

**NSW Avocado
Growers Study Tour to
Western Australia,
March 2007**

Gordon Bunch
Quadrant Australia Pty Ltd

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FINAL REPORT

HORTICULTURE AUSTRALIA PROJECT AVOCADO AVO6013

Project Title:
**STUDY TOUR OF THE WESTERN
AUSTRALIAN AVOCADO
INDUSTRY**



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- The purpose of this report is to present to the avocado industry the results of our Study Tour to Western Australia.
- We acknowledge HAL and the participant's financial contributions in making this tour possible.
- Date of Report: 20/06/2007

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MEDIA SUMMARY

Twenty New South Wales (NSW) and Queensland (QLD) avocado growers and affiliates visited the two main avocado producing areas of Western Australia (WA), Carabooda, north of Perth and Pemberton in the south. The tour extended from the 26th to 31st of March 2007. From the growers' perspective, the aim of the tour was to investigate cultural techniques employed by the Western Australian avocado industry in view of improving competitiveness within the industry. For the DPI&F researcher present, the objective of the tour was to familiarize herself with the WA avocado industry, the cultural practices and to identify areas of grower concern which may present future research opportunities for the DPI&F.

The tour commenced with a visit to the Perth Central Market in Canning Vale. Approximately 85% of the avocados traded at the Perth Market are sold within WA and the remaining 15% is transported to the eastern and southern states. The market adheres to a Mandatory Code of Conduct and is presently developing a Standard Terms of Trade.

Avocado growing conditions in WA are vastly different to those of the East Coast. The harvesting season extends from September to March which is counter season to that of the East Coast. In WA fruit set and early development occurs during the cooler wet winter months. Most of the fruit development and all of the harvesting occurs over the hot dry summer months. The hot dry conditions minimizes the insect pest and disease pressure and results in high quality fruit being produced with very little crop loss and minimum chemical intervention required. Seven avocado farms were visited during the tour, all of which rarely experience any post-harvest fruit quality problems. Another possible contributor to the excellent post-harvest quality achieved in WA is the short cold storage period of the avocado fruit. Being counter season to the major avocado producing areas in Australia, demand often exceeds supply during the WA avocado harvesting season. Fruit move rapidly through the market which mitigates fruit quality problems. Most of the avocado growing areas visited were on sandy soils requiring frequent irrigation. The well drained soil also contributed to the low incidence of phytophthora root rot in this region. In the Carabooda area most of the irrigation water is obtained from aquifers and due to the reduced rainfall over the past few years, the water quality is deteriorating. Salt burn was evident on avocado leaves and is apparently common in the autumn months. In the Pemberton area irrigation water is obtained from the winter rainfall runoff and stored in large farm dams. The water quality is good but winter frost damage is of concern to the growers in the South. As with East Coast avocado growers, canopy management is one of the WA growers' greatest concerns. Various canopy management techniques are being utilized in WA ranging from tree stumping, tree removal, mechanical hedging and selective limb removal. The success of these techniques varies and the AAL has commenced canopy management trials in the area. Some of the farms visited packed and marketed their own avocado fruit but many belonged to cooperative groups. Communication between growers, packshed managers, marketing managers and the product recipient is to be commended. In view of the expected future increase in avocado production throughout Australia, the eastern and southern states producers would be well advised to follow the WA model of effective communication and cooperation.

INTRODUCTION

The Western Australian (WA) avocado industry, currently worth in excess of \$20mil is set to triple in the next three years with mass planting of up to 400,000 trees planned for the region (The Western Australian, 17th Jan 2007). There are approximately 150 avocado growers in WA with over 1000 ha of trees in production. Although WA produced only 10% of Australia's avocado, it remains a very lucrative industry. A large part of the avocado fruit growth period and all of the harvesting season extends over the very dry hot summer months. Pest and disease pressure is minimized resulting in superior fruit quality. WA avocado industry is unique in that it enjoys a summer harvesting season whereas most other avocado producing countries harvest their crop over the winter months. Being counter season to the rest of the Australia's avocado industry means that WA can deliver avocados when supply is low and demand high. As a result fruit storage times are minimized, fruit quality maximized and high market prices are achieved. Given the success of the WA's avocado industry and the cultural practices developed to suit their growing conditions, a group of enterprising avocado growers from Qld and NSW organized a study tour to the region. The Qld and NSW growers were keen to learn from the WA growers, to establish links with them and, wherever possible, to adopt some of their cultural practices. Danielle Le Lagadec, a DPI&F researcher also partook in the study tour. Being a new comer to the Australian avocado industry, her aim was to gain insight into the WA avocado industry, establish links with growers and industry players and to identify potential research areas which the growers felt were not presently being addressed. The tour extended over the two main avocado grower regions of WA, Carabooda, north of Perth, and the Pemberton area in the south.

REGIONS, ORCHARD AND FACILITIES VISITED

PERTH MARKET, CANNING VALE, WA

The present market site was developed in 1989 and is situated on 50ha in Canning Vale, 16km south of the Perth CBD. The market handles over \$350mil of fresh produce annually. Twenty three primary wholesalers and over thirty secondary wholesalers, distributors and food processing facilities operate from the market. The market boasts 100 000 m² of shed space and 4 600 m² of cool chain trucking warehouse which is fully utilized. Expansion of the cold storage warehouse facilities is planned.

Eighty four percent of avocados traded at the Perth Market are from WA, 4% from Victoria, 8% from Qld, and 4% from NSW. The market handles East Coast avocados during winter months. Transport to the Perth Market from East Coast takes approx two days. During the summer months, 15% of the WA avocados traded at the Perth Market is sold to Eastern and Southern State retailers and markets. The major retailer stores such as Coles and Woolworths purchase avocados directly from the Perth Market in black generic boxes. The market deals mainly with Hass avocados since Hass is the dominant variety produced in WA and is favoured by consumers. However, at the time of our visit there was early season Shepard avocados from

Childers, Qld, on the market floor as well as Fuerte from WA. Hass was selling at approximately \$50 / tray and organic Hass avocados were trading at \$40 / 6.5kg tray. The market adheres to a Mandatory Code of Conduct and is presently developing a Standard Terms of Trade.

For further information:

Mike Donelly

Chief Executive Official

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CARABOODA AREA

Carabooda, approximately 45km north of Perth, has a population of 378 with agriculture being the main industry in the region (<http://www.wanneroo.wa.gov.au>).

Two avocado farms were visited in this area, Avowest, owned by Dr Washer and managed by Alan Blight, and The Avocado Grove, owned and managed by Helen and David Duncan (Appendix 1 and 2). The topography around Carabooda is relatively flat and the soil sandy. It's a winter rainfall area with hot dry summers and wet winters. Frost doesn't commonly occur in this area. Irrigation water is artesian being filtered through limestone bedrock. The ground water is replenished during the winter rainfall season but due to the lower than average rainfall encountered over the past decade, water quality is declining. Salt burn was evident on avocado leaves in most orchards visited in this area. According to the local growers, salt burn is always at its worse at the end of the dry summer season and the problem is alleviated with the onset of winter rains. Pulse irrigation is commonly practiced in the area with trees receiving approximately 800L of water per tree per day. Thick mulch is used in younger plantings and older trees are left to self mulch. The two avocado farms visited were reasonably small, 13 ha and 20 ha, with trees ranging in age from newly planted to 31 years old. Hass was the dominant cultivar on a variety of rootstocks many of which are unknown. Insect pest and disease are not of major concern to avocado growers in this area and few, if any, chemicals are applied. Given the well drained sandy soils, phytophthora root rot is not a notable problem in this region. One of the major areas of concern to growers is canopy management. Major limb removal and tree stumping is practiced as a means of controlling tree size but the results are not very satisfactory. John Leonardi of Avocado Australia Ltd is currently conducting canopy management trials on one of the farms visited.

The avocado fruit harvesting season in this area extends from September to November. Both farms visited pack their own fruit. Avowest also markets its own fruit while The Avocado Grove, markets its fruit through the Avonova group.

MANJIMUPU AND PEMBERTON AREA

Manjimup, situated approximately 310 km south of Perth, and Pemberton a further 30 km south, is in the hilly Darling Range. The soil varies from sandy to gravel clay to a richer gravel loam. The climate is milder than that of Perth with wet, cool winters and regular winter frost. Manjimup has a temperate climate while Pemberton is more Mediterranean. In the Pemberton area minimum winter temperatures drop as low as minus 7°C. Summers are dry and windy with temperatures occasionally reaching 40°C and relative humidity being very low. The regions receive between 1000mm – 1800mm of rain per year but the past few seasons have been

exceptionally dry with less than 500mm of rain being recorded on several of the farms visited. Appadene Park (Appendix 3), an avocado producing farm owned and managed by Robyn and Tom Winfield, and Applewood Packshed (Appendix 4) managed by Vic Grozotis were visited in Manjimup. In the Pemberton area four farms were visited (Appendix 5-9). Large irrigation dams are evident on all farms visited, the water being collected from run off during the winter rain season. Artesian water is not commonly used for irrigation in this area. Most of the growers visited pulse irrigate their trees using micro-sprinklers. During the flowering and fruiting season trees receive approximately 150-350 L of water per tree per day. All of the growers visited schedule their irrigation according to the soil moisture content with the majority making use of tensiometers. The WA growers are very aware of soil health issues and use a thick layer of mulching around their younger trees. Chipped Karri bark, which is readily available in the Pemberton area, is commonly used for mulching. Delroy Orchard, owned by Russel Delroy and managed by Rob Dimitrio, utilize some rather unconventional management practices. They apply a thick but narrow band of Karri bark mulch almost 1m deep around young trees and irrigate only in the mulched area. They restrict the irrigation zone to 0.5 -1m radius from the base of the tree in an attempt to limit the tree's root zone. According to Russel Delroy limiting the root zone contributes to a smaller tree size. The soil outside of the mulching zone is heavily compacted which discourages root development. Furthermore, the Delroys have used Hass as a rootstock since they believed that Hass has dwarfing qualities. Rob Dimitrio warned that although Hass on Hass does result in smaller trees yielding is delayed till the tree reached its fifth year due to the smaller tree size. All harvesting on the Delroy farm is done from the orchard floor. No cherry pickers are used. Most of the other growers visited utilize cherry pickers for harvesting. In general, due to the cooler ambient conditions in the Pemberton area avocado trees tend to remain relatively small as compared to trees on the East Coast. As in the Carabooda area, pest and disease management did not appear to be of major concern to the avocado growers in Pemberton. On a few of the farms visited the garden weevil (*Phlyctinus callosus*) can on occasion become problematic and warrants chemical intervention. According to the growers the weevils shelter in soil and emerge to feed on avocado foliage close to the orchard floor. The weevil only appears to be problematic in young trees. Throughout the Pemberton area in lower lying blocks and in the heavier soils, phytophthora root rot can result in tree decline. Growers use chemical intervention for root rot control. Both foliar application of phosphorous acid and tree injections are commonly used on ailing trees. However, very few phytophthora affected trees were observed on the farms visited. Growers belonging to the Avonova group utilize regular root analyses to test the levels of phosphonates in the avocado roots. They generally apply phosphorous acid preventatively rather than curatively in accordance to the results of the root analyses. A few of the growers in the Pemberton area had occasionally encountered Armillaria root rot in their orchards. Armillaria is an endemic fungi commonly found in gum tree roots. The fungi is only problematic if orchards are established in newly deforested soil especially if de-stumping was poorly undertaken. If the block is allowed to lie fallow for a few years after de-stumping, the problem does not usually occur. The Armillaria fungi grows in the cambial zone of the avocado tree and eventually girdles and kills the trees. In affected orchards orange Armillaria fruiting body are visible at the base of the ailing trees and mycelium growth can be found between the bark and the hardwood. According to Tom and Faye Backhouse, avocado growers in the area, the best method of preventing the spread of the fungus

is to remove the affected trees and all its major accompanying roots and to excavate all the surrounding soil. Clean, uninfected soil is then placed in the excavation site before replanting can occur. The fungi is born on larger tree roots and possibly in soil.

The dominant cultivar grown in the Pemberton and Manjimup area is Hass. The harvesting season follows that of the Carabooda area, i.e. November to early April. Some of the growers visited pack and market their own fruit and several pack and market through the Avonova group. Most of the growers visited practice mixed agriculture. Several own large cattle herds while others have diversified into kiwi fruit, tamarillo, macadamias, and even truffle production. As with the Carabooda avocado growers, despite the smaller tree size, canopy management is of major concern to most growers. Many of the growers visited are uncertain as to the best method of controlling tree height. Selective limb removal is commonly practiced, while tree removal and mechanical hedging is also used. John Leonardi, a researcher working with the AAL, has extended his canopy management research to include the Pemberton area. Furthermore, frost damage is of concern to many growers in the area. Growers utilize over head irrigation to protect younger trees. The automated irrigation systems are activated when ambient temperatures drop below 2°C. Despite all efforts, severe crop losses and even tree losses are common occurrences in this region. Growers have identified frost management control as an area needing research investment.

OUTCOMES

Growing conditions in the WA avocado industry are notably different to those of Qld and NSW. While East Coast growers are faced with a lack of irrigation water, post-harvest fruit quality problems and high pest and disease pressure, these are not challenges faced by the WA growers. WA growers north of Perth appear to have problems with poor water quality resulting in severe salt burn while the southern growers are faced with regular frost damage. The area of major concern for most WA avocado growers appears to be canopy management, a research field in which Avocado Australia Ltd has invested heavily. Both the WA and East Coast growers voiced their concern about the increasing involvement of Managed Investment Schemes (MIS) in the avocado industry. They fear that the rise in production caused by the MIS will place additional pressure on existing avocado growers.

Many of the tour participants commented on the great diversity of habitats, climates and soil types in which WA growers successfully produce a good avocado crop. Environmental conditions seem extreme for avocado production yet the growers have developed farming practices that result in excellent fruit quality. A lot of the techniques used by WA avocado growers are not directly applicable to East Coast growers. None the less, the ingenuity of many of the WA growers was greatly appreciated by the tour participants. Based on the comments made by the participants, one of the best tour outcomes was the excellent contacts made both with WA growers and possibly even more importantly, amongst growers within the touring group.

EVALUATION OF THE STUDY TOUR

A tour evaluation sheet was sent out by Quadrant Australia to all tour participants. The evaluation sheet and average score given by the participants is shown in Appendix 10. The feedback from all the tour participants was very positive.

INFORMATION DISSEMINATION

The Media Summary will be published in the National Industry Publication; Talking Avocados. The complete report will be given to AAL. Copies (CD) distributed amongst all members of the North Coast Avocado Growers Branch of NSW Farmers and tour participants.

IMPLICATIONS FOR AUSTRALIAN HORTICULTURE

The prominence of MIS will certainly add pressure to already strained markets. Further research into canopy management will help established orchards manage growth without long term loss of production. The results of John Leonardi's research is very much anticipated by all growers. Ongoing rootstock trials will help alleviate problems associated with disease and crop monitoring by individuals will combat certain pests, however fruit spotting bug seems to remain one of the eastern grower's greatest menace.

ITINERARY

DATE	ACTIVITY
26 th March	Arrive in Perth
27 th March	Visit to Perth Central Market Visit Avowest, Carabooda, farm manager Alan Blight Visit The Avocado Grove, Carabooda, owners David and Helen Duncan
28 th March	Travel south to Pemberton region Visit Appadene Park, Manjimup, owner Robyn and Tom Winfield Visited Applewood Packshed, Manjimup, owner Vick Grozotis Evening BBQ with local avocado growers
29 th March	Visit Delroy Orchards, Pemberton, manager Rob Dimitrio Visit Marron Brook Partners, Pemberton, owner Tom Backhouse Visit Roache Farm, Pemberton, owner Trish and Mark Roache Visit Bendotti Farm, Pemberton, owner Joe Bendotti
30 th March	Visit Leeuwin Estate Winery Travel north to Bunbury via Margaret River
31 st March	Travel to Perth and fly back to QLD / NSW

RECOMMENDATIONS

The trip allowed growers to experience and assess the different growing conditions and orchard management techniques used in some of the highest yielding Australian avocado orchards. They can now adopt this new found knowledge to their own orchards to help achieve greater yields and productivity. Touring this region allowed growers to see first hand different row spacings and the effects on tree growth and production, canopy management theories, irrigation practices, spray programmes, temperature monitoring devices, fertilising programmes and fruit presentation, all valuable tools to remain viable in the avocado industry.

ACKNOWLEDGEMENTS

The tour was arranged by Alison Tolson, Secretary of the North Coast Avocado Growers Branch of NSW Farmers, through Quadrant Australia, Spring Hill Qld. The technical tour guide, Eric Skipworth was arranged by Quadrant Australia and the tour participants are most grateful for his insight and excellent knowledge of the WA avocado industry.

We thank all the organizers and collaborators who made this trip possible, successful and most enjoyable. This report was compiled by Danielle Le Lagadec, Senior Horticulturist, Dept of Primary Industries and Fisheries, Bundaberg research Station, danielle.lelagadec@dpi.qld.gov.au and Alison Tolson, Secretary of the North Coast Avocado Growers Branch of NSW Farmers, Stuarts Point NSW, iatolson@bigpond.com.au

TOUR PARTICIPANTS

TOUR MEMBERS	OCCUPATION	DISTRICT
Ian and Alison Tolson	Grower	Stuarts Point NSW
Des and Bev McCulloch	Grower	Blackbutt QLD
Michael and Patricia Bonanno	Grower	Stuarts Point NSW
Don and Coral Kafer	Grower	Port Stevens NSW
Malcolm and Narelle Heather	Grower	Stuarts Point NSW
Eric and Carol Erbacher	Grower	Toowoomba
Nick and Margo Schenken	Grower	Tewinga NSW
Sam and Kylie Collins	Grower	Atherton QLD
Chris Tannock	Grower	Ravensbourne QLD
Carol Stevenson	Grower	Ravensbourne QLD
Tim Kemp	Grower	Mangrove Mountain NSW
Danielle Le Lagadec	Researcher, DPI&F	Bundaberg QLD
Eric Skipworth	Technical Guide	Perth WA

APPENDIX 1

AVOWEST, Carabooda

Manager: Alan Blight

Owner: Dr Washer, Parliamentarian & GP

Address: 4 Prospector Gardens, Edgewater, WA 6027

Tele: 0417 179 127

Area under avocado: 20 ha

No. trees: 8000 trees

Tree spacing: 7x3.5m, with the intention of removing every second tree as they reach maturity.

Tree age: 1-25 yrs old, approx 500-600 replants / yr, Alan believes that the life span of an avocado tree is only 15-20 yrs thereafter the trees should be removed & replanted, mature trees get too tall to harvest & yield decreases.

Scion: mainly Hass & a few Lamb Hass. Lamb Hass is very late yielding (December) but according to Alan a poor yielder, fruit drops as soon as tree stresses.

Rootstocks: old trees are on Mexican rootstocks, according to Alan, Mexican rootstocks produce excellent yields but are very sensitive to salt burn & tend to result in biannual bearing; later plantings are on Velvick & some A8 & A10.

Irrigation: micro-sprinklers wetting 6-7m radius, pulse irrigates hourly to increase fruit retention; Alan believes that only the top 10mm of soil water feeds roots, thus the tree stresses quickly if insufficient irrigation occurs; water source is subterranean from huge underground aquifers; salt content of the irrigation water is an ever increasing concern as the aquifer is depleted & not replenished fast enough; Alan has tried various irrigation scheduling methods, e.g. tensiometers, enviroscans, etc. Of major concern to Alan is the salt loading in soil, Alan flushes the soil regularly to avoid salt burn, salt burn is at its worse in Autumn as salt gathers in the avocado leaves over the dry summer months & reaches maximum levels just before the winter rain. Alan is experimenting with CSIRO 'Full stop' system (device buried in the soil which collects leached H₂O, EC is checked twice weekly).

Nutrition: fertilizers applied through irrigation system, except gypsum, which is broadcasts; leaf analyses done in May-June on hardened summer flush; Alan acidifies soil a bit by adding iron sulphate; water pH is close to 7 & contains a lot of calcium carbonates (high buffering capacity); there is no boron deficiency in these soils.

Canopy management: windows are pruned into the canopy through major limb removal, this is done in February – March; all pruning is done from orchard floor, smaller branches are mulched while larger ones are burned; mechanical hedging has been tried but found to result in severe crop loss next season; the ideal time to do limb removal is during a heavy cropping year, despite removing a limb a big crop load still remains.

Pest & disease control: no major issues, chemical intervention for insect pests or disease is rarely needed; leaf roller is an occasional problem; no more than 20% of entire farm is sprayed per year; no calendar spraying is done only very selective blocks are treated; anthracnose rarely occurs and is only a problem if fruit are allowed to hang too long on trees; Phytophthora is not a problem, no root rot treatments are applied

Yields: in a good year yields average 17 tons/ha; this year will be an 'off' year i.e. 7 tons/ha; reason for off year: too high temperatures during flowering resulted in poor

set, also high yield of 2006 resulted in 2007 being an off year for entire South WA; flowering occurs in September to October which overlaps with harvesting season.

Harvest method: cherry pickers are used; harvesting season extends from end August to mid November.

Packhouse: pack own fruit; excellent post-harvest fruit quality (based on agents' comments); fruit quality declines only if fruit are allowed to hang too long on the trees; Alan regulates leaf N levels to control fruit quality; ideal fruit size count 20-25, there is very little market for big fruit; Alan doesn't use Sunny[®] since he prefers smaller sized fruit

Market: Avowest does its own marketing; most fruit go to the Perth market, about 40% goes to East Coast markets; sells some fruit directly to Coles & Woolworths; most markets which they supply prefers counts 23-25 even up to count 30; Sydney & Melbourne markets will accept bigger fruit; Alan does pack some 2nd grade fruit for local & East Coast markets; transport cost to Melbourne market = \$1.50 / tray & to Perth market = \$1 / tray; no avocado processing plant or oil factory in WA therefore lower quality fruit are dumped.

Problem areas: Salt burn is a problem on leaves especially in Autumn, Alan manages salt issue through rootstock & irrigation; according to Alan canopy management needs research attention, he also states that attention should be given to PGR to control vegetative regrowth after pruning, flower physiology needs urgent work especially in understanding flower induction.

Comments: This is a very harsh area for growing avocados, poor sandy soil with hot dry summers. However, the dry summers do result in low pest & disease pressure, which equates to good fruit quality. Furthermore, being counter Qld & NSW avocado season, good marketing opportunities exist.



Varying tree sizes & ages



Salt burn on avocado

APPENDIX 2

THE AVOCADO GROVE, Carabooda

Manager & owners: Helen & David Duncan

Address: P.O. Box 105 Wanneroo, WA 6065; or 89 Bailey Rd, Carabooda WA 6033

Tele: 08 9407 5383

Area: 13 ha

No. trees: 2500

Tree spacing: 9 x 6m

Tree age: newly planted to 34 yrs old

Scion: Mainly Hass

Rootstocks: old trees are on unknown seedling rootstocks, later plantings are on seedling Velvick

Irrigation: micro-sprinklers watering 10m radius, 200L/hr; schedule: 30 minutes at night & from 10h00-17h00 pulses every 15 minutes = 800L / day / tree during flowering & fruiting season.

Nutrition: apply all fertilizers through the irrigation system using fertigation tank; on new plantings a thick layer of wood chip mulch is applied & also composted chicken & pig manure as well as mushroom compost; older trees are self mulching.

Canopy management: trees are cut back to stumps (1m - 1.5m high); stumped trees are back bearing within 2 yrs; usually entire blocks are stumped but sometimes alternate trees are stumped; stumping trees allows light into the orchard; personal observation: when stumping alternate trees very long spindly limbs tend to develop with fruit being born 5 m up, apparently lower area of trees will regain canopy in time.

Pest & disease control: no spraying for pest & disease is required; phytophthora root rot can be a problem & ailing trees are injected with Phosjet & Ausphos is applied as a foliar spray.

Yields: in good a year 20tons / ha.

Harvest method: cherry pickers are used, harvesting period is end August to mid November, pick selectively for 1st three weeks (pick for size) thereafter strip pick, harvesting is done in pairs (2 cherry pickers working together), fruit placed into 300kg trailers hitched to quad bikes & taken to the packshed.

Packhouse: own, small but very modern, fully computerized system, 9 lane size sorter, general fruit size packed is count 23-25, pack in standard 6.5kg boxes; excellent fruit tractability system, can trace a fruit from a packed box back to the block where it was grown.

Market: market through the Avonova Group.

Problem areas: salt burn on leave was prominent but not considered a problem; canopy management is a major area of concern, John Leonardi has a canopy management trial site on this farm.

Comments: Sunny[®] is not used on the farm because larger fruit size is not required.



Regrowth of stumped trees



New plantings with good mulching

APPENDIX 3

APPADENE PARK, Manjimup

Manager & owner: Tom & Robyn Winfield, 4th generation on this farm

Address: RMB 320, Seven-day Rd, Manjimup, WA 6258

Tele: 08 9771 2067

Soil: gravel clay to gravel loam, heavier soil, more fertile soil than in the northern avocado producing areas, soil pH=7

Area: 2 farms totalling 88 ha but not all under avocados, also have a few macadamia trees, limes, persimmons, and a few hectares of vegetable crops.

No. avocado trees: 3000

Tree spacing: varies, 8x5m, 7x5m, 10x4m

Tree age: newly planted – 8yr olds

Scion: Hass

Rootstocks: mostly seeding Velvick, a few other unidentified Guatemalan rootstocks, A8, A10, Reed, intends to plant Dusa & Latas for phytophthora control.

Irrigation: 150L/tree/day during peak growth season; schedules irrigation using tensiometers; micro-sprinklers with spray radius about 3m; doesn't pulse irrigate existing irrigation system is not designed for pulse irrigation.

Nutrition: broadcasts all fertilizers, applies fertilizers weekly during spring & summer, follows a fertilizer program as recommended by consultant.

Canopy management: selective limb removal but trees are still young & small; considering mechanical hedging as tree size increases.

Pest & disease control: not a problem, doesn't spray for disease or insects, has occasional garden weevil (*Phlyctinus callosus*) out breaks which feed on the leaves close to soil surface; phytophthora root rot is a problem in some of the lower blocks; ailing trees are injected with phosjet (50% dilution); no preventative spray action it taken against root rot; injects very young ailing trees; verticillium wilt also occasionally occurs but no treatment is applied, the trees either recover or die, no action is taken.

Yields: 14 000 trays per season = 80 tons from 6 ha; = 13.3 tons / ha for young trees (7 yr old).

Packshed: packs through the Avonova group.

Market: market through the Avonova grower group and trades under the name Premium Choice Produce; supplied fruit to Coles in WA & South Aus, also supplied markets in Sydney, Melbourne & Brisbane.

Problem areas: Frost damage appears to be of major concern, last season winter temperatures dropped to -7°C for 12 hrs causing severe stress & tree losses, during summer several days of temperatures over 40°C caused these frost weakened trees to stress further resulting in severe sunburn damage to stems & fruit, affected trees have strange appearance (abnormal growth shape), an automated irrigation system programmed to come on when temperatures drop below 2°C has been installed to combat frost damage.



Frost & heat stressed trees



Frost damaged trees

APPENDIX 4

APPLEWOOD PACKHOUSE, Manjimup

Owner / manager: Vic Grozotis

Packs mainly apples but has recently started packing avocados in the summer months to keep packhouse working 12 months of the year. Packs all fruit on the same line; has ability to wax fruit if necessary; has long wash line with brushes which results in very shiny avocados; no fungicides used on the line (disease pressure is low in this area), has 10 drop points (packing stations); employs 8-10 ladies working the line. The ultimate aim is to create a brand name class called 'Ultra Premium' as well as to retain generic premium grade.

The growers are charged not for tonnes delivered but for cartons packed: costs are \$4.75/ carton (6.5kg) & \$4.70 for bulk packing (10kg); doesn't handle transport to markets at all, that's the growers' responsibility. Avocados get around \$20-\$30 / tray at the markets.

Seconds (2nd grade fruit) are also packed in trays & marketed as A-grade (no one wants a 2nd grade fruit). Grading standards are maintained by the packhouse & growers do not determine grading standards. Very little reject grade fruit is sent to the packhouse. Packout for avocados is about 98%, if packout drops to below 60% the packhouse runs a serious risk of making a financial loss.

Transparency is of prime importance to growers. This is a new packhouse, 2 years old, and is relatively big. They pack 200 000 trays of apples/year. The standard packing rate is 3000 trays in an 8hr working day. The fruit (apples & avocado) are pre-cool before being cold stored. The packhouse has several cold rooms which allows for flexibility.

Vic selects who he packs for, all growers must be ICA & Freshcare accredited. The packhouse will not accept fruit from a grower unless that grower can supply a minimum of 15 bins. It is too labour intensive to keep switching between growers.

Main problem – distance to markets, transport costs \$1.30 – \$1.80 / tray depending on which market the fruit go to.



Pack line



Vick Grozotis

APPENDIX 5

DELROY ORCHARDS, Pemberton

Manager: Rob Dimitrio

Owner: Russel Delroy

Address: P.O. Box 128 Pemberton, WA 6260

Tele: 08 9776 1463

Soil: sandy loam

Area: 80 ha planted to avocado, also has some kiwi fruit & is the biggest tamarillo grower in Australia

No. trees: 45 000

Tree spacing: 3x7m with the intention of forming hedge rows.

Tree age: newly planted to 9yrs old; farms philosophy is that the life span of avocado trees is only 15-18 yrs thereafter the trees should be removed & replaced.

Scion: Hass

Rootstocks: Hass (Hass on Hass) Russel believes Hass is a dwarfing rootstocks, trees are very small but apparently they don't bear until they're 5 yr old, trees grow very slowly in this cooler climate.

Irrigation & nutrition: 35L/hr micro-sprinklers, irrigates only at night for 10hrs (350L/tree/day), wetting area is small (about 50-100cm radius) & wets only the mulch at the base of the tree; applies thick layer of mulch (about 70cm) in long bands at base of trees; mulch consisting of composted Karri bark (sawmill waste); irrigates only in the mulch, no wetting inter-rows, soil in inter-rows is as hard as concrete, root growth in the mulch is very good; fertigates monthly.

Canopy management: mechanical hedges & also removes tops, optimum height of trees is 4m; post-pruning regrowth is very slow in this area due to cool conditions.

Pest & disease control: copper is applied occasionally, very rarely sprays any insecticides, occasionally needs to spray for garden weevils.

Yields: no detail available, next season will apparently be very poor crop.

Harvest method: no cherry pickers used, only use ladders, max tree height 4 m.

Packhouse: pack all their own fruit at Donnybrook. The Donnybrook packhouse is owned & managed by Russel Delroy.

Market: market directly to Woolworths & markets in Melbourne, & South Australia, Russel handles all the marketing.

Problem areas: frost control needs research, lost 40% of crop in 2006 due to frost damage.

Comments: According to Eric Skipworth, Delroy Orchard produce 400 tons of avocado / year. They also control 70% of Australian tamarillo market and have 10 ha of kiwi fruit; Russel looks for gaps in the market & fills them; he is a visionary with very alternative farming methods.



Pile of Karri bark mulch



Young mulched trees

APPENDIX 6

Marron Brooks Partners, Pemberton

Manager: Tom & Faye Backhouse

Owner: Tom & Faye Backhouse & Marron Brooks Partners

Address: P.O. Box 206, Pemberton, WA 6260

Tel: 08 9776 1472

Soil: approx 5 soil types on the farm, red loam to white sand to coffee rock, was originally a sandy swamp with underlying clay layer, soil pH 4.5 – 7.

Area: 35.6 ha, but not all planted to avocados.

No. trees: 2000 but will remove 500 this year .

Tree spacing: older trees 10x10m, younger plantings 5x5m.

Tree age: 21 yrs, 15 yrs & 6 yrs

Scion: Mainly Hass, 40 Reed trees, a few Sharwil & 1 Hazard

Rootstocks: older plantings are on Guatemalan rootstocks, newer plantings are on Reed & a few on Zutano.

Irrigation: 2 x 75L/hr/ micro-sprinkler per tree; irrigate 1-2 hrs / day depending on tensiometer reading (150-300L/tree/day).

Nutrition: fertigate weekly & broadcast fertilizers fortnightly, apply lots of fowl manure

Canopy management: Intend to remove trees as part of canopy managing, planning on removing every 2nd row of trees in older orchards, older orchards have a very dense canopy; have done a little bit of selective limb removal.

Pest & disease control: No insecticide spray needed; there is a severe phytophthora problem in some blocks & trees are injected & spray with phosjet, Armillaria root rot is also a problem, it's a natural fungi which grows in gum tree roots, affects tree crops if planted into virgin forest soil, occurs if all natural wood is not removed from orchard & land left fallow before planting to avocados, causes avocado trees to yellow & die, orange fruiting body visible at tree base; solution: to remove tree & all surrounding soil, replace soil before replanting; fungi is soil born.

Yields: in a good year 30 000 trays are packed from 35 acres, excellent crop last season, in poor year they pack 12 000 trays.

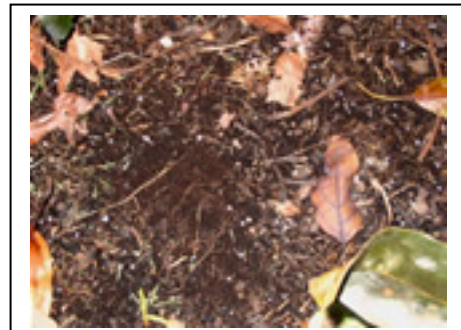
Packhouse: very neat little on farm packing facility, pack in a generic box.

Market: Perth

Comments: Very beautiful, neat farm could probably produce fruit organically with only minor management changes, excellent root mat growth, cannot move the mulch due to the thick root mat. No frost in this area, they are a little higher than other farms. Tom is growing truffles, planted oak trees & inoculated roots with spores, can harvest (if it takes) in 7 yrs.



Very neat, even orchard



Dense root mat under the trees

APPENDIX 7

D & D ROACHE, Pemberton

Manager: Trish & Mark Roache

Owner: Roache family

Tele: 08 9776 1098

Soil: heavier soils than seen previously.

Area: 15ha of avocados, 20ha potatoes & about 50ha cattle.

No. trees: 4000

Tree spacing: 10x4m, 7x8m, 9x5m.

Tree age: 22 yrs, 7 yrs, 6 yrs, 3yrs.

Scion: Hass

Rootstocks: Guatemalan

Irrigation : 95L/hr micro-sprinklers, irrigate 2 hrs/tree/day = 190L/tree/day; uses tensiometers for scheduling.

Nutrition: broadcasts every 3 weeks.

Canopy management: selective limb removal but doesn't cut limbs flush with main stem, leaves reasonably long piece of limb which allows regrowth off severed limb; paints all cut surfaces white, all prunings are mulched; takes 10hrs to prune 80 trees; John Leonardi is doing trials here.

Pest & disease control: none necessary but does spray trees preventatively for phytophthora; has a bit of verticillium wilt in some trees but doesn't apply any corrective measures.

Yields: 33 tons/ha in good year (7 yr old trees).

Harvest method: strip picking, using cherry pickers, harvest December – March.

Packhouse: pack off farm through the Avonova group.

Marketing: done through Avonova; fruit sent to Melbourne, Sydney, South Australia & also direct to Coles.

Problem areas: the Roaches feel that canopy management needs research.

Comments: frost can be severe here & uses over head sprinklers for frost control; never uses any Sunny[®] due to good fruit size.



12 year old Hass trees



Selective limb removal

APPENDIX 8

Bendotti, Pemberton

Manager & Owner: Joe Bendotti

Address: P.O. Box 29 Pemberton, WA 6260

Tele: 08 9776 1010

Soil: Deep Karri loam.

Area: 121.5 ha, 13 ha planted to avocados.

No. trees: 2700

Tree spacing: 5x10m.

Tree age: 6 yrs, 5 yrs, 2 yrs .

Scion: Hass

Rootstocks: Older trees are on seedling Guatemalan rootstock, new plantings are on Reed, Velvick, A8 & A10; Joe's observations: Reed results in very uneven tree heights, Velvick is a vigorous grower but results in very even tree size, A8 & A10 uneven growth.

Irrigation: 2 x 90L/hr micro-sprinklers/tree, irrigates 1.5hrs / day (=270L/day/tree)

Canopy management: will probably use selective limb removal, John Leonardi to advice, orchards are still very young.

Pest & disease control: does spray copper & very occasionally sprays for garden weevil; phytophthora root rot is a problem in this area; root analyses are done in March for phosphernates & if needed phosjet is sprayed every 2 weeks.

Yields: harvested 105 bins (500kg each) from 13 acres = 3.9 tons/acre (5 & 6 year old trees).

Packhouse: packs off farm through Avonova.

Market: marketing is done by Avonova; main markets are Melbourne & Sydney, and direct to Coles.

Problem areas: frost is a major problem in this area.

Comments: Orchard looks excellent, very good tree health but growth is a bit uneven (explained by the various rootstocks).



6 year old Hass trees



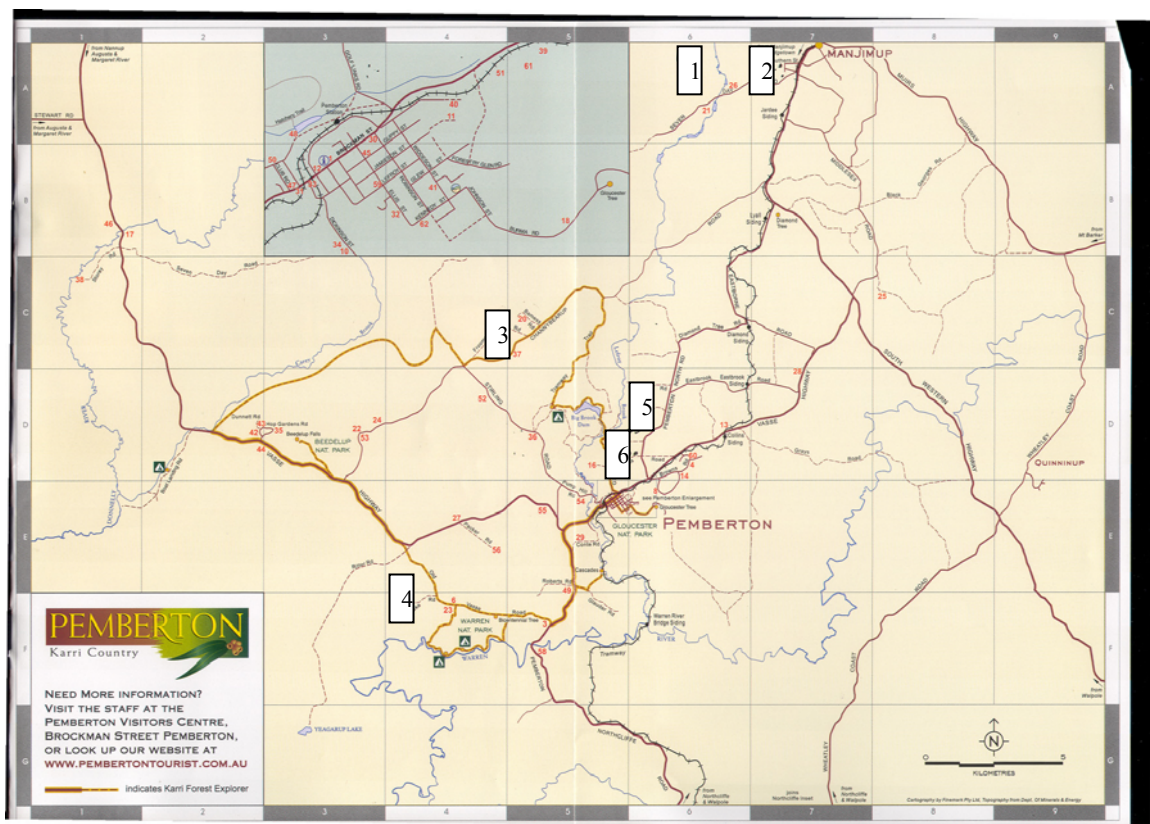
Newly planted Hass trees

APPENDIX 9

MAP OF PEMBERTON DISTRICT

Key:

1. Appadene Park
2. Applewood Packhouse
3. Delroy Orchards
4. Tom Backhouse
5. D & D Roache
6. Joe Bendotti



APPENDIX 10

NSW Avocado Growers to WA 2007



QUALITY ASSURANCE QUESTIONNAIRE

QUADRANT AUSTRALIA STRIVES TO PROVIDE A "WORLD'S BEST SERVICE" TO YOU. TO HELP US MAINTAIN AND IMPROVE OUR SERVICES, WE WOULD APPRECIATED YOU SPENDING A FEW MOMENTS COMPLETING THIS QUESTIONNAIRE.

Rating: 1- Poor 10- Excellent

1. Summary	Rating*
Name (Optional):	
Please tick box if you agree to AgTour using your comments as testimonials <input type="checkbox"/>	
How successful did you find the Tour?	9.4
Highlight/s:	
Area/s you found disappointing:	9.4
How highly would you recommend QUADRANT AUSTRALIA to other interested travellers?	8.8
How effective did you find the find your Tour Manager?	
Comments:	8
How did you find the standard of the Air Travel? (If applicable)	
Comments: _____	
2. Tour Preparation and Planning	
How professional was the QUADRANT AUSTRALIA office in servicing your requirements?	
Comments:	9.3
How relevant was the tour information supplied (eg, tour notes, tour book, verbal information)?	
Comments:	8.7
How did you find the additional individual arrangements that you requested?	
Comments:	9.6
3. Tour Content	
Australian Tour Escort: (Please give a rating and comment)	
_____	9.6
Technical Visits: (Please give a rating and comment)	
_____	8.8

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Accommodation: (Please give a rating and comment)	9.5
Meals: (Please give a rating and comment)	
Coach & Driver: (Please give a rating and comment)	6.4
Sightseeing Visits: (Please give a rating and comment)	9.6
4. General Comments (Including additional individual travel arrangements)	

* Ratings averaged from questionnaires returned by tour participants

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Dpi 60

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