



Talking Avocados



The Australian Newslite

Vol 10 Number 4

December 1999



**Mary Ravello, AAGF Director and
Chairwoman of the Marketing Forum**

- Increasing Production and Quality
- Plant Growth Regulators
- Foliar Application of Phosphonate
- Quality at Retail Level

AUSTRALIAN AVOCADO GROWERS' FEDERATION

Table of Contents

PRESIDENT

Rod Dalton 07 5466 1316

VICE-PRESIDENT

Frank Moore, Pretty Gully 02 6666 1496

EXECUTIVE OFFICER & SECRETARY/TREASURER

Astrid Kennedy, P.O. Box 19 07 3213 2477
Brisbane Markets 4106 Fax 07 3213 2480

FEDERATION DIRECTORS

QUEENSLAND

Mary Ravello, Mareeba 07 4093 2126
Rod Dalton, Grantham 07 5466 1316
George Green, South Kolan 07 4157 7127
Henry Kwaczynski, Nambour 07 5442 1767
Charlie Eden, Mt Tamborine 07 5545 1224

NEW SOUTH WALES

Frank Moore, Pretty Gully 02 6666 1496
Barry Daley, Alstonville 02 6628 5532
Geoff Betts, Halfway Creek 02 6649 4404

SOUTH AUSTRALIA

Ross Richards, Renmark 08 8595 3178

WESTERN AUSTRALIA

Wayne Franceschi, Wangara 08 9776 1332

STATE ORGANISATIONS

ATHERTON TABLELAND AVOCADO GROWERS' ASSOCIATION

President Ron Knowlton 07 4092 1018
Secretary Dianne Wellington PO Box 304 07 4096 5030
Malanda QLD 4885 Fax 07 4096 6113

BUNDABERG & DISTRICT ORCHARDISTS ASSOCIATION

President Gunther Rehberger 07 4152 4559
Secretariat Phil Cheeseman, PO Box 45 07 4153 3007
Bundaberg QLD 4670 Fax 07 4153 1322

SUNSHINE COAST AVOCADO GROWERS' ASSOCIATION

President Walter Meyer 07 5478 9455
Secretary Larissa Meyer, P.O. Box 675 07 5478 9455
Palmwoods QLD 4555 Fax 07 5478 9869

WEST MORTON AVOCADO GROWERS' GROUP

Convener Rod Dalton, Sandy Creek Road 07 5466 1316
Grantham QLD 4347 Fax 07 5466 1497

TAMBORINE MOUNTAIN LOCAL PRODUCERS ASSOCIATION

President James McCulloch 07 5545 0081
Secretary Ruth Webb, 232 McDonnell Rd 07 5545 3677
Eagle Height QLD 4271 Fax 07 5545 3699

NSW AVOCADO ASSOCIATION INC.

President Geoff Betts 02 6649 4404
Secretary Phil Connor "Erin Glen" 02 6677 1455
Upper Burrumbidgee NSW 2483 Fax 02 6677 1455

SOUTH AUSTRALIA AVOCADO GROWERS' ASSOCIATION

President Colin Fechner 08 8541 2819
Secretary Greg Liebig, 791 Benlow Rd 08 8541 2174
Waikerie SA 5330 Fax 08 8541 2174

AVOCADO GROWERS' ASSOCIATION OF WESTERN AUSTRALIA

President Wayne Franceschi 08 9776 1332
Secretary Paul Callcott P.O. Box 96 08 9776 1332
Pemberton WA 6260 Fax 08 9776 1332

Calendar of Events 3

Australian Round-up 3

25% Of Growers Take Advantage Of Opportunity 3

From Your Federation 4

Talking Avocados Survey - Please Do Your Bit 5

Poor Internal Quality Fruit At Retail Level 5

AHC

Industry Manager's say 6

Endosulfan Records Alert 6

Have Your Say 7

Field Day Reports

Lesser Known Elements Of Soil, Growth And Success 8-10

Increasing Production And Quality In Avocados 11-15

Plant Growth Regulators In Avocados 15-17

FOR SALE 15

Technical Reports

Progress On The Use Of Foliar Applications Of Phosphonate For Control Of Phytophthora Root Rot 18-21

Retail Surveys Show Little Quality Improvement 22-23

Improving Fruit Quality To The Consumer 23-25

Fruit Quality And Nutrition - The Role Of Rootstocks 26-27

Update On AHC/HRDC Amalgamation Process 28

Editor and Publisher

Orf Bartrop

Advertising Manager

Astrid Kennedy

AAGF Coordinator

Frank Moore

Imagesetting

MacBureau, Currumbin

Printing

H.W. Inprint Pty Ltd, Devonport

ISSN 1039-2394

This publication is published using Corel Ventura and is distributed free to all Australian avocado growers and is available on subscription.

Australia - \$25 (\$48 for 2 years)

NZ - \$35 (\$68 for 2 years)

Other Overseas Countries \$40 (\$78 for 2 years)
Australian currency only.

Talking Avocados is the official magazine of the Australian Avocado Growers' Federation and in conjunction with the Australian Horticultural Corporation is published four times a year (March, June, September and December).

Subscription and editorial inquiries should be addressed to Talking Avocados, 28 Nicholls Street, Devonport Tasmania 7310, Australia. Telephone 03 6423 3230, if no answer try Mobile 0417 501714, Fax 03 6423 3917 or E-mail: orf@southcom.com.au

Advertising inquiries should be addressed to Ms Astrid Kennedy, Executive Officer, Australian Avocado Growers Federation, P.O. Box 19, Brisbane Markets QLD 4106. Telephone 07 3213 2477 Fax 07 3213 2480.

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

Calendar of Events

February

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

March

- ? **Sunshine Coast Avocado Growers' Association** - meeting. Date and venue will be advised. Contact Larissa Meyer Ph 07 5478 9455
- 15 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable Growers' Office, Barolin St. Bundaberg commencing 7.30 p.m.

April

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

May

- ? **Avocado Growers' Association of SA** - AGM and Seminar. Mr. Jan Toerien, a world leader in canopy management, will be the guest speaker. The date and place are still to be finalised and will be advised.
- 17 **Bundaberg & District Orchardists Association** - meeting Fruit & Vegetable Growers' Office, Barolin St. Bundaberg, commencing 7.30 p.m.

June

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

Front Cover:

Mary Ravanello, Chairwoman of the Marketing Forum.

Australian Round-up

Sunshine Coast

It has been a busy quarter. We have had a field day, our quarterly general meeting, AAGF's AGM and grower feed back and the world congress in Mexico, along with the usual industry events. As you might know, a consortium of growers from the Sunshine Coast, with "in principle" support from the AAGF, have presented a bid at the world congress for Australia to act as the host for the next world congress. Unfortunately, this bid was not successful and Spain was chosen as the next host.

Western Australia

Perth has almost finished harvesting and flowering is at an end. The season has seen some good yields. It is still too early to tell what the coming year will be like.

The South West has started to harvest and on average most orchards are down on yields compared with last year. Flowering was heavy; however it is still too early to tell what set has occurred.

During the month of September, Graeme Thomas was invited to the west. He held two field days and both were a great success. Graeme spoke to growers about nutrition, the great debate that he himself, George Green and Rod Dalton attended in New Zealand. He also had field walks where he pointed out to growers some pruning trials and then later showed slides of what he had done on his own farm.

November was also a busy month for visitors. Tony Whiley and Ken Pegg were

invited across and after months of ups and downs, they finally arrived. To get two of the world's best on avocados in one room at the same time was great. We held two dinner nights come slide presentations. Growers had the opportunity to ask questions and Tony and Ken were kept quite busy answering as many growers as possible. We hope that some time later next year we can have them back over again.

Royal Adelaide Show

The SA Avocado Growers again ran a stand at the Royal Show. Show goers were able to taste plain avocado pieces and various types of avocado dip. Avocado Boats were also for sale.

There was a lot of interest in avocados and we had our best year yet. We sold or gave away 760 trays of avocados and ran out of fruit mid afternoon on the last day. Our thanks go to all the members who spent from 1 to 11 days working hard. Our thanks also goes to Chiquita for supplying us with great fruit as well as up to three girls a day to help with demonstrations of ways to use our avocados.

As a new innovation this year, everybody working at our stand wore a dark green polo shirt as a type of uniform. The polo shirt has a half avocado with AVOCADO GROWERS circling it, and on the front is a half avocado. The back also supports a half avocado with the words "The most nutritious fruit on earth" written in yellow.

25% Of Growers Take Advantage Of Opportunity

Tall-growing avocado trees pose particular problems to growers who are keen to apply nutrient and pesticide sprays as efficiently as possible. The challenges involve setting up the sprayer correctly so that the spray makes contact with its target, whether it is a leaf, fruit, pest or disease organism and does not drift.

As a result of an R, D&E Subcommittee initiated project, the University of Queensland conducted workshops in the major avocado production areas to provide growers with hands-on experience in setting up a variety of sprayer types for optimal performance. The workshops were mostly joint exercises with the macadamia industry, which faces similar challenges.

Rather than aim solely at growers, the workshops included a "train the trainer" components which attracted equipment distributors, pest consultants and field officers who will provide ongoing expertise in each region.

A calibration kit was also left in each region to make it easier for growers to check their sprayers at regular intervals in the future.

Separate research on the best ways to manage the tree canopy, to allow easier spraying while maintaining productivity is currently underway. The project was funded jointly from Avocado and Macadamia levies and equated to \$75 per attendee. Your Federation regards this as money well spent.

From Your Federation

By Astrid Kennedy, Executive Officer



Annual Reporting Meeting

During the year your Federation Executive visited and met with growers in Mareeba, the Sunshine Coast, Mount Tamborine and central New South Wales.

Your Federation Board and its executive are growers and are to be congratulated for committing their time free of cost to travel, prepare and conduct such meetings.

These meetings present an excellent opportunity for those growers who choose to attend to discuss issues and provide feedback to the industry decision-makers. Twenty-one local and interstate growers attended your Federation's annual reporting meeting at Coff's Harbour in September. That was a 133% increase on the attendance at the 1998 meeting.

Annual General Meeting

The Annual General Meeting is a statutory requirement and was held in conjunction with a three-day Board meeting at Coff's Harbour. The meeting re-elected Mr Dalton to his fourth term as President and endorsed/elected the membership of the various Federation committees, details of which are listed below. Please note that these are your first point of contact when you want to receive or give information.

The AGM received the Federation's Annual Report and reports from the AHC and HRDC. The Federation report is reproduced as a separate document, as is the AHC/HRDC report. Both have been enclosed with this magazine.

Varieties Committee

| | |
|--------------------|--------------------------------|
| Chairman | Rod Dalton |
| AAGF Members | Mary Ravello Charlie Eden |
| Nurserymen | Peter Young Graham Anderson |
| Technical Advisers | Tony Whiley Ken Pegg |
| Registrar | Astrid Kennedy |

Research, Development and Extension Subcommittee

| | |
|-------------------|---|
| Chairman | George Green |
| Members | Frank Moore Graeme Thomas John Dorrian Alan Blight |
| Executive Officer | Astrid Kennedy |

Marketing Forum

| | |
|----------------------|---|
| Chairwoman | Mary Ravello |
| Members | Rod Dalton Ron Simpson Garry Poole Lindsay Tilbrook Barry Ross Jennifer Overland Ron Hansen Wayne Prowse |
| AHC Executive Office | Astrid Kennedy |

The AGM endorsed the nomination of Mr Paul Scram and Mr Ron Lawrence and they will join the Forum at its next meeting in December.

Portfolios

| | |
|---|-----------------------------------|
| Export Californian Avocado Society | Henry Kwaczynski by invitation |
| World Council | Henry Kwaczynski |
| Market Research Statistics/Industry Data | Mary Ravello Barry Daley |
| Communications Advertising and Domestic Marketing | Frank Moore Mary Ravello |
| Product Handling Farm Management Practices | Henry Kwaczynski Geoff Betts |
| Quality Assurance | Wayne Franceschi |

Avocado Defects Project

After a long gestation period this project is up and running. A steering group comprising of all the key stakeholders has been formed and met for the first time on 3 November 1999. By the end of the meeting, all the components of the project had been discussed and a lot of bugs ironed out. Two articles detailing the process and timetable are included in this issue of TA so I will not expand here; however I will report that the New Zealand industry has already contributed resources and has promised financial support.

New Zealand Fruit

A copy of a letter by Mr Dalton to New Zealand was published in the last issue of Talking Avocados. That letter complained about the quality of New Zealand fruit on the Australian market, especially in the latter part of the season. New Zealand's reply is reproduced on page 7 of the enclosed Annual Report.

As a result of the letters, Mr Dalton together with the R&D Chairman, George Green, and R&D Subcommittee member, Graeme Thomas, accepted an invitation to attend the New Zealand conference in

August. Quality was the topic for the conference and the three Australians were invited

specifically to participate in a debate on the subject "New Zealand has the World's finest avocados". The New Zealand team took a light hearted approach to the debate and used the opportunity to "roast" the Australians, while the Australia team took it seriously and presented facts and figures on how and why the New Zealand fruit was of poor quality.

Next World Conference

Following pressure from SCAGA and a group of Sunshine Coast growers, the AAGF agreed in principle to a bid being presented for the 2003 event. The bid was prepared and presented by the Sunshine Coast consortium and was defeated. World Conference 2003 will be held in Spain.

Peak Industry Forum

Industry representatives including the AAGF President attended a workshop in Melbourne on 11 November 1999 to discuss the concept of establishing a Peak Industry Forum. There was strong support for the proposal; however funding of the new organisation is presenting a challenge. The steering committee will be seeking firm funding commitments from industry in the near future.

E-mail

Your Federation now has an e-mail address. If you wish to contact the AAGF our e-mail address is: aagf@uq.net.au.

Compliments of the Season to all Talking Avocados readers from myself and the Directors of the AAGF.



Talking Avocados Survey - Please Do Your Bit

Talking Avocados is a free publication to Australian avocado growers and is predominantly funded from the Marketing and R&D levies.

In order to ensure the industry is receiving the required information and growers' levies and government matching funds are being wisely spent, the HRDC has made a readers' survey a condition for funding this magazine.

You will find a reader survey form on the back cover of the AAGF Annual Report. Please take a few minutes to complete the survey and return it to the AAGF before 31 December 1999.

Please return the form to:

AAGF Executive Officer
P.O. Box 19
Brisbane Markets QLD 4106
or Fax to: 07 3213 2480

Poor Internal Quality Fruit At Retail Level

Poor internal quality fruit at retail level continues to be a major challenge for the Australian avocado industry and indeed the Australian Avocado Growers Federation. Statistics tell us that consumers are prepared to pay premium prices for avocados when compared with other fruits in the full knowledge that they may discard 25% of their purchases because of poor internal quality.

The AAGF is addressing the issue of internal fruit quality by initiating a project to track fruit back through the chain to ascertain what happened to it at what stage. This project is not focusing on packaging (see page 23).

We are all aware that poor internal quality fruit at retail level can be attributed to a variety of causes and one of the most common and fundamental causes clearly evident in the September 1998 retail surveys was bruising. Once again, bruising can be attributed to a variety of causes, packaging, handling and stacking are a few that spring to mind. We know that in the commonly used cartons fruit is carrying weight and that airflow is poor. The latter requires the fruit to be air stacked by the wholesale agent to allow efficient ripening. This is extra handling that can be prevented.

The New Zealand avocado industry has initiated a project that may result in a carton designed specifically for avocados. To date they have put NZ\$150,000 into this project and whilst it is not yet finished, they are hopeful of a successful outcome. It is anticipated that prototypes will be trialed early next year.

The AAGF has no intention of re-inventing the wheel and awaits the results of the NZ packaging project. In the interim, the AAGF recommends that growers consider

moving to the P84 Xitex style carton. This carton has good ventilation and is made of a new more solid board.

Major manufacturers of cartons were invited to submit an article on their product for comparison purposes. The material supplied is reproduced below.

Amcor Fibre Packaging

P84 Packaging Trays - A fresh, new approach and environmentally safe.

Amcor Fibre Packaging's new P84 packaging trays have started a revolution in the fresh fruit and produce packaging world. The P84 design was patented in Europe and is produced in Australia under a licence agreement with the holder of this patent. The P84s credentials are impressive. Because of its triangular profile corners, it has high stacking strength. The P84 has a laminated corrugated cardboard and bonded waterproof membrane, which prevents moisture damage and makes it ideal for coolroom storage. Its ventilation pattern allows the even distribution of refrigerated air to ensure maintenance of the highest quality out-turn for produce.

In the stackability stakes, the P84 is a real winner. Trays are designed to interlock so that the triangular corners carry the weight.

But there are still other benefits of the P84. With Amcor Fibre Packaging's graphic design and printing technology, they can ensure that your trays are printed with quality and colour to stand your produce apart from the competition. With the wide use of these trays in stonefruit, grapes, avocados, gourmet tomatoes and kiwi fruit, Amcor continues their research to provide a high quality carton.

As a result Xitex board has been introduced into the P84 trays. Xitex board consists of two flutes joined at their tips with liners on both sides. The perfect alignment of the flute tips means extra strength, at the same price. Boxes made by this technology are lighter, stronger, smoother, flatter and squarer. Base sagging of fruit trays is a common problem in conventional material; however, Xitex eliminates this peculiarity in grape, strawberry and stonefruit trays. The P84 is 100% recyclable so by using this tray, you will help Australia's environment. In summary, the P84's performance means that other produce trays simply don't stack up.

Fibre Containers Queensland (Smorgans)

Fibre Containers Queensland has been a major supplier of cartons to growers in the avocado industry in both northern NSW and Queensland for over thirty years. Fibre Containers offers a complete packaging solution to the avocado grower through;

- In line packaging systems
- In line packaging analysis
- Easipack
- Kraft liners for high humidity conditions
- Gold winning award graphics

The combination of in house availability of designing packaging systems and superior performing cartons has ensured that Fibre Containers is a market leader and is the benchmark for the packaging industry.

Fibre Containers is also introducing Xitex board into the produce industry. Xitex is a world first corrugated cardboard design that increases performance of a corrugated carton.



Industry Manager's say

By Wayne Prowse



The marketing forum last met in September to review the progress of the current program and to recommend new directions. We have agreed to review the service providers and seek alternative proposals to ensure

that the industry is being served by the most effective program.

The forum followed a successful meeting at the Sunshine Coast where growers had the opportunity for input to the marketing plans. The outcome of this meeting was a clear recommendation to focus on the education need of retailers and consumers to improve the quality of avocados and to encourage consumers to try avocados with more winter style recipes.

The marketing forum took this further and considered the major target markets that we are appealing to and this resulted in good discussion in a similar direction.

On the quality side we are reaching the retailers through a merchandising program and in an industry first cooperating with the R&D committee in a new AVOCARE program to assist all sectors of the chain to manage the quality of avocados. Every link in the chain has a responsibility and often problems are a result of a number of factors that the new project will attempt to define and recommend corrective action.

With regard to the promotion the Avocado Marketing Forum agreed that the promotion of Australian Avocados needed to target three major groups.

Baby Market

The baby market is vitally important as it reaches young mothers who are "information hungry" and also recognises that if mothers feed their babies the goodness of avocados they (the babies) will more likely retain a desired taste for avocados as they grow. Some considerations are:

- Continue with Baby Care (Bounty) advertising, as these are most effective.
- Consider extra ads in Mother & Baby magazines and possibly baby shows.
- Find out what motivates mothers. Don't they want the absolute best for their babies?

- Demonstrate that avocados are better than processed baby food in PR activities.

Young Adults

The young adult market also includes new mothers and women 18-29. This group is hard to reach and are fussy about what they eat.

- We are currently targeting through 1/3 page magazine ads in women's magazines though this is due for a creative update—possibly to more appetite appeal. The motivation factors to this age group are most important.
- Should we be positioning avocados as "sexy" "fashionable" or "trendy" food as seen by peers? Is it cool to eat avocados? These questions need to be answered by research.
- Getting young people to FEEL GOOD—with food GOOD FOR YOU.
- Recipe ideas—how do I eat an avocado (65% eat with salad)—but we need more "winter warmer" recipes for avocados as this is the peak. Therefore warm winter "trendy" recipes need to be targeted.
- Promote avocados as an alternative to butter and margarine. This is one way to bring avocados into an almost daily usage pattern if we can get people hooked on the taste and texture.

Mature Age Market (M/F 30+)

Mature aged people are the ones that are starting to think about their long-term

health so nutrition messages are vital. They may also be feeding growing families and want to do the right thing with good healthy foods.

- As it is less likely that new users will be in this group, we need to encourage existing light users to eat more avocados—say once a week would be a big lift compared with once a month.
- Modern simple and healthy recipe ideas with a focus on winter styles.
- Factual health and nutrition information and tips.
- Consider the popular food magazines such as Good Taste, Gourmet Traveller and Family Circle.

Note: We considered the Kids/Teenage market too hard because if kids will not eat avocados due to taste then no advertising strategy will change their eating habits.

The next step is to develop a new campaign that includes a suitable promotion mix of media and in store promotion strategies and to cooperate with retailers and major avocado suppliers.

The avocado marketing forum recently welcomed Ron Laurence and Paul Schramm as new members who will bring a closer working relationship with suppliers who have direct links with both growers and retailers and look forward to their contribution.

Endosulfan Records Alert

Growers are urged to carefully read the new label that will be attached to new stock of endosulfan, before applying the chemical.

It is recommended that growers obtain a copy of an "Endosulfan Spray Record" from either their chemical supplier or the National Registration Authority (NRA) as a useful guide to the information that must be recorded.

This record should then be attached to your spray diary and all necessary information recorded in either the diary or the "record". These records must be kept for

two years, and the NRA, to ensure compliance, may audit growers.

The level of record keeping is quite onerous, and was implemented without consultation with the avocado industry. Unfortunately when our concerns about the requirements were raised with the NRA it became obvious that this is part of the price we must pay for continued access to endosulfan, which for many avocado growers is still a critical management tool.

Please observe label requirements or the industry could lose access to endosulfan.



TALKING AVOCADOS - HAVE YOUR SAY

Dear Sir,

Are growers getting the full benefits of phosphorous acid?

For many years we have been involved in the treatment of avocado trees against phytophthora rot root, firstly as a grower and for some four years as a manufacturer of tree injectors.

Seldom have we seen replicated the recovery rates achieved during the early research when potassium phosphonate was being trialed. From time to time we have even doubted those results were possible.

Recently I revisited two Californian clients who had purchased our injectors in June this year and whom I assisted at the time to carry out their first series of tree injections. Both farms were showing advanced decline due to phytophthora.

The first farmer and I mixed the phosphorous acid and potassium hydroxide on the day we started injecting; we buffered the mix to a pH of 7.0 and a concentration of 40%. Five months later the farm had completely turned around, with a recovery rate faster than I have ever seen before.

The second farmer purchased a four-gallon container of premixed potassium phosphonate with a concentration of around 38% and injected at the same rate per tree as the first farmer. Five months later the trees showed no signs of recovery and, in fact, have significantly declined.

On return from California I checked a Sunshine Coast Farm that had been injected earlier this year with left over acid from a previous period. The trees showed no benefits at all.

The explanation of the difference in performance of "acid" in the case of the first farmer, the original research and other instances cited, is probably the age and the way the mixture had been stored from the time it was originally made.

It is widely accepted by industrial chemists and some researchers that phosphorous acid if not stored in full, sealed containers can oxidise, forming phosphoric acid, which has no effect on phytophthora.

This raises a number of issues that farmers may wish to consider:

- Should they purchase more potassium phosphonate than needed in the short term?
- Should manufacturers be required to provide dates of mixing and date of drum filling on the label?
- Should farmers revert to making potassium phosphonate in small quantities on farm as was done in the early days and thereby ensuring that it is always

fresh? Many other avocado-producing countries follow this practice.

I have asked the NRA to provide an opinion as to the legality of "on farm" manufacture, the precedent being the "on farm" manufacture of "Bordeaux" fungicide, a mixture of copper sulfate and hydrated lime.

*Geoff Eldridge
Sidewinder Tree Injectors*

[Further to Mr Eldridge's letter, an early phosphorous acid/phytophthora researcher maintains phosphorous acid changes to phosphoric even in sealed drums—it takes oxygen molecule from water.

Growers who would like to check their holding of phosphorous acid can have samples tested at:

Food & Agricultural Labs Australia
41 Rosedale Street
Coopers Plains Qld. 4108
Ph. 07 3345 4566

Contact Darryl Scurr and ask for a PHOSPHITE LEVELS TEST. The cost is \$39.50 and a 100 mL sample would be required. Ed]

Dear Sir,

Out Of Touch

It would appear that the AAGF is getting further out of touch with grass roots growers as highlighted in the SCAGA Newsletter.

The next World Avocado Conference was ours for the taking. Ever since the last conference, it was anticipated and expected that Australia would be the host, that is until the AAGF let it be known that they did not want it here.

As mentioned previously in Talking Avocados, and I gather, brought up at a couple of field days, the growers wanted the conference here but were ignored. Pity, but I trust the AAGF will get in touch with growers and host the next one.

Also mentioned in the newsletter was the fact that the AGM of the AAGF was once again poorly attended. It is not easy to get growers along unless there is some major and contentious matter to be discussed. A new approach must be tried. As a suggestion, better communication with district organisations to drum up attendance, a contentious or challenging agenda,

a weekend combination with a field day or research/technology updates could be used to entice growers.

To keep in touch and provide feed back to the hierarchy, growers must get along to air their problems.

*A Concerned Grower
[Name supplied, Ed]*

Sunraysia Nurseries

Have available commercial quantities of container grown

AVOCADO TREES

*Bacon, *Gwen, Hazzard, Reed,
Rincon, Ryan, Sharwil, Wurtz,
Zutano*

*Gwen avocado is a recent released "Plant Breeders Rights" protected variety.

A moderately vigorous small upright spreading tree, with green skinned, larger than average sized fruit.

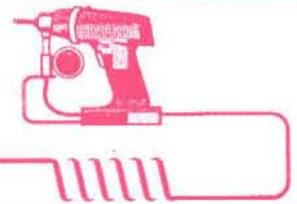
It matures 7-14 days after Hass.

Consistent heavy bearer, especially in the early years. Flower type A, needs to be cross pollinated.

**Contact Sunraysia Nurseries
For bulk prices and catalogue**

P.O. Box 45, Sturt Hwy
Gol Gol NSW 2738
Ph: 03 5024 8502 Fax: 03 5024 8551

PUT THE
SCREWS
ON



PHYTOPHTHORA

Full Range of Award Winning
POWER OPERATED
DRILL INJECTORS



**SIDEWINDER
TREE INJECTORS**

Ph/Fax: 07 5474 3033
E-mail: sideject@bigpond.com
www.users.bigpond.com/sideject

Lesser Known Elements Of Soil, Growth And Success

A presentation given by Peter Williams, AgroBest Aust. Pty Ltd, at a NSW Field Day held on 14 May 1999 at Ballina NSW

The manual of Tropical & Sub Tropical Fruit (1920) quotes Krone (1916), "The nature of the plant food required by the avocado has not been satisfactorily determined."

This morning my remarks will attempt to discover if we have made progress since then and in what direction.

I have chosen to gather some notes together on four essential nutrients or elements of the soil to discuss them in a general way and then be a little more specific in just how these elements assist us in producing a quality avocado.

Calcium

The average calcium content of the earth's crust is 3.6%, but in soils to the first metre can be up to 20%.

A good deal of the credit for the focus on calcium goes to USDA worker C.B. Shear, who in a 1975 paper condensed much of the significant information on calcium into a little more than 3 pages followed by over a hundred references. Shear's short tract is truly a treasure trove of information and should open many eyes to the magnitude of potential calcium related disorders—it can already be termed a classic. Shear also spearheaded an international symposium on calcium in 1977 that has provided an additional forward thrust to calcium related research.

It is understandable why calcium has not been given more consideration than it has. Most textbook discussions of calcium deficiency draw from nutrient culture studies in which plants are grown without calcium. Under these conditions cell wall structure deteriorates, providing classic pictures of drooping plants—such pictures are permanently etched in the minds of plant nutrition students.

These textbook symptoms of calcium deficiency are simply not seen in the field. Couple this with the fact that calcium is the fifth most abundant element in the earth's crust and it is little wonder that calcium nutrition is the furthest thing from the minds of fieldsmen when dealing with day to day problems in agriculture. When working on a crop disorder occurring on calcareous soils it is little wonder that calcium nutrition is not even considered.

I think we need to do as Shear did and differentiate between calcium "deficiency" and calcium "stress". The former is corrected

only by addition of calcium to soil and/or plant. The latter is caused by localised inadequacy of calcium; here the entire plant is usually not affected and the stress is confined to the fruiting or growing point.

I first became interested in calcium as a means of improving plant health and fruit quality while working along the Murray River in areas where pH was 8-8.5 soils based on limestone with outcrops running through orchards. Routine leaf sampling was showing us that these orchards were actually suffering from either deficiency or stress.

With this information in hand it was thought that in view of soil conditions the best method was foliar applications in a decided program.

I wish I could give you some facts and figures on what I believe we achieved, but growers back then were happy to achieve a firmer fruit without worrying about how it was achieved. Suffice to say we proved a study made in 1946 which showed that calcium deficiency could occur on calcareous soils to be correct.

I would like to suggest that if we can improve tree health and fruit quality in high pH conditions we must be able to make some improvement where calcium is low or in low pH conditions.

Calcium is released to soil as phosphates, sulphates and carbonates.

In agriculture for soil treatments we rely mainly on calcium carbonate as limestone or calcium sulphate as gypsum and to a lesser extent on calcium phosphate.

The uptake of calcium by plants is not as efficient as for other plant nutrients. Calcium is absorbed just behind the root tips and poor development of new root growth may prevent calcium uptake and induce deficiencies or stress.

A good soil analysis figure for most fruit crops including avocado would be in the order of 1500 ppm or 7.5 meg/100g.

Let's consider then avocados, the skin is much stronger than a peach. In fact two studies reported by the Journal of the American Society of Horticulture in 1980 and 1985 showed dipping avocados in calcium solutions to increase storage were shown to be impracticable, as avocados were impervious to the solutions. However, the 1985 study showed that fruit with an already high calcium level took longer to ripen. The

reason put forward was that calcium slows down the release of ethylene.

However, the 1980 study found low levels of calcium to be associated with chill injury.

Conversely, fruit with a lower level of calcium ripened more rapidly than higher levels.

What can we achieve by ensuring adequate leaf levels of calcium in avocados?

A 1949 study found the calcium content of healthy Fuerte avocado leaves from a great variety of groves to range above 1% and as high as 2.64% on a dry weight basis. In a soil culture experiment a nutrient solution was applied to avocado seedlings in which the nutrient (NPK) content was kept constant. By varying the calcium and magnesium content of the culture solution (the magnesium concentration was increased and that of calcium decreased), the average fresh weight and size of the leaves and trunk length were increased but a retardation occurred when the calcium was too low relative to the magnesium concentration. The mature upper leaves of the seedlings contained increasing amounts of calcium as the calcium content increased in the culture solution.

Studies in 1950 of calcium in relation to the effects of sodium in avocado seedlings in sand cultures found that the growth was best when a moderate range of calcium (250 to 500 ppm) to sodium (46 to 136 ppm) values were present in the nutrient solution. Generally, it has been found that calcium increased considerably as avocado leaves aged.

During 1950 a number of leaf samples were gathered for analysis from orchards showing small burned spots scattered over the leaf surface. It was found that the calcium values (0.99 to 0.55%) were low and that the calcium values in many of the avocado areas may be too low for healthy growth. In some of the newer studies of the translocation of elements in plants, we are learning that some elements such as calcium are translocated very slowly and it may be found that some of the unexplained chlorotic conditions of the tips or terminal growing points of avocados, are associated



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

with the slow translocation of calcium within the plant.

Let us remember the avocado is a relatively shallow rooting tree and as a result may not be as efficient as some other crops for "foraging" as they could be. I would like to suggest that a soil with an adequate supply of calcium may result in a root system that will remain more effective in times of heat, dry, hot winds etc.

If this was proved to be so it would be because calcium is strengthening the cells in the 'walls' of the root as it is known to in shoots, stems and leaves. If you look at leaf sample a suggested figure would be 1.0-3.0.

Magnesium

Plants take up magnesium in lower quantities than Ca and K. High levels of these elements can reduce Mg uptake.

Many areas of Eastern Australia show deficiencies both in soil analysis and leaf.

Deficiencies occur as a loss of healthy green colour between leaf veins, yellowing (chlorosis) will follow and perhaps defoliation.

Magnesium is absorbed by plants by a passive uptake system and is said to be reversible; that is, under certain conditions magnesium can move back into the soil.

Since calcium and magnesium act similarly in the soil, it is best if we think of these two nutrients together. A high calcium/magnesium ratio will cause a magnesium deficiency. A good ratio would, I believe, be in the order of 2 to 1 and no higher than 3.5 to 1.

We can sometimes increase uptake of magnesium by applying nitrogen in the nitrate form. Also leaf values have been shown to rise when phosphorous (P) is applied; of interest also is the fact that at times magnesium applications may lift the P of plants.

A soil M.E.Q. 1.6-3.0 should be OK but much will depend on Ca or K ratio and also pH, which should be in order of 6 for best uptake. In other words pH of 5 would result in a plant shortage of magnesium while stated figure may seem to be OK.

The avocado has shown response to magnesium when this element is known to be deficient in the growing media. It is probable that the general requirement of the avocado tree for magnesium is similar to that of the orange. In California, researchers found that practically all the avocado soils were either neutral or somewhat alkaline and for the most part contained abundant supplies of available calcium and magnesium.

However, in 1949 the improvement in a number of citrus orchards in California was attributed to increasing the available magnesium supply. A series of analyses

found that there was usually a greater content of magnesium and a much lower content of calcium in avocado leaves as compared with citrus leaves.

In a series of soil cultures, avocado seedlings received the same amount of nitrogen, phosphorus and potash. By varying the concentrations of calcium and magnesium it was found that as the magnesium concentration was increased and that of calcium was decreased in the culture solution, the fresh weight and size of the leaves and the trunk length were increased. However, there was a retarding effect when the calcium was too low relative to the magnesium concentration. The lower (older) leaves released some of their magnesium to the upper (younger) leaves especially when the magnesium supply in the growing medium became limited. This would probably be true of avocados. There also was a greater potassium absorption occurring in the mature upper leaves as the magnesium concentration in the culture solution increased and that of calcium decreased. Where cropping occurs for years and has removed considerable magnesium, it may be possible for a shortage to develop.

Symptoms of Magnesium Deficiency

Researchers in 1946 in outdoor sand cultures using Lula and Taylor avocado trees did not observe deficiency symptoms during the first season of growth in cultures lacking magnesium. The trees were as large as those receiving complete nutrient solutions.

By mid-summer of the second season the Taylor trees deprived of magnesium were making less vigorous growth than the control and the leaves were lighter green. Eventually, the leaves became yellowish-green over the entire area of the leaf except for slightly deeper green along the midrib and large veins. In late autumn and winter of the second season the leaves became yellow and small, and brown dead lesions were scattered over the entire leaf blade.

As I stated earlier, many of our soils appear to be 'short' on available magnesium. It appears magnesium symptoms take time to appear and growers would be well advised to look at recent leaf samples and determine a course of action; it may be foliar sprays plus soil applications are the way to go. Aim for a leaf sample of 0.25-0.80.

Boron

Boron is needed to ensure healthy pollen at flowering, which in turn ensures a good fruit set. It also plays a part in cell division; this applies to all fruits but what about avocados?

Symptoms of Boron Deficiency

A researcher in 1939 described some of the symptoms of boron deficiency on

avocado seedlings under controlled conditions. There was a cessation of shoot tip growth and many of the young shoots were deformed or burned severely when very young. In 1943, a further description of boron deficiency was given.

One of the most characteristic symptoms was gradual destruction of meristem or growing points. Death of the plants proceeded from the most distant youngest portion of the plant back toward the base of the trunk. Leaves of affected shoots became burned and distorted and growth of newly formed leaves soon ceased. The mid-rib and other veins on the lower surface of the leaves frequently were corky and split. With severe boron deficiency there were splits an inch or more in length in the trunk bark. Occasionally the terminal portions of the trunk and some of the shoots showed swellings which when cut showed pithy or corky pockets stained a brown colour. As the effect of boron deficiency became severe, the roots disintegrated.

Dry weight of the leaves from boron deficient plants contained from 9 to 20 ppm boron, whereas healthy leaves from control plants contained from 50 to 60 ppm boron. Avocado seed gathered from a number of different varieties gave a boron content of 16 to 33 ppm. Mature avocado leaves as gathered from various groves contained from 18 to 62 ppm boron. In studying the boron content of avocado pulp, he found it to be in the range from 36 to 99 ppm.

There was less boron in the stem half of the fruit than in the tip half and also less in the inner portion of the pulp than in the outer portion. Skin of the fruit contained considerably more boron than the pulp (32 to 242 ppm), varying with variety and location of the trees.

In 1946, a researcher noticed in sand culture test that Taylor and Lula avocado trees receiving no boron produced a spring flush of growth not so vigorous as that of the control trees. The internodes were slightly shortened and there was a slight increase in the number of lateral shoots produced. In the summer flush of growth, more striking signs of boron deficiency appeared. New shoots were very short and leaves at the tips of these shoots were reduced greatly in size and had a yellowish-green colour. Soon after reaching maturity many of the leaves burned at the tips and margins and finally were abscised prematurely. By fall the bud scales which were enlarged had burned at the tips and some of the terminal buds were dead.

10

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

9 

Soil B level for avocados should be in the order of 0.3-0.7 and leaf sample should be 40-100 although I feel 80 would be nearer the mark. It is also known that boron deficiency will result in misshapen fruit and at times a lesion similar to that of the navel orange will be seen.

Boron Toxicity

Haas (1944) grew avocado seedlings in soil cultures that he had treated with various amounts of sulphur to lower the pH. To these he added enough boric acid solution to equal 10 ppm of boron to the soil.

Within a month all of the boron-treated cultures showed extreme injury or death. The injury usually progressed upward, the younger portion of the shoots being the last to show injury. Also, when no sulphur was added to the soil a single addition of 10 ppm of boron as boric acid resulted in severe damage or death to the once healthy seedlings. The conclusion was well drawn that when excessive boron is brought into contact with avocado roots, severe injury will occur.

Zinc

The availability of zinc is very much controlled by soil pH, 5.5 to 6.5 would be best.

Zinc appears to be tied up at times by high levels of organic matter. Cold wet conditions, i.e. 'stress' rather than deficiency, can temporarily tie it up. High P levels may tie it up, and of course diseased root systems may be unable to supply sufficient zinc.

Soil level of zinc using the D.T.P.A. extraction method should be from 1-5 but pH would need to be taken into account. Leaf level amount should be 30-50 ppm.

Symptoms of Zinc Deficiency

A disease affecting avocados was described under the name "frizzles" in 1928, portraying many of the symptoms of zinc deficiency, as we know it today. It was described as being common on the light gravelly soils of California where drainage was excessive. An advanced symptom of "frizzles" was a rosette appearance resulting from bunching together of avocado leaves, the leaves being mottled. These avocado trees were observed in citrus orchards suffering from mottle leaf which had responded to treatment with zinc compounds.

In 1940, the little leaf condition of avocados found in Florida was corrected by zinc sulphate sprays on trees grown in the limestone soils. The deficiency was evident for the preceding two years, in the winter and spring months. The deficiency had been

especially severe in certain orchards where the nitrogen applied in the fertiliser for several years had been mainly from synthetic sources.

The outstanding symptom of little leaf was chlorotic areas between the veins of the leaves, which were somewhat smaller than normal. In severe cases the leaves became markedly smaller in size, were somewhat trough shaped with a tendency to become recurvate, and were chlorotic or slightly bronze in colour particularly between the veins. Twig growth also was reduced considerably so that the leaves were close together resulting in a rosette appearance. Dying back of twigs and branches occurred in severe cases. The fruit on severely affected branches was usually small with a decided tendency to sunburn and developed dead spots in the skin.

It is common practice now to use a zinc foliar spray whenever trees are showing a flush. Many sprays are available; I would suggest a chelate to be among the most efficient, e.g. Zinc Dextro-Lac.

To sum up, yes we have made progress since 1916 but there is still much to learn.

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

Farmpay



A proven success for fruit and vegetable growers

... and a commitment for fast payment for goods consigned
through Melbourne Markets

- ✓ It's simple and a fair way to trade
- ✓ Farmpay covers over 70 different types of produce
- ✓ Greater security for payment within 21 days

Dealing through Farmpay pays ...

**For a current list of Farmpay Accredited Wholesalers
call 1800 060 321 or poll fax 1800 678 062
or ask your local Grower Organisation**

Increasing Production And Quality In Avocados, Sustainability

A presentation given by Graeme Sait of Nutri-Tech Solutions at a NSW Field Day held on 14 May 1999 at Ballina NSW

I am the Managing Director and Chief Fertility Consultant with Nutri-Tech Solutions. Nutri-Tech has proved something of a phenomenon in horticulture during the past five years.

Contrary to popular opinion, we have proved that there is a tremendous thirst for information amongst growers. Unlike other companies, we don't have a team of salesmen on the road. Instead, all of our business is generated by a combination of the written word and word of mouth. From the beginning we have adopted an educational policy where we have attempted to increase grower awareness of the mechanics of fertility and the techniques required to increase sustainability without loss of production or profit.

Initially we were constantly told that we were wasting our time with this educational approach. We were told that growers would never bother to read 3,000-word articles about fertility and sustainable agriculture. Well, we have proved the power of the written word. Our main office has five lines, which ring 12 hours a day. In just five years we have achieved a multi-million-dollar turnover, and we continue to treble this turnover every year. Many of our 6,000 clients are now repeat customers who have experienced the dual benefits of precision nutrition and soil-life activation.

The main thrust of our approach has revolved around an intensive fertility analysis we call Nutri-Tech Soil Therapy™; it is our attempt to increase grower awareness of the importance of balanced soil nutrition and an active soil-life system in the profitable production of high-quality produce. This educational tool was designed to help counteract what we perceived as a widespread lack of knowledge about the soil—the fundamental money earner in any growing operation.

Growers have often informed themselves of every practical aspect of their business from accounting to farm machinery, but soil test data remains an incomprehensible bunch of figures to be interpreted by others—usually their fertiliser dealer. There are few other businesses that could survive this level of naivety. Mechanics who had never gained an understanding of a car engine or builders who couldn't

fathom the mechanics of construction, would all very rapidly find themselves in the bankruptcy courts.

However, farmers who are arguably involved in the most noble profession of them all—the production of the food which sustains us all—have often neglected to develop an understanding of their soil, the medium which will determine their financial success or failure. After all, there are only 17 elements to understand in the soil, it is far less complicated than repairing a piece of machinery.

Despite this, many growers continue to blindly accept advice from fertiliser salesmen. This is a ludicrous situation, equivalent to a critically ill patient accepting advice from an undertaker. The fact is that if you want to be in control of your own destiny, then you must understand the way the soil works and the way it can work for you!

Nutri-Tech Soil Therapy™ is a free service that continues to grow in popularity at a rate that is only just manageable. We have a team of trained staff dedicated exclusively to compiling soil therapy reports. Soil Therapy™ is essentially a comprehensive fertility analysis based on recent existing soil test data, but if soil tests have yet to be organised, then we will always

recommend the American soil lab Brookside Laboratories.

The eminent soil scientist Dr William Albrecht established Brookside in Ohio in 1952. Dr Albrecht was one of the first researchers to determine the link between soil health and human health, and he developed a soil-balancing approach to build fertility and to improve the food value of produce. Brookside Laboratories have gone from strength to strength. They now service 230 consultants worldwide, and their client base includes the US Government and many of the agricultural colleges in the US.

You can access Brookside reliability and accuracy through Nutri-Tech. The tests have a three-week turnaround time, and they cost \$65 per sample. If you are working with us, Brookside will fax the results to both Nutri-Tech and the client, and we will prepare the free, 30+ page personalised report, which comprises Soil Therapy™.

Part of this report will include recommendations for a personal prescription blend, designed to address every problem

12



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

ATTENTION AVOCADO GROWERS

For the best results and a personalised service
consign your fruit to

W ARKELL & SONS

12 Brisbane

Established since 1892

Proudly serving Australian growers for more than 100 years.

Contact Les Hartley (proprietor)

| | |
|-----------|---------------------|
| Phone | 07 3379 8122 (work) |
| | 07 3371 6087 (home) |
| Facsimile | 07 3397 4158 |
| Mobile | 015 571 097 |

11 

in your soil with a single application. This is how we can justify this comprehensive, free service. There is no obligation at all, but at least 90% of growers who receive Soil Therapy™ advice end up commissioning us to prepare a prescription blend designed for their individual blocks. Many of our larger clients will ask us to prepare 15 to 20 different blends for different blocks on their properties.

There is one thing that should be made clear here. This form of precision nutrition works. There is no comparison to blindly fertilising with urea or DAP or throwing around a pre-formulated fertiliser blend, in the hope that some of the ingredients will be beneficial. When a blend is constructed to precisely balance the soil and to activate microbial life, the guess work is eliminated. Our success is results-based, and our tremendous growth is testimony to the effectiveness of this approach. Virtually every grower who trials a personal

prescription blend, based on Nutri-Tech Soil Therapy™, will return the following season, because he has personally witnessed the power of nutrition.

Calcium Neglect

During the past two or three years Nutri-Tech has become increasingly involved in avocado nutrition. We have clients in all of the major growing areas, and Soil Therapy™ analysis has revealed a common theme throughout these different regions. Almost every avocado soil we analyse is calcium deficient. The reason for this calcium neglect appears to be related to a low soil pH policy originally adopted by the industry to help control phytophthora. Despite the advent of phosphonic acid as a fungus control option, the low pH legacy has remained. Now calcium is the most important nutrient in any soil. It is the cornerstone of fertility and nutrient availability. I believe that it was a dubious trade-off originally, to sacrifice calcium for improved

disease control, but there appeared to be a related reduction in phytophthora damage, and this was the only governing guideline.

For some reason no one recognised that when you reduce the activity of pathogenic micro-organisms like phytophthora through lowering pH and reducing the availability of calcium, the most essential nutrient for microbe health, then you are inevitably also reducing numbers of beneficial micro-organisms.

At this point I feel it would be valuable to offer a brief explanation of how pathogens like phytophthora are able to invade the root-zone and create havoc. In a balanced, healthy soil the tree roots are virtually smothered by thousands of billions of beneficial bacteria and fungi, which are present in such huge numbers that they do not allow the entry of opportunistic pathogens like phytophthora. The word "opportunistic" is



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



Gray Plantations

Macadamia Orchards

Contracting Services



Specialising in:

Tree Transplanting

Mechanical Tree Pruning



- Flat Topping Height 5 metres
- Vertical Hedging Height 7.5 metres
- Cutting angles from vertical to horizontal
- Fitted to 80 hp wd Case Tractor
- New Equipment - minimal downtime
- Suitable for Avocados, Macadamias, Custard Apples, Stonefruit etc.



Have successfully pruned 2200 avocados at "Balmoral Orchards" (Toowoomba Qld) under the management of Michael Flynn.

Manager
K.J. (Kim) Wilson
P.O. Box 306
CLUNES, NSW 2480

B/H 02 6688 4287
A/H 02 6629 1443
Fax 02 6688 4387
Mobile 0408 663 991

important here. These disease organisms are present in much lower numbers than the beneficial microbes, but they lurk on the outside waiting for the right break in defences, which might allow them to gain entry to the root-zone and allow them to develop a stronghold.

These pathogens are also generally more capable of survival in adverse conditions. For example, calcium is a soil flocculator. It opens the soil and allows the entry of oxygen, which is the life force for beneficial microbes. These aerobic species are dependent on precious oxygen, while many of the pathogenic microbes are anaerobic species that don't require this element. In wet, waterlogged conditions, low-oxygen, calcium-deficient soils do not offer ideal conditions for beneficial microbes. When their numbers dwindle, then this is the perfect opportunity for the pathogens to move in and gain a foothold. There is also one popular management practice that has a devastating effect on beneficial soil-life and, which I believe, may be a major contributor to phytophthora problems, but I will discuss this in a later section. At this stage I will just reiterate that calcium neglect is not the way to manage phytophthora.

Foliar Neglect

Actually, the low calcium legacy has also contributed to other areas of nutritional neglect, which reduce profit potential, yield and quality. For example, there are mixed feelings in the industry about the value of foliar nutrition. It is often argued that the shiny texture of the avocado leaf is not receptive to foliar uptake. In actual fact, inadequate foliar response is calcium related. I'm not sure that many of you understand the concept of base saturation. It is a measurement of the clay colloid's capacity to store nutrients like calcium, potassium and magnesium. Anyway, a minimum of 60% calcium base saturation is a prerequisite for good foliar response (most of the avocado soils we analyse have between 40% to 50% calcium base saturation). I'll return to foliar feeding shortly, because there are some valuable tips I can offer that will help maximise the benefits of this very valuable fertilising technique.

There are some other nutritional side effects of calcium neglect. The uptake of both phosphorus and trace elements is limited in the absence of sufficient calcium. Phosphorus is an important catalyst involved in photosynthesis. Low phosphate uptake contributes to low sugar or brix

levels in the plant. American researchers have identified a direct link between brix levels and pest and disease resistance. The higher the brix levels in your tree, the higher the inherent pest and disease resistance. If I had more time, I would explain just how this process works, but it is sufficient to say that avocados low in calcium and phosphate will inevitably suffer more disease problems.

There is also an interesting trace element link to calcium neglect. Most of you will be aware of the importance of the trace element boron in avocado production. Some of our Northern Queensland growers apply boron several times each season. Part of the reason boron is so effective in this crop is calcium related. Boron improves calcium utilisation. When calcium levels are low, boron becomes an invaluable stimulant, which increases calcium availability. Part of the apparent boron response in avocados is actually improved calcium response.

Foliar Fertilising Tips

I mentioned foliar fertilising earlier and at this stage I'd like to offer some secrets of foliar success. It has been proved that foliar fertilising can be 12 to 20 times more efficient than root feeding, but we have found that it can never substitute for good soil nutrition. We use the technique to build fruit size, yield and quality, but it is always used in conjunction with a good soil fertility program and is used to provide that extra something. There are several tricks that can dramatically increase the benefits of foliar fertilising, and I'd like to share them with you:

1. It is always best to foliar-spray in early morning or evening, when relative humidity is high, rather than in the heat of the day. There are two reasons for this suggestion: Firstly, if a fine mist is applied, there is a

risk that the sun will evaporate the solution before it can be beneficial. Secondly, in summer when temperatures exceed 32°C, trees will transpire and release rather than absorb moisture.

2. There is another temperature-related factor that affects foliar performance. In winter, when temperatures fall below 11°C, metabolic rate and nutrient translocation is slowed down considerably, and foliar-spraying will be less effective.

3. It should always be remembered that the stomata, the tiny pores on the leaf, which are the main entry point for foliar nutrients, are located predominantly on the underside of the leaf. Spray nozzles should be targeted at this area.

4. The type of spray equipment will also affect foliar success. A fine mist is required for good nutrient uptake. The stomata are surrounded by tiny hairs that trap droplets and deliver them into these pores. If the droplet size is too large, they will not be delivered to the target area, and benefits will be limited.

5. Phosphoric acid should always be included with every foliar fertiliser. There are two reasons for this suggestion. Firstly, phosphorus (as mentioned earlier) is the key to plant sugar production. Foliar fertilisers can be the most powerful brix building tool available, but they must include phosphoric acid to achieve better photosynthesis and related increases in sugar production. Part of this brix increase is also related to the fact that phosphate should always be the carrier of nutrients into the plant. Nitrogen can also perform this transport task but the end result is always vastly superior when phosphate is the carrier. Secondly, phosphoric acid can also serve

14



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



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 07 544 21657

P.O. Box 105, Woombye Qld 4559

13 

as an anchor that helps the mist make it to the plant. This characteristic is particularly important in dry conditions where evaporation can be a problem. If you have ever lifted a 20-litre drum of 85% phosphoric acid, you will understand this anchoring capacity.

6. Finally, there is a very important link between moon cycles and the performance of foliar fertilisers. The best foliar response is achieved during any of the six days leading up to a full moon. Any other time is acceptable, but always avoid any of the six days leading up to a new moon, as benefits will be minimal. There is nothing cosmic or mystical about this phenomenon. It is a simple fact that, just as the moon affects the gravitational pull of the tides, it also affects fluid movement and translocation of nutrients within plants.

Sustainable Herbiciding

I mentioned earlier a single practice that has a devastating effect on soil-life and which I suspect is directly related to phytophthora problems. This popular practice is tree-line herbiciding. During the past two years I have been privileged to interview some of the world's leading fertility consultants. These consultants are unanimous in their condemnation of herbicides in relation to soil-life damage.

During my visit to the US late last year I interviewed Professor Phillip Callahan, who has spent 5 years researching the effects of chemicals on soil-life. He confirmed that herbicides cause more destruction to soil-life than pesticides and fungicides combined. Some herbicides are toxic to soil microbes, but in general it is a side effect that creates the damage.

There are three main beneficial microbe species that inhabit the root-zone, and they include bacteria, fungi and algae. Algae are single-celled plants, which live on or near the soil surface to gain access to sunlight, which is needed for photosynthesis. Algae, like all plants, produce sugars through photosynthesis, and it is these critical carbohydrates that provide the energy source for the entire system.

When we herbicide every couple of months under the canopy, this algae energy source is decimated. Algae are, after all, plants, just like the weeds you are targeting. When this carbohydrate source has been removed from the food chain, the energy for the whole system has been effectively shut down. Soil life diminishes rapidly. It is often just beginning to re-establish itself around the time you return to herbicide again. This is a ludicrous situation.

The root-zone under the canopy is the area where you will gain most benefits from healthy soil-life, including improved nutritional uptake, increased nutrient availability, and better disease protection, as I discussed earlier. Phytophthora, like all pathogens, are opportunistic. These microbes will seize the moment. When the protective billions guarding the root zone have been reduced, these pathogens will arrive, and begin the root feast, which can eventually kill your tree.

The practice of herbiciding beneath orchard trees is not sustainable. There are two solutions to the problem. We can drop the chemicals and consider organic certification. I appreciate that there are not many of you who would consider this first option, but I assure you that it is feasible for avocados, and it can be quite profitable. The second option relates to increasing the sustainability of tree-line herbiciding. There are two main techniques that will help achieve this goal.

The first of these techniques involves the inclusion of humic acid with every herbicide application. Humic acid can help reduce soil-life damage in the following ways. It contains an enzyme that increases the permeability of plant membranes. This function stimulates the plant to absorb more active material than it would have otherwise. It is possible to reduce chemical requirements by 30% when combining humic acid with herbicide. This is a substantial reduction, but it is not the main gain from the humic acid inclusion. Humic acid is a remarkable detoxifying agent. When a child is accidentally poisoned, the first treatment at outpatients will be a dose of activated charcoal to lock up the toxins and reduce further cellular damage. Well, while humic acid works very much like activated charcoal, it can "lock up" the damaging pesticide residues and reduce soil-life destruction. Humic acid is mixed with herbicides at a litre per litre rate to achieve the desired detoxifying effect. That is, add 1 litre of humic acid to every litre of herbicide.

The second technique to increase the sustainability of herbicides involves repopulating the under-tree root-zone with beneficial micro-organisms after every herbicide application. Nutri-Tech has developed an inexpensive microbe blend, called Nutri-Life 3/20, which can be applied after herbiciding at a cost of around \$3 per acre. This blend includes 20 species of bacteria and 3 species of predatory fungus, which have proved particularly effective in the control of phytophthora. These

microbes are always applied with a carbohydrate source, which can be either sugar or molasses. The American consultants are enthusiastic about the benefits of applying sugar to the soil, as it effectively replaces the carbohydrates lost through herbicide-related algae destruction. In this case, when we include sugar with our Nutri-Life 3/20 blend, we are feeding both the new workers and providing a fast food, regenerating energy source for existing soil microbes.

Our Avocado Solutions

I'd like to take a minute before concluding to mention some of the solutions we have developed for your industry.

1. We market a double-strength humic acid, called Nutri-Hume Liquid Humus, for use with herbicides. Humic acid also offers many other benefits, including improving the efficiency of nitrogen. Urea, for example, can become a sustainable, slow-release, long-life nitrogen source when combined with humic acid. Humic acid can also be included with fungicides and pesticides to detoxify the chemical residues.

2. We have developed a potent microbe blend, called Nutri-Life 3/20, which can build the numbers for disease protection in the root-zone. The Nutri-Life blend also include species that release tied up phosphorus and potassium in the soil, other species that fix free nitrogen from the air and others that can help build organic carbon levels. This package of benefits is a genuine bargain for less than \$3 per acre.

3. We have also developed a specialist foliar fertiliser for avocados, called Avo-Tech Triple Ten, which combines the best of high-tech organics with conventional N-P-K and chelated trace elements. Avo-Tech Triple Ten can increase fruit set, build fruit size and improve fruit quality.

4. Several of our growers have been experimenting with the use of neem oil as a non-toxic control option for fruit spotting bug. This past season our growers in Blackbutt in Queensland have had particularly good results with our product, Nutri-Neem, in the control of this pest.

5. I have mentioned the importance of calcium and phosphate in determining tree health and production. Nutri-Tech is the exclusive distributor of Nutri-Phos Soft Rock Phosphate, which is the most stable and plant-available source of natural phosphate and calcium on the market. Nutri-Phos is also free from cadmium, a heavy-metal contaminant present in most other phosphate sources.



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

6. Possibly our most successful dry fertiliser for avocados is a composted, living fertiliser, called Nutri-Store 180. Nutri-Store 180 contains 3 billion beneficial micro-organisms in every teaspoon, and it has proved a revitalising, soil-building fertiliser for all orchard crops.

7. Our 70-product range also includes a liquid copper fungicide, called Liquicop, which includes far less copper than conventional fungicides and yet, due to the very small particle size, it has proved at least as effective as other copper fungicides. One gain for the avocado industry relates to the absence of visible copper residues. You will all be familiar with the nuisance value of copper residues trapped in the wrinkled skin of avocados.

8. Our most recent development for non-toxic disease control is high-tech disinfectant, called Spore-Tech™. Spore-Tech™ can kill 99.98% of all bacteria, fungi, algae and viruses on the leaf within five minutes. It has no detectable residue an hour after foliar application, and it is also a very good wetter/sticker, which can be combined with most other products.

Conclusion

I would like to conclude by emphasising the grower's role in society and his responsibility toward that society. I became involved in this business as something of a personal quest to improve the quality of the food we all eat and to reduce the toxic r

c residues that are undoubtedly playing a role in the current cancer plague. Figures released last week suggest that one in three of us will develop some form of cancer during our lifetime. I have five children, and if there is anything I can do to improve their chances, then I will give my best to promote change. In the 1950's Rachel Carson published a book called "The Silent Spring", about chemical devastation in horticulture. At the time she triggered the debate which eventually saw the outlawing of DDT.

Well, it has been 40 years since Carson's book, but the devastation continues. Last year in the US alone, there were more than 500 Million kilos of active material applied to food crops, and it has been estimated that 99% of this load actually misses the target organisms. The Monsanto promise suggests security and chemical control in our ongoing war with nature, but where is the evidence to back up these claims?

Recent research has highlighted that the overall percentage losses of crops to disease, insects and weeds are actually higher now than they were in the 1930's, before the chemical onslaught. We believe that disease and pest pressure is a nutritional issue—it is not a chemical issue—it need not be a call to arms. Spraying a stronger chemical more often is simply not the solution.

I mentioned social responsibility earlier. The grower's role as a food producer is critical to our health and happiness. As I

said, farming is arguably the noblest profession of them all, yet it concerns and amazes me when some of our small crop growers confess to keeping a separate, chemical-free plot for themselves and their families. Where is the foresight or social responsibility in this response? The desire to nurture and protect your own family is understandable, but when your healthy daughter marries the boy from down the road and they produce your first grandchild and that child develops leukemia, what is your role in that tragedy? We all must be accountable for our contributions to society's problems, and if there is anything at all we can do to improve the lot of our fellow man, then we should at least consider those options.

FOR SALE

PGF AVOCADO GRADING MACHINE

Unit comprises:

- Conveyor
- 2 Blow dryers
- 4 Bins

Lismore Area

Priced to sell at \$6,000

Ph 02 6628 7666

Plant Growth Regulators In Avocados

A presentation by Jan Toerien, Avodata, former manager of Westfalia in South Africa, at a NSW Field Day held on 14 May 1999 at Ballina NSW

Introduction

The profitability of avocados depends largely on the management of the balance between vegetative growth and the reproduction functions of flowering, fruit-set and fruit-drop. The quantity and quality of avocados can be manipulated through the correct application of Plant Growth Regulators (PGR's). The fruit shape, fruit size, total crop and fruit quality can be improved.

The success of PGR's will depend on the management of the vital production functions. Only healthy, stress free, well-managed orchards should be considered for treatment. Optimal Phytophthora control, canopy management, nutrition and irrigation management, and management of the

reserve status, are the critical elements that will determine the success of any PGR treatment.

The potential profitability of PGR treatments to avocados is excellent, but it should be remembered that it is an additional treatment to the basic management functions, PGR's will not benefit any tree or orchard that is stressed.

Development of a canopy management system will help to stabilise production in the future and I believe that the pyramid hedgerow will be the dominant system. Summer pruning and PGR's form an integral part of the new system. The development is in an advanced stage, but more work will have to be done.

PGR's are only available under experimental label for fruit-set in Australia at present.

Vital Production Factors

The effect of PGR's will be pre-determined by a number of factors that can be influenced by management. Phytophthora, canopy management, irrigation, fertilisation and reserve management are factors that will influence the yield potential of an orchard.

Phytophthora

Phytophthora attacks and destroys the small feeder roots of the avocado and

16



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

reduces the absorption capacity. The tree will suffer from water-stress and mineral deficiencies. Stress conditions in the tree will lead to a reduced yield potential and increase of the gaseous hormone ethylene. High levels of ethylene will increase abscission of flowers, fruit and leaves. This will reduce the diseased tree's capacity to bear a good crop. Without a good root system, a high yield will affect the tree condition detrimentally.

The effect on diseased trees could be seen in cases where PGR treated trees lost condition after a number of years of spraying. Diseased, poor growing trees and orchards should not be treated commercially with any PGR to increase the yield. First treat trees against *Phytophthora* and then PGR's can be considered.

Canopy management

Without exposure to sunlight, photosynthesis is reduced and the tree reserve levels will be reduced. Flower induction, flowering and fruitset will be poor and yield potential will be reduced.

Overcrowding also causes leaves, twigs and branches to be killed by shading and in practice develop into the classical cathedral type of orchards. The entire lower growth dies off and only the very high branches in the treetops remain green and productive.

Proper canopy management should provide a good exposure to light and will increase yield potential in the long term. In such orchards, PGR treatments can be very successful to increase fruit size and yield.

The pyramidal hedgerow is fully developed in Israel and very advanced in South Africa. Summer pruning and management of regrowth holds a huge potential for the future. The new canopy management systems will be fully developed in Australia in the not too distant future. More work should be done on the timing under Australian conditions and residue analysis work for registration.

Irrigation

Water stress should be prevented at all stages, but especially during flowering and fruit set. Competition from the terminal vegetative growth together with water stress will increase fruit drop. Fruit growth, through cell division and cell enlargement, is retarded by moisture stress.

Moisture stress lead to an increased level of the stress hormones. Ethylene is a gaseous plant growth regulator involved in the differentiation of shoot growth, but also increases the abscission of flower, fruit and leaves.

Fertilisation

Balanced nutrition is vital for optimal production and deficiencies and excesses should be regarded as negative factors that cause stress. Nitrogen can be regarded as the most critical element because it plays a big role in the vegetative status of the tree. Timing plays an equally important role. It should be kept in mind that vegetative growth and flowers and fruitlets compete for water and minerals.

Reserve management

Alternate bearing is associated with high yields in avocados. A high yield leads to a low reserve status, which leads to a low crop. The low crop leads to a high reserve status that leads to a high crop and the cycle starts all over again.

Harvesting the fruit when it reaches maturity is not popular amongst growers who want to wait for the high prices later in the season. It should be remembered that the oil content of fruit increases at 0.1%/day. This takes place at the cost of the reserves of the tree, and the lowered reserve status leads to a lower crop. This phenomenon has been proved in many countries and was confirmed in Australia.

When a 20 t/ha crop is stored on the trees until late in the season, when the dry matter reaches 25 to 30% or more, it should be realised that the next crop would be affected adversely. PGR treatments can increase the yield and the high yield will increase the pressure on the tree. Harvesting programs needs to be managed sensibly to give the tree an opportunity to build sufficient reserves for the next crop.

Opportunities

Phytophthora control, canopy management, balancing fertilising and reserve management, is vital in the management of increasing the yield economic potential of avocados.

Single tree studies showed that selected super trees have a delayed development of 5 days between flowering and the development of the vegetative terminal bud. In contrast, the consistent poor producing trees that have a concomitant development of the flowers and the terminal vegetative growth. This demonstrates the severity of the Cain and Abel syndrome during flowering and fruit set. It is interesting that high yielding cultivars like Nabal and Reed do not have a vegetative flush in competition with the flowers and fruitset.

Removing the terminal growth flushes physically during flowering can control vegetative growth. This will take the

vegetative competition away and favour fruit set and fruit retention.

Research results proved this principle in all avocado producing countries. Spanish flower pruning projects showed promise under Mediterranean climatic conditions. Work in South Africa confirmed that it could be beneficial in some seasons but that it is still too unreliable as a commercial system.

Plant Growth Regulators

Basic Process

Production of fruit is the result of the balance between vegetative growth and the reproduction processes of the avocado. During the flowering period strong vigorous growth will compete with the flowers and young fruit for nutrients and water.

Gibberellin Acid is the major plant growth hormone, high concentrations lead to vigorous vegetative growth. Gibberellin is involved in growth promotion of stems by stimulation of both cell division and elongation.

Gibberellins also regulate fruit set and growth and are synthesised from mevalonic acid in tissues of the shoot and the developing seed.



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

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

Birdwood Nursery

Peter and Sandra Young
71-83 Blackall Range Road
Nambour Qld 07 5442 1611

FIELD DAY REPORT

Triazole compounds

The Triazole range of chemicals is mainly known as fungicides with the exception of two PGR's, namely:

1. Paclobutrazole- Cultar®, and
2. Uniconazole - Sunny®.

These products interfere with the synthesis of gibberellic acid, resulting in lower gibberellic concentrations in the plant tissue.

Experimental and commercial results in Israel, South Africa and Australia show that PGR's increases fruit size, shape fruit and can increase yield on healthy, stress-free, well-managed orchards. Both products have been used successfully on a commercial scale for a number of years. I am convinced that the technology associated with these products will determine the success or failure of PGR treatments to the producer.

The Gibberellic inhibiting PGR's inhibits the Gibberellic acid synthesis and blocks the Kaurene to Kaurenoic Acid synthesis. This leads to the reduction of vegetative growth by suppression of cell elongation.

The soft tissue consisting of leaves, twigs and the flowers absorbs Uniconazole. Translocation is acropetal via the transpiration stream in the xylem.

The Effect of the PGR's

- Change fruit shape by reducing the long neck of fruit. This makes handling and packing easier and the fruit will ripen more uniformly.
- Increased fruit size—it is very efficient on Hass.
- Will increase yield in well-managed orchards.

Research in Israel for more than 9 years and the commercial spraying for more than 5 years developed protocols for the successful application of PGR's. They spray 25,000 litres per year with very good results. The Israeli's avocado industry is in agreement that their industry is very dependent on the use of PGR's to survive economically. Prices on the European market are low for their avocados and they need high production per hectare.

The timing of application is very important and will determine the results that can be expected. Cultivar and specific needs like fruit size or fruit shape will determine the specific spraying stage.

Markets are becoming more sensitive to chemicals and chemical residues in food. Residue will persist in lignin if the spray is applied incorrectly. The breakdown in soil is also very slow. The application systems should be well controlled to avoid contamination.

I believe that PGR's are a specialised product-range with a great potential if applied correctly. It is expensive and all orchards should be evaluated individually for suitability before a decision is taken to spray. Wrong choices in application, volume, timing or orchard could lead to poor results.

Summary

Plant Growth Regulators have a good potential to increase the relative low production of avocados in Australia. It is vital that the major production functions are managed



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



ATTENTION AVOCADO GROWERS

INTRODUCING "LAMB HASS"™



A SUMMER HARVEST HASS TYPE

THIS IMPRESSIVE NEW AVOCADO VARIETY FROM CALIFORNIA IS SHOWING GOOD POTENTIAL TO SIGNIFICANTLY INCREASE FRUIT AVAILABILITY DURING THE PEAK SUMMER DEMAND PERIOD FROM DECEMBER TO MARCH.



Palmwoods South East Queensland, November 1998

- Attractive glossy black when ripe, smaller seed and excellent eating quality to rival Hass.
- Superior fruit retention and high yields within 2 to 3 years from planting.
- Strong multi-branching upright tree suited to high density canopy managed orchards
- Earliest maturity time is 4 weeks after Hass and latest harvest time 12 to 14 weeks after Hass.

Lamb Hass™ exclusive to ANFIC
Profile Sheets available on request

TREES AVAILABLE FOR SPRING PLANTING or ORDER NOW FOR AUTUMN SPRING 2000



Contact Miles Porteous or Peter Young
Birdwood Nursery
71-83 Blackall Range Rd, Nambour Qld 4560
Phone: (07) 5442 1611 Fax: (07) 5442 1053
Mobile Advisory Hotline 0408 715 994



SPECIALIST SUPPLIERS OF HIGHEST QUALITY ACCREDITED CONTAINERISED FRUIT TREES

Progress On The Use Of Foliar Applications Of Phosphonate For The Control Of Phytophthora Root Rot In Avocados

By J. Leonardi and A.W. Whiley, Queensland Horticulture Institute, Maroochy Research Station, Nambour, P.W. Langdon and K.G. Pegg, Queensland Horticulture Institute, Indooroopilly, Brisbane, and J. Cheyne, Department of Natural Resources, Indooroopilly, Brisbane

Introduction

In 1996 the R & D committee of the AAGF requested the investigation of alternative means to trunk injection for applying phosphonate fungicides to avocado trees. Research addressing this issue has been carried out under the Avocado Health and Canopy Management project jointly funded by the AAGF/HRDC and QHI.

Delivery of phosphonate to the tree through soil drenching has been found to be unsatisfactory with increased risks in reducing the sensitivity of Phytophthora to phosphonate fungicides.

During his time with QHI, Dr Clive Kaiser began some preliminary investigations into the use of modified phosphonate formulations as foliar sprays for the control of Phytophthora root rot. This article reports on the progress that has been made during the 1998/99 fruiting season with foliar applications of phosphonate fungicide.

The research has been targeted at developing information that is required for a submission to the National Registration Authority for registration of a new label for foliar applied phosphonate since the rate being developed is substantially higher than that for the existing foliar registration. Issues that are being addressed are phytotoxicity, application timing, control of root rot and fruit residues/withholding periods.

Experimental sites to generate this information were set up in Queensland and New South Wales.

The registered foliar-applied di-potassium phosphonate currently available to the avocado industry is a 0.1% a.i. formulation that is applied at a pH of 5.0–5.6. The two new formulations tested in this program were 0.5% a.i. and 1.0% a.i. di-potassium phosphonate with the pH adjusted to 7.2.

While substantial progress has been made it will require another season's research to complete the information

required for registration of a 0.5% a.i. di-potassium phosphonate foliar spray that can be legally used by the Australian avocado industry.

Phytotoxicity

Phytotoxicity studies were conducted in a commercial orchard at Childers. Branches of non-fruiting 'Hass' trees were sprayed with 1% a.i. formulations of di-potassium phosphonate with pH adjusted to 6.8, 7.0, 7.2, 7.4 and 7.6. In addition, di-potassium phosphonate was foliar-applied at 0.5% a.i. or 1.0% a.i. (pH 7.2), with or without the surfactants Agral® (at 0.1 and 0.2%) and Nufilm® (at 0.05 and 0.2%) and in combination with copper hydroxide (Blueshield DF®) or copper oxychloride (Barmac®) plus endosulfan (Endosulfan 350 EC®). Sprays were applied to trees in the morning and evening and the leaves rated for burn within seven days of application.

Results from the evaluation of 1% a.i. di-potassium phosphonate sprays at Childers adjusted to different pH values showed that phytotoxicity (leaf burn) was related to the pH of the formulation applied to the trees.

When di-potassium phosphonate was used without any other pesticides there was significantly less damage when the formulation was adjusted to pH 7.2 (Table 1). When di-potassium phosphonate was combined with copper oxychloride plus endosulfan, the pH 7.6 formulation caused less damage than the same pesticide combination at other pHs. When 1% di-potassium phosphonate was combined with copper hydroxide and endosulfan the pH 7.2 formulation gave the least leaf burn (Table 1).

In other experiments at Childers, a reduced level of phytotoxicity occurred when foliar sprays of 0.5% di-potassium phosphonate (pH 7.2) were applied with copper fungicides and endosulfan. However, with the addition of Agral® or Nufilm® to either di-potassium phosphonate formulation there was a much greater incidence of damage—either leaf burn and/or leaf drop.

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

Table 1 Phytotoxic effects of 1% a.i. di-potassium phosphonate sprays on 'Hass' leaves at Childers. Leaf burn was rated on a 0 - 5 scale where 0 = no burn and 5 = extensive burn. Data are mean values of ratings from 12 trees.

| pH Treatments* | Pesticide Combinations | | |
|----------------|------------------------|---|---|
| | Phosphonate | Phosphonate + copper oxychloride + endosulfan | Phosphonate + copper hydroxide + endosulfan |
| 6.8 | 2.00 | 2.00 | 1.58 |
| 7.0 | 1.33 | 1.75 | 1.42 |
| 7.2 | 0.83 | 1.75 | 1.08 |
| 7.4 | 1.42 | 1.58 | 1.42 |
| 7.6 | 1.67 | 1.25 | 1.42 |

* The pH of the di-potassium phosphonate solution was adjusted through the addition of potassium hydroxide.

It should be noted that phytotoxicity was not always predictable and its severity is most likely linked to temperatures within 24 hours following spraying. **However, no phytotoxicity was observed where 0.5% a.i. di-potassium phosphonate (pH 7.2) was applied in the absence of wetters/stickers or other pesticides.**

Application Timing

The determination of a timing regime for foliar application is important for:

1. the control of the disease;
2. the minimisation of fruit residues at harvest; and
3. development of the most cost-effective application regime.

As the efficiency of uptake and distribution in the tree were unknown at the beginning of the program two strategies were employed:

1. the rate of loss of phosphorous acid concentration in roots was monitored after a single foliar application of di-potassium phosphonate to determine when re-treatment should occur; and
2. root concentrations of phosphorous acid were monitored after 0.1, 0.5 and 1.0% a.i. foliar applications and trunk injections of di-potassium phosphonate

to assess the relative efficiencies of the treatments.

Foliar di-potassium phosphonate was applied once to 13-year-old, non-fruiting trees at Maleny at either 0.5 or 1.0% a.i. (pH 7.2) and root phosphorous acid concentrations were measured every two weeks to determine the rate of loss. There was a trend for roots from trees sprayed with 1.0% a.i. di-potassium phosphonate to have higher root concentrations of phosphorous acid for the duration of the study but this was not significantly different from that of trees treated with 0.5% phosphonate (Table 2). The high root concentrations (65.2-82.3) measured two weeks after application are likely to be a result of tree phenology at the time of treatment in combination with no crop load to moderate distribution.

In the second study, 0.1% a.i. (pH 5.8) and 0.5 or 1.0% a.i. di-potassium phosphonate (pH 7.2) were foliar-applied to trees on the 17 Nov and the 15 Dec 1998. A trunk injection of 15 mL of 20% formulation per metre of tree diameter was also given on the 15 Dec 1998 when the spring flush had matured. Root phosphorous acid concentrations were measured two weeks after each foliar application of di-potassium phosphonate.

There were significant differences in phosphorous acid root concentrations after each treatment (Table 3). Two weeks after the first application, root phosphonate concentrations in trees treated with 0.5 and 1.0% a.i. di-potassium phosphonate were significantly higher than those in untreated trees or trees sprayed with a 0.1% a.i. di-potassium phosphonate. Similarly, there were significant differences in root concentrations of phosphorous acid between treatments after application of two foliar treatments or one trunk injection.

The two foliar sprays of 0.5 and 1.0% a.i. di-potassium phosphonate produced the highest phosphorous acid root concentrations while a single trunk injection was almost as effective. These three treatments gave much higher phosphorous acid root concentrations than the 0.1% foliar spray (Table 3).

Control of Root Rot

The experiment to develop disease control data was carried out on a commercial property at Duranbah, northern NSW. Three-year-old 'Hass' trees with no previous history of phosphonate treatment were chosen for the study. The trees were growing on a replant site infested with *Phytophthora cinnamomi* where health had been maintained in previous years with soil applications of Ridomil®. At the time of the first phosphonate treatment the trees were approximately 1.2 m tall and had set a light crop.

Trees were sprayed at approximately monthly intervals from the 12 Nov 98 with di-potassium phosphonate at 0.1% a.i. (pH 5.8) and 0.5 or 1.0% a.i. (pH 7.2). No surfactants were used with these treatments and trees were sprayed to complete wetness (1.5 L/tree). Trunk injections were made on the 12 Nov 98 and the 12 Feb 99. Worm casts were also applied to the soil beneath the canopy of some trees to assess their ability to control *Phytophthora* root rot. The health of trees was evaluated on the 10 Mar 99 (Table 4) and the 27 Jul 99 (Table 5).

Four months after beginning the experiment all phosphonate treated trees had significantly improved root health when compared with untreated trees and those where worm casts were used (Table 4).

A further health rating of trees 8 months following the commencement of spraying

20

Table 2. Effect of time on phosphonate root concentrations (mg/kg) in 'Hass' avocado roots following one foliar spray. Data are mean values from six trees.

| Treatment | 1 st harvest* | 2 nd harvest | 3 rd harvest | 4 th harvest | 5 th harvest |
|------------|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.5% spray | 65.2 | 44.8 | 27.1 | 16.2 | 11.6 |
| 1.0% spray | 82.3 | 49.9 | 30.8 | 25.0 | 12.3 |

* The 1st harvest was on the 12 February; 2nd harvest the 22 February; 3rd harvest the 9 March; 4th harvest the 22 March; 5th harvest the 6 April.

Table 3. Phosphonate concentrations in roots of 13-year-old fruiting 'Hass' trees following two foliar sprays and trunk injection. Data are the means of five trees.

| Treatments | Phosphorous acid conc. (mg/kg) | |
|---|--------------------------------|----------|
| | 2 Dec 98 | 7 Jan 99 |
| Untreated | 0.6 | 0.7 |
| Foliar PO ₃ at 0.1% (pH 5.8) | 5.3 | 9.0 |
| Foliar PO ₃ at 0.5% (pH 7.2) | 26.8 | 38.3 |
| Foliar PO ₃ at 1.0% (pH 7.2) | 37.7 | 50.9 |
| Trunk injection (15 mL/m canopy diameter) | Not treated | 31.6 |

* Trees were sprayed to wetness with a backpack Stihl mister unit on the 17 Nov 98 and the 15 Dec 98. Trees were trunk-injected on the 15 Dec 98.

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

di-potassium phosphonate showed that the treatments continued to provide control of *Phytophthora* root rot.

Root mass was significantly greater in phosphonate treated trees than in those treated with worm castings while the percentage of healthy roots was significantly greater in trees sprayed with 0.5 or 1.0% a.i. di-potassium phosphonate or trunk-injected with 20% di-potassium phosphonate than in untreated trees (Table 5). While there was no significant difference in the rating of tree health as judged by the canopy, there was a general trend for trees to be healthier when trunk-injected or sprayed with 0.5 or 1.0% di-potassium phosphonate (Table 5).

Phosphonate Residues and Withholding Period

Residue and withholding data were collected from a commercial orchard at Maleny, southeast Queensland. Thirteen-year-old 'Hass' trees with no previous history of phosphonate treatment were chosen for the study. At the beginning of the experiment, trees were approximately 4 m in diameter and 3.8 m tall.

Foliar di-potassium phosphonate was applied at 0.1% a.i. (pH 5.8) and 0.5 and 1.0% a.i. (pH 7.2). The first sprays were applied to the trees on the 12 Nov 98 when approximately 70% of the terminals were actively growing. Subsequent sprays were applied at 3-4 weekly intervals. Trees were sprayed to full wetness (4-5 five litres of solution per tree at each application). At the time of the second spray on the 15 Dec 98, spring growth had matured and trunk-injection was included as a treatment. A second trunk injection was made on the 15 Mar 99.

There were significant differences in fruit residues of phosphorous acid between treatments when fruit was analysed at maturity (Table 6). The 1.0% a.i. foliar application of di-potassium phosphonate resulted in fruit with the highest phosphorous acid residues (110.5 mg/kg) which exceed the maximum residue limit (MRL) set for avocado (100 mg/kg). The 0.5% a.i. foliar application of di-potassium phosphonate and the trunk injection treatment gave similar concentrations of phosphorous acid in the fruit that were well within the MRL set for this crop.

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

Table 4. Effect of worm casts and foliar-applied and trunk-injected di-potassium phosphonate on root health of 'Hass' avocado trees at Duranbah. Root health data were collected on the 10 Mar 99 by estimating the percentage of root tips that were free of disease. Data are mean values of five trees.

| Treatments* | % healthy roots |
|---|-----------------|
| Untreated | 59.5 |
| Worm castings | 41.0 |
| Foliar PO ₃ at 0.1% (pH 5.8) | 89.4 |
| Foliar PO ₃ at 0.5% (pH 7.2) | 79.0 |
| Foliar PO ₃ at 1.0% (pH 7.2) | 85.0 |
| Trunk-injected PO ₃ | 88.0 |

* Worm casts were applied at the rate of 5 L/m² under the tree canopy on the 12 Nov 98. Foliar sprays of di-potassium phosphonate were applied on the 12 Nov 98, 10 Dec 98, 7 Jan 99 and 12 Feb 99. Trunk injections of di-potassium phosphonate were made on the 12 Nov 98 and the 12 Feb 99 at the rate of 15 mL/m diameter of tree canopy.

Table 5. Effect of worm casts and foliar-applied and trunk-injected di-potassium phosphonate on root mass, root health and tree health of 'Hass' avocado trees. Root mass, root health and tree health data were collected on the 27 Jul 99. Root mass was estimated using a 0-3 rating system where 0 = low and 3 = high; root health was estimated as the percentage of root tips that were free of disease; tree health was estimated on a 0-10 scale where 0 = healthy and 10 = dead. Data are mean values of five trees.

| Treatments* | Root mass (1-3) | % healthy roots | Tree health (0-10) |
|--------------------------------|-----------------|-----------------|--------------------|
| Untreated | 1.7 | 50.0 | 2.8 |
| Worm casts | 1.3 | 74.5 | 3.8 |
| Foliar PO ₃ at 0.1% | 2.3 | 73.0 | 2.0 |
| Foliar PO ₃ at 0.5% | 2.5 | 91.0 | 1.6 |
| Foliar PO ₃ at 1.0% | 2.3 | 90.0 | 1.6 |
| Trunk-injected PO ₃ | 2.5 | 85.0 | 1.0 |

* Worm casts were applied at the rate of 5 L/m² under the tree canopy on the 12 Nov 98. Foliar applications of phosphonate were applied on the 12 Nov 98; 10 Dec 98; 7 Jan 99; 12 Feb 99; 10 Mar 99; 14 Apr 99 and the 3 Jun 99. Trunk injections of phosphonate were made on the 12 Nov 98 and the 12 Feb 99 at the rate of 15 mL/m diameter of tree canopy.

Table 6. Phosphonate concentrations in mature avocado fruit following a program of foliar or trunk injected phosphonate. Data are means of eight fruit from each of five trees in each treatment.

| Treatments | Phosphorous acid concentration (mg/kg) |
|---|--|
| Untreated | 1.5 |
| Foliar PO ₃ at 0.1% (pH 5.8) | 6.7 |
| Foliar PO ₃ at 0.5% (pH 7.2) | 52.8 |
| Foliar PO ₃ at 1.0% (pH 7.2) | 110.5 |
| Trunk-injected PO ₃ | 58.5 |

Table 7. Phosphorous acid residues measured in avocado fruit following foliar applications of 0.5 and 1.0% a.i. di-potassium phosphonate solutions at 0.08, 1, 3, 7 and 14 days after treatment. Data are mean values of 5 trees and are expressed as mg/kg.

| Spray concentration (%) | Time after foliar application (days) | | | | |
|-------------------------|--------------------------------------|------|------|------|------|
| | 0.08 | 1 | 3 | 7 | 14 |
| 0 | 0.25 | 0 | 0 | 0 | 0 |
| 0.5 | 4.05 | 4.15 | 3.40 | 2.80 | 3.70 |
| 1.0 | 4.30 | 4.30 | 4.80 | 2.70 | 3.15 |

To define a safe withholding period for foliar applied di-potassium phosphonate, bearing trees were sprayed with 0.5 and 1.0% a.i. formulations adjusted to pH 7.2 when fruit had reached maturity. Fruit were then collected for phosphorous acid analysis 2 hr and 1, 3, 7 and 14 days after spraying. Data on mean residue concentrations of phosphorous acid (phosphonate) in fruit are reported in Table 7. The range of phosphonate residue concentrations across treatments was 0-4.8 mg/kg. The data indicates that when phosphonate is applied to mature fruit there is little uptake into the flesh. This supports earlier results obtained

when trunk injection was similarly tested in relation to mature fruit.

Conclusions

The research to date has indicated that a 0.5% a.i. di-potassium phosphonate (pH 7.2) formulation can be foliar applied to avocado trees and results in a similar root concentration of phosphorous acid to that found in trees that have been trunk-injected with a 20% formulation. The 0.5% a.i. also results in fruit with phosphorous acid residues well below the MRL set for this crop and treatment of mature fruit has a negligible impact on fruit residues.

Where tested, it was found that the addition of wetters or stickers to the foliar formulation and/or other pesticides increased the risk of leaf burn or partial defoliation. When related to tree health there was no commercial difference between the 0.5 or 1.0% a.i. di-potassium phosphonate foliar sprays and the standard trunk injection treatment. Research with foliar application this coming season will focus on the frequency of application required to maintain tree health.

Our data has shown that foliar applied phosphonate moves in trees in the same manner as when trunk-injected and is strongly influenced by tree phenology at the time of application. Research with other crops has shown that pollen viability is reduced by phosphonate sprayed on trees during flowering with a potential reduction in fruit set.

Our work has also shown that if fruiting trees are treated between flowering and the end of spring flush maturity there is a greater probability that phosphorous acid residues will exceed legal limits when fruit is mature. This is because during this stage, fruit is undergoing its fastest relative growth rate and draws in proportionally more phosphonate than at any other time of its development.

The most effective times to apply phosphonate to trees in relation to minimising fruit residues and maximising root concentrations are in late spring when shoot growth has matured and in summer during times when shoot growth in trees is minimal. The data to date suggests that a late spring foliar application followed by 2-3 sprays during the summer/autumn will maintain health in a fruiting avocado tree. During 1999/2000 we will be focusing on this strategy together with testing a new plant defence promoter in combination with lower concentrations of di-potassium phosphonate that will further minimise the likelihood of phytotoxic reactions in the presence of leaf pesticide residues.

Acknowledgments

We thank J & J. Dorrian, S & L.M. Gray and G. Anderson for access to trees on their properties for the experimental program and the AAGF, HRDC and the QHI for funding this research.

Orchardists...

Here's the New, Automatic Self-levelling work platform that you've been waiting for...

TOPLAT SL5

Due to increasing demand for mobile work platforms suitable for hillsides, Bartlett Engineering are pleased to announce the development of the Toplat SL5, a self-propelled elevating platform that is capable of automatically levelling itself when working on sloping or uneven ground.

Reaching a maximum height of 5 metres the Toplat SL5 can cope with a gradient of up to 1 in 3 while still providing the manoeuvrability that is the best feature of the three wheeled design. Ideal for orchards that have mounded tree beds.

Powered by a Honda 11hp motor with electric start this machine comes standard with two speeds. Available with either 5 or 12.5 cfm air compressor for pruning. Other options include picking bag and free-wheeling hubs for towing.

Bartlett Engineering also makes standard 6m, 5m and 3m models. The latest addition to our range is an SL6 model. We have a policy of giving customers what they want and are willing to discuss with them any variation in design they feel may be appropriate to their needs.



For further information please ring

Bartlett Engineering P/L

ACN 074 324 637

58 Juliet Street (P.O. Box 108) Gayndah Qld 4625

Ph: (07) 4161 2292 Fax: (07) 4161 2535

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

Retail Surveys Show Little Quality Improvement

By Peter Hofman and Scott Ledger

Eight retail surveys over the period from 1993 to 1998 have suggested that there is little consistent improvement in quality of avocado fruit on the retail shelf. Poor internal quality is still alarmingly high today, particularly in 'Hass'.

The surveys

The surveys were conducted in Sydney in February, May and August 1993, in Brisbane in September 1995, and in Brisbane and Sydney in August 1997 and September 1998.

Similar procedures were used in all surveys. Fruit were sampled from about 20-25 retail stores, usually over two days. Only ripe or near ripe fruit that appeared sound, and therefore likely to be selected by consumers, were selected. The ripe fruit were cut into wedges, and assessed for defects using the same rating scales. The surveys concentrated on 'Hass'.

The results

Table 1 indicates that there has been no obvious or consistent improvement in 'Hass' fruit quality over the six years. The amount of unacceptable fruit ranged from 15 to 44%. Only 30-50 % of the fruit were without defects. There was no consistent pattern between Brisbane and Sydney.

Anthracoze and bruising/flesh browning were the most common defects (Table

Table 1. Internal quality of 'Hass' avocados sampled from retail outlets in Sydney and Brisbane from 1993 to 1998.

| Location | Year | % of unacceptable fruit (moderate to severe symptoms) | % of fruit with minor defects (slight to moderate symptoms) | % of fruit with no defects |
|----------|-----------|---|---|----------------------------|
| Sydney | Feb 1993 | 41 | 29 | 30 |
| Sydney | May 1993 | 34 | 26 | 40 |
| Sydney | Aug. 1993 | 28 | 32 | 40 |
| Sydney | 1997 | 20 | 30 | 50 |
| Sydney | 1998 | 29 | 29 | 42 |
| Brisbane | 1995 | 23 | 30 | 47 |
| Brisbane | 1997 | 15 | 44 | 41 |
| Brisbane | 1998 | 44 | 25 | 31 |

2). Levels were similar in 1993, but bruising was more common in the later surveys. Anthracnose severity increased in Brisbane in the later surveys, but showed no consistent pattern in Sydney.

Possible causes of defects

The surveys, and other research, suggest several factors that may contribute to the high levels of defects in 'Hass'.

1. The black skin colour of 'Hass' masks any internal defects, so that apparently good fruit may have poor internal quality. This also makes it difficult for retailers to know when quality has deteriorated to the point where fruit should be discarded.
2. It is hard to determine when 'Hass' is ripe. Skin colour is not well correlated to ripeness, so consumers often squeeze the fruit to determine softness, which can cause bruising. The thicker skin of 'Hass' also makes it more difficult to determine flesh softness.
3. It is thought that consumers checking fruit ripeness by squeezing cause a lot of the bruising. Store managers consider that it will be very difficult to prevent this type of damage, and that consumers will still squeeze the fruit even if they are labelled as "ready to eat".
4. Observations in the later surveys showed a pattern of bruising which suggested that considerable damage is caused by compression in the carton,

because the carton was not strong enough, or not high enough. The 1998 AHC Fresh Produce Merchandising Program for avocados identified damage patterns on fruit that suggested other causes of bruising might be as important.

5. Displaying fruit in multiple layers on "fruit dumps" will result in new fruit being placed directly on top of old fruit, while displaying in single layer trays will reduce customer handling and reduce the risk of over-ripe fruit. There has been a noted improvement in this area over the last six years. However, the AHC merchandising program indicated that about one-third of stores display fruit in trays, so there is still improvements to be made.
6. The AHC surveys found that about 17% of the fruit on the retail shelf were over-ripe.
7. The Market Research Report conducted by Competitive Edge found that there can be extensive storage (up to 6 weeks) at retail level. There can also be long storage times at wholesale level, which could be detrimental to quality.
8. Production practices, for example, disease control and nutrition, can have an effect on fruit quality.

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

| Survey location | Defect | % of unacceptable fruit (moderate or severe symptoms) | | | |
|-----------------|-------------------------|---|------|------|------|
| | | 1993 | 1995 | 1997 | 1998 |
| Sydney | Flesh browning/bruising | 12 | | 16 | 19 |
| | Anthracnose | 12 | | 3 | 8 |
| | Chilling injury | 4 | | 0 | 1 |
| | Stem end rot | 9 | | 1 | 0 |
| Brisbane | Flesh browning/bruising | | 13 | 14 | 21 |
| | Anthracnose | | 3 | 11 | 13 |
| | Chilling injury | | 8 | 0 | 8 |
| | Stem end rot | | 1 | 2 | 2 |

Table 2. The levels of main defects identified in retail surveys in Sydney and Brisbane from 1993 to 1998. The 1993 numbers are the average for the surveys conducted in February, May and August.

Further reading

- Improving Avocado Handling During Marketing. How to Improve Your Margin.* Competitive Edge (Asia), 1996, Hawthorn, Australia.
- AHC Fresh Produce Merchandising Program. Avocados. August 1998 Report.* Australian Horticulture Corporation, Sydney.
- Ledger, S. N. and Barker, L. R. (1995). *Black avocados - the inside story.*

Proceedings of the Australian Avocado Growers' Federation Conference "The Way Ahead", 71-7.

- Ledger, S. N., Campbell, T., Banks, A., Atkinson, I., Kernot, I. and Fullelove, G. 1993. *Internal Quality of Avocados in Retail Shops.* Internal report, Queensland Department of Primary Industries, Brisbane.
- Story, A. 1998. *Internal Quality of Avocados in Brisbane and Sydney Retail Shops. Report for the Australian Avocado Growers' Federation and Department of Primary Industries and Energy's Agribusiness Program.*
- Story, A. and Rudge, T. 1995. *Internal Quality of Avocados in Brisbane Retail Shops. Report for the Australian Avocado Growers' Federation and*

To Present Your Produce Attractively CONTACT **Label Press**

Manufacturers of:- SELF ADHESIVE FRUIT & POLYSTYRENE LABELS, GUMMED BACK, NON-TEARABLE & PLAIN TICKETS OR TAGS ON ROLLS OR SHEETS.

PRINTED TO YOUR REQUIREMENTS.

Genuine honest quotes.
No trick pricing. No hidden costs.

Phone 1800 773 207

**25 Burke Street,
Woolloongabba 4102.**



Department of Primary Industries and Energy's Agribusiness Program.

Story, A. and Rudge, T. 1997. *Internal Quality of Avocados in Brisbane and Sydney Retail Shops. Report for the AAGF and DPIE's Agribusiness Program.*

Improving Fruit Quality To The Consumer

By Peter Hofman and Scott Ledger

The avocado industry has been aware of the high level of poor fruit quality offered to the consumers for many years. Surveys of fruit quality on the retail shelf from 1993 to 1998 have indicated that considerable improvement can be made to increase consumer satisfaction (see previous article).

A well-coordinated effect is required by the participants in the supply chain (growers, transporters, wholesalers, retailers and consumers) to reduce the risk of quality loss at all stages. However, it is a challenge to get everything right, from disease control and nutrition in the orchard through to appropriate storage times and temperatures and gentle handling in the store.

There are many steps along the way where quality can be compromised, both during the production and the marketing stages.

One of the important steps to improving quality is to know what commercial practices can contribute to quality loss, and then to implement practices that improve the situation. To start the ball rolling, the AAGF and HRDC, with the NZ avocado industry, have commissioned a pilot project that will build on the efforts that many key operators in the avocado supply chain, from grower to retailer, have made to improve quality.

The project is called "Improving avocado quality to the consumer", with the short title of AVOCARE. The project team includes members from Australia and New Zealand.

The project has close links to the AHC merchandising program, which trains retail staff in avocado handling and presentation, assesses external quality and, this year, will be carrying out internal quality checks.

Project objectives

The project objectives are to:

1. Develop a practical quality assessment manual which describes the important avocado internal quality defects and how to rate for severity. This will develop a consistency between assessments, no matter who does them.
2. Establish a Supply Chain Improvement Group to assist with the project, which is important because of the complexity of the supply chains, the challenges of

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

23 

the proposed methodologies in the project, and the need to ensure that practical solutions are identified.

3. Implement recording systems for growers, transporters, wholesalers and retailers participating in the project to document how avocados are handled.
4. Develop and apply a method that identifies the points in the supply chain where significant quality losses occur, and factors contributing to these losses.
5. Recommend improved practices based on the findings from objective 4.

This pilot project will run from September 1999 to July 2000. If we can develop a method that works and which has the cooperation of the supply chain members, then there is potential to apply this on an on-going basis in the major markets.

Progress to date

The second draft of the assessment manual has been developed by the NZ project team members. A sample page is shown in Figure 1 on the next page. The manual will be "road-tested" during the retail surveys and then further improved. The final version will be completed by July 2000.

Previous retail surveys have been reviewed and summarised to ensure important information that may indicate areas of potential improvement have not been missed.

The first Supply Chain Improvement Group meeting was held on 3 November. Membership includes three growers (and representatives of the AAGF), two wholesalers, a representative from each of the three major retail chains, a representative from HRDC, AHC and the New Zealand Avocado Industry Council, and two project team members from the Queensland Horticulture Institute.

The first meeting of the Supply Chain Improvement Group developed the following methods for the retail surveys:

1. Five Brisbane retail outlets will be surveyed. The three major retail chains stores and two independent retailers will be represented. The stores will be surveyed up to four to six days every week for four weeks to ensure good representation of high and low quality fruit at retail outlets.
2. Samples of all of the avocado lines on display will be taken, and assessed for defects when the fruit are ripe.
3. Fruit samples will also be taken when the lines first arrive at the retail outlet, and temperature loggers will be placed in the cartons at this time.

4. As much information as possible about the handling history of these lines will be obtained from retailers, wholesalers and growers. Good record keeping will be essential to trace lines back to growers, and to identify the practices used.
5. The quality and history of fruit will be compared to determine those practices that may have contributed to defects.

This approach will be tested in a one week trial with one retail store to refine the methodology, and a full one month survey conducted during the avocado season in the first half of 2000.

The project team has made linkages with a packaging company, which is willing to undertake further refinement of avocado cartons if carton design is found to contribute to defects through compression damage and carton collapse etc. In addition, the New Zealand industry is undertaking avocado packaging research, which the Australian industry will have access to as required.

The success of this ambitious project will depend on the willingness of parties along the supply chain to share information and adjust practices for the common goal of satisfying the consumer. Continually providing consumer satisfaction is the only way to maintain industry profitability, so everyone needs to be committed to tracking quality and changing practices to ensure this satisfaction.

Other related activities

There are several other projects aimed at improving the supply chain of horticulture products. These projects are looking at different parts of the chain, but they are very complementary to each other.

1. The Banana Growers Federation (BGF)/HRDC project called "Development of a supply chain management system within the banana industry as a model for the Australian horticulture industry", will be looking at distribution systems and costs.
2. The Australian Centre for International Agricultural Research (ACIAR) is sponsoring a project which will develop methods to accurately identify the key practices in the production and marketing sectors that are preventing horticulture industries from fulfilling future customer demands, and thereby maintaining a competitive edge. The project is concentrating on banana, but the methods developed will be applicable to a range of horticulture commodities.
3. The HRDC commissioned the "Stone fruit cool chain" project, which is aimed at improving temperature management during transport and storage from the packhouse to the wholesaler. See web page; www.sardi.sa.gov.au/hort/coolchai/coolindx.htm for further information. Gains in cool chain management have also been made in vegetables using similar approaches.

Considerable mutual benefit will be gained from our involvement in the first two projects, as well as the new avocado project. We will keep you posted on project findings as they emerge.



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

MOUNTAIN VIEWS NURSERY PTY. LTD.

A.C.N. 010 647 784



**SMALL OR LARGE
ORDERS
CATERED FOR.**

*One of the largest
wholesale growers and
suppliers of
container grown Fruit
& Nut trees in Australia.
Exporting worldwide.*



**COMPETITIVE
PRICES. QUALITY
ASSURED.**

SPECIALISING IN: Citrus, Stonefruit, Pecan Nut, Macadamia Nut, Avocado, Persimmon and Mango.

Also offering a good range of exotic fruit trees.

Free wholesale price list available upon request.

45 PAVILION STREET, POMONA, QLD. 4568

PHONE SUE DAVIS: (07) 5485 1375, FAX: (07) 5485 1377

Trading Hours: Monday to Friday 8.30am to 4.00pm

NURSERY INSPECTION WELCOME. PLEASE PHONE FOR MUTUALLY CONVENIENT APPOINTMENT.

Photograph. The Supply Chain Improvement Group examining avocados sampled at random from several retail stores, during its first meeting. Shown are (from left to right); Peter Sillcock, Gerard McEvelly, Barry Ross, Wayne Pearce, Lindsay Tilbrook, John Dorrian, Jonathan Cutting, Scott Ledger and Astrid Kennedy. Not shown are Peter Hofman, Martin Beattie, George Green, Henry Kwacynski and Gary Poole.



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

Figure 1. A sample page from the quality assessment manual. This page illustrates the defect we call “diffuse Flesh Discolouration”. The text describes the defect, how to rate the severity, and possible causes. The pictures illustrate the defect at three levels of severity (six levels for some of the defects).

6. Diffuse Flesh Discolouration

Description

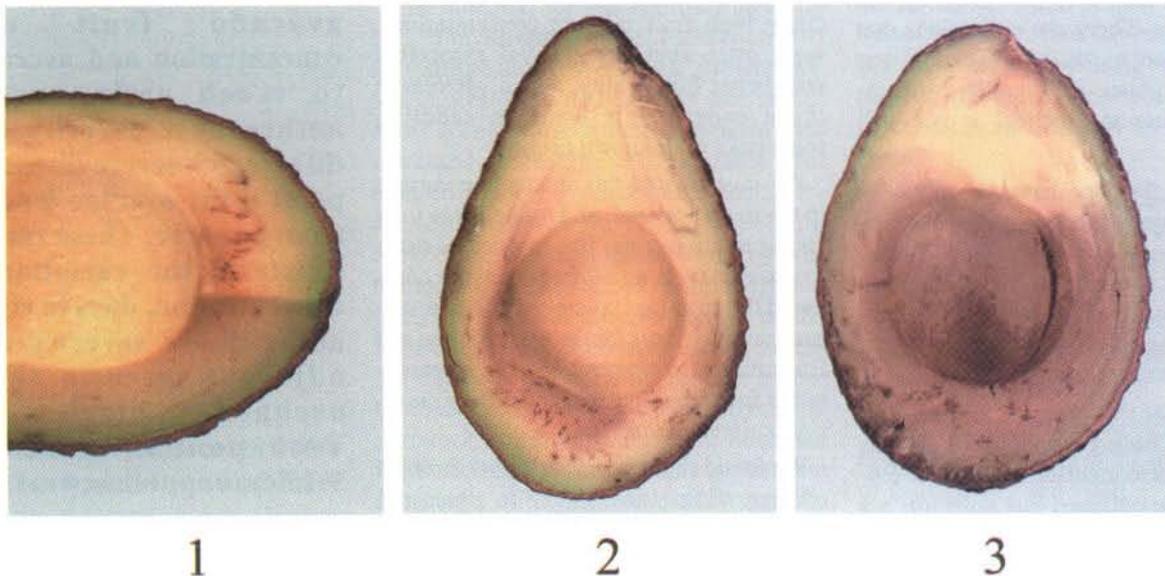
Diffuse areas of discoloured flesh, with no well-defined margin.
 Grey or grey/brown in colour. Black in severe cases.
 Usually starts at the blossom end adjacent to the seed and spreads upwards and outwards.

Rating scale

- 0 None
- 1 One or two small areas of discoloration, approx. 10% of the fruit affected
- 2 Approx. 25% of the fruit affected
- 3 Approx. 50% or more of the fruit affected

Possible causes

Fruit stored for too long and ripened at low temperatures (eg longer than 4 weeks at 6°C).



Fruit Quality And Nutrition – The Role Of Rootstocks

By Peter Hofman, Tony Whiley and Roberto Marques

Background

The avocado industry (growers, wholesalers and retailers) is becoming increasingly aware of the need to deliver a product that the consumer will buy. This is essential for long term viability of the industry, especially in light of growing competition for the consumer dollar from other fruit and vegetables and the increasing potential for competing imports.

The realisation that the industry has a problem was partly stimulated by the retail surveys in the early-mid 1990s. Those surveys indicated that the quality of fruit on the retail shelf was below standard and was having a negative impact on consumer satisfaction (see the article "Retail Surveys Show Little Quality Improvement", page 22).

Fruit quality can be affected by most practices during the production and marketing phases. We have known for many years that poor temperature management, excessive storage times and bad handling can reduce quality, and the wholesaler and retailer training programs from 1994-1997 may have gone some way to improving this area.

It is well known in temperate fruit that production practices can also affect quality, not only in the more obvious areas of postharvest diseases and pests, but also physiological disorders that often appear during storage. There are indications that this interaction exists in avocados, but ways to manipulate fruit quality by commercial production practices is not well understood.

To address this, we have completed a four year project funded by the Department of Primary Industries, Queensland, investigating the effects of production practices on fruit quality, with the final objective of being able to produce the type of avocado different consumers want.

The results of this program will be published in the coming issues of TA. In this article we want to mention some of the evidence we have obtained that nutrition is a key factor in fruit quality, and that rootstocks may be an important long-term key to fruit nutrition and consistent quality.

Evidence

We had previously observed that there is a very significant variation in fruit quality between adjacent 'Hass' trees in the orchard, even when the trees were the same age, on the same soil type, and managed the same way.

In addition, Dr Lindy Coates noted large variations in fruit disease levels between trees used in her biocontrol program, to the extent that the variation between trees was greater than the difference between treatments, so that significant treatment effects sometimes were not evident. This work was done on typical commercial orchards using random seedling rootstocks.

In contrast, Professor Lisa Korsten (South Africa) has found that there are only small variations between trees in her field disease control research, and most of the South African 'Hass' production is on clonal Duke 7 rootstocks. Thus, we have suggested that the wide genetic variability in the rootstocks we are using may be contributing to our fruit quality problems.

In our experiments to investigate the effects of production location, irrigation and Cultar[®] on quality, we noted that there were again large differences in quality between adjacent trees, and that this variation had a greater influence on fruit quality than either the irrigation or Cultar[®] treatments. We also found that fruit minerals, especially high fruit calcium concentrations, were often (but not always) associated with better fruit quality. Again, all trees in these experiments were on seedling rootstocks of unknown origin.

We investigated this interaction further in the irrigation trial, and found some very strong relationships. The trial tested three irrigation levels on 30 trees, and we compared the crop load, average fruit size, disease severity, days for the fruit to ripen and fruit mineral concentrations for representative fruit from five trees in each of the irrigation treatments.

We found that trees with higher fruit Ca concentrations took longer to ripen and had less anthracnose (Figure 1).

We also noticed that trees with higher yield had fruit with higher Ca

concentration, took longer to ripen and had less disease (Figure 2).

We think that this is mainly due to the fact that trees with higher yield had smaller fruit, but their Ca concentration is higher (Figure 3).

Similar results have been obtained in temperate fruit, where larger fruit can have lower Ca concentrations, and often have lower quality and reduced storage

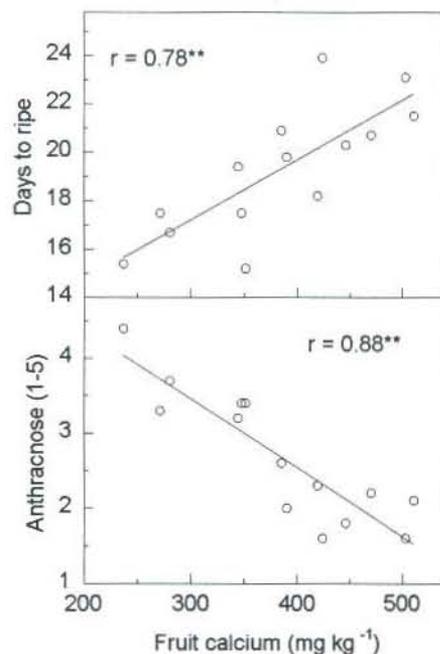


Fig 1. Relation between 'Hass' avocado fruit calcium concentration and average days to reach eating soft, and anthracnose severity (1 = no disease, 5 = severe disease). Each point is the average for the fruit from one tree. These results also illustrate the variation in Ca concentration, days to ripen, and anthracnose severity between adjacent trees in the same orchard block (From Vuthapanich, Hofman and Whiley, unpublished results).

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

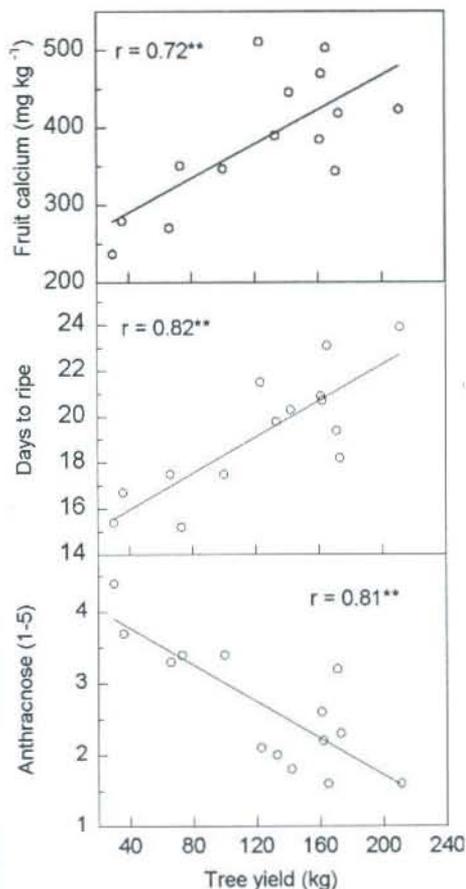


Fig 2. Relation between tree yield and fruit Ca concentration, the days for fruit to ripen, and anthracnose severity (1 = no disease, 5 = severe disease), of fruit from adjacent 'Hass' avocado trees. (From Vuthapanich, Hofman and Whiley, unpublished results).

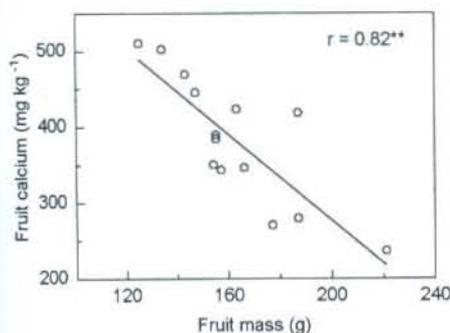


Fig 3. Relation between 'Hass' avocado fruit mass (g) and fruit calcium concentration (From Vuthapanich, Hofman and Whiley, unpublished results).

potential. This is because Ca is important in the structure and function of fruit cells. Cells with less Ca are not as strong, and are more easily "damaged", and larger cells often have less Ca.

What do these results suggest?

These studies indicate that there is a real potential to manipulate fruit quality through nutrition. Since the trees in the above experiments were in three adjacent rows and there was little effect of irrigation on quality or fruit minerals, we think that the variation between trees in disease, ripening, and fruit Ca, may be due to the differences in the ability of seedling rootstocks to accumulate and/or transport minerals. We have noticed in our trials that these relationships are not equally strong in all seasons and locations tested, but we believe that there is sufficient evidence to indicate that we have an exciting approach to improving the level and consistency of avocado fruit quality.

Again, work with temperate fruit trees indicate that rootstocks can have a significant effect on fruit minerals and quality. There is also some evidence of this in avocado, since Tim Smith and Tony Whiley have noted a rootstock effect on boron uptake, and South African researchers have noted a rootstock effect on internal quality. (See the article by Whiley, A.W., Hofman, P. J. and Coates, L.M., called "From seed to tray - some field practices to improve avocado fruit quality", in the Conference '97; Searching for Quality, held in New Zealand in 1997; pages 82-97, reproduced in *Talking Avocados*, December 1997, page 20).

The potential for this approach is being further investigated in the "Field control of avocado postharvest diseases" project (AV 9701). Results to date confirm that higher fruit Ca concentrations are associated with increased percentage of marketable fruit (caused mainly by reduced anthracnose infection) in trees on random seedling rootstocks; although the relationship was not as strong as obtained in the irrigation trial, and was not observed on all of the sites tested. Closer examination of potential rootstock effects is being done by determining fruit quality from the only clonal rootstock block known on the Sunshine Coast. Results to date again confirm that rootstocks influence fruit quality, but this work needs to be repeated over several seasons to confirm the benefits of different rootstocks.

Where to from here?

The above results indicate a real potential for rootstocks to improve fruit nutrition and quality. However, there are seasonal and production location/management interactions and we need to get a better indication of the potential importance of these. This will help us to determine how consistent rootstock effects can be, and to do this we need your help.

We are looking for orchards with trees on rootstocks of known seedling type, so that we can purchase fruit from these trees to determine fruit quality.

We would prefer orchards that are at least reasonably well managed, and where there are trees on several rootstocks in adjacent rows or blocks, so that we can test rootstock effects without the complicating factors of different soil type, management practices, tree age etc.

We would also prefer trees in south east Queensland or northern New South Wales because of the cost of freight to our laboratory at the Maroochy Research Station (Nambour), but we would also like to evaluate fruit from a few orchards in north Queensland.

So, if you have at least five to 10 trees each of several rootstocks that meet the above requirements, then please contact Peter Hofman at the Maroochy Research Station, Ph 07 5444 9647, mobile 0407 173 608 or e-mail hofmanp@dpi.qld.gov.au.

We look forward to hearing from you.

Other activities

Your industry is also looking at other approaches to improve quality. The new "avocado market chain project" will confirm those practices from harvest to the retail shelf that are contributing to quality loss, identify the most important ones and develop recommendations to address these areas.

The current "Avocado canopy management" (AV6004) project is establishing clonal rootstock blocks to further investigate the rootstock/scion interactions, and another project is being developed to provide better nutrition recommendations for optimum yield and quality.

These projects will provide very strong multiple approaches to the important issue of fruit quality and yield.

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

Update On AHC/HRDC Amalgamation Process

At the Horticultural Industry Leaders' Summit in Sydney on 11 August 1999, all of the key recommendations of the Final Report of the Horticultural Industry Alliance Steering Committee (HIASC) to Government and Industry dated 16 July 1999 (the HIASC Final Report on amalgamation of the AHC and HRDC) were adopted by unanimous resolutions.

The Summit, again by unanimous resolution, appointed the members of the Horticultural Implementation Consultative Group (HICG):

| | |
|------------------|---|
| Mr Denis Byrne | Chairman |
| Mr David Cliffe | nursery, processing tomatoes, botanical resources |
| Mr Rod Dalton | avocado, custard apples, passionfruit, strawberries |
| Mr Jon Durham | DFA (apples, pears, cherries, nashi, stone fruit, rubus, canning fruit) |
| Mr Neil Eagle | citrus, table grapes, dried fruits |
| Mr Silvio Favero | Ausveg, garlic, onions, mushrooms, potatoes |
| Mr Bob Granger | VCs inc fresh tomatoes, melons, mangoes, pistachios, nuts, QFVG and other |
| Mr Chris Joyce | macadamia nuts, other nuts, bananas |

The Summit gave HICG members a clear mandate to proceed with the transition and negotiations with government on the structural elements of the new, single service company.

During the Summit, Dr Brian Johnston (AFFA – Horticulture Implementation Team leader) presented the government's likely position on the HIASC Final Report and the implementation process. This included an indicative budget of about \$380,000 in contributions from industry. Government will match this amount approximately with a non-repayable contribution (as it already has done with the HIASC process, contributing 40 per cent of budget funding).

It is envisaged these industry contributions will, subject to Cabinet approval, be advanced by AFFA as a loan to the new company. This loan will be repayable within 12 months of the commencement of the new company.

Implementation Discussions

Following the Summit, extensive discussion and consultation took place between members of HICG, AFFA, Senator the Hon Judith Troeth and many members of the government backbench committee. This consultation culminated in a meeting with Senator Troeth on 13 October 1999 when a number of key decisions were made.

At this meeting it was agreed that a number of matters should be progressed on the understanding that Federal Cabinet had yet to approve the entire restructuring proposal. These actions included:

Preliminary drafting of the constitution of the new company, the Memorandum of Understanding for the implementation of HIASC Final Report, incorporating the voting configurations set out in the HICG Explanatory Comments on voting entitlements in the HIASC Final Report and dated 21 September 1999, and the Deed of Agreement between the government and the new company which deals with accountability and governance issues pertaining to levies.

Budgeting for the implementation process and an adequate communications strategy.

Review of the current operations and services provided by the existing corporations.

Identification of resourcing requirements for implementation process.

Senator Troeth indicated during the discussions that it was her strong wish that the AHC and the HRDC, in exploring the issue of co-location, should move to new offices away from the existing locations. HICG has indicated its support for a new location for both corporations in the interim and will seek to participate in any relevant decisions.

HICG also believes that during the implementation phase it is imperative that open and effective communication should be maintained between the corporations, government and AFFA, and HICG representing industry.

HICG will issue regular reports on the implementation process. In addition, HICG members will consult with their assigned industries on specific issues as the negotiations progress with government, following Cabinet approval.

Prior to the matter going to Cabinet, it will be necessary to complete a review of the export control powers of AHC. That review will conclude with the issue of a Regulatory Impact Statement (RIS). Under Competition Policy, any new legislation which contains a regulatory regime—such as that currently contained in the AHC legislation—must be underpinned by an RIS resulting from a public review process. This review is well underway as submissions closed on 17 November.

It is proposed to convene a meeting in the next few weeks with the Chairs and CEO's of each corporation, senior officers of AFFA and available members of HICG to develop the implementation strategy. One of the first tasks allocated to the corporations at that meeting will be a complete verification of the cost/benefits set out on page 24 of the HIASC Final Report and to identify any other costs likely to be incurred in the incorporation of the new company.

At this meeting it is intended to appoint an Implementation Team which will comprise 3-4 members of HICG, the chairs and CEO's of both Corporations and 1-2 senior officers of AFFA. This Team will drive the implementation process. HICG will continue to be the focus point for industry consultation.