Client Report

Prepared for DEEResearch

June 2005

Understanding barriers to adoption of improved land use practices

Tracy Payne, Denise Bewsell and Bruce Binnie

Understanding barriers to adoption of improved land use practices

Prepared for DEEResearch

June 2005

Tracy Payne, Denise Bewsell and Bruce Binnie

Table of Contents

1. Introduction 1

1.1 Overview 1

1.2 Other Research Undertaken 1

2. Consumer Behaviour Model 2

2.1 A model of adoption behaviour 2

2.2 Complex decision making 2

3. Methods 4

3.1 Research Methods 4

4. Results 6

4.1 Wallowing Management 6

4.1.1 Overview 6

4.1.2 Problems 6

4.1.3 Solutions 8

4.2 Waterway Fencing 8

4.3 Wintering Management 11

5. Discussion 13

5.1 Wallowing Management 13

5.2 Waterway Fencing 13

5.3 Wintering Management 14

5.4 Recommendations 15

5.4.1 Wallowing management 15

5.4.2 Waterway fencing 15

5.4.3 Wintering practices 15

6. Conclusion 16

7. Acknowledgements 17

8. References 18

1. Introduction

1.1 Overview

Our aim in this project was to understand the barriers to adoption of improved land care practices in order to provide a platform for future adoption of land care techniques. This project documents how deer farmers manage deer wallowing, waterway fencing, and wintering management practices. This research examined the factors involved in influencing farmers' decisions on these issues and identified potential pathways to change these factors. We have used a qualitative approach to identify what the issues are as an introduction to further research with a larger audience.

1.2 Other Research Undertaken

The Deer Farmers Landcare Manual project provides practical techniques and observations on methods to improve land care in the deer industry. Practices designed to minimise environmental impacts of wallowing, wintering and suggestions for fencing waterways are included (New Zealand Deer Farmers Association 2004).

2. Consumer Behaviour Model

2.1 A model of adoption behaviour

The approach we take to understanding the adoption of new agricultural technologies draws on the conceptual foundations of consumer behaviour theory (Assael 1998). This theory proposes that consumers use a variety of decision processes when purchasing products.

Consumer involvement depends on how important the purchase is to the consumer. High involvement purchases are purchases that are important to the consumer (Assael 1998). These purchases usually involve some form of risk – financial, social or psychological. We believe that the adoption of most agricultural innovations represent a form of high involvement purchase for primary producers. Usually the adoption of a new agricultural practice or technique has significant consequences for the future financial performance of the farm enterprise. The new technology or practice must be integrated into the existing mix of technologies, practices and resources that exist on the farm (Crouch 1981; Kaine and Lees 1994). This means, generally speaking, the likely outcomes of adopting a particular technology or practice are difficult to predict as the compatibility of the technology or practice with the existing farm system, and the resulting benefits, depends on a range of contextual factors that are specific to the circumstances of each farm enterprise. Consequently, the decision to adopt an agricultural innovation is often financially risky. As such it entails social risks and psychological risk in that the outcomes affect the wellbeing of family members and can influence farmers' feelings of achievement and self-fulfilment.

2.2 Complex decision making

Consumer behaviour theory suggests that consumers follow a complex decision-making process with high involvement purchases (Assael 1998). Complex decision making is a systematic, often iterative process in which the consumer learns about the attributes of products and develops a set of purchase criteria for choosing the most suitable product.

The benefit or purchase criteria represent the key benefits sought by the consumer and generally reflect their usage situation. In the case of consumer goods the usage

situation is often a function of the consumer's past experiences, their lifestyle and their personality (Assael 1998). Following a purchase the consumer will evaluate product performance. Satisfactory performance will reinforce the consumer's judgement and promote the chances of repurchase. Dissatisfaction with product performance will lead to reassessment and decrease the likelihood of repurchase.

Consumers from different usage situations will employ different purchase criteria to evaluate products because they seek different benefits from a product, while consumers from similar situations will employ similar criteria. Information on the similarities and differences in the key purchase criteria used by consumers can be used to classify consumers into market segments (Assael 1998). This information can also be used to develop and promote a suite of products with characteristics that are tailored to provide the benefits sought by consumers in each particular segment.

In the case of agriculture the purchase criteria that farmers use to evaluate new technologies should reflect the key benefits the technology offers given farmers' usage situations. In this instance the usage situation is likely to be a function of the farm context into which a new technology must be integrated. Broadly speaking, the farm context is the mix of practices and techniques used on the farm, and the biophysical and financial resources available to the farm business that influence the benefits and costs of adopting an innovation (Crouch 1981; Kaine and Lees 1994). Similarities and difference among farm contexts for an agricultural innovation will translate into similarities and differences in the key purchase criteria that farmers will use to evaluate that innovation.

Given that the usage situation for agricultural innovations is defined by farm contexts, differences in farm contexts will result in different market segments for an innovation. Logically, the market for an innovation will be defined by the set of farm contexts for which the innovation generates a net benefit (see Kaine and Bewsell 1999; 2000; 2001; 2002; Kaine and Niall 1999; 2001 for examples). Complex decision making can be influenced in two ways (Assael 1998). One is to persuade consumers to change the purchase criteria they use to evaluate products. The second is to change their beliefs about the extent to which products meet their criteria. Both these changes lead to changes in consumers' evaluations of products which, in turn, may cause changes in product choices.

3. Methods

3.1 Research Methods

The use of complex decision making in high involvement purchasing implies that the purchaser develops explicit chains of reasoning to guide their decision making. This is consistent with explanation based decision theory, where the focus is on 'reasoning about the evidence and how it links together' (Cooksey 1996). This suggests that there should be shared and complementary patterns of reasoning among deer farmers and consistency in the decisions they reach. Hence, to identify the factors influencing deer farmers decisions we followed a convergent interview process (Dick 1998). Convergent interviewing is unstructured in terms of the content of the interview. The interviewer employs laddering techniques to systematically explore the reasoning underlying the decisions and actions of the interviewee (Grunert and Grunert 1995).

We interviewed 16 deer farmers, eight from the Hawkes Bay and eight from Otago. The New Zealand Deer Farmers Association provided us with the names and details of deer farmers in these regions. Care was taken to interview farmers who were operating large and small scale enterprises, and whose properties were located on flat, rolling or steep terrain. Farmers were asked questions based around four key themes; demographics, wallowing management; waterway fencing; and wintering management. The demographics of their property included the size, number and type of stock and the number of years they had been involved in the deer industry (see Table one). Wallowing management focused on problems farmers had experienced and the methods they had used to solve these. Waterway fencing covered the reasons for or against fencing these areas, while wintering practices focused on feed management. Pseudomonas have been used where exerts or descriptions from interviews have been inserted.

In this study we only define the segments rather than qualifying them because of the small sample number. A qualitative approach was used to identify what the issues were. This study will be the basis of a larger phone or postal survey so that we can quantify the overall numbers in each of the segments identified.

Table One: Demographics of farmer properties

	Years in the industry	Total size of property (hectares)	Size of deer block (hectares)	Total Deer Numbers	Total Cattle Numbers	Total Sheep Numbers
Maximum	27 years	2100	1850	6800	1520	8500
Minimum	5 years	35	35	220	0	0
Average	16 years	604	309	1330	349	2167

4. Results

4.1 Wallowing Management

4.1.1 Overview

In our interviews we discovered that farmers generally accepted wallowing as a natural part of deer behaviour. For some it was not an issue. Generally wallows were kept to one per paddock and were never abandoned. Farmers believed that wallows were made over time and therefore it was important to monitor each individual wallow for potential problems. When farmers were asked what time of year was most common for deer to wallow three specific times were mentioned. Hinds tended to wallow when they were hot, while stags wallowed during the roar. Throughout October till December, when deer are moulting, many farmers noticed an increase in the amount of wallowing occurring.

4.1.2 Problems

While there were a few farmers who did not believe they had any problems with wallowing, those who had experienced problems could be outlined in five groups;

1. soil and pasture damage
2. trough damage
3. danger to humans
4. acceptance by meat processing plant
5. visual problems

Most farmers believed that deer choose one spot in a paddock in which to wallow and therefore erosion and soil damage occurred over time. Farmers complained about the large holes which deer made through wallowing. For example, Kevin and Mary *(Hawkes Bay)* had a six feet deep wallow which had gradually got deeper over 20 years and it was not until it had reached this level that they decided to do something about the problem.

Another problem associated with soil damage was the damage wallows caused to pasture quality. Farmers observed that deer wallow in the wettest areas of the paddock,

destroying grass. In some cases, the deer would make further wallows in the paddock, while still using the original wallow, ruining even more pasture. Some farmers commented on wallows being formed around troughs. When the weather was hot farmers noticed that deer liked to splash the water from the troughs and make a wallow. An example of this was given by Tony *(Hawkes Bay)* who piled rocks around a trough to try to prevent the deer wallowing. He noticed that his deer *"got water out of it* [the trough] *and over the rocks and made a wallow".* So although he had attempted to solve the problem, he had merely moved the wallow area.

The most common problem associated with deer wallowing was the potential danger to humans. Farmers spoke of having six feet deep wallows which is a danger for farm machinery, including motorbikes and tractors. Farmers therefore needed to be aware of the location of every dangerous wallow on the property and be able to tell anyone on the farm where they are.

The meat processing plant not accepting muddy deer was another problem which was commonly cited by farmers (especially clients of PPCS). When deer wallow they get muddy and farmers stated that it was not easy to clean them. If these deer are not accepted by the processing plant then it costs the farmer time, money and effort. As Michael from Hawkes Bay discovered, *"last year 50 deer were rejected due to mud"* but he did not find out until they arrived at the plant and they had to be transported back to his farm, which involved time and money, as well as annoying the transport company. Another farmer stated that it was a *"bloody awful problem" (Ken, Otago)* and one to which he could not see a solution.

Furthermore, wallowing was perceived by farmers to be a visual problem and farmers did not like looking at them as "*wallows detract from a tidy looking place" (Bruce, Hawkes Bay)*, while another farmer believed wallows were *"annoying and ugly, especially when one was in the middle of the paddock" (Martin, Otago).* For others, although they were a visual eyesore they did not consider them a problem, as Alan stated he *"didn't like seeing wallows but not a problem yet"*

4.1.3 Solutions

While there was a diverse range of problems caused by wallowing, many farmers had implemented solutions to either halt or decrease the damage caused by wallows. For a few farmers if the wallows were out of the way they did not worry about them that much unless they started to get too deep. A few farmers left the wallows because if they fixed them, the deer started another wallow somewhere else.

To stop the wallows getting deeper some farmers placed rocks and bricks into the holes to try to decrease the damage. This stopped the deer from making the wallow deeper. Farmers who had problems with wallowing around their troughs tried to minimise it by either not putting as much water into sheep troughs so the deer could not get it out and make a wallow or by buying little troughs which the deer can only drink from. Where wallows were being made in wet areas of the paddock farmers tried to decrease the problem by draining these areas. Others let the deer play in their dams so they would not damage the pasture. Where deer had started to make a mess one farmer had fenced off a 0.5 kilometres by 0.5 kilometres area and planted it in pine trees. There were five such areas on the property.

4.2 Waterway Fencing

We classified deer farmers into segments based on reasons why they did or did not fence off waterways on their property. The segments are outlined in Table two and Figure one. The first segment consisted of farmers who did not have troughs or dams in the paddock. Therefore, they did not fence off these areas as they were the only available water source in the deer block. Alan is an example of farmers in this segment:

> *Alan owns a 247 hectare property in Hawkes Bay with 150 hectares in deer fencing. Every deer paddock has a waterway running through it, which leads to the main river off the property. These waterways are the only source of water available to the deer and therefore Alan has not fenced them off. If he was required to fence off all waterways it would be expensive, as an extensive trough system would be needed, along with many metres of deer fencing.*

Segment two included farmers who did not fence off for practical reasons. While farmers in this segment had other water sources available to their stock they believed it was neither practical nor possible to fence off their waterways. This largely was due to the steep terrain of their property. An example of farmers from this segment included Tony:

> *Tony owns a 240 hectare property in Otago. Every paddock on the property has a trough however Tony does not believe it would be practical to fence off every creek on the farm. He feels it would be physically impossible to fence off every waterway, due to the enormous cost and the steep terrain of the property.*

The third segment involved deer farmers who had sources of water for stock other than streams and who felt it was practical and possible to fence off the waterways on their property. These farmers saw fencing off their waterways as a priority. Kevin and Mary were an example of farmers from this segment:

> *Kevin and Mary have been involved with deer since 1995 and own a 535 hectare property in Hawkes Bay. They have fenced off all waterways on their property for practical reasons. They have many deep gorges and fencing off these areas keeps their stock safe.*

Segment four consisted of deer farmers who did not fence off as it was not a priority for them. However, these farmers had sources of water available to them other than streams and believed it was possible to fence off their waterways. An example of farmers from this segment included Eric and Clare:

> *Eric and Clare manage an 850 hectare property in Otago. While they would like to fence off all waterways on the property and plant trees the owners believe the money should be spent elsewhere. Eric and Clare try to save the paddocks with major waterways for silage and hay so stock run-off does not go into the Taieri River.*

And,

> *Lance and Megan own a 240 hectare property in Otago. While all paddocks have troughs fencing off waterways is not a farm priority. Lance and Megan*

feel the money could be spent in other areas, especially as most of the waterways on the property are small and not all streams run throughout the entire year.

Table Two: Segments for Fencing Waterways

	Segment One	***Segment Two***	***Segment Three***	***Segment Four***
Waterways the only water source	Yes	No	No	No
Practical/possible to fence off	_	No	Yes	Yes
Farm priority	-	-	Yes	No

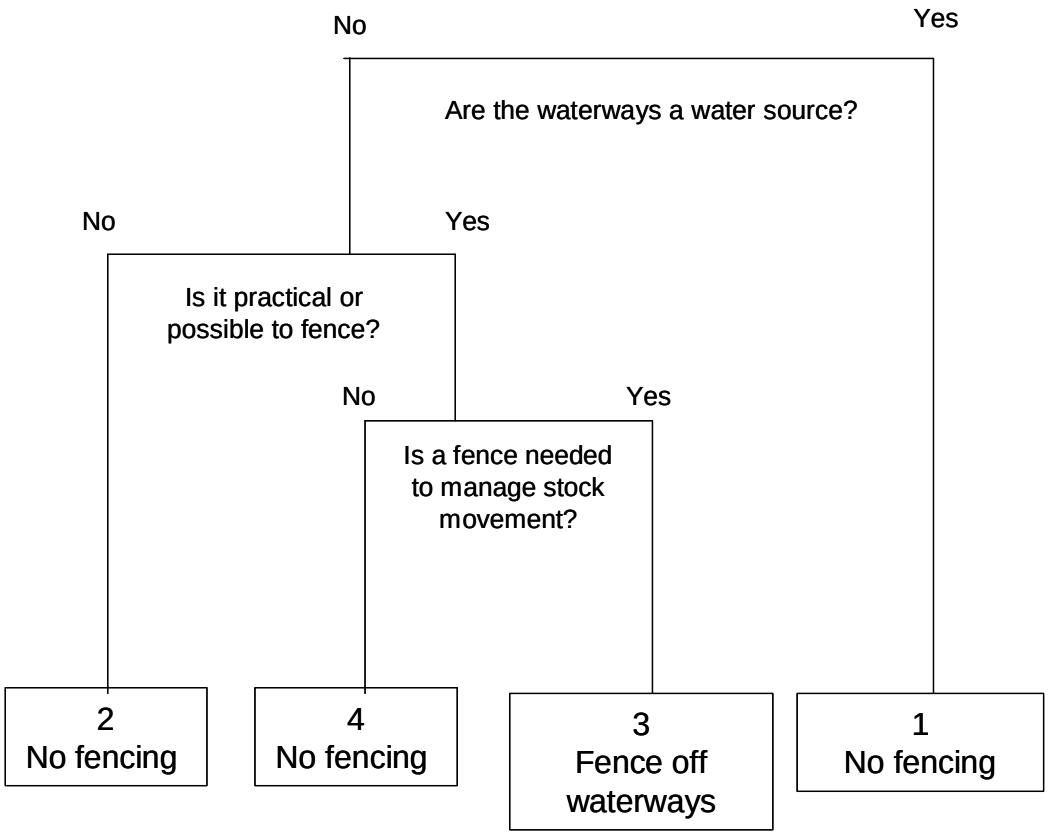

Figure One: Typology of segments for Waterway Fencing

4.3 Wintering Management

The information we gathered during our interviews with farmers regarding wintering management revealed only one farmer identified deer pugging as a problem. This farmer saw pugging as an extreme worry – as the number of stock on the property had increased. However, he was not doing anything to remedy the problem as he did not know what to do. The adoption of wintering practices was influenced by feed requirements and the resources available to farmers at the time.

Many farmers had stopped feeding maize to their deer as the returns for their deer were not enough to cover the expense of maize, or they wished to avoid the possibility of avian Tb being introduced in the maize. Instead farmers fed their deer a variety of supplements including:

- Silage
- Hay
- Swedes
- Carrots
- Turnips
- Kale
- A great variety of other horticulture and vegetable products

Generally most farmers separated their deer into mobs of fawns, hinds and stags for feed requirements. Nearly all farmers fed their fawns on a paddock of swedes during the winter period. This gave the deer extra supplement and stopped pasture and soil damage over the rest of the farm. Hinds were put into one paddock or a block of trees for two months and fed silage, to stop the pugging of grass. Other farmers fed their hinds on a fast pasture rotation, moving stock every couple of days, on Swedes and grass, again to provide the deer with enough nutrients for the winter, while minimising the time spent in each paddock and thereby reducing pasture and soil damage. Farmers commented that feeding out silage with a wagon caused more pugging problems than the deer.

There were three farmers who kept their deer off grass all winter, but only one of them used a feed pad for the hinds. Many farmers commented on the expense of feed pads and that it was not viable in the present economic climate to build one, while others did not use feed pads as *"they did not see the point" (Mike, Hawkes Bay)*. One farmer put

his stags and some hinds into a big gravel pit from the start of June till mid August. The deer were fed silage in troughs and were kept in one acre which was fenced into four blocks, with 50 deer in each. The final farmer kept his deer in an old quarry with self-fed silage. Trees had been planted around the outside of the quarry to protect the animals from the elements and to stop people looking in at the deer. Furthermore, the trees acted as a filter for effluent.

5. Discussion

5.1 Wallowing Management

Generally, farmers commented that it was a strange topic to bring up, as they saw wallowing as a natural phenomenon. The farmers we interviewed identified a number of factors that influenced their adoption of wallowing management practices. These factors concerned the problem which wallowing caused and the solutions available to them. While farmers raised a number of issues caused by wallowing, every farmer had attempted to either decrease or stop the specific problem depending on their farm context. For example, when a wallow became too deep farmers would place whatever materials were available, including rocks, bricks and rotten rock, to stop the wallow growing.

The problem of muddy deer at the processing plant occurred during the period when deer were shedding their winter coats (they seek relief from the associated itching by wallowing) and were being processed by conventional hind leg hanging (c.f. inverted dressing). Surely, even clean deer would be shedding hair over the carcass and causing just as much bacterial contamination. The sensible approach from the company without inverted dressing would be to avoid all processing during the shedding season, or change their plant to inverted dressing.

5.2 Waterway Fencing

In our interviews, most farmers stated that they were waiting for us to bring up the issue of waterway fencing. This demonstrates that farmers are aware of other interest groups and individuals' views on the topic, which may differ from theirs. Furthermore, many farmers were quite defensive when explaining their reasons for or against waterway fencing and this suggests that farmers believe that the general public believe in fencing off waterways but do not understand the practical implications of such an activity. Also, farmers questioned our definition of a waterway and argued about whether a stream that ran for half the year was considered a waterway, or a small drain. This is a significant finding, as if legislation makes fencing off waterways compulsory, a working definition of 'waterways' must be created, one on which farmers and the public agree.

When the only source of water for animals is a waterway many farmers do not see the need nor do they want to spend money on a trough system. For some farmers, waterways run through every paddock and the logistics and money required to fence off waterways would be substantial. Therefore, if it was required, measures would have to be put into place which either subsidised farmers or allowed fencing to be undertaken over a period of time. Otherwise, especially with the current slump in deer prices, farmers would find it financially difficult and may refuse.

Farmers stated that it was impractical to fence off every waterway on their property due to the terrain. Many believed it was impossible to fence off their waterways and if they were forced to, many would have to retire paddocks from deer altogether as it would be too expensive and render the paddocks unproductive.

For those farmers who did fence off waterways it was a farm priority for two reasons, both practical; erosion and bank control and stock control. Fencing off gullies and waterways meant that farmers with steep properties did not lose valuable stock or have to search for stock in dangerous areas. Farmers who fenced off for erosion and bank control did so to protect the land surrounding the waterway. This suggests that when promoting fencing off waterways, practical issues should dominate.

5.3 Wintering Management

The farmers we interviewed focused their wintering management on feed requirements for their deer, and this was influenced by the price of supplements. Many farmers had turned away from feeding maize as the expense outweighed the benefits and there is a risk of introducing avian Tb. Therefore, farmers feed cheaper supplements, such as silage and hay, when the return from deer is low. Other farmers fed their deer free or cheap vegetables to keep the supplement costs down. This finding indicates that farmers are influenced by the returns when deciding what to supplement deer with during the winter period.

Pugging of the soil was a problem for only one farmer and he was presently doing nothing about it as no information was available to him. Other farmers we spoke to had strategies for managing deer over winter. Avoidance of pugging was a consideration in

many of these strategies. These included; putting deer onto swedes; wintering in a quarry; or putting the deer in a sheltered block. These strategies were designed to make the most of the resources available to the farmer.

5.4 Recommendations

The most effective method to identify recommendations for the adoption of improved land use management practices would involve running a number of workshops. Such workshops would involve members of the science community, deer industry representatives and farmers themselves. However due to time constraints these workshops could not be organised for this project. Therefore the following recommendations are those of the authors.

5.4.1 Wallowing management

If researchers believe that wallowing is an environmental problem then awareness programs need to be established. This would raise the issues associated with wallowing in farmers minds. This could provide a platform for discussion amongst farmers and researchers resulting in new ideas or innovative solutions for halting the damage caused by wallowing.

5.4.2 Waterway fencing

Waterway fencing is a topical issue for farmers and a greater understanding of the problems associated with it would aid scientists and councils in creating practical solutions. To begin with there needs to be a working definition of what a stream or waterway is. An understanding of when it is not practical to fence due to the terrain or the vast costs involved also needs to be acknowledged by scientists and regulators. An analysis of the costs involved to fence difficult areas and to replace the natural water source with a trough system needs to be undertaken, along with investigation into innovative solutions.

5.4.3 Wintering practices

Further research is required to gain more specific examples of regions which have problems with pugging and the solutions farmers have adopted to halt this problem.

6. Conclusion

The aim of this project was to understand the barriers to adoption of improved land care practices and examine the factors involved in influencing decisions to change these factors. Wallowing was considered a natural phenomenon and there was a general level of "just dealing with it" amongst farmers. While farmers raised a number of issues caused by wallowing, every farmer had attempted to either decrease or stop the specific problem depending on their farm context. Waterway fencing was a sensitive topic, with many farmers arguing that it is impractical to fence off every waterway on their properties. Furthermore, many questioned our definition of a waterway and argued was a stream that ran for half the year considered a waterway, or a small drain. Finally, wintering management was influenced by feed requirements and this in turn was influenced by the price of supplements and the returns gained from deer.

7. Acknowledgements

The authors wish to thank Dave Stevens and Geoff Asher for their invaluable contribution during the implementation and writing up of this project. Thanks must also go to the deer farmers who gave up their time to share their experiences with us. Without them this project would not have been possible.

8. References

Assael, H. (1998). Consumer Behaviour and Marketing Action. Cincinnati, South Western.

Cooksey, R. W. (1996). Judgment Analysis: Theory Methods and Applications. San Diego, Academic Press Inc.

Crouch, B. (1981). Innovation and Farm Development: A Multi-Dimensional Model. Extension Education and Rural Development. Brisbane, Wiley and Sons.

Dick, B. (1998). Convergent Interviewing: A Technique for Data Collection [on line].

Grunert, K. and S. Grunert (1995). "Measuring Subjective Meaning Structures by the Laddering Method: Theoretical Considerations and Methodological Problems." International Journal of Research in Marketing **12**(3): 209-225.

Kaine, G. and D. Bewsell (1999). Soil Monitoring, Irrigation Scheduling and Fruit Production, University of New England, Armidale.

Kaine, G. and D. Bewsell (2000). Soil Monitoring, Irrigation Scheduling and Fruit Production, University of New England, Armidale.

Kaine, G. and D. Bewsell (2001). Managing Irrigation for Grape Production, University of New England, Armidale.

Kaine, G. and D. Bewsell (2002). Soil Monitoring, Irrigation Scheduling and Vegetable Production, University of New England, Armidale.

Kaine, G. and J. Lees (1994). Patterns in Innovation. Armidale, NSW, The Rural Development Centre, UNE.

Kaine, G. and E. Niall (1999). Market Segmentation and Wet Soils Management, University of New England, Armidale.

Kaine, G. and E. Niall (2001). Sheep Breeding: Complex Decision Making and Brand Loyalty, University of New England, Armidale.

New Zealand Deer Farmers' Association (2004). The New Zealand Deer Farmers' Land Manual. Timaru, Herald Print.