



The Australian Newsline

Talking Avocados



Vol 9 Number 2

June 1998



The Manager's Assistant

- AVOMAN - Here at last
- Pollination and Fruit Set in Avocados
- Manipulating Flowering in Avocados
- Quality Assurance - Part 2

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Table of Contents

Alec Kidd OAM Retires From The Varieties Committee	3
From Your Federation.....	4-5
Levy Increase Starts on 1 July 1998	5
Chemicals	
Agricultural Chemical Application Accreditation	6
National Support For Minor Use Program	6
HRDC	
Technology Transfer Study Has Lessons For Avocados	7
AHC	
Industry Manager's say	8-9
World Avocado Congress IV	9
Australian Round-up	10
AVOMAN	
AVOMAN What Is It?	12
AVOMAN: The big picture	12-13
AVOMAN: The release and beyond	13-14
AVOMAN: How much data entry is required?	14-16
AVOMAN survey results - the importance of training	16-17
What sort of computer do you need to run AVOMAN?	17
Growers' thoughts on AVOMAN ('97 Prototype)	18
New AVOMAN contact person for the Burnett	18
Technical Reports	
Pollination Biology And Fruit Set In Avocado	19-21
Use Of Gibberellic Acid To Manipulate Flowering In The Hass Avocado	22-23
Quality	
Avocado Quality Assurance: Who? Where? When? How? Part 2.	24-27
New Recruit To Avocados	27

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Calendar of Events 1998

July

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

August

- 4 **Avocado Growers' Association of WA** - Annual General 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.
- 27-30 **Fresh '98 AUF/AHC Conference and Exhibition** - Hilton Hotel, Sydney, NSW Contact AUF Office Ph. 02 9763 1767.

September

- 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.
- 27 **AAGF Annual General Meeting** - Tentative date late September, Brisbane Markets. Contact Executive Officer Ph. 07 3213 2477

October

- 5 **Sunshine Coast Avocado Growers' Association** - Field Day during week commencing 5 Oct. Contact Secretary 07 5478 9135.
- 6 **Avocado Growers' Association of WA** - meeting Conference Room, Market City commencing 5.30 p.m.

Front Cover:

With the release of the operational version of AVOMAN, the computer is truly an assistant to orchard management.

Back Cover

Peter Young of Birdwood Nursery demonstrates grafting avocado trees at the Field Day held in May at Stuarts Point, NSW.

Alec Kidd OAM Retires From The Varieties Committee

Mr Alec Kidd, foundation member of the Australian Avocado Growers' Federation and the Varieties Committee, recipient of the Order of Australia Award and the AAGF Award of Merit, retired from the Varieties Committee in March 1998.

Mr Kidd started his career as an avocado grower and champion for the avocado industry in 1933 when he planted his first avocado tree. In the early years Alec was a citrus grower and in 1944 help reform the Tamborine Local Producer Association and was subsequently elected as their delegate to the then Committee of Direction of Fruit Marketing (COD).

As his avocado orchard increased in size, at the expense of the citrus trees, Alec became a foundation member of the Queensland Avocado Advisory Committee and later the Avocado Subcommittee of COD.

Mr Kidd was a grower with vision. He saw the need for a strong national body representing the fledgling avocado industry so that the growers in every State could combine to address common problems rather than deal with them in a fragmented fashion.

Accordingly, in 1974 he guided the emergence of the Australian Avocado

Growers' Federation (AAGF), of which he was inaugural chairman. He served as an executive member including 5 years as chairman until the late 1980's.

On farm, Mr Kidd developed an "organic farming" system that is now standard practice for many avocado growers. Knowing that the avocado tree evolved in the rainforests of Central America, he devised a unique system in an attempt to maintain rainforest conditions in his orchard.

Research indicated that Alec's new management practices encouraged the activity of resident antagonistic micro-organisms which were able to suppress the root rot fungus *Phytophthora cinnamomi*, which had on several occasions almost destroyed the Australian avocado industry.

In 1978 Alec played a major role in the formation of the Avocado Nursery Voluntary Accreditation Scheme (ANVAS). Its objectives were, and still are, the production of disease free avocado trees for industry use. This scheme has been very successful in improving orchard establishment and limiting the spread of avocado root rot fungus.

For five years Alec was the AAGF delegate to the Federal horticulture bodies, the Australian Horticultural Growers Council and Australian United Fresh. He was presented with the AAGF Award of Merit in 1986, the highest honour the industry can give and received an Order of Australia Medal in 1989, a justly deserved award in recognition of a lifetime of meritorious service to the avocado industry.

On behalf of Industry and members of the Varieties Committee, the Federation Board extend their thanks and appreciation to Mr Kidd for his courtesy, knowledge and dedication to the industry and wish him health and a happy retirement.



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

From Your Federation.

By Astrid Kennedy, Executive Officer

Your Federation Board met over two and a half days at the end of March to progress a range of issues. Approval was given to the Marketing Forum to proceed with the marketing plan for the next twelve months and the R, D & E Subcommittee's recommendation that no new projects be funded until the levy increase was effected was also approved.

Directors spent a day revising the industry strategic plan. The Strategic Plan sets out the industry's goals and objectives for the foreseeable future and the Federation is charged with the task of implementation and/or overseeing the activities. Reviewing the Plan periodically enables the Board to ascertain whether or not it is still working towards the industry's brief and allows updating and refocusing to meet changing needs.

The main changes to the plan accommodate the new R & D focus discussed below and the evolving marketing plan. Changes were made to portfolio functions and project timings and a new objective relating to communication was added. The amended Strategic Plan is being reprinted and a copy can be obtained from your Federation's Executive Officer (Ph. 07 3213 2477) or from your representative on the Federation Board.

R, D & E Program Audit Report

Over the 5-6 March, an audit was made of the R, D & E program to ensure existing projects were relevant and on track and that the Subcommittee was adhering to industry's original brief. A professional facilitator was engaged to work with the Subcommittee, guests Tony Whaley and Gerard McEvilly and researchers from current projects. As a result a refocus of priorities was recommended as well as allocating dedicated resources to assist with the management of subcommittee activities.

Refocus

The audit found that the R, D & E plan and subsequent program appeared to be very much focused on production issues prior to the farm gate. It was noted that projects associated with the consumer end were all category C. A realignment was recommended to place the emphasis on growing and delivering fruit that meet or exceed consumer expectations. This led to the reorganisation of the R & D plan around four key focus areas.

Strategic Issues

These are issues that are related to maintaining a viable industry although the outcomes may not be reflected at the farm or the market place:

- Endosulfan use
- exotic pests and diseases
- industry data intelligence
- economic analysis
- crop forecasting
- industry statistics
- hurt analysis
- agrochemicals and environmental issues
- co-operation with NZ R&D
- export
- industry structure
- research funding
- value adding

Growing, Harvesting and Post Harvest

These issues are not necessarily separated from the next two key focus areas. They have been grouped to assist in the management of the overall R, D & E Program. The issues grouped in this area are:

- canopy management
- insect control including IPM
- spray technology
- tissue culture
- plant genetics
- fruit shelf life
- plant nutrition
- irrigation
- fruit size
- technology transfer
- orchard management
- disease control
- AVOMAN

Internal Quality and Consumer Acceptance

Many of the factors listed above interact with or overlap the issues in this focus area. They do, however, contribute significantly to increasing AAGF capability to meet the strategic goals and connect the needs of consumers with the farm and product delivery systems. The issues considered in this area are:

- disease including anthracnose
- rootstock effects on nutrition
- strategic use of irrigation water
- product shelf life
- testing for maturity and ripeness
- strategic use of pesticides

- consumer research and education
- nutritional advantages
- organised marketing
- food safety
- increased fruit storage life
- packaging and transport

Code of Practice

The audit process identified the need for a comprehensive Code to link growing to consumption—to bring together all of the known information from harvest to consumer. The review identified some areas where data/information may be limited and this has been built into the ongoing R, D & E Program. The issues that will be covered in the Code are:

- on farm storage and handling
- grading and packaging
- transport
- temperature regime
- ripening procedures
- disease control
- consumer requirements
- retailer requirements
- time in chain

Your Federation recognised that for a Code of Practice to be useful it must cover all facets from tree to plate and indeed become the industry "bible". A committee has been established to consider and advance the concept. The AAGF Strategic Plan including the restructured R, D & E plan is being reprinted.

HRDC/AHC/Industry Strategic Alliance

At a meeting of Industry Presidents/Chairpersons hosted by the HRDC on 25 February 1998, it was agreed that the timing was right for creating a strategic alliance between AHC, HRDC and Industry. A workshop was convened on 18 March 1998 to advance the matter and the AAGF President and Executive Officer attended.

Following a full day of discussion, 40 participants from a wide range of commodities agreed that a working group should be formed to consider creating a new single service provider. The working group was to consist of five industry representatives, two from each corporation and a representative from DPIE.



AHC and HRDC participating industries conducted a ballot to determine who their representatives on the Strategic Working Group should be. AAGF President, Rod Dalton, and Brian Carroll from the Potato and the Vegetable industries have been elected to represent HRDC participating industries. David Cliffe from the Nursery Industry and Jon Durham from Apple and Pears have been elected to represent AHC member commodities.

The remaining committee members will be the Chairmen and Managing Directors from both service providers, Mike MacNamara from DPIE and Richard Armstrong, Chairman of QFVG. Mr Armstrong will represent HRDC voluntary contributors. Mr MacNamara was involved in the restructuring of the Meat and Livestock industries in 1996. The first meeting was scheduled for 6 May 1998.

Multi-commodity R & D Group

The HRDC in conjunction with Industry has initiated the formation of a reference group to develop policy guidelines for multi-industry R & D projects. Four industry categories were identified and representatives elected from each category to work on the Reference Group. The categories and representatives are as follows:

1. Vegetables and other crops - Brian Carroll, Ian Rickuss and Tim Dyer.
2. Temperate Fruit and Nuts Stonefruit - Kevin Baddiley and Rod Lewis.
3. Citrus, Tropical Fruits and Nuts - Neil Eagle, Mark Panitz and Andrew Pearce.
4. Nursery and Cut Flowers - Jolyon Burnett.

The avocado industry fits into group 3 and will be represented by Andrew Pearce from the Macadamia Nut industry. The group will have its first meeting on Thursday, 11 June 1998.

AAGF Constitution

It is proposed to update the AAGF Constitution to correct anomalies, to bring it into line with current practice and to conform to current legal requirements. Past Federation Director, Mr David Rankine, in conjunction with current directors, is undertaking the task.

Quality Project

The quality project is finished. The final report and whole-of-project audit has been completed and accepted by the DPIE. The project came in under budget with \$13,729 grant and levy funds unspent. The Department has approved your Federation's request that the unspent money be used on further retail surveys.

Two Directors Retire

Two directors retired at the March board meeting, Mr Phil Conner from NSW and Mr Ron Hansen from WA. Mr Dalton, President of the AAGF, thanked both Mr Conner and Mr Hansen for the dedication and expertise they brought to the board and wished both well in future endeavours.

New Chairman for AHC

Senator Troeth announced on 11 May 1998 that Mr Robert Seldon, the Chairman and CEO of Sydney-based merchant bankers Seldon & Associates, is the new Chairman of the AHC. Mr Seldon, who is also Director of a number of other companies, has had previous experience on a primary industry statutory board, being Director of the Australian Fisheries Management Authority for six years.

Your Federation extends a welcome to Robert Seldon and looks forward to developing a harmonious working relationship.

In Brief

Mexican Avocados

There was no truth in the commercial television report that three containers of fresh Mexican avocados were held up on the Melbourne wharves during the recent waterfront dispute.

AQIS has no knowledge of any such import. Firstly, imports of fresh avocado from any country other than New Zealand and Norfolk Island are prohibited and secondly, all imported fresh fruit and vegetables must have an import permit issued by AQIS. No such permit was issued for Mexican avocados. We believe however, that frozen avocado has been imported for some time. Fresh fruit flesh once frozen is not a quarantine concern.

New Faces for Quarantine Peak Body

Anne Story, consultant to the recently completed Quality Project, has been appointed to the Quarantine and Exports Advisory Council (QEAC). The Minister for Primary Industries and Energy, John Anderson, recently announced the appointment of two new members to the advisory committee—Ms Story to replace Dr Beth Woods and Mr Ken Matthews to replace Mr Paul Barrett. The QEAC provides independent advice to the Minister on major quarantine and export certification policy issues.

TA Editor - Clean Bill of Health.

Mr Orf Bartrop, editor of Talking Avocados has undergone treatment for a medical condition since mid-December 1997. Orf received the results of his final tests on

Wednesday, May 13, and I am pleased to report that he has been given a clean bill of health.

The Heart Tick Program

The Tick logo has become the registered trademark of the National Heart Foundation and the TM symbol adjacent to the logo replaces the © symbol. When reprinting any new packaging or other material with the Tick it is requested that you change to the new TM symbol (AAGF has a few samples).

The National Heart Foundation also require that all labelling, advertising and promotional material relating to the Tick must be sighted and approved by the Foundation prior to finalisation.

Contact Michelle Patterson - Fax (02) 6282 5147 Ph. (02) 6282 2144.

AHC Managing Director Position

An advertisement for the new Managing Director for the AHC appeared in the Weekend Australian during the weekend 18-19 April. Stanton Chase International (formerly Lucas Partners) is the recruitment firm.

Endosulfan Review

We have been advised that the NRA Board did not consider public comment to the Endosulfan Review at its April meeting. The staff had some 120 public responses to wade through, of which 60-70 were from the Avocado and Macadamia Industries. Consequently, there was not enough time to prepare the final submission for board consideration.

Levy Increase Starts on 1 July 1998

The Commonwealth Department of Primary Industries and Energy has advised that the Government has approved the increase in the statutory avocado R & D levy from 6 cents to 8 cents per standard tray and from \$10 per tonne to \$13.33 per tonne for avocados in bulk.

The increase will take effect from 1 July 1998.

National Support For Minor Use Program

"We need a minor use program which is easy for growers to access and allows effective chemicals to be made available," explained John Bishop, a farmer from Queensland's Lockyer Valley and a member of the Queensland Fruit and Vegetable Growers subcommittee for vegetable crops.

This comment reflected the industry view expressed at a national workshop on approval of pesticides for minor use held on 23/24 March at the Institute for Horticultural Development (IHD), Knoxfield in Victoria.

More than 50 delegates representing the vegetable industry in all states, other horticultural industries, agricultural chemical manufacturers, consultants and resellers, various government agencies and research corporations gave overwhelming support to the development of a national program for the approval of minor use chemicals in horticulture.

The workshop was funded by the Australian Vegetable Growers organisation (Ausveg), the Horticultural Research and Development Corporation (HRDC) and the Rural Industries Research and Development Corporation (RIRDC).

Dr Peter Merriman, Manager of Plant Health Programs at IHD and chairman of the organising committee, believes that the workshop outcomes will provide a platform for launching a national minor use chemical program for horticulture.

"The initial drive and support has come from the vegetable industry but all horticultural industries are interested and there could be a real opportunity to widen the program to cover all plant industries" said Dr Merman.

A meeting of the National Vegetable R&D Committee in early April will consider a recommendation from the workshop to provide interim funds to develop a blueprint for the national scheme.

This document, prepared by the workshop planning group, will be circulated nationally for endorsement by appropriate industry and government agencies. The final copy will then be used to formulate a mid-1998 submission to HRDC, RIRDC and other organisations for funds to commission a three-year pilot program.

The first step in this new initiative will be the appointment of a project manager who will assist in the fine-tuning of the planning and development phase and then be responsible for implementation.

An industry convened steering committee comprising representatives from Ausveg, HRDC, RIRDC and other stakeholders will regularly review progress and future plans to ensure outcomes are delivered on time.

The Knoxfield workshop, facilitated by Dr Peter Box of Integra, included a number of plenary presentations followed by working syndicate groups in which delegates developed issues, strategies and actions for:

- communication,
- initiation and prioritisation of minor use proposals,
- data generation and analysis,
- liability and legislation, and
- national management and co-ordination.

The introductory plenary sessions provided information on the current system and protocols for off-label use; perspectives from the vegetable and agricultural chemical industries and descriptions of minor use programs in the United Kingdom and the United States.

Peter Chapman, of the Pesticides Safety Directorate, and Dr Martin McPherson, of Horticultural Research International, explained the United Kingdom situation and described the operation of their Specific Off-Label Approval (SOLA) scheme. Rick Melnicoe, Western Region

Co-ordinator of the IR-4 Program and the Pesticide Impact Assessment Program based at the University of California, Davis, dealt with the United States model.

"The international inputs were invaluable, not only in providing guidance but also in showing that off-label, minor use programs operate successfully overseas," said Dr Merriman.

"Our overseas visitors demonstrated that programs are possible in geographically small countries like the UK and also in the United States where the wide range of crops and growing conditions are more like Australia," concluded Dr Merriman.

Further information about outcomes from the workshop and progress with the development of the national program for approval of pesticides for minor use may be obtained from:

- Brian Newman, Executive Director, Ausveg, Ph. 03 5790 5247; Fax 03 5790 5259.
- Dr Mark Smith, Program Manager, HRDC, Ph. 03 9210 9320; Fax 03 9210 9321.
- Dr Rob Brown, Program Manager, RIRDC, Ph. 03 9874 7462; Fax 03 9873 1853.



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

Agricultural Chemical Application Accreditation

By Rod Dalton, President AAGF

All avocado growers are urged to gain the "Farmsafe" accreditation for agricultural chemical application as soon as possible. The courses at state level such as Chemsafe in Queensland are part of the Farmsafe program.

If the draft recommendations on the use of endosulfan (see TA March 1998) are implemented only those growers with current accreditation will be able to purchase endosulfan after 1 July 1998.

It is appreciated that many growers have previously gained accreditation. You should check your

certificate to confirm it is still current, as they must now be renewed every five years. If staff is employed and they apply chemicals it is strongly recommended that they attend a course, if they are not already accredited.

In the near future it is highly likely that all S7 chemicals such as endosulfan, sprayseed and supracide will only be able to be purchased by accredited growers.

Contact your local AAGF Director or Association to enable training sessions to be organised in the various growing regions.



Technology Transfer Study Has Lessons For Avocados

By Gerard McEvilly, Program Manager, HRDC

A recent detailed study of the technology transfer needs of citrus growers is very relevant to the avocado industry. The study was commissioned by HRDC on behalf of the citrus industry and was carried out by John Yencken of Karingal Consultants. The key issue was how best to allocate the limited R&D funds to the crucial area of raising awareness and adoption of new technology.

The study involved focus group discussions with a wide range of people associated with the industry, followed by a detailed telephone survey of 200 growers. This explored the avenues currently used by growers to seek information and the likelihood of alternative avenues being used in the future.

Not surprisingly, the answers were found to vary according to certain factors, such as farm size and time in the industry. Overall, there was strong support for being able to exchange information with other growers face to face, through grower groups. The citrus industry has been funding part-time coordinators to assist in citrus technology transfer groups for six years.

The study found that the approval rating for Citigroups among those growers attending was very high. However, not everyone wants, or is able, to attend meetings so alternatives are needed.

Citigroups were often a source of information prompting change, but not used as a source of information when a grower had a problem. The coordinators have an important role in facilitating exchange of

information among growers - not for replacing extension officers or consultants.

There are parallels here with the Regional Productivity Groups (RPGs) organised through AVOMAN. The AVOMAN team is keen to develop the scope of RPGs, but this depends on the level of grower interest.

The survey also explored computer usage and found that 57% of respondents had a computer on-farm, with 60% of these having a CD-ROM. Currently these are used more for farm records and bookkeeping than for "getting information on the farm enterprise".

However, the trends are clear, with 34% of citrus growers responding that they would like to be connected to the Internet, on top of 14% already connected. Some 74% were interested in a citrus Internet site, with interest highest among those who were Citigroup participants, under 30 years of age and with larger citrus areas.

What of the part-time grower or the mixed holding with only a portion devoted to citrus? These were less likely to attend Citigroup meetings, but are more likely to make use of a "one-stop information shop". This concept gained a lot of support in the survey, with options ranging from a regularly updated CD-ROM to a national information officer with 1800 telephone access.

The avocado industry now has its own AVOINFO CD-ROM, to be released in August and Queensland growers can access the DPI Call Centre from 8 a.m. to 8

p.m. Monday to Friday on 13 25 23. The DPI Call Centre is an innovative service designed to guide callers to the information they need.

HRDC and the citrus industry are currently investigating similar options, in order to find a cost-effective way to provide citrus growers with access to the information they need.

There were two more key findings from the study. Firstly, the increased use by the larger growers of paid consultants to provide advice and services. It seems that these growers are more likely to recognise that, in running a complex farm business, it may be necessary to hire expert help in specialist areas.

Secondly, the need for growers to develop skills in information management. We are all familiar with the feeling of information overload and yet it is often hard to find the piece of information you need at the right time. The study recommended that a training module be developed for assisting growers in managing information.

Copies of the summary report, Information and Technology Transfer strategies for the Citrus industry, are available on request. The full report, CT97014 Delivery of information to the citrus industry - survey of options, is available from HRDC for \$20.

With the launch of AVOMAN and AVOINFO and the associated training sessions, the increased focus on RPGs and the expected launch of the Agrilink Avocado package early in 1999, the next 12 months will be significant in terms of information flow for the avocado industry. The recent Avocado R&D Audit highlighted that there is no extension plan for the avocado industry—perhaps it is time to give this issue detailed consideration, as have other industries such as citrus.

Talking Avocados itself is seen as a key information source for the industry and is supported in part by the HRDC R&D levy for this purpose. It also provides a forum for growers to share any thoughts on ways to improve information flow. It's a critical issue for the future of the industry, so make sure you have your say.



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

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



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



Industry Manager's say

By Wayne Prowse



The Australian Horticultural Corporation's 1998/99 program is about to start and we will see the largest promotion program for Australian Avocados for some time. The major components this year are:

- Magazine advertising.
- Public Relations activity.
- In store demonstrations.
- Merchandising.

In this issue I will be outlining the new components of magazine advertising and the merchandising program as well as the outcomes of the trial by weight.

The Beginning of a Lasting Impression

"When you fall for the smooth creamy taste of an Australian avocado it will stay with you forever". At least that is what we would like to happen to young females 18 - 35 who make up the largest sector of main grocery buyers and are likely to see our latest advertisement in popular women's magazines such as Cosmopolitan, New Woman, Better Homes and Gardens and Who Weekly.

The campaign was developed by our agency Jarvis Fielding & More in Brisbane and captures a sensual feeling that is certain to raise some interest in avocados. As 95% of avocados eaters enjoy the creamy taste, and though some say it is an acquired taste, we are really promoting the taste with the underlying good health and nutrition message.

As the headline says: "the beginning of a lasting impression", we want the first avocados that new consumers try to create a lasting impression and a long term relationship. Quality, availability and advertising working together at their best will help generate extra sales and satisfied customers.

Merchandisers Spread the Quality Word

The AHC's team of merchandisers will be visiting some 700 high delivery retail stores spreading a quality message about avocados to produce managers in August.

The team have worked together for over 12 months and have built a strong relationship with their retail contacts so coming in with avocados is not a one off, rather a product variation in their monthly visits. They've been talking apples since March so avocados will definitely get some attention!

Apart from delivering new Point of Sale material the merchandisers' main task is to discuss with the produce managers tips for handling precious avocados. It will be an extension of the successful retail quality program recently completed and takes information directly to retail produce managers. Indeed when the merchandisers are brought together for training next month, they will be taken through the "improving avocados at retail" quality manual.

The other task they have in each store is to collect some pertinent marketing information such as pricing, display areas, presentation (loose or tray stack) and quality appearance.

This information is analysed to identify issues, concerns and what is working well.

Each merchandiser visits a set territory of approximately 80 - 100 stores per four week cycle (Brisbane, Sydney, Melbourne, Adelaide and Perth) and gets to know the produce managers in each store over time. They only work on fresh produce—and indeed most were recruited for their fresh produce knowledge—according to programs that are funded by various industries. They discuss a maximum of two products per visit and avocados will be included in the August cycle and then again in March as greenskin varieties come in again.

It is a great opportunity to communicate directly with retail produce managers who are at the coal face with consumers and can make a real impact on the quality of avocados that reach consumers.

Your Levy at Work

April - June 1998

Recipe Leaflets

- New Recipe photography completed - May.
- New Recipe Leaflet prepared for printing - June.

In Store Demonstrations

- Avocado Industry in-store demonstrations conducted in the May - June quarter focused on greenskin varieties.

NSW	90 x 4 hr
VIC	94 x 4 hr
QLD	62 x 4 hr
SA	90 x 4 hr
WA	Nil

- In August/September we are contributing \$25,000 directly to a Woolworths program involving avocado demonstrations with complementary Woolworths products. The benefit of this will be exposure in over 250 demonstration stores instead of 125 that this money would buy.

Merchandising

- Training scheduled - 24 June, Melbourne for August 1998 and March 1999 cycles.

Public Relations

- Good media response to Fuerte release.
- Family Circle TV (fctv) filmed a segment at Barry Back's orchard at Palmwoods Qld which went to air 16 June. It was the first time that Food Editor Jo Anne Calabria had prepared a cooking segment outside the studio.
- Better Homes and Gardens is filming a TV segment on avocados in July and is scheduled to screen on their 4 August program.
- Vikki Leng featured avocados on What's Cooking - 21 May.
- Sally James - Nutritionist - will again represent Australian Avocados at the Australian Cardiologists' Conference in Perth - August 1 - 5 to promote the health benefits to one of our most important opinion leader groups.

Advertorials.

- Bounty Magazines - new magazine out for distribution to Maternity Hospitals - on going.

Advertising

We have prepared a new "winter" themed advertisement for inclusion in the following magazines:

- Cosmopolitan - July and September issues.



- New Woman - August issue.
- Who Weekly - 9/8, 13/9.
- Better Homes & Gardens - August issue.

Remember that our target market is young women 18 - 35 and this influences the choice of magazines.

Trial by Weight

The results of the "selling avocados by weight" trial have been presented to the AAGF.

Whilst early results indicated that the trial by weight actually achieved significantly lower volumes there were some critical control measures that were not taken into account and I mentioned that I could not release the results at that stage (March TA).

When the difference between the normal sales volume in the trial stores were compared to the normal volume sales in the control stores the results told a different story.

In fact when the trial stores were factored up by the "normal" difference the only significant difference was in week

one (some consumer confusion expected), then over the next three weeks there was little if any significant difference between the trial stores (during the trial) and the control stores.

Based on the scope of this study there is no advantage or disadvantage in selling avocados by weight. However other influencing factors have not been studied. For example "weight" selling seemed to encourage more purchases of small fruit. This may reduce retail wastage.

Other price factors may need a 12 month study to determine the effects of seasonal pricing. For example what impact would \$2.99 avocados have at \$14.99 kg in summer.

If these questions and others need to be answered then a larger scale research project needs to be implemented.

From these results and discussion with several retailers there is no clear cut direction that will dictate a change. If anything there was an argument by some for selling high value avocados by each (\$1.99+) and lower value/small avocados by weight. At the end of the day the retailer makes the decision.

World Avocado Congress IV

The International Avocado Society has issued the first announcement of the IV World Avocado Congress. The congress will be held in Morelia, the beautiful pink city, and capital of the state of Michacaan, Mexico—the world's avocado capital, in October 1999. The organisers advise that the program will include sessions on:

- Legislation.
- Production and quality.
- Commercialisation.
- Industrialisation.
- Cultural aspects of avocado producing countries.

The Congress will include debates, symposia, seminars, workshops, technical papers, posters and exhibits. They seek suggestions on additional topics and activities for the program. For input please E-mail details to: dteliz@colpos.colpos.mx

SOFT TOUCH ... Now we have it, we can't do without it.

As you are aware major buyers are requesting PLU stickers on your produce. A cost effective and reliable Pneumatic Labeller marketed as the "Soft Touch™" has been released by Compass Labels and is ideal for the small to medium grower. It enhances produce, making it more identifiable whilst complying with the new PLU numbering system.



Mr. David Milligan (W. Donald Milligan Pty Ltd)

"In all the years our company has been growing, we have never been able to source a reliable and labour saving Sticker Gun for our fruit. With reservation, we tried the "Soft Touch" from Compass Labels and found it to be very successful.

Our labour costs are down and there is less staff frustration, unlike previous guns we have used in the past. We would never have been able to sticker our present volume of fruit if it wasn't for the "Soft Touch". In fact, now that we have it, we can't do without it. We have judged the equipment on its own merits." ... David Milligan.



This tray in 5 seconds.

The "Soft Touch™" requires only 40 psi air pressure to run, dispensing around 4 labels per second.

Request a demonstration.

Contact Charlene Morris if you require further details.

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Australian Round-up



Dr. Tony Whiley and Dr Clive Kaiser visited avocado growers in the West in late February. Tony was here seeking possible sites for the National Rootstock Trials.

Clive explained to growers his interesting new theory and practice of Canopy management. A number of growers have decided to trial his technique in a small way for purposes of comparison but expect it will be 3 or 4 years before results are apparent.

A small group of people have worked for the last year putting together a SQF2000 Qualify Control Manual. The manual is about to go for desk audit, following which a generic system will be published and made available for purchase.

Expect a two part package; one concerning Production, from Orchard Design to Harvest, the second covering Packhouse Procedures from Receipt to Dispatch. The package to be sold will include a bound version of the generic plan, a floppy disk of the generic plan and empty folders with tagged dividers to hold personalised SQF systems. Access to computer skills and HACCP trained personnel will be necessary to adapt the generic plan to the individual property.

Point of sale, release date and price will be advised through "Talking Avocados" and the AAGF.

Tamborine Mountain

The good season continues, however, some unlucky orchards suffered large jagged hail on Easter Friday. Luckily it affected only small areas from Tamborine and Rathdowney south to the border.

The incidence of FSB has been greater than for some years, doing quite a lot of damage to the Fuerte crop even where regular spraying programs have been conducted.

The early marketing of Fuerte is a worry, with the Sunshine Coast and other packhouses wanting Fuerte in before the first of May. This resulted in the fruit in many areas being picked up to four weeks before normal and could create problems for consumers.

The Hass crop is heavy and filling out well—should result in a good end to the season.

Sunshine Coast

When the dust settles on qualifying for Interstate Certification Assurance (ICA) and growers have completed the appropriate Chemsafe training to certify them as chemically aware and competent to apply endosulfan to their own orchards, there may be time to once again focus on the business of producing avocados. If so, there are a number of production issues that may be worthy of a day's farming lost in order to be better informed.

To this end, SCAGA in association with the Principle Horticulturist at QDPI's Maroochy Horticultural Research Station, Dr Tony Whiley, is planning a field day to be held in the week commencing 5 October 1998. This field day is intended to be the platform from which growers can be brought up to date on the following current research projects:

1. The response of *Phytophthora cinnamomi* to long term phosphonate use.
2. The potential to control rootrot by soil applications of phosphonate.
3. Progress in the field control of *Anthraxnose*.
4. Low-Pressure v High-Pressure trunk injection of trees.
5. Field management effects on post-harvest fruit quality.
6. Canopy Management - a preliminary report.
7. Field walk to observe canopy management trial plots in the local district.

The field day will feature a number of QDPI research officers including Mr Ken Pegg, Mr Peter Hofman, Ms Lindy Coates and Dr Clive Kaiser.

Clive's work in the area of canopy management has been a tremendous source of interest to growers across Australia. His work on managing apical development and increasing flower and subsequent fruit set has been sponsored scientifically by Dr Whiley and financially by the AAGF. Dr Whiley believes that Dr Kaiser's approach to the canopy management problem is soundly based and offers the opportunity to build on previous work. Dr Whiley has specifically requested SCAGA to support his work in order that advances in this technology may be achieved.

At this stage it is intended that the day should commence at MHRS and continue from there to the Big Pineapple or similar location for lunch and then on to the orchard walk in a hired bus. Naturally there will be a nominal charge to cover the cost

of the bus and lunch. The amount will be advised at the time when final arrangements are confirmed.

As it promises to be a highly informative and intensely busy day, all growers planning to attend should register their interest as soon as possible. First seats will go to SCAGA members who have not had the benefit of earlier Canopy Management Workshops but there should be room for other growers who are members of regional LPA's. All attendees must be sponsored by the LPA involved and growers should first register with their association who in turn may contact the Secretary SCAGA, PO Box 235, PALMWOODS, Qld 4555, or phone 07 5478 9135, fax 07 5478 9134 to confirm members wanting to attend. The final date and numbers will be advised direct to LPA's a little later in the year.

SCAGA growers are advised to register their intentions with the Secretary as soon as possible.



The Fuerte season is now at an end for Northern growers and most will be harvesting their Hass crop. Prices for Fuerte

were good but began to fall away in May.

NSW growers will have received a circular reminder about membership of the NSW Avocado Growers Association. Please DON'T FILE IT—ACT ON IT! Your Association needs your support.

Chemical handling accreditation is also a subject of this circular. Public attitudes to chemicals and how they are used are getting harder by the day. Be assured, soon only persons with accreditation will be able buy and use farm chemicals. This subject is dealt with more fully on page 6 of this magazine.

NSW growers are asked to complete a questionnaire on chemical handling to assist the Association to plan courses in areas where they are most required. It is in your interest to make this information available.

About 70 - 80 growers attended a very successful Field Day at Stuarts Point in May. Peter Young demonstrated top working, grafting and the operation of his Side-winder injection equipment.

The latest ABS avocado statistics show that national production has increased 19% with NSW providing 21% of total production by weight.

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**ALL TREES GROWN IN
FULL SUN UNDER STRICT
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Tree Guards: Generally not
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Tree Establishment: Our well
developed, guaranteed quality
tree with our proven planting
and establishment guide results
in earliest possible production
24-30 months from planting

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Schemes to regularly monitor
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types grown.

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root sample testing by QDPI
laboratory over and above
normal ANVAS tests is
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supply you with the cleanest
trees possible.



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Tree Appearance: Dark
green, healthy appearance, well
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pruned in nursery to produce
multi leaders to promote earlier
fruiting.

Tree Height:

Min. - 650mm
Max. - 1200mm

Trunk Diameter:

Ground level - min. 12mm
- max. 25mm

Graft Union:

Smooth and totally calloused
Graft height - min. 200mm
- max. 450mm

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AVOMAN What Is It?

AVOMAN is a powerful computer software program that enables users to optimise the management of their orchards. The following series of articles have been written by members of the AVOMAN Team and two growers who use AVOMAN. The articles will give the reader an insight into what is AVOMAN and AVOINFO. The articles also address where the project goes from here, what is required to use the software, how much data is required to get good results and what users think of the prototype software currently in use.

An order and booking form has been enclosed in this magazine to help those wishing to buy the final version of AVOMAN and to book a spot at an AVOMAN training session. The form also allows growers to indicate the preferred activity for Regional Productivity Group meetings and field days.

AVOMAN: The big picture

It is always interesting to hear feedback from AVOMAN prototype users. The comments we hear help us to make the system more useable and useful. It has been especially interesting to discover that people often have slightly different perceptions about the AVOMAN project and particularly its main product, the AVOMAN software. Regardless of what you think AVOMAN may be about, by the time you read this it will be basically complete, so we thought it was a good time to take a look at the objectives of the project and what the AVOMAN software does to help achieve those objectives.

If you have never seen the AVOMAN program before, you will find this article a good starting point to learn more about it. If you're currently using AVOMAN, you've probably already discovered that there is a large range of features in the program, but you may learn something here you did not know before.

A little history

The idea for the AVOMAN project began back in 1992 when the AAGF discussed its research and development objectives for the coming years. A common deficiency identified then was technology transfer (which is jargon for getting knowledge out to the people who can benefit from it). The need for this was clear when it was discovered that several existing methods and technologies were either unknown to many growers or not always being appropriately applied. A variety of pre-harvest management and postharvest quality problems were identified.

In what was a very forward thinking move at the time, the AAGF and HRDC agreed to support the DPI in the development of a sophisticated decision support

computer program for avocado growers. The aim was to provide every member of industry with access to the most up to date agronomic knowledge available.

Some decision support systems in the past have failed to deliver in the long term so we wanted more than just something that could ask a series of questions and spit out an answer. We wanted a system that would take into account all relevant growing conditions such as leaching, crop load, root rot symptoms, canopy vigour, tree size and age, soil type and texture, leaf and soil element levels, variety and rootstock. Also at this time, a phenology cycle (a sort of growth blueprint) had been developed for Fuerte in southeast Queensland and published in the very popular "Growing Avocados" handbook.

In an effort to more closely match the management of trees to their growth patterns, it was proposed that the new system would incorporate phenology cycles for a range of varieties and locations and that these should be used to determine the correct timing of management activities to be recommended.

To help growers effectively use all of the technology available, the system would also need to include substantial avocado management information on issues such as nutrition, irrigation and pest and disease management. Where relevant, pictures were to be used (for example to help identify symptoms). To effectively monitor management activities, a comprehensive farm recording system was required. For those who wish to keep detailed farm records but do not necessarily have access to a computer, a wall chart was devised.

The ability to produce a range of specific summary reports from all of these farm records was also requested and this has become increasingly important as quality

assurance and food safety issues have emerged. As the avocado industry is a national one, the whole system has to work as effectively for farms on Queensland clays as it does for farms on West Australian sands.

How did we do?

The original plans were certainly ambitious, but nearly six years on the AVOMAN system is nearing completion and it is pleasing to look back and see that while the program has evolved significantly over the years, we have achieved what we originally set out to do.

The AVOMAN program provides comprehensive record keeping and reporting facilities as well as a range of agronomic recommendations. Users can easily record their own custom growth cycles which are then used by the management recommendations as the basis for timing of activities. There is also a large volume of information about many aspects of growing avocados including pests, diseases, disorders, nutrition, irrigation, quality and leaf and soil analysis. Over 230 growers are testing the latest AVOMAN prototype, which certainly has stimulated a broad range of feedback and ideas.

One of the great side benefits that the AVOMAN project has offered industry is that in putting the system together, we have been able to identify the issues that most urgently require more research and development. Indeed some of the past and current project work being done has been given priority as a result of these findings. AVOMAN will also provide an effective vehicle for distributing the results of these and other future projects to industry.



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



That's not all folks!

Now if you think that is all there is to AVOMAN, you are wrong! While all eyes are now on the release of the AVOMAN software, it is perhaps a good time to look back on some of the other important products and activities that have been, and in many cases continue to be, part of the AVOMAN project.

Scott Ledger's retail surveys in 1993 took growers on a guided tour following their fruit from farm gate to retail shelf. The results of this quality work were surprising and somewhat alarming and valuable lessons were learned by all of those who attended these significant events. The results of this work were reported at the 1995 AAGF conference in Perth (see "Black Avocados - The Inside Story" in the proceedings).

Another series of activities, which regularly occur around the country that many people do not always associate with the

AVOMAN project, is the regional productivity groups (or RPGs for short). There are 14 of these grower groups around the country, which meet to share ideas and information. Although these groups were established primarily for the purpose of trailing the AVOMAN system, their scope is much wider than this and in many cases these groups now meet independently of the project. Over 200 growers are now part of this network and new members are always encouraged.

In trying to provide growers with access to as much information as possible, the AVOMAN team has amassed a huge collection of avocado related references from around the world, including scientific papers, conference proceedings, industry yearbooks and magazine articles. The bibliographic details of all of these references have been documented in a database that can be searched according to any combination of title, author, subject, source or key words. In cases where we have copy-right permission, we have also included

abstracts or even whole articles. This system is called AVOINFO and it will be completed at the same time as AVOMAN. Because of its size, AVOINFO will be available on CD-ROM.

So you can see that while we have certainly been focused on producing the AVOMAN software, there have been a number of other activities and initiatives that are definitely an important part of the AVOMAN project.

It's not over yet!

Even though the development project will finish at the end of June, the team will continue to support AVOMAN users through a formalised maintenance project that begins as soon as AVOMAN is available. This project will be totally funded from sales of the AVOMAN and AVOINFO software. The services and activities offered by this project will be available to all registered AVOMAN users and include formal software training and technical support and various regional productivity group events.

AVOMAN: The release and beyond

The next exciting phase of the AVOMAN project is about to start. This new phase is one of adoption and helping growers to get the most out of the products that have been developed. It follows the six-year development period that comes to an end this June. During its growth, growers have provided the AVOMAN team with feedback and suggestions that have helped the AVOMAN products evolve into very powerful and informative orchard management tools.

The new project "AVOMAN Stage 3" will commence with the publication and launch of the full versions of the AVOMAN and AVOINFO software products in the new financial year.

Following distribution, hands-on training will be run in each of the major growing areas in Australia. After this, local AVOMAN team members will be working locally with their RPGs to organise various growing and quality related activities. Software support will always be just a phone call away with minor software enhancements and modifications being made as necessary.

How will it be funded?

This phase of AVOMAN (publishing, training, support, maintenance and RPG activities) will be funded entirely from

sales of the AVOMAN and AVOINFO software products. The duration of the project (currently planned for two years) will depend entirely on the number of packages sold. The sale price is solely designed to cover the costs of this phase of the project, so the fee you pay will be used directly for your benefit. The prices are listed on the order form.

Objective and Strategies

The main objective of this next project remains the same as for the current AVOMAN project, namely to raise the productivity and quality of the Australian avocado industry through improved transfer of technology.

The two main strategies are:

1. to show growers how to get the most out of the products that have been developed, in recognition of the benefit that producers get from interacting with others; and
2. to organise get-togethers and workshops on a variety of key topics for RPGs around the country.

Importance of training

We very strongly recommend that all purchasers of the AVOMAN software attend training. Apart from teaching you how to use it correctly, it will

comprehensively cover all parts of the program including those that may not be obvious to you, and you will also learn how to use it much quicker than you could on your own. Because we feel so strongly about it we have incorporated the cost of training in the price of the software.

Training details

In response to feedback from the recent user survey, training will consist of two consecutive part-day sessions and will involve formal instruction as well as time to practise under supervision. A schedule of training events will be released well in advance of training to allow you to fit it into your schedule. Training will occur mostly during the months of September, October and November, and you will need to book your seat in advance, which can be done on the order form.

Regional Productivity Group Activities

Once the training sessions have been completed team members will concentrate on providing users with software support,

14



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maintaining the software and organising Regional Productivity Group activities. It is envisaged that these RPG activities will centre on various key topics that affect orchard productivity and fruit quality; however their focus will ultimately be determined by RPG members in consultation with their local AVOMAN coordinator. On the software order form there is a space for you to indicate which broad topics are of interest to you.

How do you join a Regional Productivity Group?

Easy! Simply ensure that you are on the local coordinator's mailing list. If you have received an AVOMAN prototype in the past or if you are ordering the final version you will automatically be a member. Check

with your local RPG coordinator (listed in the table below) if you are uncertain.

How do you get your copy of AVOMAN and AVOINFO?

An order form that covers both AVOMAN and AVOINFO will be distributed through the industry but if you do not receive one please contact one of the RPG coordinators. The form will also contain a section for booking the training session you wish to attend and space to record the topics you would like to see considered for RPG activities. If you are not already an AVOMAN user, upon receipt of your order form we will send you a registration form to complete. We prefer to supply your ordered copy(s) of the software at the training sessions but if requested we can send them out independently upon receipt of the moneys. Payment is required either in advance or when you collect your copy

at the training session. Bankcards, Visa, MasterCard or cheque (made out to the Department of Primary Industries, Qld) are accepted.

Overseas people please note that AVOINFO is available to you but arrangements for supplying AVOMAN have not yet been finalised.

It is worthwhile remembering the overall aim of the AVOMAN project. It is to assist growers in the management of their orchards with the long-term objective of strengthening the viability and sustainability of the Australian avocado industry as a whole. We believe that the release of the final software products and the other activities of this new phase of AVOMAN will go a long way towards achieving this aim.

The AVOMAN team looks forward to helping you to get the maximum benefit for your enterprise out of the AVOMAN initiative.

Regional Productivity Group (RPG)	AVOMAN coordinator	Address	Phone	Fax	E-mail
Atherton	Irene Kernot	DPI, PO Box 1054, Mareeba, Qld 4880	07-40928555	07-40923593	KernotI@dpi.qld.gov.au
Bundaberg Childers	Chris Searle	DPI, M/S 108, Ashfield Rd, Bundaberg, Qld 4670	07-41556244	07-41556129	SearleC@dpi.qld.gov.au
Nambour Glasshouse West Moreton Tamborine Mtn	Simon Newett	DPI, PO Box 5083 SCMC, Nambour, Qld 4560	07-54412211	07-54412235	NewettS@dpi.qld.gov.au
Burringbah Alstonville	John Dirou	NSW Agric, PO Box 72, Alstonville, NSW 2477	02-66262400	02-66285209	Dirouj@agric.nsw.gov.au
Coffs Harbour Sunraysia	Greig Ireland	NSW Agric, PO Box 530, Coffs Harbour, NSW 2450	02-66519040	02-66512780	Grieg.Ireland@agric.nsw.gov.au

AVOMAN: How much data entry is required?

How much data do you have to enter to use AVOMAN?

There is a perception amongst some growers that a lot of data needs to be entered to get any information out of AVOMAN. To a new user AVOMAN may look a little daunting but in reality it requires surprisingly little data input, especially compared with what you can get out of it. One of the great things about AVOMAN is that the amount of data you put in is up to you, though like life, the more you put into it the more you can get out!

So the answer is "it depends on the level at which you choose to use it".

Parts of AVOMAN can be used with NO data entry at all!

You can get a lot of information from AVOMAN without entering a single record.

With no data entry at all you can:

1. Access over 300 pages of growing information either via "Help" on the main menu (you can use the logical headings or the search facility) or via short cuts from various points in the program using the F1 ("help" key) or the "i" buttons. Some of the topics covered are:
 - a. Detailed information on the management of root rot and anthracnose.

- b. Background information, diagnosis and management of;
 - (i) 11 nutrients and pH
 - (ii) 30 pests
 - (iii) 5 other diseases
 - (iv) 26 disorders.
- c. Information on how and when to take leaf and soil samples correctly.
- d. Information on irrigation of avocados including monitoring methods.
- e. Pesticide safety.
- f. Using Cultar®.



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AVOMAN

2. Get detailed information on over 160 chemicals and fertilisers commonly used in avocado or-

chards including:

- a. Fertiliser analyses.
 - b. Active ingredients.
 - c. State registration details.
 - d. Registered high volume rates.
 - e. Withholding periods.
 - f. Suitable application methods and standard rates.
 - g. Material Safety Data Sheets for many of the pesticides.
 - h. Neutralising value and fineness percentages for commonly used liming materials.
3. View and compare growth cycles for over 26 different variety/locality combinations around Australia (accessed under "View" on the main menu).
 4. Study optimum leaf tissue levels and optimum soil levels for 6 commonly used laboratories.
 5. Get comprehensive instructions on how to use the program.
 6. Use an on-screen calculator.
 7. You can even print out a number of reports including:
 - a. The 26+ growth cycles from around Australia.
 - b. Any of the 300+ pages in the growing information ("help") files.
 - c. Any of the instructions on how to use the program.

All other parts of AVOMAN can be used after only 3 minutes of data entry!

In order to go further in the program you need to record some basic information about each section (block) of trees you

handle as a separate management unit. For users who are familiar with the program, recording of this information takes approximately 3 minutes per block. Remember too that you only have to fully describe a block once and shortcuts are provided for keeping these records up-to-date.

Quick and easy data entry

To minimise the time you need to spend entering information, data entry has been made as quick and easy for you as possible. To minimise key strokes the program provides tick boxes or lists of possible answers to choose from. For example, to record the variety of the block, you choose from a predefined list. To describe the root rot status of the block you simply click one of four possible answers (none, mild, moderate or severe).

If you need help when entering a particular record a click of the help (F1) key will take you directly to information that will help you. To help you choose which of the four soil types you have, the F1 key will take you directly to a series of colour photos and descriptions of each type.

30 seconds to get a NPK recommendation (and record it!)

Having spent the three minutes or so describing your first block you can now use the rest of the program. For example upon completion of the block description (which included choosing an appropriate growth cycle) the nutrient recommendations for this set of conditions are automatically made and are displayed in the fertiliser page for any 8 week period you care to choose. Predefined points automatically determine the week the recommendation appears in the growth cycle.

It takes an average of 30 seconds to convert one of these recommendations into a

rate of fertiliser that you or the computer chooses using the units you nominate (such as grams per tree, kg per block).

To get recommendations with a higher level of applicability you should enter a current leaf analysis and/or a soil analysis (1.5 minutes each). Once entered, AVOMAN will take account of the leaf and soil analysis for a whole year.

Once you are happy with a recommendation, one keystroke records it for you with the detail you desire.

AVOMAN will automatically display all the jobs you have recorded (either as reminders or as completed jobs) on the planner, which can be viewed any time on a monthly or yearly scale.

Choose your level of detail

You can choose the amount of information you wish to record with each entry. When recording an insecticide spray for example, AVOMAN will record the date, material and rate but you can go further if you wish. The name of the employee doing the job can be record (these can be predefined with wage rates). Also how many hours of labour it took, how many machinery hours it took (the cost per hour of machinery can also be predefined) and for those who have spray drift concerns, the time spraying commenced and finished and the wind speed and direction at each of these times.

If you like to keep records or set reminders for other orchard operations such as irrigation, harvesting, pruning and leaf sampling, each one takes about 30 seconds. There are also short cuts to set recurring reminders and to record a job on multiple blocks.

Reports

Once you have entered a record in AVOMAN the software provides you with easy data retrieval and data processing in the form of a large number of reports.

The program provides you with over 20 specially designed reports to choose from including:

- spray diary,
- fertiliser application summary,
- job reminder list,
- block measurements history,
- block observation history,
- irrigation summary,
- leaf analysis history,
- leaf analysis graphs,

The AVOMAN fruit prices screen

Fruit Prices									
Record Customers Reports Close									
Record 4 of 6									
Packed Fruit Other Sales									
Date	12/05/1998	Trays	11/12	Quantity sold	10	Net \$ per tray	\$10.50	Total net \$	\$105
Consignment ID	1234H	Extra large	13/14	25	50	\$11.30	\$0.00	\$283	\$568
Customer	Wilson Brothers	Large	15/16	15		\$12.00		\$180	
Variety	Hass	Medium	18	40	105	\$13.50	\$0.00	\$540	\$1450
Tray wt.	5.8 kg	Small	20	65		\$14.00		\$910	
Bulk wt.	10 kg	Grade 1A	22	80		\$14.70		\$1176	
Cocktail wt.	8 kg	Grade 1B	23	95	245	\$13.50	\$0.00	\$1283	\$3355
		2nd Grade	25	70		\$12.80		\$896	
		Cocktails and totals	28/30	30		\$10.50		\$315	
		Notes	Bulks	5		\$18.00		\$90	



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15

- soil analysis history,
- soil analysis graphs,
- weather summary,
- weather graphs,
- growth cycle graphs,
- water quality summary,
- yield report by size and grade,
- fruit income reports by size, grade and customer,
- operation summaries,
- chemical expenditure, and
- labour and machinery expenditure.

These reports are designed to help you manage your farm more efficiently and provide you with some of the documentation for quality assurance and HACCP requirements. A few keystrokes will provide you with summarised data for any date range you specify.

If you use AVOMAN to record your fruit sales there is a report that can show you the average prices for each grade and size over the period you nominate. Another can show you the average yield per tree or hectare in each of the size ranges and grades as well as show you where your losses are occurring in the reject analysis summary.

The chemical expenditure report will group and summarise on a time or category basis the amounts of chemical (such as fertilisers, weedicides and insecticides)

you have used and the expenditure on them. If you use AVOMAN to keep your weather records AVOMAN can provide coloured weather graphs for one or more years.

In summary

The amount of data you have to enter to use AVOMAN can range from absolutely none to regular inputs of records. A significant amount of information is available to you without entering a single record and all parts of the program, including the customised recommendations, can be accessed after only 3 minutes of data entry. The beauty of a computer program such as AVOMAN is that the output you can get from it increases significantly with each new record you make.

AVOMAN survey results confirm the importance of attending training

A thank you goes to the 40% of AVOMAN users who returned their surveys. The results from each year's survey have a major influence on the content and functionality of the next version. Here is a brief summary of the results:

- One of the facts that has stood out from the survey and other feedback is the importance of attending the hands-on training sessions.
- The most frequently used parts of the program at present are the nutrition recommendations, followed by the soil and leaf analyses, pest and disease recommendations and block records.
- Users envisaged their main use of AVOMAN to be for getting recommendations, followed by keeping records, producing reports, keeping yield and quality records, analysing performance and keeping growth cycle records for each season. 67% of growers saw AVOMAN as a means of supporting quality assurance systems and this use is rapidly gaining popularity.
- 14% of respondents still saw a need for retaining the static growth cycles in the program. The main reason given was to provide guidance in selecting a dynamic cycle, so these will remain in the program.
- On the question of including more pictures, 28% of respondents said they would like more. The main reason given was for convenience. Many growers see AVOMAN as a "one-stop shop" for their management and

information needs. We will be including more pictures where these assist growers to use the program e.g. illustrations of soil types to help users pick the correct one when describing their blocks. Unfortunately it is beyond the resources of the current project to include a comprehensive range for diagnosing problems and identifying pests and diseases; however it will be considered for funding in the future. In the meantime we intend including references in the help files to publications where these illustrations can be found.

- We received an enormous amount of feedback on things that growers liked about the program (122 items) which was encouraging. The point that came up most (in 41% of returns) related to its ease of use. So for those who have had difficulties or who are reluctant to use it, take heart and stick with it! The other things most liked were the recommendations, record keeping, information and reports.
- Of the things that growers liked least about the program no single point stood out. The most frequent (but only 9%) was the amount of information that needed to be entered to get started, for 6% it was the bugs in the program and only 7% thought it was too complex to use. One grower said they would like to see the user guide written by a user but unfortunately for us nobody stepped forward!
- There was a strong response to the question about reports. Growers were

most likely to use the leaf and soil analysis reports (and graphs), the spray diary, dynamic growth cycle, and block measurements and observations. Improvements are being made to some of these reports as per suggestions and new ones are being developed including yield, quality, fertiliser and cost analysis reports.

- 77% of respondents reported that they had attended training. We would like to see this figure closer to 100%. Our own training records show that 157 people received instruction.
- We had many positive comments (102 in all) put forward about the training, which was pleasing. One of the unexpected but frequent comments made was the benefit trainees gained from interaction with other growers. This tends to confirm the need for more RPG activities in the future. Other popular responses were the hands-on nature of the training, the quality of the training, being able to learn how to use it quickly, approachability of trainers (we're a pretty friendly bunch!), and the ability to practise under supervision.
- 11 of the 29 dislikes put forward on the training sessions related to trying to fit too much information into too short a time and the sessions being too long (only one person found the pace too slow). This was a pretty strong



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AVOMAN

message so we have decided to hold the training for the final version over two part days (4 to 5 hours on each of two consecutive days). We believe this investment in time will be very worthwhile. Two part days were also the most popular choice for the length of training. Time will be provided during the sessions to allow trainees to practise using the software with instructors present.

- Of the people who recorded that they did not attend training, the most

common reason given was that the time did not suit. We are publishing a training schedule well in advance of the events this time, and for the bigger centres there will be more than one set of dates to choose from.

- The manual was well received (85% said they used the manual if they had difficulties and 86% of these found that the manual addressed their difficulty). We are making the manual for the final version simpler to use and clearer in its explanations. It will include enhancements such as an index and quick find tabs.

- 96% of respondents intended purchasing the final copy of AVOMAN and 90% intended purchasing AVOINFO, some of the others were not sure.

Overall it was a very useful survey for the project and we would like to take this opportunity to thank all those growers who have been prepared to test the prototypes (warts and all!) and provide feedback in any way throughout the life of the project.

The project has been one of partnership between developers and end users and feedback has been an extremely important part of it. We hope the usefulness of the final products will justly reward you all.

What sort of computer do you need to run AVOMAN?

Below is a description of the type of computer that AVOMAN will run well on.

Computer Requirements

An IBM compatible personal computer
A Pentium® Processor (or later)
At least 16 megabytes of RAM (memory)

Software Requirements

Windows 95 (or later)

More Details

The hardware details above are **not** the absolute minimum standard of computer required to run AVOMAN. Rather, this is the sort of computer that AVOMAN runs well on. There are currently several users successfully running AVOMAN on earlier style 80486 computers and while the

program still works on many of these older computers, it does not run as efficiently as it was designed to.

Apart from a slow processor, another common reason for poor performance is lack of memory (or RAM). We have proved in tests that it is possible to run AVOMAN with 8 megabytes of memory or even less, however performance suffers accordingly.

Many new computers are now sold with around 32 megabytes of RAM, which is an ideal amount for running AVOMAN and most other modern business software. For those who may want to increase their computer's memory, additional RAM can be added to most computers quite cheaply.

The biggest change with the final version of AVOMAN is that you will need Windows '95 or later to run it. During the

development and testing phase we deliberately postponed upgrading our development tools to allow as many growers as possible to test AVOMAN. These tools have however imposed several limitations on how we have constructed AVOMAN.

To rectify this problem and to ensure ongoing compatibility with subsequent Windows releases, the final version of AVOMAN is built with improved Windows '95 tools.

While we appreciate that this may cause concern to a few users, the majority of AVOMAN users have indicated they either already use or are prepared to upgrade to Windows '95 (some are even waiting for Windows '98 to be released before upgrading). The benefits of running AVOMAN under Windows '95 or later will be significant.

If you want to upgrade an earlier version of Windows to either Windows '95 or Windows '98, make sure you take into account all of the software that will be run on your computer. Those who are not ready to upgrade just yet will be able to continue using the 1997 AVOMAN prototype until the end of the year.

If you have any concerns or questions about computer requirements for running the final version of AVOMAN, you can contact either Shane Mulo or Christine Bezzina from the AVOMAN Development team by one of the methods below.
Ph: (07) 5441 2211. Fax: (07) 5441 2235.
E-mail: MuloS@dpi.qld.gov.au or BezzinC@dpi.qld.gov.au.

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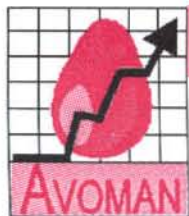
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Growers' thoughts on AVOMAN ('97 Prototype)

Apart from the Survey earlier in this series of articles, little has been published about what the users think of AVOMAN.

The AVOMAN team have been receiving feedback as they developed the program and have changed the software to incorporate many of those comments.

In order to address the lack of printed comments, two growers were asked to submit their thoughts on the AVOMAN '97 Prototype. Their stories are brief and to the point:

Charles & Robyn Feher
Lone Gum Avocados
Tolga Qld

We have been using AVOMAN since the first prototype was developed. Up until now, AVOMAN has undergone many changes, which saw it develop from a program of simplicity, to one that is considerably more comprehensive.

AVOMAN is an all-encompassing program that contains extensive information regarding avocado growing. The program has an excellent record keeping system which (provided the input of details is constant), enables a farmer to have comprehensive facts on the development and growth of his/her orchard.

Although AVOMAN is a user friendly program, one can find loading initial information, in order to attain accurate recommendations for a particular orchard, very taxing. Most importantly, AVOMAN provides comparative analysis and subsequent recommendations for treatment of your avocado trees.

Because AVOMAN is an interactive, analytical program, it is essential that users work hard to input correct and detailed information about their orchard. However, once the initial bulk of information is loaded and saved into the program, it requires consistent but minimal updating to keep AVOMAN's recommendations as accurate as possible.

We are looking forward to the final version of AVOMAN and suggest that if used properly, AVOMAN would be a benefit to any avocado grower.

Keith Johnson
Red Lane
Alstonville NSW

AVOMAN is, in my view, a very useful tool for Avocado growers. Like most tools you do have to learn how to use it effectively. If one simply expects the system to be so easy that no great effort is required to learn how use it, then you will be disappointed. Like any other complex tool you have to put in effort to get started and then keep using it until it is mastered.

The benefit of AVOMAN resides (as with most computer systems) in the analytic power you have at your fingertips. The cost is in the work you must do to provide AVOMAN with the data it needs for analysis.

If you are one of those people who keep extensive records then with AVOMAN, you probably will not have an increased load in gathering and recording data. However, if you have few or no records and no filing/collating system, then with AVOMAN you will simply have to start

recording in some detail—but relax, the effort is worth it.

I attended a 2-day course before starting to use AVOMAN seriously. The course is, in my view, essential—although it is hard to find two full days. But you will have to put in that time, or more, so it is best to do so on a structured and informative course.

The feature I like about AVOMAN is its flexibility. You do not have to use every function available, simply pick out the ones that are of value to you and use them.

With time you can start making fuller use of AVOMAN features but at the outset you can go for the basics only.

I chose to use AVOMAN primarily as a fertilising adviser. To do this I only had to put in the relevant data about the avocado blocks I have and then the detail of soil and leaf analyses as they were received. Then by using AVOMAN's "Block Analysis" functions I obtain AVOMAN's recommended fertiliser applications and timing.

Another feature I like and use is the "Products" function. It is a library of data on products used in the industry—to which I can add if I wish. So, now the job of looking up products to do a job is much easier. Equally important, the job of gathering and storing product information becomes simpler and recall is child's play.

As you may see, I am still learning to use AVOMAN. So far, I have gone far enough to convince myself it is an effective tool and I will continue to use it and expand the extent of my use.

New AVOMAN contact person for the Burnett

AVOMAN welcomes a new representative for the Burnett area, Chris Searle.

Chris will be the contact point for the AVOMAN project and the RPGs following the departure of Garry Fullelove to the DPI in Gayndah.

Chris Searle moved to Bundaberg in August last year from Maroochy Research Station where he had been working with Tony Whiley on mangoes, bananas and avocados.

Chris is not new to the AVOMAN project, for the past year, in between other duties, he has been working painstakingly through every single reference in the AVOINFO software allocating keywords.

The AVOMAN team would like to acknowledge the work of Garry Fullelove who was with the development team for over five years.

Garry made significant contributions to the project leading the Bundaberg and

Childers RPGs, coming up with novel ways of tackling particular issues.

He was largely responsible for developing the AVOMAN wall chart and writing some of the software including the electronic planner and the NPK fertiliser blend facility.



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Pollination Biology And Fruit Set In Avocado

An edited extract from a paper presented at Conference '97 by Carol J. Lovatt, Department of Botany and Plant Sciences, University of California, Riverside, USA

Although this and the next article are technical in nature, they are worth reading because they indicate what research is being done to increase tree yield.

Introduction

The seasonal cycle of flowering, fruit set, and fruit development of the 'Hass' avocado in California is depicted chronologically in Figure 1. (Please note that in this review, all references to months of the calendar are for the northern hemisphere.)

As illustrated in Figure 1, during flowering, pollination and fertilisation also occur. The successful completion of these two biological processes influences fruit set. The fruit set/early fruit drop period is the most critical stage of ovary (fruit) development from the grower's/producer's point of view.

Pollination is defined in this review as the arrival of the pollen (the male part of the reproductive cycle) on the stigma of the pistil (the female part of the flower) (Figure 2).

Under optimal conditions, the stigma is in a receptive condition and the pollen germinates, producing a pollen tube that grows through the stigma, style, and ovary tissues, to the ovule, which contains the egg. The pollen tube delivers the sperm to the egg. The fusion of sperm and egg is fertilisation. The product of fertilisation is the embryo, which develops into the young avocado seedling within the ovule. After fertilisation, the ovule develops into the seed within the ovary, which develops into the avocado fruit (Figure 2).

Avocado fruit that fail to set can be divided into two categories:

1. fruit resulting from flowers in which pollination occurred, but subsequent fertilisation failed to take place (in some crops, pollination in the absence of fertilisation is sufficient to stimulate development of the ovary into a mature, seedless fruit; this process, called stimulated-parthenocarpy, rarely occurs in avocado); and
2. fruit resulting from flowers in which both pollination and fertilisation

occurred, initiating the development of the embryo and seed.

Weather impacts both pollination and fertilisation in a number of ways. Both low and high temperatures adversely affect pollen development. For tropical fruit trees, the period from meiosis to the pre-vacuolate stage of pollen development appears to be the most sensitive to temperature. Temperatures below 15°C or above 33°C reduced pollen viability. Night temperatures below 10°C reduced pollen germination by more than 50%.

For the 'Hass' avocado in California, this developmental period occurs around the end of January, beginning of February. At temperatures between 12 to 17°C, only a small percentage of flowers open in the female stage, i.e. with receptive stigmas, the majority open as males only.

When flowers do open in the female stage, there are only a few hours during

20

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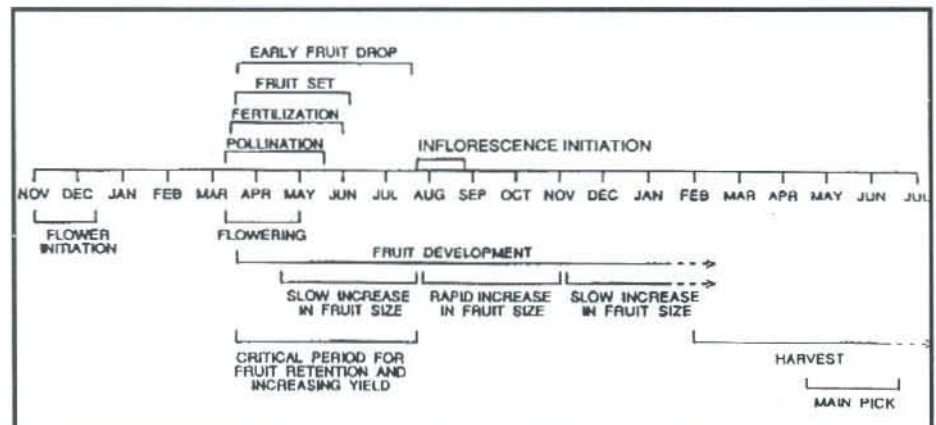


Figure 1. Flowering, Fruit set and fruit development of Hass avocados in California
(Based on San Diego - Riverside environmental conditions)

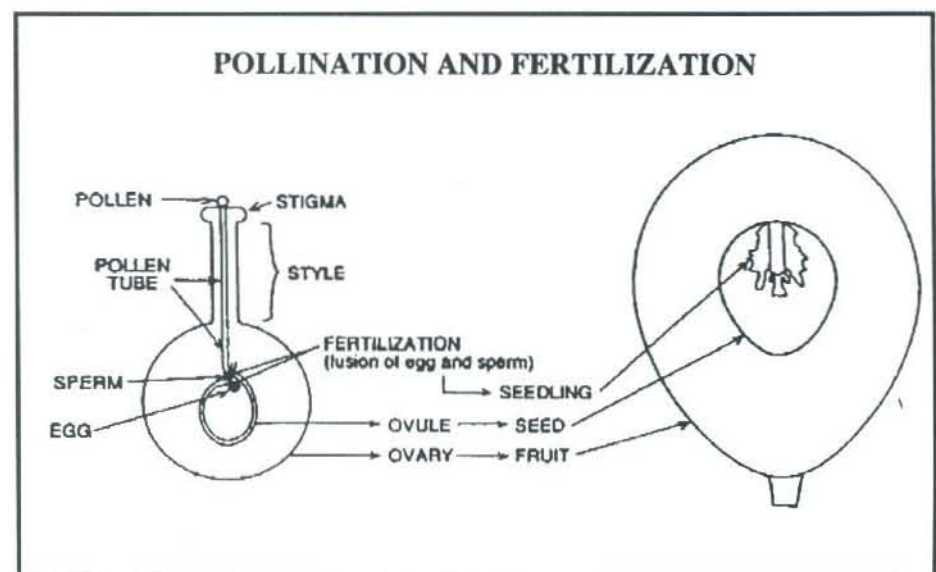


Figure 2. Factors affecting pollination and fertilisation (fusion of egg and sperm)

which successful pollination can occur. Low temperatures, especially if accompanied by fog, drizzle or rain, dramatically reduce bee activity, which further compromises pollination. In addition, at these temperatures pollen tube growth ceases before reaching the ovule, and thus no fertilisation occurs.

Pollination stimulates the ovary to start developing into a fruit, but the stimulation is exhausted within a couple of weeks and the fruitlet abscises.

Pollination has recently been found to increase gibberellin levels in developing ovaries of seeded varieties of citrus. A similar study in avocado could identify the complement of endogenous hormones necessary to sustain stimulated-parthenocarpy.

The most successful fruit set occurs at temperatures between 20 to 25°C. At these temperatures, the opening of flowers in female and male stages overlaps for several hours. At temperatures above 28°C, abscission of individual floral buds and flowers is accelerated; entire inflorescences abscise before flowers open.

Temperatures prevailing during bloom also affect the viability of the egg and ovule, as well as pollen germination and pollen tube growth and thus, influence avocado fruit set.

The relationships among the ovule, pollen, and fruit set are integrated in the concept of "effective pollination period", which is the length of time the ovule is viable minus the length of time necessary for the pollen tube to reach the ovule in order to deliver the sperm to the egg.

Cool temperatures during the flowering period decrease the viability of the ovule and increase the length of time it takes for the pollen tube to grow from the stigma to the ovule. Thus, the duration of the effective pollination period is significantly shortened and fruit set is reduced.

Warm temperatures during flowering increase both ovule longevity and the growth rate of the pollen tube. This correspondingly increases the effective pollination period and fruit set.

Tree nutritional status and fertiliser applications influence the effective pollination period in avocado.

Prebloom canopy application of nitrogen, as low biuret urea, to the 'Hass' avocado during the cauliflower stage of inflorescence development (during this stage, secondary axes of the inflorescence are elongating, processes leading to the formation of the sperm and egg are initiated) significantly increased the number

of viable ovules, the number of pollen tubes that successfully reached the ovule, and cumulative yield.

Boron is another nutrient that influences the effective pollination period. It is well documented that boron is essential for pollen germination, for successful growth of the pollen tube through the stigma, style, and ovary to the ovule, and for the mitotic divisions necessary to produce the sperm and egg.

Boron sprays applied either during fall or spring to deciduous fruit tree species not deficient in boron based on leaf analysis have proved effective in increasing fruit set and yield, especially when cool temperature and overcast or wet weather prevail during bloom. Benefits from boron sprays are less likely when conditions are optimal for fruit set. Thus, there has been considerable interest in the use of boron fertilisation to increase fruit set in the avocado.

When pistils (female reproductive structures) harvested from avocado trees receiving a foliar application of boron were pollinated with pollen from trees also sprayed with boron, pollen germination and pollen tube growth were significantly better than in flowers from untreated trees. Fruit set and yield also increased in response to the boron sprays if the concentration of boron in the leaves close to the shoot tip was sufficiently high well in advance of flowering.

In South Africa, there was always an increase in yield in response to boron, but in some experiments or in some years, only a marginal improvement over the control trees was obtained. Boron applied to the canopy during the cauliflower stage of inflorescence development significantly increased the number of pollen tubes that reached the ovule, increased ovule viability, and increased cumulative yield.

In California, yield increases in response to prebloom canopy applications of nitrogen or boron were variable from year to year and represented only a 25% increase in kg fruit per tree over three years compared to untreated control trees. Applying boron in high boron orchards (180 ppm B by leaf analysis) resulted in statistically significant decreases in yield in some years. Yield increases are greater with canopy applications of boron.

The results of trials provided evidence that root absorption of boron is very restricted and could not increase yield with trunk injections of boron despite the fact that trunk injections increased the boron status of the trees to a greater degree than the canopy sprays.

An interesting observation was made in open pollinated 'Hass' avocado flowers from untreated field trees. They had many pollen grains, which had successfully germinated but growth of the pollen tubes had ceased mid-style.

The prebloom canopy sprays of nitrogen and boron, to a significantly greater degree than nitrogen, increased the number of pollen tubes that grew completely through the style to the opening in the ovule, which is consistent with the break down of the barrier preventing self-fertilisation. Thus, in the absence of cross-pollination under adverse climatic conditions, boron or nitrogen sprays might facilitate self-pollination and increase yield, a response that would be without effect if cross-pollination occurred.

Recently, there has been increased effort on the part of researchers and growers to increase pollination, outcrossing, and fruit set by increasing the number of bees in an orchard, increasing bee activity and movement through the orchard by the use of pheromones, and by planting or grafting other avocado varieties into an orchard to enhance cross-pollination.

It has been reported that outcrossing rate and yield per tree were significantly higher in interplanted versus pure groves of 'Hass' avocado. Yield of 'Hass' avocado trees in orchards planted next to 'Ettinger' orchards decreased as the distance of the 'Hass' trees from the 'Ettinger' orchard increased. By analysis, 90% of the harvested fruit had been cross-pollinated by 'Ettinger'.

Within the inland regions of California, a clear correlation was found between outcrossing and yield when 'Hass' trees were located near 'Bacon', 'Fuerte' or 'Zutano'. Outcrossing and yield declined as the distance between 'Hass' trees and the alternate pollen source increased.

In the coastal avocado growing areas of Santa Barbara and Ventura, outcrossing and yield were not correlated. The effect of temperature differences between the inland and coastal orchards during bloom is being investigated. The possibility that other pollen sources were available cannot be ruled out. The best variety for cross-pollinating 'Hass' under California conditions has not been thoroughly investigated.

Recent research in California confirmed that honeybees are the primary insects in avocado orchards. They remain the most likely candidates for improving



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pollination since they can be easily manipulated.

However, data provides evidence that it may not be the lack of pollinators in cool springs that limits fruit set, but that temperature itself negatively impacts flower opening, pollen tube growth, or ovule viability as discussed above or that successfully fertilised (normal) fruit drop due to limited resources or abiotic stress as discussed below.

Factors Affecting the Abscission of Normal Fruit

The abscission of normal fruit during the early drop period is a critical factor in avocado production. The limited research that has been conducted to study early drop in avocado has concentrated on the competition between the young fruit and vegetative shoot growth occurring during the period critical to fruit retention and yield (Figure 1).

Early work indicated that mineral nutrient applications could stimulate shoot growth during the period critical to fruit retention resulting in increased fruit drop and loss of yield. The optimal time and quantity of nutrient applications for improved fruit set still has not been adequately investigated for avocado.

Yields were significantly increased over a period of four harvests in California by applying 1/3 of the total annual nitrogen to the soil in April during fruit set and shoot flushing or in November, which we now know to be the time of flower formation. Mid-February and mid-June nitrogen applications significantly reduced yield.

The results suggest that if nitrogen is not limiting, vegetative growth does not negatively impact fruit set. Sustaining vegetative shoot growth has the advantage of increasing photosynthetic area and flowering and fruiting points for the following season. Reducing vegetative growth during the period critical to fruit retention either by pruning or by the use of paclobutrazol resulted in increased fruit set and yield.

The effect on fruit size has been variable. Pruning increased the calcium content of the fruit, making them less susceptible to postharvest disorders.

Combining a pre-anthesis soil application of nitrogen with a mid-anthesis foliar application of paclobutrazol increased yield without a reduction in fruit size and improved fruit storage quality.

Gibberellic acid₃ (GA₃) canopy sprays in November or January resulted in precocious development of the vegetative shoot of indeterminate inflorescences, such that

the majority of leaves were sources at the time of fruit set rather than competing sinks; the GA₃ treatments increased yield without reducing fruit size.

When competition has been demonstrated to be a factor influencing fruit drop in a tree crop, lack of available carbohydrate has been assumed initially to be the cause. For avocado, this argument is supported by the fact that yield has been correlated with tree carbohydrate status.

Properly timed branch girdling is a technique used to increase carbohydrate levels above the girdle to increase fruit set and size. How many and how frequently branches can be girdled without adverse effects long-term to avocado tree health and production remains to be determined.

Experiments with other tree crops, such as citrus, for which fruit set and early drop have been studied in more depth, ultimately precluded carbohydrate availability as the key factor limiting fruit set and causing increased early drop.

Cultivars of *Citrus sinensis*, like avocado varieties, undergo a period of excessive fruit drop commencing during flowering and continuing through the first stage of fruit growth. For both crops, fruit drop is completed by approximately mid-July. During this critical period, fruit retention/fruit drop in both crops is characterised by:

1. competition between the young fruit and vegetative growth;
2. sensitivity to temperature extremes; and
3. water-deficit stress.

Studies on fruit set in citrus have yielded the current hypothesis that fruit set is favoured by a greater ratio of endogenous growth promoting (GA and/or cytokinins) to growth inhibiting [abscisic acid (ABA)] hormones.

Evidence is beginning to appear in support of this hypothesis in avocado. Determinate inflorescences of the 'Hass' avocado in California were confirmed to set threefold more fruit than indeterminate inflorescences.

During fruit set, fruit of determinate inflorescences had a significantly higher ratio of endogenous GA to ABA than fruit borne on indeterminate inflorescences, demonstrated that 'Hass' avocado fruit growth and abscission were related to changes in cytokinin to ABA ratio. In vivo application of ABA reduced fruit growth and increased fruit abscission, whereas co-treatment with isopentyladenine reversed the effects. March canopy applications of GA₃ increased yield and fruit size of the 'Hass' avocado.

Some degree of early avocado fruit drop likely results from high temperatures and transient water-deficit stress. It remains to be determined whether ABA or ethylene levels increase in avocado and/or GA or cytokinin levels decrease in response to abiotic stresses leading to fruit drop. The lack of basic information regarding hormonal regulation of these processes in avocado leaves opens the possibilities for significant improvement in fruit set and yield in the future as our knowledge base increases.

Conclusions

Pollination and fertilisation are two processes critical to fruit set that have been targeted to increase avocado yield to a greater degree than preventing abscission of normal fruit during the early drop period.

The roles of hormones in the stimulation of fruit growth in response to self- or cross-pollination, in the subsequent development of a normal fruit in the fruit abscission process in the presence or absence of stress, and in alternate bearing have been minimally investigated.

The results of such studies would undoubtedly provide new information of practical value for improving fruit set and yield.

Whereas cross-pollination of 'Hass' by 'Ettinger' in Israel is an important factor to maximise production, many 'Hass' orchards produce good yields without benefit of outcrossing. For many growers, the significant yield differences between "on" and "off" years cannot be overcome in the "off" year with our present abilities to increase yield by improving pollination.

For countries in which paclobutrazol cannot be used in avocado production, canopy sprays of boron or nitrogen improve yield, but not consistently.

Similarly, interplanting pollinisers to increase outcrossing, importing bees into an orchard and luring them through the orchard with pheromones increases yield more in some years than in others.

It is this author's opinion that our ability to dramatically increase avocado production awaits the results of further research into the mechanisms by which endogenous plant hormones regulate developmental processes and mediate the responses of the avocado tree to the environment. Recent results of trials clearly demonstrate the potential of such research.



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Use Of Gibberellic Acid To Manipulate Flowering In The Hass Avocado

An edited extract from a paper presented at Conference '97 by Samuel Salazar-Garcia, Campo Experimental Santiago Ixcuintla, Mexico, and Carol Lovatt, Department of Botany and Plant Science, University of California, Riverside, USA

Introduction

Exogenous gibberellins have been shown to alter floral development in temperate fruit trees, such as peach, apricot, almond, cherry, plum and apple as well as in tropical fruit trees, like mango and citrus. The results of these studies and others have created a consensus in the literature that the effect of exogenous gibberellins on flowering is highly influenced by concentration and time of application in relation to the stage of floral bud development.

It was found that the application of Gibberellic Acid (GA_3) any time from early November until bud break resulted in a significant inhibition of flowering in several citrus species. The researcher concluded that flower meristems could be reverted to vegetative apices even after petal formation.

In contrast, other researchers found that irreversible commitment to flowering of the 'Washington' navel orange probably occurred once sepals were initiated. GA_3 application (100 mg/l) prevented flowering in 90% of potentially flowering shoots only when applied to resting buds well in advance of sepal formation.

Application of GA_3 , in lanolin paste, to apical buds of mango cv. Dashedari before floral initiation stimulated vegetative growth in 75% of shoots. However, once flower meristems were present, GA_3 did not inhibit flowering. In another study, GA_3 was sprayed to deblossomed branches of 'Keitt' mango. A single application of either 10 or 50 mg GA_3 /l delayed further flowering by more than four weeks. The greatest effect was observed with 250 mg/l. These researchers proposed that the delay in flowering was due to repression in floral bud initiation.

A promotive and/or inhibitory response to GA_3 application has also been reported for treatments made after floral initiation. In strawberries, GA_3 accelerated the appearance of flowers that had differentiated at the time of application but inhibited the initiation of new flowers under inductive conditions. With coffee (*Coffea arabica* L.), application of GA_3 (100 mg/l) stimulated early anthesis of floral buds that were

4 mm long at the time of treatment. No differences were apparent in the time of flowering for buds that were treated either earlier (4 mm long) or later at the candle stage (10 mm), which is just prior to anthesis. Thus, the effect of GA_3 was dependent on the stage of inflorescence bud development.

In the case of avocado, there is no published information on the effect of exogenous GA_3 on flowering. Considering the several physiological similarities reported for avocado, mango, and citrus, it would be beneficial to conduct research to determine the role of GA_3 in avocado flowering. The results may provide information useful to commercial production of the avocado. Careful documentation of the time and pattern of floral organogenesis is a necessary prerequisite to any attempts to manipulate flowering in woody perennials.

Given that the response of various plant species to GA_3 was dependent on the stage of inflorescence and flower organogenesis, a series of studies under controlled environment conditions and in commercial orchards was undertaken to determine when vegetative buds of the 'Hass' avocado change to inflorescence buds and to determine the time and pattern of subsequent organogenesis. This research was in order to develop strategies using foliar applied GA_3 to regulate inflorescence phenology and intensity of flowering in order to increase yield and even out alternate bearing of the 'Hass' avocado.

Materials and methods

Inflorescence development

In a commercial 'Hass' avocado orchard, two apical buds (or expanding inflorescences) from 20 tree-replicates borne on summer shoots were collected weekly from July to August during an "on" and "off" crop year. Buds from each sample collected were sorted by shape and degree of expansion, fixed, sectioned and analysed microscopically to determine anatomical development.

Another study was undertaken to determine the stage of development during

which commitment of the shoot primary axis meristem to flowering occurs in avocado.

Three-year-old 'Hass' avocado trees on Duke 7 rootstock were induced to flower with low temperature treatments of 10 hour days at 10°C and 14 hour nights at 7°C for one, two, three, or four weeks in a growth chamber. At the end of the induction treatment, the temperature was increased to 25/20°C (day/night) through to the end of the study. To further test commitment to flowering, GA_3 (100 mg/l) was applied to apical and axillary buds at the end of 2, 4, and 6 weeks after exposure to low-temperature floral-induction treatments.

Effect of GA_3 on Flowering and Yield

To quantify the effects of GA_3 on the 'Hass' avocado under field conditions, branches of 10-year-old 'Hass' avocado trees were sprayed with 0, 50, 100 or 1000 mg/l in November, December or January. All treatments were made after commitment to flowering and inflorescence initiation but prior to bud break.

Another study was conducted to quantify the effect on yield of GA_3 canopy sprays during "on" and "off" crop years of the 'Hass' avocado. GA_3 (25 or 100 mg/l plus Triton X-100 at 1 ml/l) was applied to separate sets of trees in September (during inflorescence initiation), November (end of inflorescence initiation), January (initial development of the perianth of terminal flowers), March (cauliflower stage), or monthly sprays from September through January. Control trees did not receive any treatment.

Results and discussion

A conical-shaped primary axis meristem was related to formation of leaf primordia or inflorescence bracts. Near the end of summer shoot extension, two secondary axis meristems were formed in the axils of inflorescence bracts. The primary axis meristem changed shape from conical to



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flattened to conical followed by the initiation of additional bracts and associated secondary axis inflorescence meristems rather than additional leaf primordia.

The transition phase from the vegetative to reproductive condition occurred in less than one month from the end of July through August for summer flush shoots. A period of dormancy was not prerequisite for the shift to inflorescence development. Formation of microspores and ovule integuments occurred at the cauliflower stage (elongation of secondary axes of the inflorescence); a stage that has been found to be responsive to treatments designed to improve pollen vigour ovule viability, and yield. This shows how knowledge of developmental events related to flowering can be used to guide production strategies.

Commitment to flowering was determined by using temperature and GA₃. Anatomical sections of apical buds at the beginning of the low-temperature floral-induction treatments and after one, two, three, or four weeks of low temperature (83% of the buds were committed to flower by the end of week 4) were indistinguishable, having a conical primary axis meristem with two inflorescence bracts bearing secondary axis meristems without apical bracts.

Commitment to flowering resulted in formation of additional bracts with secondary axis inflorescence meristems. In the

field, secondary axis inflorescence meristems were produced from August to October, anthesis was seven months later. GA₃ application to apical and axillary buds when at least one pair of secondary axis meristems were present and thereafter had no effect on flowering. While there was no anatomical feature to mark commitment to flowering, the results defined a system in which regulation of flowering can be critically studied in the future.

Macroscopic grading was very reliable for predicting the microscopic stage of inflorescence development. Eleven stages of external bud and subsequent inflorescence development were correlated with organogenesis for use in predicting specific stages of inflorescence development in the field. Yield had little effect on the rate of inflorescence development, which was correlated with the cumulative number of nights with temperatures 15°C. The high yield during the "on" crop year (average of 66.1 kg/tree) reduced inflorescence number with a concomitant increase in the number of vegetative shoots.

Application of GA₃ on branches stimulated apical growth of all shoots. Thus, if an inflorescence bud was already differentiated, the inflorescence developed in advance of inflorescences on branches not treated with GA₃. Early GA₃ treatment (Nov.) reduced flowering intensity by stimulating the expansion of inflorescences that were only partially formed, i.e. having fewer secondary axes. In addition, GA₃ caused precocious development of the vegetative shoot of indeterminate inflorescences relative to the flowers in the same inflorescence and relative to the vegetative shoot of indeterminate inflorescences from untreated branches. GA₃ treated branches reached the cauliflower stage of inflorescence development earlier than untreated controls, but the time of anthesis was not significantly affected by GA₃. Growth of axillary buds was inhibited with increased GA₃ concentrations.

GA₃ sprays to whole 'Hass' avocado trees in September reduced flowering intensity in the two years of the study. November sprays reduced the number of inflorescences produced in the spring when the tree was bearing an "off" crop year with a concomitant increase in production of vegetative shoots; there was no effect in the "on" crop year. January and March applications had no effect on flowering or shoot production either year. GA₃ treatment did not affect flower parts. GA₃ had no effect on time of flowering (days to presence of 50 inflorescences at anthesis

per tree). Application of GA₃ (25 mg/l) in November or January stimulated the precocious development of the vegetative shoot of indeterminate inflorescences.

The only effect on fruit set was that the November application of GA₃ (25 mg/l) increased fruit set in the "on" year and decreased it in the "off" year. GA₃ was applied during the "on" crop year; thus, the yield data for the first year are for an "off" crop—18 kg/control tree. GA₃ (25 mg/l) applied in November, January, or March increased yield to 35, 27, and 34 kg/tree, respectively, but no treatment was significantly better than the control.

The November GA₃ application resulted in approximately a 3-fold increase in fruit weighing 135-177 g compared with the control. The March application resulted in a twofold increase in fruit weighing 213-269 g. GA₃ (25 mg/l) applications in November, January and March increased the number of late-harvested fruit (May) with green skin, i.e. reduced the number with black skin, with no negative effects on internal fruit quality or maturity.

This study provides a visual index of the external characters of the inflorescence bud and subsequent inflorescence that researchers and growers can use in the field to predict specific stages of inflorescence development at the microscopic level within the bud or after bud break. Results of foliar GA₃ applications to avocado have not been previously reported.

This study defined the effect of GA₃ dose and timing on vegetative shoot and inflorescence development, fruit set and fruit maturation. Our results establish that GA₃ causes precocious development of both the vegetative shoot apex of indeterminate inflorescences and the secondary axes of indeterminate inflorescences, but not of flowers. Depending on the time of application, GA₃ showed the potential to reduce flowering intensity, make leaves in indeterminate inflorescences sources rather than sinks during fruit set, and increased yield and fruit size. The larger leaves of GA₃-treated trees protected fruit from sunburn earlier in their development and GA₃ kept the peel of late-harvested fruit green. The results of this research provide evidence that strategies using foliar-applied GA₃ to manipulate flowering can be developed at the commercial level to increase yield and fruit size and/or even out alternate bearing for the benefit of the avocado industry.

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Avocado Quality Assurance: Who? Where? When? How?

Part 2

An edited Extract from a paper presented at Conference '97 by Dr Lindsay Milne, Merensky Technological Services, Duivelskloof, South Africa

In the previous issue of this magazine, details of quality requirements were given for avocados in the orchard and from the orchard to the packing shed.

Part 2 takes the subject of quality one step further and covers quality concerns from the packing facility to the consumer.

Quality

All fruit destined for export is inspected at packhouses in South Africa, using PPECB inspectors. It is their duty to reject consignments of fruit that do not meet the industry established standards of quality or that have not reached the correct temperature for transport. Fruit destined for export are currently required to have a pulp temperature not exceeding 13°C at the time of packhouse inspection.

Temperature recorders are seen as an essential part of the process of monitoring the cold chain. In South Africa, 'Ryan' recorder instruments are positioned in one pallet out of every ten during palletisation. It is necessary at the outset, to enter the name of the packhouse, the vessel for which the consignment is destined and the pallet number on the chart. The position of the recorder must also be clearly marked in the pallet, for ease of recovery. The Ryan recorder will reflect the air temperature surrounding the fruit at a particular point, and has been found to provide valuable information in cases where the cold chain has been broken. This applies whether the consignment is to be sent by sea or air. "Squirrel" data loggers may also be used, the advantage being that they electronically record fruit pulp temperatures at various points in a consignment. Miniaturised data loggers are now available for this purpose.

Rapid feedback to the Grower/Packer/Exporter of temperature data is

essential so that adjustments can be made where necessary.

During road transport to the port or market

The following advice is given to ensure adequate cooling, especially over long distances using road transport (RT):

- Temperature control thermostats must be operating correctly and recording instruments must be functioning accurately.
- The RT must be set at the correct temperature and be precooled to that temperature for three hours prior to loading the fruit.
- The temperature control thermostat should be set to measure delivery air temperature.
- In the case of top-down cooling sufficient space should be allowed above the load to allow for adequate air circulation.
- All fruit should be precooled to the required carrying temperature prior to loading and at least one pulp temperature per pallet must be recorded during loading.
- This data should be retained by the transporter for delivery to the receiving depot at the port.
- Only RT's with well-insulated and well-sealed compartments should be used. Road temperatures can reach more than 80°C and this radiated heat can cause heat build-up in palletised fruit. It is also essential that pallets be aligned in such a way as to allow adequate airflow through the load.
- The grower should know how his fruit is being handled and has the right to request feedback of temperature data.

At the docks

Road transport loads must be monitored for temperature deviations on arrival at the docks or container-depot. Using probe thermometers generally does this. However thermocouples placed in fruit in the centre of pallets at the time of palletisation

can be used specifically to monitor pulp temperature at possible 'hot-spots' deep within the pallet. Depending on the process involved at the specific harbour, fruit can generally be held under effective cooling in a holding store or container terminal prior to loading aboard a vessel. It should be noted however, that breaks in the cold chain could and do occur during this process. The 'Ryan' or other recorders should facilitate pinpointing of problems of this nature, which can be followed up with the relevant authority. Fruit should not be loaded aboard the vessel unless it is within 0.5°C of the required carrying temperature.

In addition to accurate monitoring of arrival temperatures at the docks, it is essential to record the age of fruit (i.e. from the date of packing, based on the date-code). The South African industry has a cutoff date of 12 days after packing. Older fruit will not be allowed for export and must be disposed of on the local market.

It is important for growers to be aware of the time taken for the exporter or agent to get their fruit to the port, as this can significantly affect outturn quality.

During sea transport

In porthole container vessels it is essential to maintain a continuous record of delivery air temperatures (DAT) and return air temperatures (RAT). DATs are adjusted according to the differential between DATs and RATs. If the RAT is more than 1.5°C higher than the DAT, this is an indication that the cooling process is not coping with the heat generated by the fruit. A downward adjustment of DAT is therefore made. This decision, based on reliable facts, is taken by an Industry Temperature Committee, which responds rapidly to data radioed to shore by the ship's engineer on a regular basis. In the case of integral and controlled atmosphere containers, temperature data is not normally available on a day-to-day basis and



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correct loading temperatures therefore become even more critical.

In studying shipping conditions in terms of age and temperature of fruit in relation to outturn fruit quality, fruit firmness decreased with an increase in fruit age, particularly in the case of Fuerte and Edranol, which should therefore not be stored for longer than 25 days. 'Black cold' and 'grey pulp' also increased significantly with time. Although 'black cold' has little or no effect on internal quality, it is strongly rejected by the trade. Lenticel damage increased with fruit age but was also found to correlate with specific growing areas. A deviation in temperature (higher) during loading of sea containers strongly correlated with fruit softness on arrival. Delays in recooling during loading also had a significant effect on fruit firmness on arrival.

Two factors are of great importance. First, communication and response must be extremely rapid if corrective action is to be taken and second, any deviations from the norm must be linked to specific quality outturn on arrival.

Controlled Atmosphere

It has been shown that a mixture of 10% CO₂ and 2% O₂ extended the shelf life of Fuerte, Edranol, and Hass avocados while reducing grey pulp and virtually eliminating pulp-spot. However, an increase in anthracnose was observed. It has also been shown that a 25% CO₂ shock treatment applied one day after harvest also gave very good results in reducing physiological disorders, without the concomitant increase in anthracnose.

Hass avocados can be stored successfully for up to 60 days, using a CA of 5% CO₂ and 2% O₂.

During the 1996 and 1997 seasons, South African exporters resorted to CA export of many sea containers of avocados to Europe, due to the inherent vulnerability of the fruit resulting from excessive rains.

The results of shipping CA and conventional containers from the same sources at the same time, were monitored and evaluating them overseas. It was found that in general, both Hass and Fuerte fruit arrived much firmer under CA, with up to a week of extra shelf life. In addition CA fruit had a lower incidence of postharvest diseases such as anthracnose and stem-end rots (*Dothiorella/Colletotrichum* complex). In some cases external cold injury of Fuerte was higher under CA and, as expected, CA was not a cure-all for age-related symptoms such as grey-pulp. Nor did CA have any impact on uneven colouring of Hass.

Controlled atmosphere containers have less cooling capacity than porthole containers and loading temperature is therefore even more critical. However, because CA reduces respiration rates, and therefore heat of respiration is less, less cooling is required in such containers.

Modified Atmosphere Packaging (MA)

Passive atmosphere modification uses the respiration rates of fruits and vegetables to consume the oxygen and produce carbon dioxide and water vapour in the pack. If the respiration characteristics of

the commodity can be accurately matched to the permeability of the film used for packaging, a favourable modified atmosphere can be created passively within the package when an equilibrium concentration between the oxygen and carbon dioxide is reached.

A mathematical model for determining film-permeability characteristics for MA storage of tropical fruit has been prepared.

It is reported that Mission Produce from California has expanded its ability to pre-condition fruit through a modified atmosphere program. The program allows avocados to remain in storage an additional two weeks. The process requires an extra refrigeration step after fruit is hydro-cooled and ripened with ethylene gas. The remaining gases are removed from an air-tight carton, which is then kept at a constant temperature of 4.5°C.

On arrival at the discharge port

It is the responsibility of the exporter to ensure that his agent applies the correct procedures at the discharge port. Recooling (using clip-ons, a cold-wall or cold store) must be applied within two hours of unloading, using the same delivery air temperature as that applied by the vessel prior to discharge. Air vents of ducted containers must be kept open during transit to prevent buildup of heat and carbon dioxide.

The importer should retrieve Ryan recorders or other recording equipment and the charts returned to the exporter and or packer as soon as possible. This data should then be correlated with fruit quality in the same consignment.

On ripening, shelf life (days to ripen) and internal disorders such as pulp-spot, grey pulp and vascular browning are also recorded (the colour of Hass skin does not necessarily correspond to its ripeness and fully coloured, rock-hard fruit can sometimes be found on the tree. Fruit firmness is a much better indicator of Hass ripeness. If fruit are only sold at the completely black stage, many of the fruit may be over-ripe and postharvest diseases will consequently increase significantly).

Feedback

The South African industry makes use of an Overseas Technical Officer who is stationed in Europe during the avocado season (April to September). His task is to

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monitor fruit arrivals and to give feedback on all quality parameters.

Fruit is evaluated first on arrival and is then held for ripening, at which time a second evaluation is carried out. The following parameters are evaluated using a rating system where relevant:

- Exporter
- Packer
- Grower
- Container no.
- Vessel no.
- Ryan recorder(s)
- Pallet no.
- Cultivar and count
- Date code
- Age of fruit
- Firmness (using Densimeter)
- Black cold
- Brown cold
- Dusky cold
- Lenticel damage
- Mechanical damage
- Stem-end rot
- Anthraxnose
- Sooty-mould
- Cercospora spot

The information is faxed back to the industry office, who in turn distributes the information rapidly to exporters and packers.

These records are of vital importance to all concerned in the export process. If properly evaluated and collated they will show up orchard problems, area deviations, packer problems, shipping problems and seasonal variations. The speed of this feedback can do much to prevent recurrence of specific quality problems.

Cold injury definitions

Black cold

Black cold is a severe early cold injury resulting in shiny, black, sunken lesions with clearly defined edges. It does not penetrate below the skin. This symptom is almost always seen immediately upon arrival of fruit overseas, and is normally associated with a severe cold shock early in the cold chain, e.g. in the packhouse cold store. Such cold injury may also result from the application of too low delivery temperatures on the vessel. Black cold may also continue to develop in cold storage after fruit arrival overseas, although this is rare. All cultivars are affected, in particular Fuerte, Pinkerton and Edranol. Black cold on Pinkerton often results in internal grey pulp development.

Brown cold

Brown cold is a symptom that can be described as a severe, light brown discolouration on the skin of Fuerte, with defined, but not sunken edges. The lenticels remain green and healthy in the midst of a rapidly spreading discolouration.

This symptom is rarely seen immediately upon arrival of fruit overseas, although old and soft fruit are more likely to display brown cold. It usually manifests itself as a result of prolonged cold storage after arrival. It may be absent on fruit just removed from cold storage, but can develop extremely rapidly (within less than one hour) once exposed to ambient temperatures.

Brown cold is more common on old fruit and excessive moisture loss during transit and cold storage is thought to play a major role in the development of this symptom.

Lenticel or lenti-damage

This symptom is usually seen immediately on arrival of the fruit overseas. It involves severe injury and browning or blackening of the lenticels due to either rough handling of the fruit or too low cold storage temperatures. Fruit is also more likely to develop lenti-damage when picked during and immediately after significant rain. Hass is particularly prone to lenti-damage due to the exposed nature of the lenticels. However, the greenskin cultivars are also affected, particularly during the early part of the season. Prolonged exposure to too low storage temperatures may ultimately result in lenti-damage developing into 'black cold'.

Dusky cold

A faint sooty-brown or black discolouration associated with the cold storage of fruit that is aging, especially Fuerte and Edranol. It is often correlated with internal grey pulp symptoms.

At the prepackers/ripening facilities

The average consumer does not want to wait a week before eating the avocados they have bought. There is therefore a major trend in the United States, Australia, the UK, South Africa, and other countries, to pre-ripen or 'trigger' fruit prior to sale.

This process is generally carried out by prepackers or retailers and has become an important part of the marketing chain. However, it is also a potential disaster area where the grower may be penalised with heavy losses due to incorrect handling procedures. Because of increasing

softness, pre-ripened fruit will be extremely susceptible to bruising.

The role of ethylene in the natural ripening process has already been discussed. However the commercial use of ethylene together with heat, to initiate or trigger ripening is now common.

It has been demonstrated that respiration in Fuerte fruit can be increased by ethylene levels as low as 0.01 μl^{-1} during storage at 10°C. However higher levels (1.0 μl^{-1}) were required to boost respiration rates in Hass fruit held at 8°C, implying a lower level of ethylene sensitivity in this cultivar.

In commercial trials carried out at Westfalia Estate in South Africa, waxed fruit was found to respond less evenly to ethylene triggering of fruit indicating that the wax may serve as a partial barrier to entry of ethylene.

Treatment of commercial consignments with 100 μl^{-1} of ethylene at 20°C for 24 hours is generally regarded as sufficient to trigger fruit for marketing of ready-to-eat fruit. The use of nondestructive fruit firmness testers is an important part of this process to ensure uniformity of ripening.

It is essential for the grower to ensure that monitoring of the pre-ripening process occurs and that he is given feedback on losses occurring at this stage of the marketing chain. Where necessary, corrective measures can then be taken.

In supermarkets/retail stores

Education of the person or persons who sell to the consumer is of great importance, particularly where ready-to-eat fruit is being sold. Correct handling of sensitive fruit, an understanding of the effects of time and temperature on the fruit and the use of "best-before" or "sell-by" dates, are all part of the education process to ensure that losses do not occur at this penultimate stage of the marketing chain.

For the consumer

Just as is the case for the seller, the consumer must be educated on the correct storage procedures for the fruit they buy, whether rock-hard or ready-to-eat at the time of purchase. However all the education and promotion in the world, will be valueless if the inherent quality and reliability of the product is not there.

Quality: The role of research

Research should be aimed at three main facets:



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1. Production research.
2. The commercial process from grower to consumer.
3. Market research.

Production research funded by the South African Avocado Growers' Association was recently revised and showed that for a grower investment of **one dollar** the return, due to implementation of research findings, is **\$60**.

The commercial process from grower to consumer includes virtually all the aspects dealt with in this article. It is the entire process of monitoring, evaluating and reporting on the quality control chain and carrying out the necessary research to solve the problems that are found to occur. This research can be of enormous financial benefit to the grower.

Market research is obviously of vital importance in order to identify what

customers want and also in order to determine what customer-education is required.

Quality: The role of grower organisations

ISO 9000 and HACCP

This article covers many of the principles expounded in ISO 9000 and Hazard Analysis and Critical Control Points (HACCP). ISO 9000 can be seen as an internationally accepted, overall quality control system dependent on acceptance of management responsibility, effective documentation, entrenchment of quality control systems and regular auditing by accredited auditors, followed by appropriate and documented corrective action.

- HACCP is divided into two facets:

1. Hazard Analysis in which a total flow diagram is produced, identifying the

type of hazards (whether physical, chemical or biological) that may impact on the end product.

2. Critical Control Points which include identification of the critical points in the flow chart at which quality aspects must be monitored to ensure a safe and dependable end-product. Appropriate preventative measures are then documented, applied, monitored and regularly reviewed. The HACCP process is basically the one followed in this article.

It is you the grower who can and should have the greatest impact in ensuring that you grow a good product and that a good product arrives at the consumer. That is what this article is about. In the end it is you who must ensure that the necessary quality control systems are in place to guarantee that your production and marketing remain profitable now, and into the future.

New Recruit To Avocados

The latest recruit to the team of scientists working on avocados is Jose Roberto Marques. Jose is a Brazilian who obtained his degree in Agronomy from the University of Sao Paulo in 1987, specialising in horticulture. He then worked for six years at the Horticulture Division of the largest Brazilian agriculture co-operative, managing information for production, trading and quality of fruits.

In the last two years, as a part of his Masters in Applied Science at Massey

University, New Zealand, he investigated the effects of pre-harvest application of ethylene synthesis inhibitors on the post-harvest quality of kiwifruit.

Jose has accepted a PhD scholarship funded by the HRDC/AAGF within the project on "Field management of avocado postharvest diseases", managed by Dr Lindy Coates (Plant Protection Unit, In-dooroopilly). He shall be working with Dr Peter Hofman (QHI, Hamilton), Dr Tony Whitley (QHI, Nambour) and Dr Daryl

Joyce (UQ Gatton) on the effects of fruit nutrition on fruit quality and disease after harvest. This will extend the work conducted by Mr Surachat Vuthapanich (another of Peter Hofman's PhD students), which identified the very strong influence of fruit minerals on quality of avocado and mango.

The goal of his program will be to identify how nutrition affects postharvest disease, and the tree characteristics that influence optimum fruit mineral concentrations. It is hoped this will ultimately result in the selection of rootstocks for better fruit nutrition and quality.

The opportunity of working within this project is going to be a very challenging and rewarding experience, both personally and professionally for Jose. In addition to completing his PhD course, he hopes to contribute to the improvement of the avocado industry in Australia.

Jose arrived in Queensland in March with his wife Cristi and his little 'kiwi' daughter Anna Luisa, and will be based at the Hamilton laboratories in Brisbane. He and his family are looking forward to experiencing the Australian way of life.



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Peter Young of Birdwood Nursery demonstrates grafting at the NSW Field Day held at Stuarts Point in May.