

# AUSTRALIAN NUFFIELD FARMING SCHOLARSHIP



## 2001 SCHOLARSHIP

REPORT COMPLETED FEBRUARY 2004

Dennis Moon

2001 Nuffield Scholar

RMB 1210 Kyabram Rd  
Rochester Vic 3561

Email: [djm1@iinet.net.au](mailto:djm1@iinet.net.au)

Ph: 03 5484 2576

Mobile: 0417 102 711

**Topic:** Alternative Rotational Crops & New Crop Options for  
Australian Tomato Growers  
Precision Agriculture and its Applications in the Tomato Industry

**Sponsored by:** Australian Processing Tomato Industry  
&  
Horticulture Australia Limited



Horticulture Australia

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## Introduction

I am Dennis Moon, a mixed irrigation farmer from Rochester in Northern Victoria. My agricultural business is a partnership that was originally set up to achieve economies of scale by sharing land, plant and equipment between 2 neighbouring family farms.

The business called North Central Produce grew from there and now runs as its own entity, owning both land and equipment and other businesses.

N.C.P's main business is processing tomatoes, which we annually produce up to 20,000 tonnes for local processors for canning, dice, whole peel and aseptic tomato paste. We are in a major dairying area and grow fodder crops for dairy production such as maize for grain and silage, Lucerne hay and about 1000ha cereal crops for hay and grain. We planted an 80ha vineyard in 1997 growing premium quality Shiraz and Cabernet Sauvignon grapes for wine production. We are also currently establishing a retail irrigation business, knowing irrigation in Australia is about to change forever as a result of the recent severe drought.

I applied for a Nuffield Scholarship in 2001 after seeing grower numbers in the processing tomato industry fall from the hundreds to only 30 in the last 20 years. Finding profitable rotational crops or crops as an alternative to tomatoes is more important now than ever. I hope to be growing tomatoes for many more years but realise if this turns out not to be the case, growers will need an option.

I am committed to exploring new options for our business and our industry alike, whether it be trying new crops, adopting new technologies or exploring new markets for our existing crops. I am the first to admit that things we have tried in the past may not have worked, but I see this step towards finding a crop that does work is positive, rather than it being a failure.

Being awarded a Nuffield Scholarship has had a major influence on the direction we taking with our agricultural business. The broad range of businesses I have been fortunate enough to visit with the aid of Nuffield has not only helped me identify the strengths with in our own industry but more importantly identify our weaknesses.

I look forward to sharing any information and ideas I have gained with other tomato growers and farmers in general if they have an interest in anything I have done.

## Executive Summary

Deregulation of Australia's Processing tomato industry along with Globalisation and the phase out of import tariffs has no doubt driven increases in production and scale of the Australian tomato industry beyond what we ever could have imagined even 10 years ago. Unfortunately it has also left growers and processors alike, in a very precarious position.

Rationalisation of any agricultural sector sadly has its casualties with smaller or less efficient producers and processors exiting the particular industry. In the Australian Processing tomato industry we are now seeing producers leave the industry that are very good farmers and probably would be in the top 25 percent of tomato growers in any other country in the world. We are currently losing 10 percent of our grower base annually and at this rate we are fast reaching critical mass and before long, possibly not have an industry.

Growers answered the challenge when the industry was threatened with cheap tomato paste imports from California in the early 90s by almost doubling yields and increasing efficiencies to set world's best practice. Our threat today comes from developing nations where they can produce tomato products with cheap fuel and fertiliser, cheap labour, no environmental constraints and quite often are government sponsored. Raising efficiencies to compete with this can only go so far and we could efficiently put our selves out of business if we are not careful.

There is a number of ways we can address this disturbing trend; firstly we could sit around and wait for the federal government to realise their level playing field policy is seriously flawed, and that is not going to happen or we could find alternative crops to plant. This would protect us from being in a position of having to plant tomatoes if we were offered a below break even price.

Growers have tried various crops as an alternative to processing tomatoes in the past with varying degrees of success. Rotational crops for processing tomatoes have always been seen as a secondary crop to the main business and are usually planted to improve soil condition or make preparation for tomatoes easier, rather than their profitability.

After completing my Nuffield Scholarship I am sure most Australian tomato growers given the skills they have could turn their hands to a wide selection of other crops as an alternative or as a rotational crop with a high degree of success provided a few basic principles are adhered to.

## Nuffield Scholarship Report

The most successful Tomato growers and other farmers that I visited during my studies all had a number of things in common:

- They are farming their land and utilising their machinery, assets and labour base as close as possible to maximum efficiency
- They are very diverse in their farming activities giving themselves insulation in the event of a particular crop failure or poor commodity price.
- Are not price takers. Their array of crops allows them to drop a crop if prices are unacceptable and still be able to return to that crop when market conditions improve.
- Have a good understanding of their own industry as well as global agriculture and can read the markets, enhancing their decisions on what crops to grow and when and where to market them.
- Were quite often small family farms and not always corporate giants. Size isn't always important with some smaller producers running some of the best operations I visited.
- Are willing to take a calculated risk on trying new crops.
- Work well together with other farmers, sharing information and ideas and generally have the best interests of the industry at heart.

As part of this report I have listed a number of crops that could be considered by processing tomato growers as a rotation with their existing crops or as an alternative. Not everything I have listed would be suitable for various reasons, however I would be comfortable trying a few of these.

I have also identified and listed any new row crop technologies and trends in the production systems of processing tomatoes I saw during my travels. Although there is huge room for improvement when it comes to maximising sustainable returns from our total assets, I believe that Australian farmers are generally at the forefront of developing methods and technologies so if any one overseas has a new method or technology that could give them an advantage over us we need to know about it.

## **Aims\Objectives\Study Goals**

- Rotational Crops to work with processing tomatoes.
- Alternative crops to processing tomatoes.
- New technologies and precision farming applications in tomatoes.
- New opportunities for processing tomato growers.

The Australian Processing Tomato Industry has found its self in a position both through deregulation and globalisation that while we are generally suppling to a domestic market we have to compete for that domestic market with our international competitors. Australian tomato growers have changed their growing practices markedly over the last five years to increase efficiencies and remain viable including preparing ground 12 months in advance, investing in expensive drip irrigation systems with a view to obtaining a return over a long period and investing in larger more specialised machinery specifically for growing processing tomatoes.

This has achieved two things. We have become very efficient by world standards and are not only able to compete with our main international competitor in California but also managing to hold our own against the threat of cheap low quality imports from developing nations. The downside to this is we have put ourselves in a very poor bargaining position with our customers. The rules of supply and demand dictating price don't apply when you are in a position of "having "to plant a crop regardless of the price offered because you have already invested a significant amount in to it.

The down side of this for processors is that despite the efficiencies the growers have gained over the last 10 years which has kept their purchase price of raw materials down, investment and the uptake of new technologies is now stalling and will continue to do so until confidence returns. Declining grower numbers and increasing debt loads of remaining growers will have a serious impact on the viability of the industry if this trend is not reversed.

The diversification of Australian tomato growers in respect to their array of irrigated summer crops and their options available is quite low by world standards. Common explanations for this on enquiry are "There are no markets" "what do you grow" "Jim down the road tried that

and nearly went broke”. Maybe this is true but for our industry to go ahead and prosper we need to find an option.

The primary farming system for processing tomatoes incorporating raised beds with sub surface drip irrigation has been well developed and should be suitable for a wide variety of other crops that could give growers a viable rotational crop and also an option in years of low tomato prices.

Many tomato growers are enjoying success with other irrigated crops such as wine grapes irrigated Lucerne and fruit trees and whilst this is good it doesn't utilise the tomato equipment or make use of the drip irrigation either as a rotational crop or an alternative.

My studies have hopefully identified possible options for both alternatives to tomatoes and suitable rotational crops that can provide economic benefit to growers in their own rite.

Tomato growers in Australia are generally very receptive of new ideas and technologies and are prepared to try anything if they can see a future in it whether it is a new crop or a new farming method that can be applied to an existing crop.

## Choosing Alternate Crops

Tomato growers in the U.S.A, Canada, New Zealand, Israel and parts of Asia seem to have the luxury of planting different crops at will with changing market conditions. In Australia we seem to feel isolated and think that unless our produce can be marketed and consumed domestically there is no market for it. A few points to keep in mind are firstly the U.S.A produces around 25% of the world's food but makes up only 5% of the population so they are export dependent but are no longer low cost producers. The U.S successfully exports produce in to markets such as Singapore on quality not price. Canada has only 30 million people and although it consumes the bulk of its processed tomato products domestically, the rotational and alternative crops commonly grown by Canadian tomato growers are usually exported and quite often in to the US market. New Zealand with its small population exports the bulk of its agricultural produce.

### *What Crops can I grow?*

Commonly grown crops as an alternative to or in conjunction with processing tomatoes with similar agronomic practices, i.e. 5ft raised beds, transplanted with sub surface drip irrigation, may include the following.

- Chilly peppers for fresh and processing (jalapeños ect)
- Capsicums, Bell peppers for fresh and processing.
- Rock melons (cantaloupes)
- Eatable beans for export
- Soya Beans
- Potatoes for fresh and processing
- Cotton in warmer areas
- Sweet Corn for fresh, export and processing
- Maize and Corn for grain, silage corn chips, pop corn, starch and corn flakes
- Onions and spring onions
- Sweet Potato
- Carrots
- Broccoli
- Strawberries
- Pumpkins and Squash for fresh and processing
- Kabocha (Japanese pumpkin) for export





*Carrots / Ontario Canada*

*Processing Chilli / Ontario Canada*

All the above crops either are or have been grown by a processing tomato grower in Canada or the USA and could be grown here with our existing farming systems with minimal modifications to machinery and bed layout other than harvesting and planting. A number of these crops I saw were grown with surface drip irrigation but I don't expect it would be a problem with our sub surface systems.

In choosing an alternate crop several factors must be considered

- What do I grow?
- Where is my market?
- Domestic or export
- How big is the market?
- Will it be flooded if everyone plants the same crop.
- What competitive advantage do I have in the market place?
- What are my potential returns?

### ***Competitive Advantages and Disadvantages***

When choosing a new crop to grow you may have established that yes it will grow in our climate, no I don't need any specialised machinery and yes I can grow this crop as well if not better than any one else, but the success or the failure of being able to market and sell the crop profitably will lie in your advantages and disadvantages. Australia's geographical location and our high labour costs will be a significant factor in what may or may not be suitable.

***Australia's advantages include the following,***

- Sophisticated cultural practices and an ability to mechanise.
- Economies of scale (Having the land and resources available to operate on a large scale)
- Support services - Dept of sustainability, Horticulture Australia, Agronomists, Aus Trade ect.
- Clean green image in Europe
- Quality.
- Geographical location allowing counter seasonal supply to nth hemisphere.
- Climate provides for a wide range of crops

***Australia's disadvantages include,***

- High labour costs and restrictive labour laws.
- High sea freight costs and unreliable air freight.
- Lack of confidence in processing sector prohibiting establishment of new plants.
- Small domestic market
- Having to compete against Europe CAP and the U.S.A's farm bill subsidies.

With these points in mind, in choosing a new crop to grow it would be obvious not to grow a crop that was export dependent and was labour intensive, could not be mechanised and can be successfully grown in Asia or South America. Also it is important to have an idea of what crops attract support payments in the U.S.A as some crops are grown with the luxury of support payments.

***Domestic***

Crops that have extremely high yields but a low value per Kg like Potatoes, pumpkins and fodder crops will generally not be subject to pressure from cheap imports and are a better option for the domestic market.

At the time of completing this report, I have just finished growing a trial crop of potatoes on land that was prepared for tomatoes with subsurface drip irrigation. Yields and quality seem to be very good and given that our existing row crop equipment and irrigation systems seem adequate to grow the crop, our cost of production should be low enough to make it a viable proposition on a commercial scale. Contracts for processing potatoes in Australia are around \$200 to \$230 per tonne with yields up to 60 tonnes possible. Potatoes grown for the fresh market have the potential to generate huge returns at over \$500 per tonne but the market can

be flooded easily leaving growers with no market at all. I had always been led to believe potatoes and tomatoes don't mix but a processing tomato grower in Leamington Ontario Canada has a very successful rotation between the two.

Tomato Processors here in Australia could be encouraged to look in to what other crops they may be able to process with their existing plants.

### ***Export***

Growers that may be interested in growing produce for the export market should visit a wholesale fruit and vegetable market like the Pasar Pajang market in Singapore. Market agents and cold chain logistical management companies like WLNA are very helpful in identifying what type of produce and at what time of the year it could be sent. Aus Trade has programs in place to help first time exporters. Preconceptions of Asian farmers delivering cheap low quality produce to markets on donkeys are unfounded with the sophisticated consumer demanding a consistent high quality product.

Profitable crops for the export market will change from year to year but for an example Strawberries and Rockmelons would have been very successful crops to export at the time of my travels.

It is impossible to pick a particular crop and say "yes, that is what we all should plant to solve all our problems." Farmers will have different requirements and expectations to each other so it is a matter of choosing something suitable for your own operation.

Produce in markets and supermarkets in Asia are quite often full of Californian produce exported directly from farms to cold chain logistics companies or markets. Despite the distance, many Californian companies are able to compete very well in the Asian market by supplying well packaged high quality produce. My point here is, if a North American producer can successfully export produce in to markets on our door step, so can we!

A good counter seasonal supply opportunity in to the northern hemisphere exists for us, with our main competitors being New Zealand and other Australian farmers. Peppers, Sweet Corn, Broccoli and Strawberries would be some examples of crops that could find ready markets in the Northern Hemisphere winter.

Exporting produce will obviously not be as easy as supplying to a local processor or domestic market but it is something we will have to look at seriously. Many agricultural analysts are predicting that with forth coming free trade agreements with the USA and some Asian countries, agriculture hasn't got much of a future here with out exporting.

## New Technologies and Precision Farming Applications

The Australian Processing Tomato industry has always been at the forefront of adopting new technologies and adapting them to our particular farming system. Drip irrigation, automatic transplanters and the more recent introduction of the satellite navigation systems has seen our industry constantly visited by tomato growers from around the world over the last few years. My study tour was an excellent opportunity to look at new technologies and how farming methods vary in processing tomatoes around the world and see if there are any improvements we can make here.

### Hard Hose Boom Irrigators

Drip irrigation has been possibly the biggest benefit since the introduction of tomato harvesters in the early 70s. The water use efficiency and sustainability gains have been enormous but most growers have experienced a few common problems that they have been unable to find a solution to. On initial crop establishment, whether the crop is direct seeded or transplanted the wetting pattern of sub surface drip can be erratic especially in fields that have more than one soil type. When irrigating the crop up to 80% of the crop may water up in a timely manner but it may take a number of days to get the water up to the remaining 20% causing saturation of the sub soils, leaching of fertilisers and water pooling on the beds. Farmers are often heard making comments like “Finished transplanting a block today and will need some rain or I am going to lose half my plants” referring to the situation of planting transplants in to dry soil and being unable to get water to sub up to them before they wilt and die. The obvious solution of overhead irrigation to establish the crop has never been looked at seriously in Australia due to a perception of high cost and being labour intensive.

A new irrigation system being used on tomatoes in Canada involving a traditional hose reel pulling a boom type irrigator instead of a gun looks like it could be just what we need to address these problems.



*Briggs Boom Irrigator (England)*

Dennis Moon

Alternative crop options



*Cadman Hose reel (Ontario, Canada)*

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A typical initial irrigation application to strike seed in direct seeded tomatoes would be 75mm with applications up to 250mm required in hard to wet sub soils or on second and third year country. To sub water up to transplants the water requirement is usually between 50 and 150mm. By using this type of irrigator for plant establishment I estimate you would only require an application of 50mm to strike direct seed and less than 25mm to establish transplants. Application rates depend on design but a mid sized machine can be expected to apply around 25mm per acre per hour, if an application for transplants of 25mm was required the machine has the capacity to irrigate about twice the area that a transplanter can plant in a day. Even a large grower with 200 ha running two planters would be able to keep up with one machine. On this level of scale and utilisation with the cost of a mid range machine of about \$80,000 a yield increase through better more uniform plant establishment and improved soil health would need only be 4 tonne per Ha to recoup your investment.

### **Benefits of overhead irrigation for crop establishment**

- Substantial water and energy saving.
- Improved soil health by minimising water logging
- Versatility (The exact amount the crop requires can be applied)
- Plant losses minimised
- No leaching of fertilisers and nutrients
- Minimal loss of soil temperature
- Uniform soil moisture
- Increased yields
- Activation and incorporation of pre emergent chemicals

### **2004 Trials of overhead irrigation for crop establishment**

Following investigation of this type of irrigation system for crop establishment, the Australian Processing Tomato Research Council has applied to AFFA and has been successful in receiving a grant to purchase a hard hose irrigator with a towable boom and do trial work on a number of tomato farms for the coming season. The trial machine will be available to all members of the tomato industry to perform any evaluation trials they like.

## ***New Row Crop Technologies***

### **Self Propelled Transplanters**

One of the most interesting adaptations of a current piece of machinery for a new purpose I have seen was in Canada. As in Australia, early model tomato harvesters are now virtually worthless so the Canadian growers are converting them in to self propelled transplanters. The beauty of this conversion is the ability to be able to carry enough plants and water to plant up to 5 acres in a fill. Harvesters are striped down to a bare prime mover and a 4000 litre water tank is fitted on the chassis. Plant racks replace the original walkways on the side and a conventional planter is then fitted to the back via 3 point linkage. The machine's original hydraulic system is then used to run water pumps. This overcomes one of our biggest problems with transplanting:- spending more time at the end of the field loading up with plants and water than actually planting.

### **5 Row Row Crop**

The only major change I noticed with row crop systems in California is that they are converting to 5 rows. Growers are claiming production increases of up to 100% over the old 3 row system with less tractors, machinery and labour needed to get the crop planted in a timely manner. Australia's 3 row system was developed in the 70's when most growers would have been using 70 to 80 hp tractors. Although tractors have improved and become bigger, it seems that our row crop systems have developed very little. There is a trend towards rubber tracked machines in the United States with 5 row equipment; however I am not sure this is a direction we should explore, as many farmers seemed to be having problems with the tracks and rollers being damaged when used in vee shaped furrows like we have here.

### **GPS Technologies**

GPS Auto Steer systems (Beeline, Trimble ect) are becoming common in row crop work in the US, and are no longer seen as a novelty but more a necessity. Farmers using permanent bed farming systems and particularly those with sub surface drip irrigation are benefiting the most from this technology. One grower suggested the biggest advantage for him was being able to use less skilled operators for precision work, leaving his best workers free to do other jobs. GPS yield mapping on harvesting equipment will become important here with the ability to identify areas of fields not performing up to scratch, allowing treatment of these areas to benefit subsequent crops. Yield mapping is also highlight flaws in drip system uniformity.



*5 Row Johnson plantivator*

*California*



*Self propelled transplanter (Blackwelder)*

*Ontario Canada*

## **Minimum Tillage**

A tomato grower in the Williams area of California has developed a machine called the Wilcox Eliminator for farmers with intense row crop rotations. The concept of the machine is to be able to go in to trash or stubble from tomatoes, corn, and wheat and with one pass deep rip, break down the trash, level and provide a seed bed ready for hilling into beds.



*Wilcox Eliminator turning in tomato trash for re hilling*

### ***Wilcox Eliminator***

The manufacturer claims this can replace mulching the trash, discing the field, levelling the field and deep ripping. The machine achieves this by using coulters at the front followed by ripper tines, then a gang of discs in front of a rotating blade to finely chop the trash. This combination is then repeated on the back half of the machine with a flexi coil style roller at the back. This particular machine is very similar to the machines commonly used in Europe where they are popular for turning in stubble behind a combine harvester to provide a seed bed in one pass.

### ***Harvester Mulches***

A new generation tomato harvester I saw in California was fitted with a trash mulcher as standard. Growers are claiming a saving of US\$30 per ha on clean up costs allowing direct drilling of follow up crops straight in to existing beds. Trash mulched on the harvester doesn't get a chance to fall in to furrows and get packed in by bin tractors. Mulch ends up very fine and rots down much easier.

With increasing costs of fuel labour and machinery, the trend for North American farmers is significantly reducing the amount of passes required to plant, cultivate and clean up a crop. Saving a few passes in the preparation of a crop may on paper not add up to a huge saving but the benefits are coming from less machinery and labour. Machines like the Wilcox Eliminator, mulches on tomato harvesters and direct drills are reducing the number of passes required by up to 50 percent.

## **Variable Rate Fertiliser Technologies**

As part of my initial study objectives I was interested in variable rate fertiliser technology after reading about the cost savings farmers were making on their fertiliser applications. The concept of the technology involving soil mapping and then subsequent yield mapping allows automatic variation of rate to the areas of the field that need more or less fertiliser. This system is commonly used with grain farmers in the Alberta area of Canada where large areas of fields are unproductive due to water logging. Fertiliser is then only applied to the areas of the field at planting that will produce grain. This application in row crop work on tomatoes would probably bring very little in the way of benefits, as fields chosen for tomatoes are usually even and any unproductive areas of the field are improved prior to bed forming.



## **Liquid Fertilisers**

Tomato Growers in the USA and Canada have access to the full range of high analysis fertilisers in liquid formulations and no longer use any granulated mixes. Application of pre plant fertilisers is simplified with much lower volumes needed allowing for faster application. Exact mixes can be formulated in response to soil test reports, so all your pre plant requirements can be banded in one pass with a high degree of accuracy. We need to put pressure on our chemical resellers to make these products available here. The row crop machinery required for applying liquid fertilisers is far simpler than our current fertiliser box setups and with plain tanks needed to store and transport fertilisers, it is cheaper than using groupers.

## **Farm-Eco**

During the European leg of my group study tour I was placed with a host farmer for one week. My host farmer was David Rose from Newark in England. David ran a business called FARM-ECO that was developed by a group of neighbouring farmers getting together and selling all their plant and equipment and purchasing new larger equipment between them and operating it as a contract business. This gives them great economies of scale with an area of 6,000 acres cropped and harvested annually with very little machinery and a small work force. David explained that this concept must become wide spread in the UK for farmers to survive. Utilisation of the equipment used by tomato growers in general is very poor. Growers all seem to have one of everything and quite often, particular pieces of machinery may only be used for a few days per year. Growers could investigate the possibilities of working together more in individual areas, investing in and sharing some of the infrequently used plant and machinery. The next step taken from there would be to form mini co/ops to gain some marketing power in the contracting and sale of their produce. Other benefits of operating under this kind of structure would include group buying power and the ability to streamline labour requirements such as the employment of a full time agronomist for example, to work between 3 or 4 farms.

## Conclusion

Prior to my group study tour in 2002 and study tour of 2003, I was of the opinion that Australian tomato growers in general are as good as farmers you will find anywhere in the world. While I still believe this to be the case, my views on “what is a good farmer?” have changed. Our agronomic practices, our embracing of new technologies, yields and cost of production are certainly world’s best practice, however I think there is huge room for improvement when it comes to sustainably maximising returns from our total asset.

Many farmers in Asia, the USA and Europe have generally, from the a need to survive, learnt to extract every last ounce of production from their farms through intense rotations to gain the maximum return from their land, water, machinery and labour base. We may be happy with our farming systems and our returns at present but as we move towards a full global economy with remaining tariffs reducing and free trade agreements signed we will “need to do a lot more with what we have” to prosper. This doesn’t mean farms have to get bigger or become corporatised, it means we will have to do more with our existing assets or maintain current production with less. The positive here for Australian tomato growers is that despite the pessimism in the industry given that our returns have being slowly eroding over the last 10 years I believe we still have plenty of room to move in increasing the profitability of our businesses.

There is a number of other crops out there that would be suitable either as rotation or an alternative to tomatoes and it is just a mater now of growers being adventurous enough to give something a go.

North American trends of minimum tillage and reducing the amount of passes required to grow the crop will be applicable for here and could be beneficial on our fragile soils.

## **Acknowledgements**

I would like to sincerely thank the Australian Nuffield Farming Scholars Association for the fantastic opportunity to study my fields of interest around the world. This once in a life time opportunity has been made possible by the financial support provided by the sponsors, Australian Processing Tomato Industry, Horticulture Australia Limited, Qantas, Nuffield Australia and Business Travel International.

I must thank my fellow scholars that I travelled with during my group study tour, Trevor Caithness, Steven Dilley, Phillip Hatty, Paul Smith and Rob Fisher from Zimbabwe. The experience of travelling with this fantastic group of guys for 12 weeks is something I will never forget and I look forward to a continuing association with them all in the future.

During my travels through Asia, North America and Europe many people provided time, resources, presentations and quite often a bed and home cooked meal with very little notice at times. I would sincerely like to thank them for this.

This study tour would not be possible with out the support of my family and friends who kept everything running smoothly at home during my long periods of absence. Thank you to John and Viv, Mark Hill, Shane Connely, Joel Dyer, Geoff Lawry and last but not least my partner Marlene.