

# Macadamia integrated orchard management case studies 2016



Jeremy Bright and Stephanie Alt

### Acknowledgements

Many thanks to the grower case study participants who opened up their progress, plans and goals for all to see and learn from (listed in geographical order north to south): Scott Alcott & Dave Harris, Peter Reinbott & Clayton Matiazzi, Tim Salmon, Mark & Polly Penfold with Sue and Greg Johnson, John & Emma Brugman, Peter Boyle, David and Ann Anderson, Rick Paine & Bill Johnstone, Bob Maier, Chris Cook.

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### Cover photos

Photos courtesy of NSW Department of Primary Industries, Queensland Department of Agriculture and Fisheries, Stephanie Alt, Peter Boyle, Bill Johnstone, Peter Reinbott.

Main image: A Queensland orchard manages slopes with generous grassed interrows and grassed watercourses. Photo Stephanie Alt.

Inset (L - R): A profiler shapes an interrow drain, photo Peter Reinbott. Compost stockpiled for spreading to tree rows, photo Jeremy Bright.

A healthy orchard floor with living groundcover and mulch supports nut production, photo Stephanie Alt.

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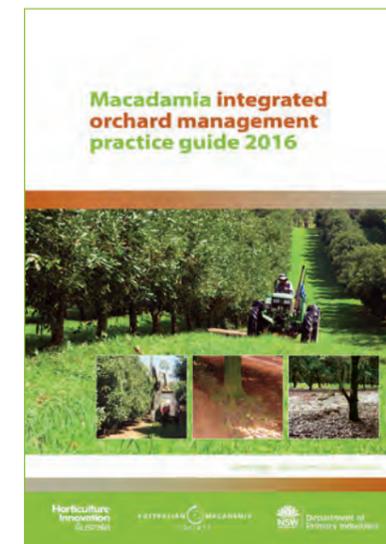
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This booklet is a companion to the **Macadamia integrated orchard management (IOM) practice guide 2016**.

IOM is a framework for maintaining high productivity orchards, and the recovery of orchards in decline. The IOM practice guide describes the ways macadamia growers can manage canopy, orchard floor and drainage. Growers use the IOM framework to assess their orchards, and choose practices appropriate for the orchard's stage of development. We might call that the *theory*.

This booklet is the *practice*. It's about what growers decided was limiting their orchard performance, and what they did about it. Each story tells how growers have used the theory from the IOM practice guide to identify problems on their farms, and take on management changes to sustain or recover their orchard productivity.

# How IOM works

The Macadamia IOM (integrated orchard management) framework encourages growers to assess the stage of development of canopy, orchard floor and drainage within orchard blocks, and notice 'red flags' - visible signs that processes that will undermine orchard productivity are active. The checklists to carry out this assessment are at the back of the IOM practice guide. The assessment helps identify areas of concern and prioritise management changes needed to sustain orchard productivity.

In the IOM framework there are seven management aims that support orchard productivity:

**Canopy (C)**

-  Access for machinery and sprays
-  Light penetration into tree canopies and through to the orchard floor
-  Productive canopy at manageable heights

**Orchard floor (OF)**

-  Protection for soil
-  Favourable conditions for feeder roots
-  Harvestable surface

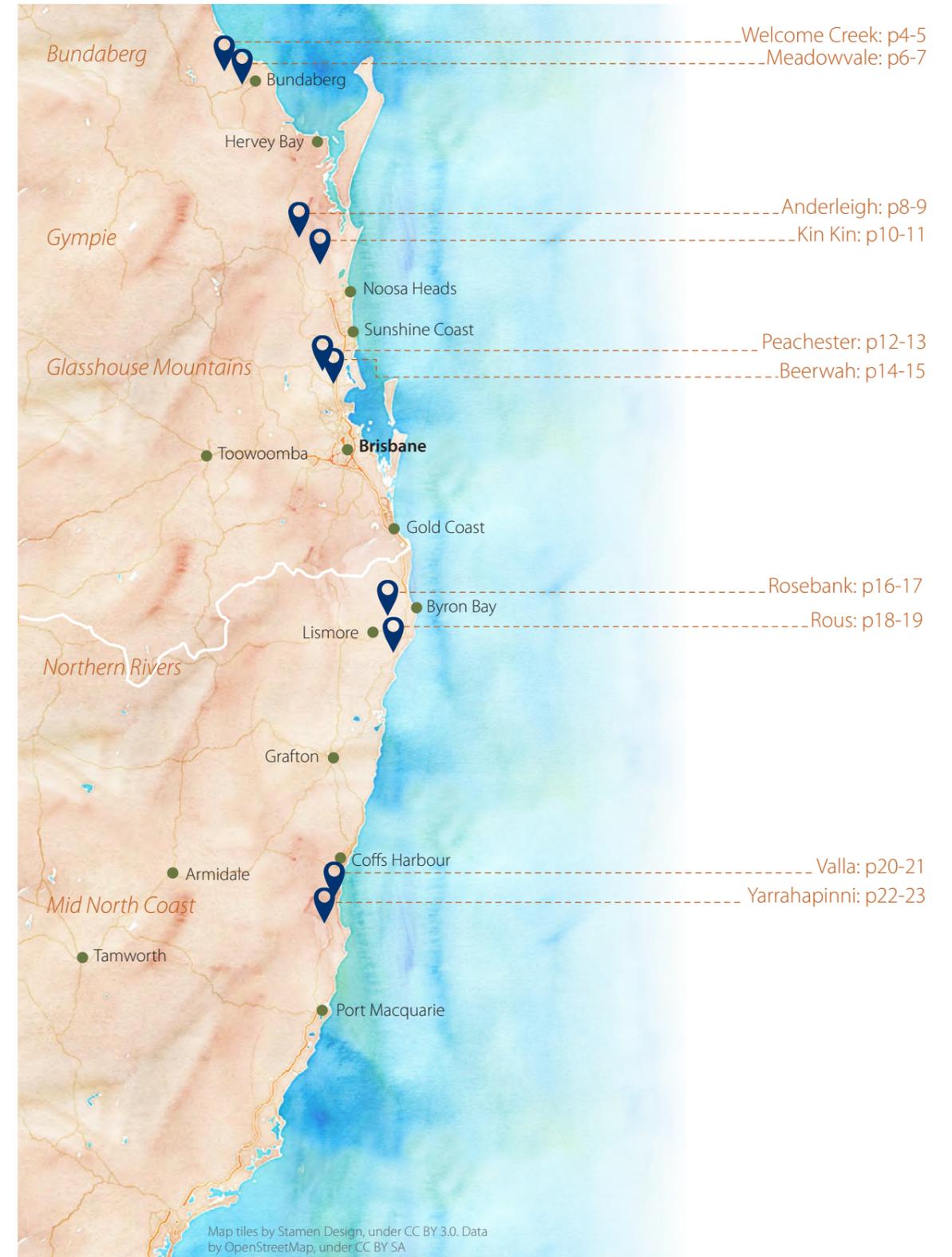
**Drainage (D)**

-  Managing water flows

Each IOM management practice used in macadamias is linked to these management aims. Growers can have confidence that the management practices they select:

- will contribute to maintaining or moving towards a peak performance orchard
- are appropriate for their orchard's stage of development.

# Case study locations



# Welcome Creek, QLD

David Harris, Scott Alcott - Macadamia Farm Management



Scott Alcott and Dave Harris

### The situation

In 2011 production in this block (Kona) was around 2 t/ha. Trees were not healthy. High rates of chemical fertilisers were being applied. The canopy had closed over the interrow, with almost no living ground cover on the orchard floor. A subsurface hardpan was limiting development of tree roots and, despite an almost flat site, erosion channels and exposed roots were present.

The **best** thing by a long shot was the yield increases.

The **hardest** thing was getting acceptance and understanding of what we are trying to achieve, and persuading the larger business organisation to finance the changes.

### Assessment

	IOM Stage	
	Before	Now
Canopy (C)	3 to 4	2 to 3
Orchard floor (OF)	4	2
Drainage (D)	3 to 4	1 to 2
Red flags	5 of 8	0 of 8



Fine root hairs proliferate in rich organic topsoil.



Thinking big - stockpiles of mulch ready to spread after harvest.



Growth and production now from the skirt to the manageable height of the tree.

### IOM practices

Pillar	Practice	Purpose	How it was done
C	Heavy hedging		Initial heavy hedging got rid of dead wood.
C	Limb removal		Selective limb removal followed to reduce tree height and allow light through to the orchard floor. The pruning has also reduced stemflow, reducing erosion.
C	Alternate side hedging		The hedging cut is very light, to maintain shape and interrow opening.
OF*	Mulching		Substantial amounts of compost, mulch and mill mud have been applied to tree rows, with the addition of Zeolite to boost Cation Exchange Capacity.
OF*	Biostimulants		While continuing to use conventional fertilizers there is a big effort to stimulate soil biology. Inputs include seaweed extract, fish hydrolysate and molasses, applied via irrigation. Irrigation frequency ensures the soil does not dry out. The subsurface hard pan gave way to earthworms within 6 weeks
OF	Road broom		After harvest loose material from the interrow is swept back into the tree row.

\* Including biostimulants, mulches and conventional fertilisers OF input costs have doubled from \$1000 to \$2000 per hectare.

### Yields

2008: 3 t/ha	2014: 3 t/ha
2012: 2 t/ha	2015: 4.6 t/ha
2013: 3 t/ha	2016: Tracking towards 5.5-6 t/ha at time of interview.

### Next for this grower

Keep progressing along the same path while striving to improve.

### Contact this grower

riverset1@bigpond.com

# Meadowvale, QLD

Peter Reinbott, Clayton Matiazzi - Hinkler Park

## The situation

The farm was planted in 1992, yield issues began in 2010. Bare earth was the norm and almost all the red flags were present. Three consecutive years of 1.9 t/ha yields were the trigger for starting the IOM works, focusing on improving soil health.

The *best* thing is that limb removal and profiling showed good results. Now we are achieving good nutset throughout the whole tree volume and not just up the top of the tree.

The *hardest* thing is getting water to go where we want it to go.



Peter (PJ) Reinbott



Organic material is built up in the tree line. The grassed interrow accommodates runoff.

## Assessment

	IOM Stage	
	Before	Now
Canopy (C)	3 to 4	2
Orchard floor (OF)	4	3
Drainage (D)	3	1
Red flags	7 of 8	0 of 8



Before: scouring on the drip line and exposed roots.

## IOM practices

Pillar	Practice	Purpose	How it was done
C	Tree removal		Every second tree from every row was removed to go from a 4 x 8 to 8 x 8 spacing. All AVG variety trees were removed.
C	Limb removal		Pruners receive specific training to make sure limb removal is done as intended. Two or three cuts are the maximum per tree. Prunings are chipped in the row. There are five people in the pruning team, 2 on chainsaws cutting, 3 laying out the branches feeding into the chipper.
OF	Mulching		Woodchip from prunings, husk from Infield dehuskers and grass clippings accumulate in the interrows. Each year about 40% of the orchard gets manures and mill mud spread on top, with gypsum spread over this. A profiler is used to throw all this into the tree row.
OF	Profiling		Once the interrow shape is formed very little soil is moved - the profiler is used to mix and throw the mulches that accumulate in the interrow into the tree rows.
OF	Biostimulants		Mulches are watered immediately after being placed into the tree rows.
D	Grassed watercourses		Blocks are broken up by purpose built grassed watercourses that shift concentrated water flow past the blocks.
D	Graded banks		Banks are built at strategic intervals to break up long slopes and direct water flow to designated grassed watercourses.
D	Interrow drains		Scoured channels were filled in. The continuing build up of organic material in tree rows is held in place by feeder roots.



This profiler formed the interrows and now mixes and places mulches into the tree rows.

## Yields

- 2012: 1.9 t/ha work started
- 2013: 2.5 t/ha
- 2014: 3.2 t/ha
- 2015: 3.4 t/ha
- 2016: Tracking >4 t/ha at time of interview

## Next for this grower

- Aim to maintain with no yield decline.
- Ongoing limb removal pruning
- Moving away from hedging
- Continue applications of mill mud and manure.

## Contact this grower

PeterR@hinklerpark.com.au

# Anderleigh, QLD

**Tim Salmon**

## The situation

The orchard was planted around 1983, and production had peaked at 20–25 years. By around 2005 yields were low. A lot of soil erosion was happening. The place looked terrible and wasn't very profitable.

We'd been trying to save money focusing on cost per hectare. The nut price crash around 2008 was a trigger for change.

The *best* thing was once we stopped using herbicide and started mowing we could sense the soil was starting to rebuild.

The *hardest* thing was that at the beginning we really didn't know what we were doing that was so badly wrong.



Tim Salmon and Joe



Friable soil in the tree rows is full of feeder roots.

## Assessment

	IOM Stage	
	Before	Now
Canopy (C)	3	2
Orchard floor (OF)	4	2 to 3
Drainage (D)	4	2 to 3
Red flags	7 of 8	1 of 8



Dark areas like this are candidates for limb removal.



This track between blocks used to be an erosion hot spot. Changing orchard traffic patterns has allowed it to grass over.



A mosaic of grass and mulches. Removing pairs of trees across this block has created a grass buffer strip that slows water and reduces erosion downslope.

## IOM practices

Pillar	Practice	Purpose	How it was done
C	Tree removal		Strategically located pairs of trees were removed, creating a mosaic of living groundcover with blocks. In some locations the living groundcover acts similarly to a formed cross bank to break water velocity down longer slopes. The living groundcovers slow runoff and trap nutrients and soil. Aiming for a mosaic of living groundcover and mulches rather than no bare soil.
OF	Living groundcover		Herbicide use ceased. Grass cover was established with seed and natural recruitment. The orchard is mown with two smallish zero-turn mowers. Changing traffic patterns within the orchard allowed badly eroded tracks to stabilise.
OF	Mulching		Mowing throws towards the tree row outside the harvest times, concentrating residues in the tree row. Mulches of woodchip, nut husk, bagasse and paper are spread at 20L/m of tree row each year.
OF	Biostimulants		Irrigation is applied with sprinklers to support microbes in the surface soil as well as the trees themselves. Fertigation cycles include fish hydrolysate, kelp extract and molasses.

## Yields

2010: 2.0 t/ha

2015: 4.0 t/ha

Costs per hectare have gone up but the increased yield means our cost of production per kg is reduced.

## Next for this grower

- Limb removal with a cherry picker platform to allow more light to the orchard floor for more living groundcover.
- Three drainage lines to open up for grassed watercourses.

## Contact this grower

tsalmon@spiderweb.com.au

# Kin Kin, QLD

**Mark and Polly Penfold, Greg and Sue Johnson**

### The situation

A change of ownership for a 27,000 tree orchard prompted a recovery plan. Three years ago looking over the orchard dead tops were like a 'sea of silver'. Working with consultant Alan Coates, the growers have been working to recover tree health and yields. Initial yield mapping and tree health matched soil pH across the farm. The starting point was pH correction, and systematic efforts to improve soil conditions.

The **best** thing we did was stopping herbicide strips and starting to apply compost

The **hardest** thing is that there is so much orchard to get around.



Greg Johnson



Some dead branches are still visible.

### Assessment

	IOM Stage	
	Before	Now
Canopy (C)	2 to 4 varies by block	2 to 3
Orchard floor (OF)	4	2 to 3
Drainage (D)	4	2 to 3
Red flags	7 of 8	1 of 8



Mulches are stockpiled and turned on site before spreading.



Thick mulch cover around tree trunks.

### IOM practices

Pillar	Practice	Purpose	How it was done
C	Phasing out		In blocks where tree height is well over row width every second row is being hedged, for later row removal.
OF	Profiling		Three passes in each direction (6 total) for each interrow. To cover exposed roots and create more mounded tree rows.
OF	Aeration		A 3m wide spike aerator is used in the interrow. To begin with the spike wheels were used on an angle to get a cultivation effect.
OF	Mulching		Organic material is applied to tree rows using a custom 22m <sup>3</sup> spreader, converted from a forage cart. Hundreds of loads have gone out - compost, chicken manure, paper and ash. Mulches are brought on site in bulk and turned several times before spreading. Fine mulches are preferred as these don't get in the way at harvest.

### Yields

2013: 1.1 t/ha

2015: 3.2 t/ha

### Next for this grower

- Keep on applying lots of organic material to tree rows.
- Soil and leaf tests will be done block by block to help refine how each is treated.
- Row removal in some blocks.

### Contact this grower

[pollypenfold@gmail.com](mailto:pollypenfold@gmail.com)



Much more grass in the interrow now.

# Peachester, QLD

## John and Emma Brugman

### The situation

Twelve years ago the farm was in a run down condition. New owners Emma and John needed more revenue, and saw poor tree health was holding back production. They wanted to see a renewal of fertility in the orchard and understood tree health was related to soil conditions.

The *best* thing was seeing things come to life using biological approaches for tree health.

The *hardest* thing is the workload and finding time for pruning. We've not been happy with contract pruners, they were too heavy handed.



Emma and John Brugman

### Assessment

	IOM Stage	
	Before	Now
Canopy (C)	2	3*
Orchard floor (OF)	4	3
Drainage (D)	4	4
Red flags	6 of 8	2 of 8

\*This 'project' has run over 15 years. Trees stunted by poor soil conditions have responded to better management. An emerging need for canopy management is a good sign in this case!



The oldest trees are 45 years old.



Friable and full of life – soil in the tree row.

### IOM practices

Pillar	Practice	Purpose	How it was done
C	Limb removal	 	Chainsaw pruning to improve canopy form.
C	Manual skirting	 	Chainsaw pruning.
OF	Soil spreading	 	3,000m <sup>3</sup> of soil recovered from dam spread under trees to cover exposed roots, 10-15cm depth of soil around trunks in some places.
OF	Mulching		A blend of cow and chicken manure is spread every 2 years. Macadamia husk and chippings from pruning are spread as produced. Crushed minerals are also applied.
OF	Biostimulants		A blend of mineral dust prilled with a catalyst is applied to tree rows. An organic liquid fertiliser blend including seaweed and humic acid is watered onto tree rows three times a year (32,000L).

### Yields

15 years ago: <2 t/ha  
Now: >4 t/ha

### Next for this grower

- More selective limb removal pruning and chipping.
- Purchasing a spreader to keep up mulching.
- Profiling and soil spreading where water is running down tree rows.
- Drainage work to break up long runs of slope.

### Contact this grower

johnandemma7@bigpond.com



Younger trees are off to a good start.

# Beerwah, QLD

**Peter Boyle**

## The situation

In the early 2000s high intensity rain events caused scouring out of the centre of interrows. The orchard floor has needed repeated stabilisation works. Concentrated runoff from a neighbouring suburban area increases erosion within the orchard. Despite past work recent storms have created more damage.

The **best** thing we did was establish smothergrass in the orchard, and develop a stabilisation strategy for after profiling.

The **hardest** thing is the logistics of limb removal pruning.



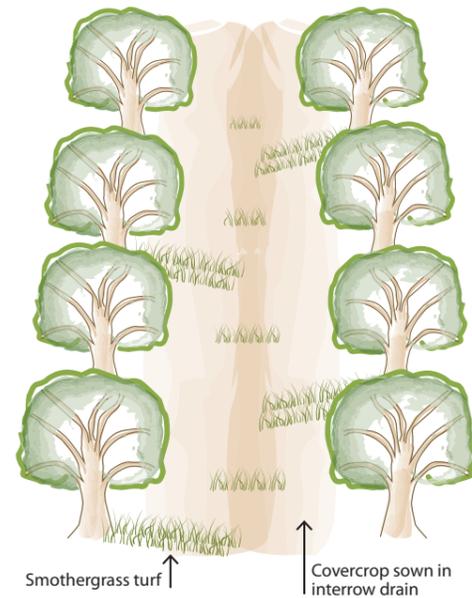
Peter Boyle



This is what we're happy with.

## Assessment

	IOM Stage	
	Before	Now
Canopy (C)	2	2
Orchard floor (OF)	3	3
Drainage (D)	2	3
Red flags	6 of 8	3 of 8



The soil stabilisation strategy – all disturbed soil is sown with covercrop seed, smothergrass turf is placed in a herringbone pattern to slow and direct water to the interrow drain.



This is what we want to fix.



Poultry manure is placed in the tree rows.

## IOM practices

Pillar	Practice	Purpose	How it was done
C	Limb removal	 	Main objective was to increase light to orchard floor. Adequate living groundcover is the indicator of success. Needs repeating after 3 years.
OF	Profiling	  	An extended cutting blade (900mm wide) fitted to a rotary digger enabled a shallower shape to interrow drains. Sediment recovered from dams has also been spread to cover exposed roots.
OF	Living groundcover	 	Smothergrass turf was planted in a pattern to reduce erosion damage during establishment. Oats and sorghum were broadcast for temporary groundcover during establishment of the smothergrass.
OF	Mulching	 	Poultry manure is spread in bands along tree rows.
OF	Mowing	 	A toolbar with offset mounting points for the slasher allows mowing closer to the trees. A roller trailing the rear discharge presses clippings into grass, increasing contact with soil to promote decomposition and nutrient cycling.

## Next for this grower

- Row removal in a block with taller A4 trees and more trouble with drainage and soil erosion - to get sufficient light to orchard floor for stable groundcover in the interrow.
- Tree removal to reshape and grass a water flow line that scoured out last summer.
- More limb removal pruning.

## Contact this grower

peter.karyn1@bigpond.com

# Rosebank, NSW

David and Ann Anderson



David and Ann Anderson in their orchard.

### The situation

Growers were concerned production had plateaued and might have started to decline, although yields were above industry average at 4.5t/ha. Tree heights were greater than row width at around 14–18m high in a row spacing of 7m. Soil and nuts were being lost from a bare orchard floor with every rain event.

The **best** thing about what we did is the orchard now looks fantastic.

The **hardest** thing was deciding to do it.



Before row removal, the block pictured on page 17 would have looked much like this one.

### Assessment

	IOM Stage	
	Before	Now
Canopy (C)	4	2
Orchard floor (OF)	3	2
Drainage (D)	4	2
Red flags	8 of 8	2 of 8



Compost spread in tree rows.



What remains of a removed tree in the grassed interrow.



A grassed watercourse has replaced an eroding gully.

### IOM practices

Pillar	Practice	Purpose	How it was done
C	Tree removal		Every second tree row was removed. Trees were felled and mulched using a forestry grinder. Stumps were trimmed flat at ground level.
OF	Mulching		Chip from removed trees mulched the remaining tree rows. Ongoing annual application of banded compost.
OF	Living groundcover		Smothergrass pots planted by hand in the reshaped interrows, 6–7 across the row, 3 m apart down the row.
D	Interrow drains		Soil between the remaining tree rows was reshaped with an excavator to form interrow drains where the removed rows had been.
D	Diversion bank		An access road was built up diverting runoff from an upslope block to a grassed watercourse via a culvert.
D	Grassed watercourse		Trees were removed from an eroding gully at the lower end of a block. The profile was reshaped to a wide shallow spoon shape and grass cover established.

### Yields

- Production before works: 5.48 t/ha
- Year of works (2013): 2.87 t/ha
- 1 year later (2014): 3.74 t/ha
- 2 years later (2015) 4.9 t/ha

### Next for this grower

Continue with tree and row removal in more blocks when nut price drops off.

### Contact this grower

gwerna@bigpond.com



Three years on from removing rows

# Rous, NSW

**Rick Paine and Bill Johnstone**

## The situation

In 2009 the orchard yielded 6.3 t/ha. Trees were 20 years old. Instigating strategic IOM in 2010 was not about a decline in production. It was about getting back groundcover, retaining soil and compost and directing water into established drainage lines to the bottom end of the rows. Mounded tree rows were 500m long and concentrated runoff was a problem in the lower areas.

The *best* thing about what we did is total control of where the water flows: *"...even 400mm of rain in 12 hours goes exactly where we want it to go."*

The *hardest* thing was timing the works. Using ethrel in July gave the opportunity to implement all of the canopy and earth works early enough to not interfere with the following year's crop.



Grower, Rick Paine and consultant, Bill Johnstone.



Tree height reduced by limb removal in pairs of trees.

## Assessment

	IOM Stage	
	Before	Now
Canopy (C)	4	2
Orchard floor (OF)	3	2
Drainage (D)	3	1
Red flags	8 of 8	0 of 8



Tall trees had unproductive centres.



Spreading good quality compost to tree rows.



A cross drain (graded bank in IOM) to left delivers water to the farm's main drain in rain events.

## IOM practices

Pillar	Practice	Purpose	How it was done
C	Tree removal		Trees removed in pairs, first to create cross banks, and then strategically to allow more light into the orchard floor. Trees were felled and towed to a tub grinder / chipper, the wood chip stockpiled for composting.
C	Limb removal		Pruning reduced tree height from >12 m to 4 m on alternate pairs of trees. Trees were allowed to grow back to 6 m high.
OF	Mulching		40 t/ha of good quality compost is applied to one third of the orchard each year, each tree getting compost every three years.
OF	Living groundcover		Smothergrass was reintroduced to newly formed drainage channels and interrows, as well as sowing a self regenerating pasture mix.
D	Interrow drains		An excavator formed new, well defined interrow drains.
D	Graded bank		Paired trees were removed in lines at 45° to tree rows for grassed drains, 60 m apart down the slopes. These were put in 120 m apart in the first year, the remainder a year later. These collect and divert run off to the farm's main drain (a grassed watercourse).
D	Grassed watercourse		A main drainage line was formed to accept flows. Canopy management ensures living groundcover is sustained.

## Yields (at 33% SKR @10% MC)

- 2010: 5.43 t/ha (4,650 trees)
- 2011: 4.56 t/ha (4,550 trees)
- 2012: 5.58 t/ha (4,300 trees)
- 2013: 5.46 t/ha (4,300 trees)
- 2014: 5.78 t/ha (3,940 trees)
- 2015: 6.47 t/ha (3,750 trees)
- 2016: 5.40 t/ha at time of interview (3,750 trees)

## Next for this grower

- Continue to maintain tree height of the pruned trees at 6 m through strategic limb removal and hedging. Eventually all trees will be reduced to this height.
- Get total ground cover back for the orchard floor.
- Maintain drainage to keep control of water flows.

## Contact this grower

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# Valla, NSW

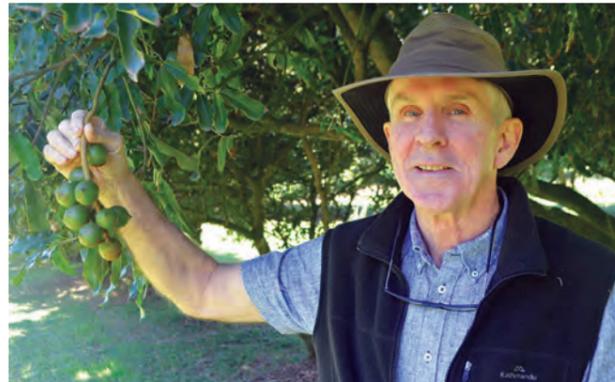
**Bob Maier**

## The situation

The orchard's production peaked at 4.5 t/ha. Tree height was greater than 80% row width, trees had unproductive centres, the orchard was getting darker, smother grass becoming sparse and soil erosion obvious. Each big rain event exposed more roots. Good spray coverage was becoming more difficult.

The *best* thing we did was increasing light levels through the canopy and re-establishing smothergrass in the orchard.

The *hardest* thing was taking trees out. Four months after the removal cyclonic wind following heavy rainfall blew over several 30 year old trees and significantly damaged limbs in the 'diamond pattern' removal area. There was less damage where every 2nd row was removed.



Bob Maier

## Assessment

	IOM Stage	
	Before	Now
Canopy (C)	4	2
Orchard floor (OF)	3 to 4	2
Drainage (D)	4	2
Red flags	6 of 8	2 of 8



Before tree removal the orchard floor was bare with some scoured channels.



Compost ready to spread after harvest is complete.

## IOM practices

Pillar	Practice	Purpose	How it was done
C	Tree removal/ row removal		Half the block was every second tree in every row removed in a diamond pattern. The other half of the block every second row was removed. Trees in a natural water flow line were removed.
OF	Mulching		All material from removed trees was chipped in situ and placed under remaining trees. Compost is applied in a band to tree rows after harvest.
OF	Living groundcover		Sprigs harvested from elsewhere on the farm were planted in inter row (during wet times) 10 m apart within row.
OF	Mowing		Groundcover is left to grow longer in strategic areas to support beneficial insects and slow water flows.



Trees were removed from this drainage line. Swathes of groundcover are left unmown to offer habitat and food resources for beneficial insects.



Trees removed in a diamond pattern. Grass is suppressed under trees with mulch, and left long in the interrow to slow runoff.

## Contact this grower

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## Yields

- Pre-tree removal peak: 4.5 t/ha
- 2012: 1.9 t/ha, then trees removed
- 2013: 3.2 t/ha
- 2014: 3.6 t/ha
- 2015: 4.0 t/ha
- 2016 tracking: >4.0 t/ha

## Next for this grower

- Profiling to implement a drainage plan based on LIDAR mapping.
- Limb removal to reduce tree height over time.
- More mulching, making use of prunings and continuing compost applications.

# Yarrahapinni, NSW

**Chris Cook - Dymocks**

## The situation

Production had dropped off in this 42 ha block. Tree health was an issue with what appeared to be phytophthora throughout most of the block. Root exposure and soil erosion were increasing.

The *best* thing we did was profiling to cover the exposed roots. Tree health appeared to pick up shortly after.

The *hardest* thing was picking the right time to do the earth works. In some cases there was 20 hectares of exposed soil that, if it rained, would have washed away.



Chris Cook



Before work, water was running down the tree rows exposing roots.

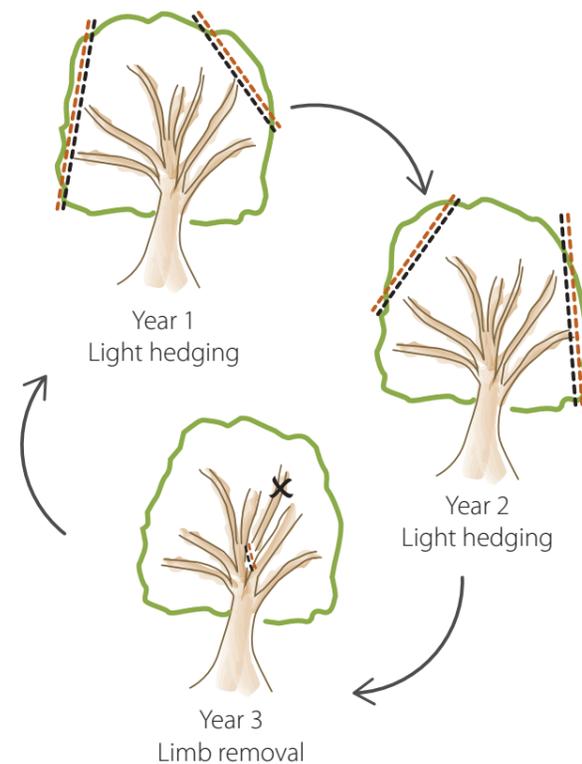
Diagram to right: A three year pruning cycle aims to maintain nut production throughout an accessible canopy and light to the orchard floor.

## Assessment

	IOM Stage	
	Before	Now
Canopy (C)	3 to 4	2 to 3
Orchard floor (OF)	3 to 4	2 to 3
Drainage (D)	2 to 3	2
Red flags	5 of 8	2 of 8



Feeder roots near the tree trunks.



After work, mounded tree rows and water runs in the interrows.

## IOM practices

Pillar	Practice	Purpose	How it was done
C	Light hedging and limb removal		Cutting top and bottom of canopy on opposite sides each year. Plan to repeat this in future years, with limb removal in the third year.
OF	Profiling		Before profiling poultry manure is spread 20 to 30 L/tree, then profiling covers the manure and redefines interrow drains. Plan to repeat in seven years, or sooner if required.
OF	Mulching		0.5m <sup>3</sup> of compost per tree plus wood chip on top, repeated every 7 years, or sooner if required.
OF	Biostimulants		Dilute molasses is applied to disturbed soil after earthworks and to newly applied mulches.
OF	Living groundcover		Grass seed sown to disturbed soil after profiling.
D	Check structures		Hessian bags filled with husk and grass seed were placed across the slope in steep areas. Bags were pinned down with biodegradable pins and mowed over when grassed up.
D	Interrow drains		Built up soil in tree line allows run-off from trunk to drain into grassed interrows.

## Yields

- 2011: 5.09 t/ha
- 2012: 2.54 t/ha
- 2013: 2.97 t/ha
- 2014: 2.85 t/ha
- 2015: 2.0 t/ha
- 2016: 4.3 t/ha

## Next for this grower

- Modifying a road broom to a wider broom in a V-shape that can sweep up loose soil onto tree line, in harvest time can reverse and windrow nuts.
- Tightening up the harvest period by developing a nut knocking machine. With ethrel treatment we're trying to finish harvest by July. Early finish allows time to prune and for trees to recover for September flowering.
- Would like irrigation, especially for nut set to nut development.

## Contact this grower

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## Growers say...

*“If you don't expect a great result you won't get one.”*

*“Stopping what you know isn't helping can be harder than doing something new.”*

### ... about canopy

*“Pruning is a necessary evil.”*

*“Groundcover tells you if you have the canopy right.”*

*“If 10% is an acceptable yield loss from hedging then removing less than 10% of trees from a block might be ok instead.”*

*“With row removal you need to plan your cashflow, and do it when nut prices are low.”*

### ... about orchard floor

*“A mosaic of grass and bare soil is a big improvement on all bare soil.”*

*“Mow the orchard floor after each harvest.”*

*“Fine mulches are the key - anything too big is just a pain when you harvest.”*

*“Macadamia chip is the best mulch you can get hands down.”*

### ... about drainage

*“Soil's a bloody lot more expensive to replace than a few nuts.”*

