately prior to maturity has been connected to the development of firm flesh around the seed. Using only deep, well-drained soils for

production in areas prone to high rainfall intensity periods, and maintaining a healthy root system, should reduce the incidence of uneven ripening from excessive rainfall.

For the most part, flavour and texture is under the control of growers through the selection of cultivar, and harvest time. High-price opportunities on early and late markets often see eating quality compromised, and with decreasing intervention by government authorities in the market place, the industry will need to guard against practices which damage consumer confidence in this way.

### Internal disorders and ripening

Internal disorders develop after fruit begin ripening and are generally more prevalent in fruit subjected to cold-temperature storage for extended periods. Cultivar maturity at harvest, locality, irrigation practices, rootstock and tree yield can all affect the susceptibility of fruit to internal disorders. While the relationship between these factors and physiological disorders are documented, little is known of the mechanism(s) that result(s) in reduced internal fruit quality.

It has been reported that heating of fruit in the field following harvest increases the incidence of internal discoloration. Fruit left unprotected in bins for a number of hours after harvest were 22°C warmer than covered fruit and had a corresponding 25% increase in the incidence of flesh discoloration when ripe.

Mineral content and balance have been related to the development of physiological fruit disorders. Calcium is the mineral most frequently implicated and there are numerous published reports of reductions in disorders in a range of fruit following improved calcium nutrition. In avocado, higher fruit calcium concentrations have been correlated with reduced chilling injury, flesh browning, pulp spot and vascular browning. In addition, there have been reports that potassium and magnesium concentrations, and in particular various ratios of fruit calcium, magnesium and potassium, are correlated to fruit quality. This is not surprising, as there is an interaction between these three minerals for uptake by roots.

A higher incidence of internal discoloration has been reported in 'Hass' fruit stored at low temperature for four weeks when taken from trees with low boron

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status. Boron is closely linked to calcium in plant nutrition, being physiologically active at similar sites in the plant.

It has also been shown that fruit with lower calcium concentrations ripen more quickly than those with higher concentrations do and also found that there were large variations in days to ripen between trees in the same block.

While management of calcium to optimise fruit concentrations would seem desirable, it is difficult to achieve. Calcium is absorbed through the roots and distributed to the rest of the tree mainly through the xylem (water conducting tissue).

Leaves, which lose the largest amount of water, accumulate more calcium than other organs. Thus, factors affecting fruit calcium accumulation are soil calcium concentrations, concentrations of other cations (because they compete for calcium uptake by the roots), tree vegetative vigour, water management, and possibly rootstocks. Calcium foliar sprays during fruit growth have little effect on internal concentrations in most fruit due to poor absorption by fruit, and lack of retranslocation within the tree.

Management of all factors influencing fruit calcium accumulation is essential for best results. Too much soil calcium may reduce the uptake of other nutrients including potassium, magnesium and boron, which are also implicated in fruit quality. Excessive vegetative vigour will increase the amount of calcium going to the leaves at the expense of the fruit. Water stress will have the same effect. Thus, a holistic approach to calcium management is required.

## Fruit rots

In subtropical climates, anthracnose and stem-end rot are the most important fruit diseases of avocado, which reduce eating quality. The anthracnose pathogen infects fruit during periods of extended rainfall and remains latent until the fruit begins to ripen. Stem-end rots may be systemic within the tree and grow down the pedicel into the fruit during growth. The susceptibility of fruit to disease is dependent on cultivar and fruit calcium concentration.

At present, control of these diseases is through a comprehensive field spray program with protectant (copper) fungicides followed by postharvest treatment with the systemic fungicide Sportak® (prochloraz). Orchard hygiene and postharvest temperature management also play an important role in disease reduction.

The current field control of anthracnose is only as good as the protectant coverage given to the fruit. A 14 or 28-day field spray program with copper oxychloride to selected trees in an unsprayed orchard provided a 70% reduction in fruit disease. When the whole orchard was sprayed with copper at 28-day intervals, protection increased to 91%, the improvement possibly due to reduced inoculum levels. In separate trials, postharvest treatment of fruit with prochloraz increased anthracnose and stem-end rot control to about 98%.

## The Continuing Problem!

We have reviewed proven strategies that will improve fruit quality. Growers have successfully implemented many of these, with resultant reductions in fruit deformity and disease, and increases in fruit size and eating quality. Yet, the avocado industry still has major problems with lack of consumer confidence in its product. Is there more to the story than meets the eye?

Consumer surveys identified anthracnose, stem-end rot, chilling injury and flesh browning as the major factors reducing confidence in fruit quality. While research has reported high levels of disease control with fungicidal programs (98%), the implementation of these programs at the commercial level will not be as effective.

Research procedures also make use of statistical analyses to reduce the background variability so that a true measure of the various treatments can be obtained. This luxury is not available to the commercial operator, who must work with the variation within the orchard.

Is variation between blocks and individual trees in the orchard of commercial significance? We believe the answer to this is most likely "yes", and supporting data is now available.

Considerable inter-tree variation in anthracnose infection within single rows of 'Hass' has been found, even though all trees were exposed to the same spray program and presumably the same inoculum pressure. For example, the average anthracnose rating for fruit harvested from a single tree varied from 7 to 57% within a single row of trees. While microenvironment effects may be a contributing factor to this variability, we believe there are stronger forces responsible for the variation.

## Is it in the Genes?

*"No factor of the avocado industry is more important than rootstocks, and there is no problem that we know less about, or which requires a longer time to solve".*

This statement was made in California when avocado commercialisation was in its infancy, but it could equally apply to Australia today. The power of tree manipulation through selective use of rootstocks or rootstock/scion combinations has long been recognised by other fruit industries and substantial gains have been made in fruit quality and yield through this approach.

Avocados were first introduced into Australia around 1850, and shipping traffic from the Americas ensured the establishment of a diverse population of seedlings in subtropical east coast regions. While representing all races, this pool of material was predominantly of Guatemalan and West Indian origin. Selections from this material were used to establish the first commercial orchards in Queensland (seedlings) and subsequently were used as rootstocks as improved cultivars from California gained in popularity.

Like any industry growing up in a hurry and without a sound knowledge base, rootstocks were obtained from many different sources with selection criteria based on availability and nursery performance. Unfortunately, little has changed with time and our knowledge of rootstock performance remains small. However, some research and diligent record keeping has provided insights into potential problems through indiscriminate use of genetically diverse material in orchards.

Mr Graeme Thomas (see article page 24) has kept detailed yield records over six years for 'Hass' trees grown on mixed, seedling rootstocks of Guatemalan/West Indian origin. His data have revealed large and consistent differences between the productivity of individual trees, with the best trees producing 400% more fruit than the worst trees over the period studied.

Dr Tony Whitley has reported rootstock effects on tree growth and physiology with 'Hass' grafted to seedling or cloned 'Velvick'—a Guatemalan selection. In these trees, an overgrowth of the scion compared to rootstock was detected when cloned 'Velvick' rootstocks were used. In contrast, the scion/rootstock interface in trees grafted to seedling 'Velvick' was near normal.

In *Pinus contorta* (a species of pine), scion overgrowth has been attributed to reduced movement of sugars from the top of the tree to the roots due to partial degeneration of tissues at the graft union. Similarly this has been found in avocado, where trees with a scion overgrowth (grafted to



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clonal 'Velvick') had higher starch concentrations in the top of the tree than where no scion overgrowth occurred (grafted to seedling 'Velvick'). It was also reported that rootstocks changed the percentage of flowering shoots in 'Hass' which produced new leaves in the spring, with trees grafted to cloned 'Velvick' producing about 20% and trees grafted to seedling 'Velvick' rootstocks producing about 40% of flowers with new shoot growth.

Rootstocks have been reported to influence aspects of fruit quality. It has been found that fruit from 'Hass' trees grafted to 'Duke 7' were rounder than fruit from trees grafted to 'G6' and 'G755C'. Also, fruit from low-yielding 'Hass' trees (those grafted to 'Barr Duke' or 'D9' rootstocks) developed more internal disorders in storage. Fruit from high-yielding trees are known to be of better storage quality than fruit from low-yielding trees in Israel.

The effect of rootstocks on mineral nutrition of fruit tree crops has been extensively reported, with selections in many crops being made to withstand adverse soil conditions. Studies with avocado have also demonstrated clear rootstock effects

on tree nutrition. For instance, researchers reported higher leaf calcium concentrations in trees grafted to Guatemalan compared to Mexican rootstocks. In contrast, trees on Mexican rootstocks had higher leaf potassium concentrations than trees on Guatemalan rootstocks.

Higher leaf boron concentrations have also been found in 'Hass' trees grafted to the Guatemalan rootstock 'Velvick' compared to those grafted on the Mexican rootstock 'Duke 7'.

Field observations confirm that under marginal soil boron conditions, trees grafted to Mexican race rootstocks have stunted growth and low yield compared to trees on 'Velvick' rootstocks. Also reported are higher leaf boron concentrations in 'Hass' trees grafted to 'Edranol' (a Guatemalan race cultivar) than those grafted to 'Duke 7'.

Thus, the influence of rootstocks on mineral nutrition may be a factor in the observed variability in anthracnose susceptibility, ripening and disorders, because of the relationship between fruit calcium and boron, and quality.

### Growing More Robust Fruit

To meet the marketing challenges of the future, a more robust product is required; a fruit that will better withstand the stresses imposed from the "shed to the plate", and a fruit that consistently and reliably meets consumer quality and price requirements. How is this likely to be achieved?

Effective control of anthracnose and stem-end rot still poses one of the greatest challenges to fruit quality. Protectant fungicides are effective when applied correctly but there are practical limitations in what they can achieve. For instance, prolonged wet weather can break the cover and prevent the application of new material, thus allowing a window for infection. This may occur several times throughout a season.

Attention to spray application techniques to optimise coverage is likely to result in some gains, as is the acceptance that a regular field program is required for 'Hass' because of its lack of immunity to anthracnose and stem-end rot infections.

The high level of variability in disease susceptibility and storage potential of fruit between trees urgently needs to be addressed. This is potentially the area of greatest gain for improvement in anthracnose and stem-end rot control, and storage performance and internal quality.

Although genetic solutions are long-term in both delivering results and in implementation, it is highly likely that the

solution lies with the development of rootstocks or rootstock/scion combinations that will enhance and improve the uniformity of tree nutrition.

The calcium connection warrants further investigation both on its effect on quality and its long-term management in the orchard.

In relation to other disease control strategies, studies of the antifungal compounds in avocado fruit may lead to opportunities to manage these potentially powerful and natural fungicides, which are found in high concentrations in the skin and flesh of unripe avocado fruit. For example, it has been shown that the naturally occurring antifungal compounds in peel of unripe avocado fruit completely inhibit germination of anthracnose spores (*Colletotrichum gloeosporioides*). However, these compounds are broken down during ripening, allowing latent infection structures of the anthracnose fungus located in the peel to resume growth and infect fruit.

There appears to be a correlation between the fruit concentration of antifungal compounds and the degree of anthracnose tolerance in avocado cultivars. In the anthracnose-susceptible cultivars Fuerte, Horshim, Wurtz, Rincon and Benik, the peel concentration of an antifungal compound in soft fruit was about one tenth that of the more resistant cultivars Hass, Nabal, Netaim and Pinkerton. Thus, the challenge is to maintain higher antifungal concentrations in fruit as they ripen, so that fruit are consumed before disease is excessive.

A number of different approaches to maintaining high diene concentrations are currently being explored, including various chemical, physical and biological treatments. For example, US/Israeli research has shown that diene levels can be maintained to some extent through the application of nonpathogenic strains of the anthracnose fungus to detached avocado fruit. Development of anthracnose symptoms in fruit was delayed as a result of this treatment, presumably due to enhancement of diene levels. Thus nonpathogenic strains can be used to "cross-protect" against normal pathogenic strains of the anthracnose fungus. We intend to explore this option in more detail.

In conclusion, it is important to remember that there are no easy answers to these problems, and they will only be solved through a holistic approach involving integrated management strategies.

## Glossary of Terms

<b>Biosynthesis</b>	making compounds within the plant.
<b>Cations</b>	nutrients which carry a positive charge, e.g. potassium, calcium and magnesium.
<b>Cultivars</b>	varieties.
<b>Diene</b>	a natural antifungal compound found in avocados.
<b>Genotype</b>	variety.
<b>Gibberellins</b>	naturally produced plant hormones which control shoot growth.
<b>Metabolise</b>	breakdown or digest
<b>Micronutrients</b>	trace elements such as copper, zinc, iron, manganese and boron.
<b>Pedicle</b>	fruit stalk.
<b>Phloem</b>	tissue in plants which moves sugars (bark).
<b>Scion</b>	grafted plants consist of two parts, the rootstock and the scion or variety.
<b>Xylem</b>	tissue in plants which moves water and mineral nutrients from the roots to the leaves and fruit.



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# Rootstock Influence on Yield of Hass Avocado

*An edited extract from a paper presented at Conference '97 by Graeme Thomas, Hampton via Toowoomba, Queensland*

The orchard yield of avocados in Australia has remained static for many years. With the lowering of returns, relative to the late 1970s, we, as an industry, need to address the reduced economic viability of production in Australia.

As a part of my management, I have individual yield records of all of my trees. The data clearly shows that some trees maintain very high levels of production, while others consistently yield small crops. All trees are grafted to seedling Guatemalan rootstock, are fertilised via fertigation, and have similar leaf nutrient levels. The highest and lowest producing trees have tested negative for sunblotch viroid and for the purposes of this comparison, data from trees significantly larger or smaller were discarded along with that from trees at the end of rows.

It is clear that the effects of rootstock are very large (416% between the highest and lowest yielding trees). The long-term economic benefit of selecting the best rootstock/scion combination for clonal propagation to improve our genetic base would far outweigh the initial costs in carrying out such a program. It is my belief that with such varied growing conditions (soil and climate) across our industry, it would be difficult to select a rootstock that would suit all circumstances. I would therefore strongly recommend that growers instigate a record-keeping program to identify their best producing trees for rootstock recovery to clone for use in future orchards.

## Introduction

From 1972-73 until 1995-96 the average yield for bearing avocado trees has been 36 kg/tree taken over the whole Australian industry. With a wide range of planting densities, it is estimated that this equates to about 7 t/ha.

From energy balance studies, Professor Wolstenholme estimated the theoretical sustainable yield of avocado at 32 t/ha. Dr Whiley has reported single year production for Hass on a block basis at 50 t/ha. However, sustainable yields from well managed Fuerte and Hass orchards in subtropical southeast Queensland are in the vicinity of 23-25 t/ha. It was concluded that such yields on a sustainable basis have reached the genetic limits of cultivars and

rootstocks (seedling populations) currently used by the Australian industry in subtropical climates.

I would expect that many of the trees grown in Australasia, are not recipients of best management practices and therefore will never attain their production potential. However, for those trees that are well managed, it is likely that genetic factors will restrict their production potential thereby limiting their economic performance.

The Australian avocado industry needs to examine the genetic composition of its trees if it is to remain competitive and viable in the future.

In this comparison I have addressed what I see as the factors causing variations in yield within a block of similar age trees. These are nutrition, irrigation, severity of root rot, virus/viroid infections, genetic variations in scion lines, tree size differences, end-of-row effects, and genetic variations in rootstocks. Management strategies have been developed to minimise the effect of these factors on production yet a significant variation in yield between trees is consistently recorded. Reasons for this result are discussed.

## Materials and Methods

Data presented in this article has been collected from my orchard located 30 kilometres north of Toowoomba in SE Queensland, on the edge of the Great Dividing Range (Longitude 152°E; Latitude 27°S; Elevation 667 m above sea level). The orchard slopes gently to the north and the soil is a deep (30 m), light-texture krasnozem. Natural rainfall (average 950 mm p.a., summer dominant) is supplemented with irrigation from 90 litre per hour, under-tree sprinklers (2 per tree) and scheduled by tensiometers. Irrigation water is drawn from bores.

Tree nutrition is serviced by decisions developed from regular soil and leaf tissue analyses with most fertiliser being applied by fertigation. Temperatures are mild with summer mean max/min of 27.6/16.6°C and winter mean max/min of 16.3/5.2°C. Temperature extremes are 39.2°C in summer and -4.4°C in winter.

The block chosen for comparative analysis was planted in October 1985 and consisted of 86 Hass trees grafted to Guatemalan seedling rootstocks planted 9x 9 m



**Graeme Thomas presenting his paper at Conference '97**

apart. Three high yielding and three low-yielding trees were selected from this block for the study. Replacement trees were excluded from selection, as were all trees on the ends of rows to remove the effects of light on crop performance. Trees significantly larger or smaller than the average were also not used in the comparative analysis.

In May 1997, leaf nutrient concentrations of trees selected for comparative yield analysis, were determined following the collection of 10 leaves per tree which were pooled for each category, oven dried and then analysed by standard techniques. Tree health was maintained by one injection per year of Fosject® using low-pressure syringes to control *Phytophthora* rootrot. Trees showing any visible signs of reduced vigour received a second injection treatment.

The orchard is in an area of low disease pressure. Yield reduction in avocado due to sunblotch viroid has been reported from South Africa. To reduce the likelihood of sunblotch effecting tree yields in this study,



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## TECHNICAL REPORT

high and low-bearing trees were tested for sunblotch viroid using the recently developed and highly sensitive PCR technique.

Harvesting in the orchard is assisted by the use of a cherry picker and individual tree yields have been recorded since 1991. This is done by picking into crates that hold 20 kg of fruit when full. Data are then recorded on a site plan and subsequently transposed to computer records.

### Results

All trees tested for sunblotch viroid produced a negative result. With the level of detection now possible using the newly developed PCR technique (1000 times more sensitive than previous methods), it is reasonable to assume that sunblotch is not present in the trees used for this study.

There was no real difference in leaf nutrient levels between high and low-yielding trees (Table 1). Most nutrient concentrations fell within the recommended critical concentrations though N and Ca were a little lower than target levels for Hass.

Annual production from high and low-yielding trees from 1991-1996 inclusive is presented in Table 2.

Based on data for the high-yielding group, production peaked when trees reached 8 years old. The decline thereafter may be due to shading, as trees grew taller and closer together. From 1991 the low-yielding group showed a pronounced biennial bearing pattern (based on mean

values); however, this was not seen in either the high-yielding trees or the overall block yields. From block yields for the six-year period of the study, production from the high-yielding group was 38% higher than the block average and 416% higher than the low-yielding group.

### Discussion

The data I have collected demonstrates a significant variation in yield characteristics of Hass trees growing within a block in a well-managed commercial orchard planted on a uniform soil type. There is cause for concern that production differs by 416% between the highest and lowest yielding groups of trees, but it also illustrates the potential for significant improvements in avocado yields.

The results suggest that the greatest source of variation in yield can be attributed to the use of seedling rootstock. In similar long-term studies with seedling rootstocks, it was found that outstanding individual trees of Hass produced 100% more than the average trees of the block where they were growing.

It was also demonstrated that the recovery and cloning of high-producing trees has the capacity to significantly improve orchard yield. The effect of elite, cloned rootstocks on Hass yield also has been previously reported. Clear differences in yield based on canopy efficiency, when

trees were grown in the absence of *Phytophthora* root rot, have been demonstrated between a range of clonal rootstocks when grafted to Hass.

The pronounced biennial-bearing pattern recorded for the low-yielding trees is of interest and suggests an imbalance in tree physiology.

Dr Tony Whiley was able to induce biennial bearing and lower cumulative yields in Fuerte and Hass trees by hanging fruit late. He also reported differences in tree physiology between high and low yielding trees and suggested that the rootstock/scion interface is likely responsible for differences in tree performance.

Advances in the understanding of nutrition, irrigation, disease management and general crop physiology over the last 10 years, should have resulted in a measurable improvement in production; however, this has not occurred (Table 3).

It could be said that industry is responsible for the lack of progress in yield improvement through directing funding to where results can be achieved in the short-term, thus avoiding the harder long-term commitment to genetic improvement through encouraging the development of improved rootstock/scion combinations.

Tony Whiley has said that rootstock improvement offers the greatest opportunity for advancing the performance of avocado in Australia. Indeed, if we examine what has been achieved in other agricultural industries from this approach we can be encouraged that this is a step in the right direction. For example, I would like to compare the performance of the avocado and SE Queensland dairy industry over the last 10 year.

The dairy industry in this region was inefficient when compared with other production areas in Australia and it was a case of improving efficiency or leaving the industry.

The impressive gains in production by this industry have been largely attributed to the improvement of the genetic base through herd recording and selecting for performance, both from the male and female stock. This has resulted in an 80% improvement in the production from dairy cows during the last 9 years whereas avocado production has remained relatively static—1986-87 avocado production is atypical of long term records (Table 3).

**Table 1.** Leaf analysis results comparing high with low-yielding trees taken in April 1997.

N	P	K	Ca	Mg	Na	Zn	Fe	Cu	Mn	B
(%)	(%)	(%)	(%)	(%)	(%)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
<b>High producing trees</b>										
2.21	0.18	1.1	0.6	0.58	0.01	44	77	596	77	102
<b>Low producing trees</b>										
2.25	0.17	1.0	0.6	0.63	0.01	47	76	416	60	93

**Table 2.** Yield comparisons between consistently high and low-yielding trees from 1991 to 1996.

Year	TREE DESCRIPTION								Block Mean
	High-yielding (kg/tree)				Low-yielding (kg/tree)				
	R21T8	R22T7	R19T5	Mean	R23T3	R20T8	R14T5	Mean	
1991	190	140	138	156	5	1	44	17	99
1992	183	107	219	170	82	21	95	66	124
1993	328	325	328	327	57	0	2	20	176
1994	195	263	228	229	106	61	80	82	170
1995	256	240	145	214	50	23	8	27	84
1996	160	302	225	229	145	110	70	108	172
<b>Total</b>	<b>1312</b>	<b>1377</b>	<b>1283</b>	<b>1324</b>	<b>445</b>	<b>216</b>	<b>299</b>	<b>320</b>	<b>825</b>
<b>Mean</b>	<b>219</b>	<b>230</b>	<b>214</b>	<b>221</b>	<b>74</b>	<b>36</b>	<b>50</b>	<b>53</b>	<b>138</b>

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On examining trends for avocado production over longer periods, it is clear that yields have not changed in the last 23 years (Table 4). However, it is interesting

to note the marked reduction in yield from 1976-77 to 1982-83, probably due to the "big wet" which affected many mature trees in northern NSW and SE Queensland.

**Table 3. Summary of production for the SE Queensland dairy industry and the Australian avocado industry for the year's 1986-87 to 1995-96. Data for avocado are only calculated from bearing trees.**

Industry	86/87	90/91	91/92	92/93	93/94	94/95	95/96
SE Qld. Dairy cow production (l/cow)	2856	4218	4411	4847	5228	5232	5108
Australian avocado production (kg/tree)	49.74	38.85	36.52	38.81	41.79	40.41	37.75

\* Source: QDAS summary of results for SEQ dairy farms

**Table 4. Summary of the Australian avocado industry statistics for the period of 1972-73 to 1995-96 (Source: Australian Bureau of Statistics).**

Year	Trees '000	Bearing trees '000	Production Tonnes	Yield/bearing tree (kg)
72-73	65	21	953	45.4
73-74	71	21	701	33.4
74-75	74	20	677	33.9
75-76	92	23	710	30.9
76-77	105	25	570	22.8
77-78	118	33	662	20.1
78-79	164	47	980	20.9
82-83	356	163	3355	20.6
83-84	425	202	5429	26.9
84-85	459	157	6200	39.3
85-86	492	173	7467	43.2
86-87	455	195	9700	49.7
87-88	450	217	9797	45.2
88-89	462	267	11081	41.5
89-90	472	304	11413	37.5
90-91	445	309	12005	38.9
91-92	450	316	11541	36.5
92-93	483	333	12925	38.8
93-94	600	402	16801	41.8
94-95	607	387	15640	40.4
95-96	712	448	16914	37.8

**Table 5. Projected cash returns from high and low-yielding Hass trees assuming all fruit was marketed.**

Year	High-yielding trees		Low-yielding trees		Block	
	Mean yield (t/ha)	Return (\$/ha)	Mean yield (t/ha)	Return (\$/ha)	Mean yield (t/ha)	Return (\$/ha)
1991	19.2	38,376	2.0	3,936	12.2	24,354
1992	20.9	41,820	8.1	16,236	15.3	30,504
1993	40.2	80,442	2.5	4,920	21.7	43,296
1994	28.2	56,334	10.1	10,086	20.9	41,820
1995	26.2	52,644	9.0	6,642	10.3	20,664
1996	28.2	56,334	13.3	26,568	21.2	42,312
<b>Mean</b>	<b>27.2</b>	<b>54,325</b>	<b>7.5</b>	<b>11,398</b>	<b>16.9</b>	<b>33,825</b>

## Economic Benefits

It is quite obvious that there are considerable economic benefits to be gained from planting an orchard from high producing trees. To put this into perspective, I have developed a simple exercise using an average wholesale price of \$2.00 per kg. I have assumed that the trees are planted at a density of 123 per hectare. From these parameters the mean of the high and low yielding trees can then be compared with the block average (Table 5).

From Table 5 it can be seen that the return per hectare for low-yielding trees is substantially less than for high-yielding trees. The other comparison to be made is the effect of the low-producing trees on the block average when compared with the high-producing trees (the block average is what was picked off all trees in the block).

When comparing yields in Table 5, reference should be made to the estimated Australian average production of 7 t/ha. Compared with the block average production in my orchard, there is an opportunity to substantially improve production firstly through the implementation of better management practices, and secondly by improvement of the genetic base of our orchards.

### As a grower, what to do?

If you are new to the industry, plant a wide variety of rootstocks including those that have some track history, e.g. Velvick and Duke 7. Make sure that the rootstocks have been identified and recorded according to their maternal source, by the nursery. Ensure, from local knowledge, that they include the best rootstocks for your area.

As these trees develop, record their yields, and any other pertinent factors such as grade percentages, growth characteristics etc. As your trees reach full production, remove low producing trees and replace them with clones of your high producing trees. If you are continuing to expand, select your highest producing trees to clone for your new blocks.

For established growers, the first step is to record yield. This can be done in a number of ways. The simplest technique is to rate each tree prior to picking. The trees are then marked according to whether they are poor, average or excellent producers. This can be achieved by means of colour-coded trunk marks. The same person should carry out the assessment.



*The article on this page is sponsored by HRDC and the avocado industry.*

## TECHNICAL REPORT

This system can work for all sized orchards. For smaller family run orchards, the system can be developed to record an approximate weight of fruit from each tree. Yield data need to be collected for at least three seasons to make an accurate assessment.

Once the high producing trees have been established, you have two methods available to clone the rootstock. These are:

- Cut down those trees below the graft. The rootstock will then sucker profusely. It is from this new growth, that you can clone your new rootstock. Prior to cutting your best tree, budwood can be taken and re-established, so as to reproduce the exact genetic replicate.
- By exposing some of the larger roots of the selected tree to light and cincturing

them, the root will then produce suckers. It is these suckers that you can then clone for your new trees. The scion can then be simply matched from the existing tree.

### Conclusions

During the last 25 years, our understanding of all factors relating to growing avocados should have substantially increased; however, we have not paid any attention to improving the rootstocks that we use.

The industry in both Australia and New Zealand at times has looked at clonal rootstocks. They are more expensive to produce and in many areas, the resultant yield was comparable, or in some instances, inferior to a nearby tree on a seedling rootstock. There were no perceived benefits to growing avocados on clonal rootstocks.

What clonal rootstock did you use? Was it performance tested in your region? Has it been proved to be the best rootstock for your management style? Answers to these question are needed if you are serious about improving productivity. They are questions that are answered from keeping records, and acting on the results.

Our research scientists are working towards the goal of finding the best general rootstock for a number of areas suited to Hass. Trials will further quantify the benefits of improved rootstocks and will identify those that are best suited to various conditions. This will benefit the industry, but it will be the activities of you, the growers, that can turn this problem of low production around. You need to keep yield records for a period of three seasons, and select that best combination of root and scion to be the basis of your new orchards.

## Avocado Research

*By Dr Tony Whiley, Queensland Horticulture Institute, Queensland Department of Primary Industries*

Research aimed at producing more robust fruit to withstand stresses imposed by the marketing chain is currently being funded by the Australian avocado industry through HRDC in two projects, "Avocado Canopy Health and Management" and "Field Management of Avocado Postharvest Diseases".

As the first criteria for robust fruit is healthy trees the "Avocado Canopy Health and Management" project is re-examining the effectiveness of Phytophthora root rot

control with phosphonate fungicides, looking specifically at different application techniques. Preliminary results from this work suggest that soil applications are not cost-effective when used on red basaltic soils. Other areas of investigation in this project are the development of pruning strategies during orchard establishment and for the maintenance of mature orchard canopies.

In addition, this project is evaluating the performance of varieties grafted on to a

range of identified rootstocks growing across all major production areas in the country. This is expected to produce performance benchmarks and extend the range of recommended rootstocks for use in Australia. Apart from cropping performance, the quality of fruit from the different genetic combinations will be carefully monitored. Genetic consistency using high performance rootstock/scion combination in orchards is the ultimate aim of this research.

The "Field Management of Avocado Postharvest Diseases" project is aimed at getting a better understanding of factors influencing the infection of fruit by anthracnose and exploring new options for the field management of this disease. Variability in host physiological factors such as fruit mineral status (particularly calcium) and natural antifungal compounds will be studied, along with methods for manipulating these factors to reduce disease. Dr Tony Whiley is leading the "Avocado Canopy Health and Management" project while Dr Lindy Coates heads up the "Field Management of Avocado Postharvest Diseases". There is strong collaboration between both of these projects to ensure that successful outcomes are developed for industry.

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