



Farmer Views on the Use of Genetic Engineering in Agriculture

John R. Fairweather
Crystal Maslin
Peter Gossman
and
Hugh R. Campbell

Research Report No. 258
May 2003



LINCOLN
UNIVERSITY
Te Whare Wānaka O Aoraki



PO BOX 84, LINCOLN UNIVERSITY, CANTERBURY 8150, NEW ZEALAND

Research to improve decisions and outcomes in agribusiness, resource, environmental, and social issues.

The Agribusiness and Economics Research Unit (AERU) operates from Lincoln University providing research expertise for a wide range of organisations. AERU research focuses on agribusiness, resource, environment, and social issues.

Founded as the Agricultural Economics Research Unit in 1962 the AERU has evolved to become an independent, major source of business and economic research expertise.

The Agribusiness and Economics Research Unit (AERU) has five main areas of focus. These areas are trade and environment; economic development; business and sustainability, non-market valuation, and social research.

Research clients include Government Departments, both within New Zealand and from other countries, international agencies, New Zealand companies and organisations, individuals and farmers.

Two publication series are supported from the AERU Research Reports and Discussion Papers.

DISCLAIMER

While every effort has been made to ensure that the information herein is accurate, the AERU does not accept any liability for error of fact or opinion which may be present, nor for the consequences of any decision based on this information.

A summary of AERU Research Reports, beginning with #242, are available at the AERU website www.lincoln.ac.nz/aeru/

Printed copies of AERU Research Reports are available from the Secretary.

Information contained in AERU Research Reports may be reproduced, providing credit is given and a copy of the reproduced text is sent to the AERU.

Farm Surveys and Rural Monitoring

Farmer Views on the Use of Genetic Engineering in Agriculture

**John R. Fairweather
Crystal Maslin
Peter Gossman
and
Hugh R. Campbell**

May 2003

Research Report No. 258

**Agribusiness and Economics Research Unit
P O Box 84
Lincoln University
Canterbury
New Zealand**

Ph: (64) (3) 325 2811

Fax: (64) (3) 325 3847

<http://www.lincoln.ac.New Zealand/AERU/>

ISSN 1170-7682

ISBN 0-909042-39-X

Table of Contents

CHAPTER 1 INTRODUCTION: BACKGROUND, RESEARCH OBJECTIVES AND DEFINITIONS	1
CHAPTER 2 SURVEY METHOD	3
2.1 Introduction	3
2.2 The Questionnaire	3
2.3 Pre-testing, Sample Size and Questionnaire Distribution	4
2.4 Response Rates and Sample Representativeness	5
2.5 Conclusion	5
CHAPTER 3 RESULTS	7
3.1 Introduction	7
3.2 Farmer Profile	7
3.3 Results from the General Attitudinal Questions	11
3.4 Comparison of Data from 2000 and 2002 Surveys	16
3.5 Summary of Results for the Whole Sample	19
3.6 Farming Intention Groups	20
3.7 Attitudes and Responses of the Three Intention Groups	28
3.8 General Attitudes of the Three Intention Groups	35
3.9 Conclusion: Overall Profile of Each Intention Type	46
CHAPTER 4 DISCUSSION AND CONCLUSION	49
4.1 Introduction	49
4.2 Overall Attitudes	49
4.3 Change in Attitudes	49
4.4 Intention Groups	51
4.5 Implications for Policy	52

Table 1 Population and Sample Characteristics	6
Table 2 Demographic Information	8
Table 3 Income (\$)	9
Table 4 Predominant Farming Activity by Farm Size (hectares)	10
Table 5 Farmers' Attitudes towards GMO and New Zealand's Environment (%)	11
Table 6 Intention to use GMOs	12
Table 7 Intention to use Organic Methods	13
Table 8 Farmers' Attitudes Towards Differing Types of GMO (%)	13
Table 9 Farmers' Beliefs About GMOs (%)	15
Table 10 Level of Agreement with GE Free New Zealand, 2000 and 2002	17
Table 11 Intention to use GMOs, 2000 and 2002	18
Table 12 Intention to use Organic Methods, 2000 and 2002 (%)	19
Table 13 Derivation of Farming Intention Groupings	21
Table 14 Farmer Age by Intention Group	22
Table 15 Gender by Farmer Intention Group	22
Table 16 Educational Levels by Intention Group	23
Table 17 Farm Type by Intention Group	24
Table 18 Self-reported Financial Intensity of Farm Operation	24
Table 19 Income by Intention Group (\$)	25
Table 20 Farming Activities by Intention Group	26
Table 21 Definitions of Organic Farming	27
Table 22 Profile for Each Intention Group	27
Table 23 Attitudes towards New Zealand's use of GMO by Intention Group	28
Table 24 Attitudes Towards GMO use on Farms and in the Lab by Intention Group	29
Table 25 Attitudes towards the Potential Affects of GMO use by Intention Group	30
Table 26 Attitudes towards the Necessity and Principle of GMO use by Intention Group	32
Table 27 Compatibility of Organic and GMOs in New Zealand by Intention Group	33
Table 28 Beliefs About GMO Crops and Foods by Intention Group	34
Table 29 Attitudes towards Farming Practises to Improve Biodiversity and Soil Condition by Intention Group	34
Table 30 Farm Sustainability by Intention Group	35
Table 31 Attitudes about New Zealand's Environment by Intention Group	36
Table 32 Farmers' Environmental Attitudes by Intention Group	37
Table 33 Role for Type of Agriculture in NZ Farming by Intention Group	38
Table 34 Opinions of Federated Farmer Representation by Intention Group	41
Table 35 Attitudes about Technology by Intention Group	42
Table 36 Attitudes about General Social Issues by Intention Group	44
Table 37 Attitudes Towards Trust and Influence by Intention Group	45
Table 38 Summary of Attitudes by Intention Group	47

List of Tables

Table 1 Population and Sample Characteristics	6
Table 2 Demographic Information	8
Table 3 Income (\$)	9
Table 4 Predominant Farming Activity by Farm Size (hectares)	10
Table 5 Farmers' Attitudes towards GMO and New Zealand's Environment (%)	11
Table 6 Intention to use GMOs	12
Table 7 Intention to use Organic Methods	13
Table 8 Farmers' Attitudes Towards Differing Types of GMO (%)	13
Table 9 Farmers' beliefs about GMOs (%)	15
Table 10 Level of Agreement with GE Free New Zealand, 2000 and 2002	17
Table 11 Intention to use GMOs, 2000 and 2002	18
Table 12 Intention to use Organic Methods, 2000 and 2002 (%)	19
Table 13 Derivation of Farming Intention Groupings	21
Table 14 Farmer Age by Intention Group	22
Table 15 Gender by Farmer Intention Group	22
Table 16 Educational Levels by Intention Group	23
Table 17 Farm Type by Intention Group	24
Table 18 Self-reported Financial Intensity of Farm Operation	24
Table 19 Income by Intention Group (\$)	25
Table 20 Farming Activities by Intention Group	26
Table 21 Definitions of Organic Farming	27
Table 22 Profile for Each Intention Group	27
Table 23 Attitudes towards New Zealand's use of GMO by Intention Group	28
Table 24 Attitudes Towards GMO use on Farms and in the Lab by Intention Group	29
Table 25 Attitudes towards the Potential Affects of GMO use by Intention Group	30
Table 26 Attitudes towards the Necessity and Principle of GMO use by Intention Group	32
Table 27 Compatibility of Organic and GMOs in New Zealand by Intention Group	33
Table 28 Beliefs About GMO Crops and Foods by Intention Group	34
Table 29 Attitudes towards Farming Practises to Improve Biodiversity and Soil Condition by Intention Group	34
Table 30 Farm Sustainability by Intention Group	35
Table 31 Attitudes about New Zealand's Environment by Intention Group	36
Table 32 Farmers' Environmental Attitudes by Intention Group	37
Table 33 Role for Type of Agriculture in NZ Farming by Intention Group	38
Table 34 Opinions of Federated Farmer Representation by Intention Group	41
Table 35 Attitudes about Technology by Intention Group	42
Table 36 Attitudes about General Social Issues by Intention Group	44
Table 37 Attitudes Towards Trust and Influence by Intention Group	45
Table 38 Summary of Attitudes by Intention Group	47

Preface

The results of the survey reported here continue the ongoing surveys of farmer opinion that have been a longstanding feature of research conducted by the AERU. The current topic is of considerable importance to the current debate about genetic engineering. Promoters of genetic engineering point out the advantages to New Zealand in adopting this technology and detractors argue against its use pointing out there are many disadvantages. What is often not considered in this debate is the viewpoint of farmers who may or may not adopt the products of genetic engineering (GMOs). It is vital that farmer viewpoints are considered since their reaction to the new technology will drive what will actually happen on the ground. This report presents responses to a carefully prepared questionnaire and gives both an overview of farmers' responses as a whole and then analyses these responses in terms of intention to use either GMOs, organic methods or conventional methods of production. The results will be of interest to farmers, policy makers and those concerned about the use, or lack of use, of GMOs.

Professor Caroline Saunders
Director

Acknowledgements

We thank all those farmers and growers who took time to reply to the questionnaire.

Funding for this research was provided by the Foundation for Research, Science and Technology under contract number UOO X007, Greening Food: Social and Industry Dynamics.

Summary

The objective of the research reported here was to determine farmers' views about genetic engineering, including their intentions to use GMOs, and their views about GMOs, environment attitudes and sustainability. Questionnaires were posted to a random sample of 2,240 farmers from which 805 usable responses were received giving a response rate of 38 per cent.

Half of the farmers believe the GMO moratorium should be extended beyond October 2003 and 62 per cent of farmers think that New Zealand's environment is 'clean and green.'

Farmers indicated fairly consistent support for the development of GMOs for medical applications and there was strong support for GM activities that could be contained in laboratories. Only around 33 per cent of farmers support the use of GMOs for human or animal food production. Farmers are clearly split into thirds (agree/disagree/neither) on the issues of the environmental friendliness of GMOs and the effect on the quality of life of animals. Half of the farmers surveyed believed that the spread of farm GMOs cannot be controlled. More than 40 per cent of farmers believe that GMOs may cure the world's major diseases and solve the world's food problems. Finally, 43 per cent of farms believe that GMOs can be used in New Zealand without adversely affecting organic farming.

Comparisons of farmers' responses from 2000 and 2002 indicate that farmers' attitudes towards keeping New Zealand GE free changed between 2000 and 2002 so that, while still a majority viewpoint, fewer now disagree (down from 50 to 46 per cent) and more agree (up from 32 to 38 per cent). There was a change in farmers' intentions to use GMOs with fewer farmers, down from 45 to 35 per cent, now indicating an intention not to use GMOs while the proportion intending to use GMOs remains constant at 22 per cent. The majority (up from 35 to 43 per cent) now have no intention to use GMOs. There are now more farmers with an intention not to use organic methods (up from 19 to 29 per cent) and fewer farmers indicating an intention to use organic methods (down from 38 to 23 per cent).

Environmental attitude questions showed that most New Zealand farmers are moderately supportive of the ideas of co-operating with nature in production, and general intentions of agroecological production. However, despite holding these views, the great majority of farmers considered that their own farms were sustainable into the medium term. Thus, the main finding of this survey is that while there has been some shifting in the composition and intensity of the minority alternative groups to conventional farming (organic or GMO intending), most farmers do not foresee that they have significant problems on their farms that require these alternative solutions. Put simply, when faced with the possibility of GMOs, the majority of farmers are neither strongly opposed to GMOs nor keen to adopt them.

The sample of farmers was split into three groups based on their intentions to use conventional, GMOs or organic methods. The profile of each intention group is shown below, followed by a summary of attitudes for each group.

Profile for Each Intention Group

	GMO Intenders	Organic Intenders	Conventional Intenders
Proportion of Sample	18%	19%	58%
Age	54	49	51
Male	92%	77%	77%
Post Secondary Qualifications	33%	53%	38%
Type of farm	Pastoral 38% Dairy 40%	Pastoral 50% Horticulture 22%	Pastoral 58% Dairy 23%
Farm financial intensity	Top ten 19% Above Average 51%	Top ten 9% Above Average 36%	Top ten 12% Above Average 46%
Income from farm	\$63,000	\$35,000	\$43,000
Gross income	\$640,000	\$250,000	\$332,000
Activity	Not organic	Some organic	Not organic

Summary of Attitudes by Intention group

	GMO Intenders	Organic Intenders	Conventional Intenders
GE Free NZ	No	Yes	Neither
Moratorium extension	No	Yes	Moderate yes
NZ 'clean and green'	Yes	Moderate Yes	Yes
GMOs for food production	Yes	No	Moderate No
GMO development for medical applications	Yes	Depends if lab/farm	Yes
GMO environmentally friendly	Yes	No	Neither
The spread of farm GMOs is controllable	Yes	No	Moderate No
GMOs will cure diseases / solve food problems	Yes	No	Neither
GMOs improve the quality of life for animal	Yes	No	Neither
I would use GMOs if caused harm to animals/ people/ environment	No	No	No
GMO fits with my principles and beliefs	Moderate Yes	No	No
GMO can be used without harm to organic farming	Yes	No	Moderate No
GMOs will have negative environmental consequences	Moderate No	Yes	Yes
Quality of NZ environments	Good	Moderate Good	Good
Improving biodiversity and soil conditions is important	Yes	Yes	Yes
Farm is sustainable	Yes	Yes	Yes
Federated Farmers represents my view	Yes	Neither	Moderate Yes
I trust technology	Moderate No	No	No

Attitude towards social issues	Conservative	Liberal	Moderate Conservative
I trust government	Neither	No	No
I trust biotech companies	Moderate No	No	No
I trust policy based on research	Yes	Moderate No	Moderate yes

The typical GMO Intending farmer expresses conservative social views, is male, and is optimistic about the potential for GMOs to solve the world's food problems and cure diseases. As a result he is in favour of GMO development for medical applications and for food production. He feels that New Zealand should not strive for GE free status and that the GMO moratorium should not be extended.

The typical Organic Intending farmer expresses liberal/centrist social views and is in opposition to almost every application for GMOs. This group is still strongly represented by men but has some female representation. They feel that there may be negative environmental consequences of GMO use. As a result they think that New Zealand should try to achieve GE free status and extend the moratorium on GMOs. They do not believe that the spread of GMOs can be controlled and believe that the use of GMOs will adversely affect organic farming.

The typical Conventional Intending farmer expresses moderately conservative social views and occupies the middle ground between the GMO and Organic Intention farmers. In most cases this farmer expresses a cautious attitude towards GMO use, and this group is still strongly represented by men but has some female representation. They express no support for or against GE Free status but indicate moderate agreement with extending the moratorium on GMOs. They do not support the development of GMOs for human or animal food but do support the idea of GMO development for medical applications or in lab containment. They express neutral opinions on the issues of the environmental friendliness of GMOs, the ability of GMOs to cure diseases and food problems and the potential for GMOs to improve the quality of life for animals.

Despite the majority of farmers (78 per cent) having either no intention or a negative intention towards GMOs, there is a small minority (five per cent) who have a strong or very strong intention to use GMOs, and they will provide a first group of enthusiastic adopters should the technology become available.

Similarly, despite an apparent slackening of overall level of support for organic production, the organic industry is still faced with around eight per cent of farmers who state either strong or very strong intention to use organic methods. The current size of the organic sector is one per cent of all farmers so this level of interest is enough to enable an eight fold increase in the size of the organic sector should that level of intention be carried into actual organic conversion.

Chapter 1

Introduction: Background, Research Objectives and Definitions

The AERU has surveyed farmers over many years and the results from these surveys have been useful for improving our understanding of farmers and farming. Often, these survey results form an important basis for policy formulation or help farming and related organizations better deliver their policies and plans. Cook et al., (2000) and Fairweather et al. (2002) are the latest reports of this kind of survey. The former reported on New Zealand farmer intentions to use genetic engineering technology and organic production methods, and the latter analysed the data from the same survey in terms of organic, conventional and GE intending farmers. Consequently, the two reports establish a baseline understanding of New Zealand farmers and their responses to novel technologies. It is timely to again consider farmers responses to new technologies.

The main objective of the research reported here was to determine farmers'¹ views about genetic engineering. In particular, we wanted to assess farmers' intentions to use the products of genetic engineering, identified in this study as GMOs, and compare these intentions with results to the same question asked in our survey conducted in 2000. Further, we sought to clarify their views generally about genetic engineering, including their level of support for different uses of genetic engineering and their responses to issues associated with genetic engineering. The questionnaire included other questions that measured environment attitudes, opinions about farming sustainability and worldviews. Constructs based on these variables could be useful in developing a better understanding of why farmers think the way they do about genetic engineering.

The rationale for the survey was, first, the need to monitor farmers' attitudes on a regular basis in order to see if they change. Careful attention to farmers' attitudes is important because they will be important players in any developments of genetic engineering use in New Zealand. It is likely that attitudes may have changed since the Royal Commission on genetic engineering report was made public in 2001. Since that time the Commission's findings have been considered by the public generally and farmers in particular, so that it is possible that it has had an effect. Second, having established a good understanding of intentions in the 2000 survey we wanted to move on to consider why particular intentions are held.

For the purpose of this study we have assumed that plants and animals or other farm inputs produced using genetic engineering may be available to farmers in the future. We define 'Genetically modified organisms' (GMOs), following the Environment Risk Management Authority (ERMA), to include any plant, animal or micro organism developed through genetic modification. A GMO is any organism in which the genes have been modified by using in vitro (recombinant DNA) techniques, i.e., created in the lab.

This report comprises three subsequent chapters, the first outlining the methods used, the second presenting the results and the third presenting a discussion and a conclusion.

¹ We use the term 'farmers' to refer to both farmers and growers.

Chapter 2

Survey Method

2.1 Introduction

A postal questionnaire was developed to gather information about farmer views on genetic engineering. The postal questionnaire was selected as the best method of gathering this information because it allowed for a large number of farmers from various parts of New Zealand to be sampled within the time period available for the study. The questionnaire was designed to record farmer intentions, their level of support for different uses of genetic engineering and their responses to issues associated with genetic engineering. The questionnaire included other questions that measured environment attitudes, opinions about farming sustainability and worldviews (Slovic, 2000).

2.2 The Questionnaire

The questionnaire comprised a twelve page A4 booklet, printed on both sides of each page (see appendix 1). A total of 28 separate questions were asked yielding approximately 100 data items, or variables, per completed questionnaire.

A separate covering letter introduced the questionnaire and it outlined the purpose of the study. The front page of the questionnaire defined and explained terms used within the questionnaire. This section also gave respondents the instructions to assume that the products of genetic engineering would be available to them in the future.

Briefly outlined below are the main sections of the questionnaire.

Future farming intention

Future farming intentions were measured by asking farmers about their intentions to use GMOs and/or organic methods on their farms within the next ten years. Response was measured using a seven-point scale ranging from (1) "I have very strong intentions to use ..." to (7) "I have very strong intention not to use ..." The mid point of this scale was described as "no intention to either use or not use..." meaning respondents were not able to select positive or negative intention. The format and wording for the GMO intention and the organic intention was identical to that of an AERU survey conducted in 2000 (Cook et al., 2000) to allow a comparison of results to be undertaken. The same was true of the agreement / disagreement statements relating to New Zealand's GE free status.

Attitude towards Genetic Engineering

Farmers were asked a series of five questions, each with a number of statements, to measure their attitudes towards genetic engineering either specifically on the farm, in relation to New Zealand or more generally. A majority of the questions were asked using a seven-point scale to measure the responses ranging from (1) "very strongly disagree" to (7) "very strongly agree." One question asking about the farmer's support or opposition to 4 types of on-farm GMO use used a five-point scale from (1) "totally opposed" to (5) "totally supportive".

Attitudes towards the environment

Farmers were asked two questions, one of which investigating the respondent's anthropocentric / bio centric values. This question had farmers rate eight statements about the environment using a seven-point scale from (1) "very strongly disagree" to "very strongly agree." The second question in the section used a five point scale ranging from (1) "very bad" to (5) "very good" to measure farmers opinions of the state of New Zealand's environment.

Attitudes towards sustainability

In this section farmers were asked three questions about the sustainability of farming in New Zealand. The first question uses a five point scale ranging from (1) "very unimportant" to (5) "very important" to measure farmers attitudes towards the importance of four farming practices. The second question asked farmers to rate the sustainability of their own farms using a five-point scale from (1) "completely unsustainable" to (5) "completely sustainable." The final question in the section asked farmers about the role of different systems of production in New Zealand agriculture. The farmers were asked to rate the systems of production on a four-point scale from (1) "no role" to (4) "dominant role."

Attitudes towards general farming related items

Farmers were asked to rate the representation that they received from Federated Farmers using a seven-point scale from (1) "very poorly" to (7) "very well." Additionally farmers were asked three more sets of questions about technology, social issues and trust or influence. Farmers used a seven-point scale ranging from (1) "very strongly disagree" to (7) "very strongly agree" to rate each of the statements.

Factual farm information

The questions in this section collected factual farm information, for example farm size, certification registration, etc.

Demographic information

Information was collected about the individual completing the questionnaire, this included: their position on the farm, age, income and highest level of completed formal education. As with the factual farm information this was collected to examine possible relationships with other survey information.

2.3 Pre-testing, Sample Size and Questionnaire Distribution

Six people from farming families formed the pre-test group. Each person provided comments about the ease of completion of the questionnaire and how other farmers might react to the questions. Revisions were made to the questionnaire, in the light of those comments, prior to its implementation.

A random sample of 2000 farms was supplied by Quotable Value New Zealand. The 2000 questionnaires were mailed out on the 11th October 2002. The original sample was meant to include all farm types, however an error in the sample supplied by Quotable Value New Zealand meant that horticultural farms were accidentally omitted. Quotable Value New Zealand then supplied a supplementary sample of 240 horticultural farms, or a two per cent sample of all horticultural farms, and additional questionnaires were mailed out on 18th November. In total, there were 2240 questionnaires posted out.

The survey was mentioned in radio interviews on National Radio on the midday rural news segment on Monday 21st October and subsequently, in a separate interview, on the weekly Country Life programme on Friday 25th and Saturday 26th October. A reminder card was mailed on 31st October and for the horticultural farms on 29th of November.

2.4 Response Rates and Sample Representativeness

From October 11th to December 16th 2002 of the 2240 circulated questionnaires 934 were returned giving a crude response rate of 42 per cent. Of these, 129 were either returned undelivered or the addressee was no longer farming or had died. Consequently, there were 805 questionnaires suitable for analysis giving an adjusted response rate of 38 per cent.

The sample was tested against data supplied by Quotable Value New Zealand on farm type, farm size and farm value for all farms in New Zealand in order to test for sample representativeness. The data for the population and the sample are shown in Table 1. The results of chi-squared tests showed that there were significant differences only for farm capital value ($\chi^2 = 65, 8 \text{ dof}$) and no significant differences were found between farm type ($\chi^2 = 7.45, 4 \text{ dof, NS}$) and farm size ($\chi^2 = 9.44, 6 \text{ dof, NS}$). The table shows that for capital value there were fewer sample farms in the smallest value range (\$0-\$99,999) and more sample farms in the \$250,000-\$499,999 and the \$500,000-\$999,999 ranges. Thus, fewer smaller-scale farmers replied to the questionnaire. It is unlikely that this discrepancy is likely to have any bearing on the characteristics of the sample. If it does have any influence then it is likely that the bias is in favour of full time farmers. Overall the sample matched the population on two important and objective characteristics.

2.5 Conclusion

The response rate for this survey at 38 per cent compares favourably with the 2000 survey at 35 per cent. The sample is representative of the farming population

Table 1
Population and Sample Characteristics

Farm Type	Population		Sample	
	n	%	n	%
Specialist	4,599	4	44	5
Dairy	28,489	26	201	25
Arable	3,818	3	23	3
Pastoral	61,601	56	450	56
Horticulture	11,623	11	86	11
Total	110,130	100	804	100
Area				
0 to 99	80,557	74	558	70
100 to 499	24,308	22	208	26
500 to 999	2,548	2	22	3
1,000 to 4,999	1,640	2	14	2
5,000 to 9,999	161	0	-	-
10,000 to 49,999	76	0	-	-
50,000 plus	2	0	-	-
Total	109,292	100	802	100
Capital Value				
0 - 99,999	23,275	21	84	10
100,000 - 249,999	17,680	16	125	16
250,000 - 499,999	26,193	24	231	29
500,000 - 999,999	27,043	25	241	30
1,000,000 - 1,499,999	9,641	9	78	10
1,500,000 - 1,999,999	3,242	3	22	3
2,000,000 - 2,499,999	1,240	1	11	1
2,500,000 - 2,999,999	539	0	7	1
3,000,000 plus	908	1	5	1
Total	109,761	100	804	100

Chapter 3

Results

3.1 Introduction

This chapter presents the results from the survey. It includes cross tabulations and statistical analysis for the questions asked, mostly focusing on farmer intention and how this influences other responses. The first section covers basic demographic data in order to build up an understanding of the nature of the sample of farmers. The second section then reviews the results from the general attitude questions, which indicate attitudes to GMOs and intention to use either GMOs or organic methods. The next section compares these results from the 2002 farmer survey with a similar survey in 2000. This comparison is useful for assessing any changes in farmer attitudes or intentions. These three sections form a coherent whole which gives a detailed account of respondent characteristics and attitudes as a whole. Readers interested in this more general picture will find these sections most relevant. Readers more interested in variations within the sample will find the subsequent sections relevant. These sections analyse the survey results in terms of subgroups of farmers, and we find that the different intentions relating to the use of technology proves to be useful in showing how there are marked differences between groups of farmers.

3.2 Farmer Profile

This section will provide a snapshot profile of New Zealand farmers who responded to this survey including information on six characteristics: gender, age, level of education, predominant farming activity, income, and farm size.

Table 2 shows the demographic profile of the farmers who responded to this survey. In overview it can be observed that 83 per cent of respondents were males. The majority of farmers, 58 per cent, were between the ages of 41 and 60 years of age. Thirty-nine per cent of farmers indicated that they held a post-secondary qualification. Fifty-two per cent of farmers indicated that their predominant farming activity was pastoral, a category comprised of fattening, grazing, high-country and stud operations. Ninety-one per cent of respondents indicated that they were either the owner or joint owner of the farm. In summary then, the typical respondent was a mature man, the owner of the farm, and operating a pastoral farm.

Table 3 reports the results of three questions about the farmers' income: personal income from the farm, personal income from other sources and the annual gross income of the farm. The first results in the table are for farmers reporting their personal income from the farm. The majority of farmers (60 per cent) reported earning less than \$40,001 annually from their farms. Twenty-six percent of farmers indicated that they earned between \$1 and \$20,000 from their farm and a further 27 per cent reported earning between \$20,001 and \$40,000 from their farms. Seven per cent of these farmers indicated that they had no personal income from their farm or that their income from the farm was negative. Meanwhile two per cent of farmers reported earning more than \$200,000 from their farm in the previous 12-month period. It should be noted 214 farmers (27 per cent) did not answer the question about their personal income from their farm

Table 2
Demographic Information

	n	%
Sex		
Male	644	83
Female	137	18
Total	781	100*
Age		
≤ 20	6	1
21-30	19	3
31-40	110	14
41-50	207	27
51-60	251	31
61-70	122	16
>70	52	7
Total	767	100
Highest Level of Education		
Primary	24	3
High school without qualifications	185	24
School Certificate	120	15
Sixth form certificate	102	13
High School Certificate / Bursary	42	5
Diploma	176	22
Bachelors degree	82	10
Postgraduate qualification	55	7
Total	786	100
Predominant Farming activity		
Dairy – factory	187	24
Dairy - town supply	8	1
Pastoral – fattening	229	30
Pastoral – grazing	143	19
Pastoral - high country	18	2
Pastoral – stud	7	1
Specialist livestock	38	5
Forestry	7	1
Arable	17	2
Horticulture	91	12
Other	20	3
Total	765	100
Position in relation to the farm		
Owner	387	49
Joint Owner	330	42
Share Farmer	11	1
Paid Manager	14	2
Paid Farm Worker	2	0
Member of a farming family	25	3
Unpaid Spouse	6	1
Other	11	1
Total	786	100

* Sums may not equal 100 due to rounding. This applies to all tables in this report.

Table 3
Income (\$)

Personal income (\$) from farm	n	%
0 or negative	44	7
1 to 20,000	155	26
20,001 to 40,000	157	27
40,001 to 60,000	106	18
60,001 to 80,000	40	7
80,000 to 100,000	32	5
100,001 to 120,000	16	3
120,001 to 140,000	3	1
140,001 to 160,000	14	2
160,001 to 180,000	1	0
180,001 to 200,000	11	2
200,000 plus	12	2
Total	591	100
Personal income (\$) from other sources	n	%
0	65	16
1 to 20,000	176	42
20,001 to 40,000	64	15
40,001 to 60,000	47	11
60,001 to 80,000	19	5
80,000 to 100,000	22	5
100,001 to 120,000	6	1
120,001 to 140,000	2	1
140,001 to 160,000	5	1
180,001 to 200,000	3	1
200,000 plus	8	2
Total	417	100
Annual gross income (\$) from the farm	n	%
0	14	2
1 to 50,000	111	18
50,001 to 100,000	59	10
100,001 to 150,000	61	10
150,001 to 200,000	51	8
200,001 to 250,000	49	8
250,001 to 300,000	38	6
300,001 to 350,000	27	4
350,001 to 400,000	34	6
400,001 to 450,000	13	2
450,001 to 500,000	26	4
500,001 to 550,000	9	2
550,001 to 600,000	15	3
600,001 to 650,000	4	1
650,001 to 700,000	10	2
700,001 to 750,000	15	3
750,001 to 800,000	10	2
800,001 to 850,000	3	1
850,001 to 900,000	8	1
950,001 to 1,000,000	15	3
1,000,000 plus	40	7
Total	612	100

The table then reports data for personal incomes from other sources. Sixteen per cent of farmers reported no income from other sources and a further 42 per cent reported a modest income from other sources of less than \$20,000. Fifteen per cent of farmers reported incomes between \$20,001 and \$40,000 and an additional 11 per cent reported earning between \$40,001 and \$60,000 from other sources. Collectively then, 26 per cent of farmers earn between \$20,000 and \$60,000 annually from other sources. A small proportion (two per cent) of farmers reported earning in excess of \$200,000 from other sources in the previous 12-month period. Three hundred and eighty-eight farmers did not respond to this question.

The table finally presents the results for the annual gross income. Two per cent of farmers reported no annual gross incomes from their farms. Eighteen per cent of farmers reported annual gross incomes of between \$1 and \$50,000. An additional 20 per cent of farmers indicated that they earned between \$50,001 and \$150,000. The reported gross incomes ranged up to 10 million dollars with seven per cent of farmers indicating that the annual gross income of their farm was more than a million dollars.

Table 4 reports the mean farm sizes for each of the farm types and the range of sizes listed by farmers indicating that farm type. Farmers were asked to indicate their farm size and predominant farming activity. The size range for each of the farm types has also been included to give an idea of the breadth of the sample, showing that it included large-scale farms and small-scale farms (down to one hectare). It should be noted that the pastoral farmers (excluding the stud farmers) have huge ranges in their reported farm size resulting in very large standard deviations for the sizes of those farms. On average, high country farmers report the largest farms with a mean size of nearly 3,000 hectares. The smallest average farm size was reported by horticulturalists who reported a mean farm size of roughly 24 hectares.

Table 4
Predominant Farming Activity by Farm Size (hectares)

	n	Mean Farm Size	Standard Deviation	Size Range
Dairy - factory	187	195.80	308.33	3 – 3,500
Dairy - town supply	8	65.43	87.71	1 – 250
Pastoral - fattening	229	519.07	1,741.58	2 – 23,000
Pastoral - grazing	143	741.24	3,933.51	2 – 45,000
Pastoral - high country	18	2,931.89	2,948.13	160 – 10,000
Pastoral - stud	7	267.57	295.35	30 – 720
Specialist livestock	38	268.76	392.26	8 – 2,000
Forestry	7	370.29	769.12	15 – 2,100
Arable	17	246.12	179.25	11 – 654
Horticulture	91	23.96	48.37	1 – 295
Other	20	109.16	181.08	1 – 680
Total	765	434.63	1998.86	1 – 45,000

In summary then we can say that the typical farmer in New Zealand who has responded to this survey is a male, over 40 years of age, who owns his farm. He farms pastorally on approximately 434 hectares of land and earns less than \$40,000 in personal annual income from his farm.

3.3 Results from the General Attitudinal Questions

Results from several general questions have been selected to illustrate the attitudes of farmers as a whole to issues surrounding the GMO debate.

Farmers were asked to indicate their agreement or disagreement with two statements concerning New Zealand's GMO use and one statement about New Zealand's environment using a seven-point scale from very strongly disagree to very strongly agree. Their responses are presented in Table 5. The table shows responses for each of the seven point scales and also for the sum of the disagree and the agree scales. For all three statements there is a consistent 14 to 15 per cent of farmers who were neutral, that is, unwilling or unable to commit to a definite position. Later results show that this is a low proportion – on other perhaps more contentious issues, the neutral position can be up to 24 per cent. First, farmers were asked to respond to the statement: “New Zealand should try and achieve GE free status.” In general terms, 46 per cent of farmers disagreed, 38 percent agreed and 15 per cent indicated they neither agreed nor disagreed with the statement. More specifically, 29 per cent of farmers indicated that they disagreed nearly doubling the number of farmers who agreed at 16 per cent. The proportion of farmers selecting the more extreme ends of the scale are similar with 17 per cent strongly or very strongly disagreeing and 22 per cent strongly or very strongly agreeing. Overall then, farmers tend not to support GE free status, but opinion is divided with a significant group in strong support.

In the second item farmers were asked to indicate their level of agreement or disagreement with the statement: “The GMO moratorium should be extended beyond October 2003.” Collectively 50 per cent of farmers agreed that the GMO moratorium should be extended beyond October 2003, while 36 per cent felt that the moratorium should not be extended and 14 percent neither agreed nor disagreed with the statement. The responses to this statement show a clear increase in the numbers of farmers selecting the very strongly agree category with no comparable increase in the very strongly disagree category.

Table 5
Farmers' Attitudes towards GMO and New Zealand's Environment (%)

	Very strongly disagree	Strongly disagree	Disagree	Neither	Agree	Strongly Agree	Very Strongly Agree	Total
New Zealand should try and achieve GE free status (n=786)	10	7	29	15	16	7	15	100
	46				38			
The GMO Moratorium should be extended beyond October 2003 (n=784)	9	7	20	14	23	9	18	100
	36				50			
New Zealand's environment is 'clean and green' (n=783)	2	3	19	14	43	13	6	100
	24				62			

Comparison of results from the first two statements suggest that while 46 per cent of farmers disagreed with the statement that New Zealand should try to achieve GE free status only 36 percent of the respondents indicated that the moratorium should not extend beyond October 2003. This difference perhaps indicates a degree of caution about the use of GMO by some farmers who have not outright rejected the use of the technology.

Finally, farmers were asked to indicate their level of agreement and disagreement with the statement: “New Zealand’s environment is ‘clean and green.’” Collectively 62 per cent of farmers indicated that they agreed with the statement about New Zealand’s environment while 24 per cent disagreed.

Respondents were asked about their intention to use GMOs on their farms within the next ten years and the results are presented in Table 6. Forty-three per cent of farmers indicated no intention to use or not use GMOs on their farms. Cumulatively, 35 per cent of farmers indicated some degree of intention not to use GMOs in the future, with 15 per cent of farmers indicating a very strong intention not to use GMO. Twenty-two per cent of farmers indicated that they had some intention to use GMOs on their farm in the future, but only two per cent indicated a very strong intention to use GMOs. Overall, nearly one half of farmers indicated no GMO intention, and of those who have an intention about one third intend not to use GMOs and one fifth intend to use GMOs. Importantly there is a core of 15 per cent of farmers who have a very strong intention not to use GMOs whereas only two per cent with a very strong intention to use GMOs. Putting it another way, most of the farmers intending to use GMOs state only a modest level of intention while most of those farmers not intending to use GMOs state a very strong intention.

Table 6
Intention to use GMOs

Intention to use GMOs within the next ten years	n	%
Very strong intention to use GMOs	17	2
Strong intention to use GMOs	24	3
Intention to use GMOs	135	17
No intention to use or not use GMOs	341	43
Intention not to use GMOs	104	13
Strong intention not to use GMOs	59	7
Very strong intention not to use GMOs	116	15
Total	796	100

Table 7 indicates the responses of farmers to a question about their intentions to use organic methods on their farms within the next ten years. Forty-eight per cent of farmers indicated no intention to use or not use organic methods on their farms within the next ten years. Cumulatively, 29 per cent of farmers indicated some degree of intention not to use organic methods in the future, while four per cent indicated a very strong intention not to use organic methods on their farms. Twenty three per cent of farmers indicated that they had some intention to use organic methods on their farms, with five per cent having a very strong intention to do so. The proportion of farmers indicating either a strong or very strong intention to use or not to use organic methods is nearly equivalent at eight and nine per cent respectively. Overall then, this table shows a normal distribution of responses indicating that farmers are less polarized on this issue compared to intention to use GMOs. Nearly one half

of farmers have no intention to use organic methods, about one quarter do, and about one quarter do not.

Table 7
Intention to use Organic Methods

Intention to use organic methods within the next ten years	n	%	
Very strong intention to use organic methods	39	5	23
Strong intention to use organic methods	23	3	
Intention to use organic methods	123	15	
No intention to use or not use organic methods	383	48	48
Intention not to use organic methods	158	20	29
Strong intention not to use organic methods	40	5	
Very strong intention not to use organic methods	32	4	
Total	798	100	

Table 8 presents the attitudes of farmers towards four general types of GMO products. The table shows percentage scores for each scale and also accumulates responses to show the sum for opposition and for support. The first item indicates the responses of farmers to a question about their support or opposition for the “on-farm use of GMOs for human food production.” Collectively, 45 percent of farmers oppose the idea of on-farm use of GMOs for human food production with the proportion evenly split between those opposed and totally opposed. Meanwhile 32 per cent of farmers indicated support for the idea with five per cent of those farmers indicating that they were totally supportive of the idea. Twenty-three per cent of farmers indicated that they were neither supportive nor opposed to the idea of on-farm use of GMOs for human food production. Generally, farmers oppose this type of GMO.

Table 8
Farmers’ Attitudes Towards Differing Types of GMO (%)

	Totally opposed	Opposed	Neither	Supportive	Totally supportive	Total	Overall Attitude
On-farm use of GMOs for human food production (n=796)	22	23	23	27	5	100	- ve
	45			32			
The development of GMO products in the laboratory for medical applications (n=797)	5	3	11	45	36	100	+ ve
	8			81			
On-farm use of GMOs for animal feed production (n=794)	20	24	22	28	6	100	- ve
	44			34			
The harvesting of GMO products on the farm for medical applications (n=796)	11	12	13	40	24	100	+ ve
	23			64			

The second item in the table indicates the responses of farmers to a question about their support or opposition for “the development of GMO products in the laboratory for medical applications.” Collectively 81 per cent of farmers indicated some degree of support for the idea with 45 per cent of farmers indicating they were supportive and 36 per cent totally supportive of the idea of developing GMO medical products in the laboratory for medical use. Eight per cent of farmers indicated some degree of opposition for the idea and 11 per cent of farmers indicated that they neither supported nor opposed the idea of development of GMO products in the laboratory for medical applications. Generally, farmers strongly support this type of GMO.

The third item in the table presents the response of farmers to a question about their support or opposition for “the on-farm use of GMOs for animal feed production.” Forty-four per cent of farmers indicated that they were either opposed or totally opposed to the idea with 20 per cent of those farmers indicated that they were totally opposed to the idea. Thirty-four per cent of farmers indicated some degree of support for the idea with 6 per cent of those farmers indicating that they were totally supportive of the idea. Nearly a quarter of the farmers surveyed indicated that they were neither supportive nor opposed to the idea of the use of on-farm use of GMOs for animal feed production. Generally, farmers oppose this type of GMO.

The fourth item in the table reports the responses of farmers to the harvesting of GMO products on the farm for medical applications. Forty per cent of farmers indicated that they were supportive of the idea of harvesting GMO products on the farm for medical applications, combined with those farmers that are totally supportive results in 64 per cent of farmers indicating some level of support for the idea. Collectively 23 per cent of farmers were opposed to the idea with those farmers equally split between opposition and total opposition. Thirteen per cent of farmers indicated that they were neither supportive nor opposed to the idea of harvesting GMO products on the farm for medical applications. Generally, farmers support this type of GMO.

Comparison of items from Table 8 suggests that farmers demonstrate a consistent degree of support for the use of laboratory or on-farm GMO products for medical applications and opposition to on-farm use of GMOs for either human or animal food. The proportion of farmers supporting GMO medical developments drops from 81 to 64 per cent when the process is shifted from the laboratory to the farm.

Analysis of these results also suggests that farmers as a whole are more receptive to the idea of GMO development for medical applications either in the laboratory or on the farm than for any type of food production. The support for the development of GMO products drops from a high of 81 per cent for laboratory-based medical development to a low of 32 per cent for the on-farm use of GMOs for human food production.

Table 9 reports the attitudes of farmers towards several scenarios resulting from GMO use. The farmers were asked to indicate their level of agreement or disagreement on a seven-point scale from very strongly disagree to very strongly agree. This table shows a large proportion of farmers in the neutral category, ranging from 16 to 28 per cent. Clearly, many farmers are undecided on these issues and presumably lack information with which to make a decision. The table also shows for five out of the six questions, relatively high proportions at the extreme ends of the scale. This again reflects the polarized views of farmers about GMOs.

The first question asked farmers to indicate their agreement or disagreement with the following statement: “Farm GMO products are environmentally friendly.” Nearly one-third

or 28 per cent of farmers responded that they neither agreed nor disagreed with the statement that farm GMO products are environmentally friendly. Twenty per cent of farmers very strongly agreed with the statement about the environmental friendliness of GMO products, and cumulatively 38 per cent of farmers expressed some degree of agreement with the statement. Twelve per cent of farmers indicated they very strongly disagreed with the statement that farm GMO products are environmentally friendly and collectively 34 per cent of farmers disagreed with the statement to some degree. Generally, farmers are split three ways on these issues about one third are neutral, one third agree and one third disagree.

The second question asked farmers for their opinion on the following statement: “the spread of farm GMOs can be controlled.” Collectively 51 per cent of farmers disagreed to some degree that the spread of farm GMOs can be controlled, with 17 per cent of those farmers indicating very strong disagreement. Thirty-three per cent of farmers felt that the spread of farm GMOs could be controlled, with 15 percent of those farmers indicating that they very strongly agreed. Sixteen per cent of farmers surveyed indicated that they neither agreed nor disagreed with the statement.

**Table 9
Farmers’ Beliefs About GMOs (%)**

	Very strongly disagree	Strongly disagree	Disagree	Neither	Agree	Strongly Agree	Very Strongly Agree	Total	Overall Belief
Farm GMO products are environmentally friendly (n=795)	12	6	16	28	16	2	20	100	0
	34				38				
The spread of farm GMOs can be controlled (n=796)	17	9	25	16	16	2	15	100	-ve
	51				33				
Farm GMO technology will solve the world’s food problems (n=798)	14	7	22	21	17	6	13	100	-ve
	43				36				
Other GMOs will cure the World’s major diseases (n=795)	7	5	16	27	20	5	20	100	+ve
	28				45				
Farm GMOs will improve the quality of life for animals (n=798)	11	7	19	26	17	4	16	100	0
	37				37				
GMOs can be used in NZ without adversely affecting organic farming (n=796)	16	6	19	24	26	4	4	100	-ve
	41				34				

The third question asked farmers for their opinion on the following statement: “farm GMO technology will solve the world’s food problems.” Twenty-two per cent of farmers indicated that they disagreed with the statement while a further seven per cent strongly disagreed and 14 per cent very strongly disagreed with the idea that farm GMO technology will solve the

world's food problems. Cumulatively forty-three per cent of farmers indicated some level of disagreement with the statement. Seventeen per cent of farmers indicated that they agreed with the statement while a further 6 per cent strongly agreed and 13 per cent very strongly agreed with the idea that GMO technology will solve the world's food problems. Twenty-one per cent of farmers indicated that they neither agreed nor disagreed with the statement.

The fourth question asked farmers about their level of agreement or disagreement with the statement "other GMOs will cure the world's major diseases." Twenty per cent of farmers surveyed indicated that they very strongly agreed that GMOs will cure the world's major diseases cumulatively 45 per cent of farmers agree with that statement. Sixteen per cent of farmers indicated that they disagreed that GMOs will cure the World's major diseases and cumulatively 28 per cent of farmers disagreed to some degree with the idea. Twenty-seven per cent of farmers indicated that they neither agreed nor disagreed with the statement.

The fifth question asked farmers about their attitude towards the statement: "farm GMOs will improve the quality of lives for animals." Twenty-six per cent of respondents indicated that they neither agreed nor disagreed with the statement about GMOs improving the quality of life for animals. The proportion of farmers agreeing and disagreeing with this statement is equal at 37 per cent with near equivalent intensities at each increment of the scale.

The final question asked farmers about their level of agreement or disagreement with the statement "GMOs can be used in New Zealand without adversely affecting organic farming." A total of 34 per cent of farmers indicated agreement with the statement. Collectively 41 per cent of farmers disagreed with the statement with 16 per cent very strongly disagreeing that that GMOs can be used in New Zealand without adversely affecting organic farming. Twenty-four per cent of farmers indicated that they neither agreed nor disagreed with this statement.

The results to these statements about GMO use show variable responses with some statements receiving support and others not. As noted earlier, farmers are ambivalent about GMO products being environmentally friendly, and they are ambivalent about farm GMOs improving quality of life for farm animals. However, in overview, farmers disagree with the idea that the spread of farm GMOs can be controlled, that they will solve world food problems, and that they can be used in New Zealand without adversely affecting organic farming. They agreed that other GMOs will cure the world's major diseases.

3.4 Comparison of Data from 2000 and 2002 Surveys

Several questions from the 2000 survey were repeated in the 2002 survey to allow for the measurement of attitudinal shifts over time. The same wording was used each time.

In 2000 and 2002 farmers indicated their level of agreement or disagreement with the statement "New Zealand should try to achieve GE free status." Table 10 shows some shifts in the attitudes of farmers to the idea of keeping New Zealand GE free and a difference of means test indicates that the change in the mean score is statistically significant. In 2000, 50 per cent of farmers indicated disagreement with GE free status in New Zealand while in 2002 that proportion decreased slightly to 46 per cent. Perhaps more importantly there is a notable decrease in the intensity of those who disagreed with the statement. There was a change from 18 per cent to ten per cent who very strongly disagreed and an increase from 21 to 29 per cent who disagreed. There is an increase in agreement with the idea that New Zealand should try

and achieve GE free status, with 32 per cent of farmers indicated support for the statement in 2000 and 38 per cent indicating support in 2002, with an increase in the intensity of agreement (from seven to 15 per cent who very strongly agreed). Finally, the proportion of respondents who indicated that they neither agreed nor disagreed with the statement decreased from 19 to 15 per cent between 2000 and 2002, a decrease that indicates that farmers in 2002 have more definite ideas about the prospect of a GE free New Zealand.

Table 10
Level of Agreement with GE Free New Zealand, 2000 and 2002

	2000 %	2002 %
Very strongly disagree	18	10
Strongly disagree	11	7
Disagree	21	29
	} 50	} 46
Neither	19	15
Agree	20	16
Strongly agree	5	7
Very strongly agree	7	15
	} 32	} 38
Total	100	100
n	644	786
Mean	0.49	-0.0025
Std Dev.	1.81	1.81

Notes: 1. Range = -3 to 3
2. $p < 0.001$, $t = 5.14$, significant.

In 2000, farmers were asked about their intentions to use gene technology on their farms in the next ten years, this question was replicated in the 2002 survey with a slight wording change. In 2002 farmers were asked about their intentions to use GMO, not gene technology. This change was made for the following reason. The 2000 survey had not included any definitions about what was meant by gene technology and in 2002 a definition was included on the front cover of the survey. In 2002 the definition read as follows and was intended to be inclusive of the concepts of gene technology.

Genetically modified organism' (GMOs), defined by ERMA, include any plant, animal or micro-organism developed through genetic modification. A GMO is any organism in which the genes have been modified by using in vitro (recombinant DNA) techniques, i.e., created in the lab. In this questionnaire, we are referring to GMOs, and offspring or products derived from them, for on-farm use. They do not include the use of genetic information to aid in breeding programmes.

The statements from 2000 and 2002 are compared here on the understanding that the same concept was intended to be measured with the terms 'gene technology' and 'GMOs'.

Table 11 shows the proportions of farmers intending to use GMOs. The comparison of data from 2000 and 2002 indicates a ten per cent decrease in the proportion of farmers, from 45 percent in 2000 to 35 per cent in 2002, reporting an overall intention not to use GMOs with the largest decrease of five per cent in farmers who had very strong intention not to use

GMOs. The proportion of farmers who in general indicated an intention to use GMOs was consistent at 22 per cent in 2000 and 2002. However closer inspection of these proportions shows that there is a notable decrease in 2002 in the proportion of farmers with very strong intentions to use GMOs, dropping from 16 per cent in 2000 to two per cent in 2002. There was a comparable increase in the proportion of farmers who indicated that they had an intention to use GMOs, increasing from two per cent in 2000 to 17 per cent in 2002. These results perhaps indicate that while many farmers still do not intend to use GMO themselves some are becoming less adamantly opposed to its use. The proportion of farmers who indicated no intention to use or not use GMO increased from 35 per cent in 2000 to 43 per cent in 2002. These findings are statistically significant and suggest that farmers have become less negative and more neutral about their intentions to use GMOs. Part of this shift might be accounted for by the change in wording from the 2000 wording which included all gene technology compared to the more specific demarcation of GMOs in 2002.

Table 11
Intention to use GMOs, 2000 and 2002

	2000 %	2002 %
Very strong intention not to use	20	15
Strong intention not to use	9	7
Intention not to use	16	13
	} 45	} 35
No intention to use or not use	35	43
Intention to use	2	17
Strong intention to use	4	3
Very strong intention to use	16	2
	} 22	} 22
Total	100	100
n	649	796
Mean	-0.64	-0.13
Std Dev.	1.53	1.84

Notes: 1. Range = -3 to 3
2. $p < 0.001$, $t = -5.43$, significant.

In 2000 and 2002 farmers were asked to indicate their intention to either use or not use organic methods on their farms in the next ten years. A difference of means t-test was not statistically significant, however, the chi-square is significant at 280 showing that the differences between the individual intention categories are significant. Comparison of these data shows a shift towards the intention not to use organic methods with the proportion of farms indicating a negative intention increasing from 19 per cent in 2000 to 29 per cent in 2002. Most of this increase is in the intention not to use category, that is, not strong intention.

Table 12
Intention to use Organic Methods, 2000 and 2002 (%)

	2000	2002
Very strong intention not to use	4	4
Strong intention not to use	2	5
Intention not to use	13	20
	} 19	} 29
No intention to use or not use	44	48
Intention to use	7	15
Strong intention to use	7	3
Very strong intention to use	24	5
	} 38	} 23
Total	100	100
n	650	798
Mean	0.29	0.15
Std Dev.	1.25	1.51

- Notes: 1. Range = -3 to 3.
2. Mean $p > 0.05$, $t = 1.89$, NS.
3. Chi-square = 280, significant.

There is comparable drop in the proportion of farmers who indicated a very strong intention to use organic methods, from 38 per cent in 2000 to 23 per cent in 2002 and most of this decrease is in the very strong intention category going from 24 per cent in 2000 to five per cent in 2002. The proportion of farmers who indicated that they had no intention to either use or not use organic methods increased slightly between 2000 and 2002 from 44 to 48 per cent of farmers. Overall, there appears to be less intention to use organic methods. Part of this shift might be accounted for by the 2002 questionnaire using a clear definition of organic farming. This may have excluded farmers who might claim that all or any farming techniques (including their own) were ‘organic’.

3.5 Summary of Results for the Whole Sample

In overview, then we can say a number of general things about farmers in New Zealand. Nearly one half of New Zealand farmers disagree with the idea that New Zealand should try to achieve GE free status. Half of the farmers believe the GMO moratorium should be extended beyond October 2003 and 62 per cent of farmers think that New Zealand’s environment is ‘clean and green.’

Nearly one half of the farmers reported they had no intention to use or not use organic methods and just over 40 per cent of farmers reported no intention to use or not use GMOs. Clearly then over half of the farmers plan to farm conventionally in the next ten years.

Farmers indicated fairly consistent support for the development of GMOs for medical applications but over 40 per cent of farmers oppose the use of GMOs for human or animal food production. Farmers are clearly split into thirds (agree/disagree/neither) on the issues of the environmental friendliness of GMOs and the effect on the quality of life of animals. Half of the farmers surveyed believed that the spread of farm GMOs cannot be controlled and more than 40 per cent of farmers believe that GMOs may cure the world’s major diseases and solve the world’s food problems. Finally, 43 per cent of farms believe that GMOs can be used in New Zealand without adversely affecting organic farming.

Comparisons of farmers' responses from 2000 and 2002 indicate that farmers' attitudes towards keeping New Zealand GE free changed between 2000 and 2002 so that, while still a majority viewpoint, fewer now disagree (down from 50 to 46 per cent) and more agree (up from 32 to 38 per cent). There was a change in farmers' intentions to use GMOs with fewer farmers (down from 45 to 35 per cent) now indicating an intention not to use GMOs while the proportion intending to use GMOs remains constant at 22 per cent. The majority (up from 35 to 43 per cent) now have no committed intention to use or not use GMOs. There are now more farmers with an intention not to use organic methods (up from 19 to 29 per cent) and fewer farmers' indicating an intention to use organic methods (down from 38 to 23 per cent).

3.6 Farming Intention Groups

In this section the survey findings have been broken down by farmer type. The three main groups identified were: GMO Intenders, Organic Intenders and Conventional Intenders. The first part of this section explains how the intention groups were derived. The section focuses on some demographic characteristics (age, gender, education) and farming characteristics (type of farm, financial intensity, income) of each intention group.

The allocation of respondents to intention groups was based on the responses of the farmer to two questions. The first was: "which one of the following best represents your intention to either use or not use GMOs on your farm within the next ten years". The second was: "which one of the following best represents your intention to use or not organic methods". Both questions offered respondents seven options, three intention to use, one neither and three no intention to use statements. We reduced the responses into two basic positions for each question: either pro or else a combination of undecided or against the position. This gives a total of four basic positions. The position occupied by those who were both GMO and organic intenders comprised just four per cent of the sample and will not be discussed in great detail. The other three intention groups comprised 762 farmers and account for 95 per cent of the total sample. These groups were: GMO Intenders (18 per cent), Organic Intenders (19 cent) and Conventional Intenders (58 per cent). Table 13 illustrates the simplified cross-tabulation of the farmers' responses, using these two basic positions.

The largest group was the 'Conventional Intenders' group that included farmers who intend to continue farming in a conventional way. This group is made up of respondents who were (1) undecided or anti organic, or (2) undecided or anti GMO. The smallest group was those for whom GMOs and Organic methods are not exclusive and who intend to use both 'on their farm within the next ten years'. The two remaining groups were those who were positive for one of the two methods and negative or undecided for the other. Putting aside the issue of compatibility, it is important in this analysis of intentions to focus on the three main groups. Note that the 18 per cent GMO intenders is less than the 22 per cent reported in Table 11 because here the responses to two questions are considered together. Similarly, the 19 per cent Organic Intenders is less than the 23 per cent reported in Table 12.

Table 13
Derivation of Farming Intention Groupings

	Pro Organic intention	Undecided or anti organic intention
Pro GMO Intention	30 (4 %) Both GMO and Organic Intenders	144 (18 %) GMO Intenders
Undecided or anti GMO intention	154 (19 %) Organic Intenders	464 (58 %) Conventional Intenders (by principle or by default)

To better understand the type of farmer in each of the three intention groups it is necessary to explore possible differences in demographic information and farm characteristics. Table 14 shows the average ages of the respondents. Overall, the average age of farmer was nearly 52 years of age. Results of a t-test between the farmer types suggest that there is a significant age difference between the each of the three groups, as indicated by the reference to the pairs of column numbers for which a significant score was found. The Organic Intenders were slightly younger (mean age 50) than the other intention groups and the GMO intenders were the oldest (mean age 54).

Table 14
Farmer Age by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All groups	T-tests (p<0.05)
Age	Mean	54.34	49.52	51.61	51.86	1&2, 2&3 1&3
	sd	11.81	11.24	12.23	12.00	
	n =	140	143	441	767	

Table 15 shows the proportions of men and woman by farmer type. A chi-squared test shows a high degree of statistical significance for this comparison. The highest proportion of male respondents was from the GMO Intenders group (92 per cent) while the proportion of female respondents for the other intention groups was roughly 20 per cent.

Table 15
Gender by Farmer Intention Group

	GMO Intenders		Organic Intenders		Conventional Intenders		Total		Chi Square test
	No.	%	No.	%	No.	%	No.	%	
Male	132	92	119	77	354	77	605	80	17.7, df 4 p<0.001
Female	9	6	29	19	96	21	134	18	
No Response	3	2	6	4	11	2	20	3	
Total	144	100	154	100	461	100	759	100	

Respondents were also asked to indicate their highest level of education. Table 16 shows that the majority of GMO Intending and Conventional Intending and nearly half of Organic Intending farmers had high school qualifications rather than tertiary related qualification. When the education categories were collapsed to those with secondary (1) or post-secondary (2) education, statistically significant differences in highest educational level were found. The most highly educated group, that is, those with highest proportion of post-secondary training was the Organic Intenders of whom 25 per cent had Diplomas or Trade certificates, 14 per cent had Bachelors degrees and 14 per cent had Postgraduate qualifications for a total of 53 per cent of Organic Intention farmers with post-secondary training. The GMO intending farmers had the highest proportion of farmers indicating their highest level of schooling was secondary school at 66 per cent while 47 per cent of Organic Intenders and 62 per cent of Conventional Intenders had secondary school educations.

Table 16
Educational Levels by Intention Group

	GMO Intenders		Organic Intenders		Conventional Intenders		Total		Chi Square test
	No.	%	No.	%	No.	%	No.	%	
Primary School	3	2	9	6	10	2	22	3	Between school qualification and the remainder: 10.4, df 2 p<0.01
High School	37	26	27	17	107	23	171	22	
School Cert	27	19	13	8	76	16	116	15	
UE or 6 th form	22	15	16	10	60	13	98	13	
HSC, bursary, scholarship	6	4	4	3	29	6	39	5	
Subtotal (1)	95	66	69	47	282	62	446	60	
Diploma or trade cert.	29	20	37	24	105	23	171	22	
Bachelors degree	12	8	21	14	42	9	75	10	
Postgraduate qualifications	7	5	21	14	25	5	53	7	
Subtotal (2)	48	33	79	53	172	38	299	40	
No response	1	1	6	4	10	2	17	2	
Total	144	100	154	100	464	100	762	100	

Overall these findings suggest that Organic Intending farmers have the highest level of education followed by the Conventional Intenders and the GMO Intenders have the lowest level of formal education. Putting it another way, the Organic Intenders, who have been shown to be the most highly educated of the farmer types, are also the younger farmers who on average earn significantly less annually from their farms than farmers in the other intention groups.

Table 17 illustrates farmer intention type (GMO Intenders, Organic Intenders, Conventional Intenders) by farm type. The statistically significant chi-square shows the GMO Intenders group is dominated by dairy farmers (40%) and pastoral farmers (38%). Half of the Organic Intenders group are pastoral Farmers (50%) while an additional 22 per cent are horticulturalists. Over half of the Conventional Intenders are pastoral farmers (58%) and dairy farmers comprise a further 23 percent of the group. In sum, each of the farming intention groups is composed of a mixture of farms with dairy and pastoral farmers comprising between 65 per and 81 per cent of the farmers in each intention group.

Table 17
Farm Type by Intention Group

	GMO Intenders		Organic Intenders		Conventional Intenders		Total		Chi Square test
	No.	%	No.	%	No.	%	No.	%	
Dairy	55	40	22	15	102	23	179	25	43.9, df 8, P<0.001
Pastoral	53	38	74	50	255	58	382	53	
Specialist Livestock	6	4	10	7	20	5	36	5	
Horticulture	14	10	32	22	40	9	86	12	
Other	10	7	9	6	24	5	62	6	
Total	138	100	147	100	441	100	726	100	

Farmers were asked to rate the financial intensity of their farming operation compared to other farms of the same type. Table 18 reports a significant chi-square test indicating a difference between the three intention groups. It can be observed that GMO Intending farmers reported the largest proportion of high financial intensity (19%). The majority of GMO Intenders and Conventional Intenders indicated that their farms financial intensity was above average (51 per cent and 46 per cent respectively). Organic Intention farmers were quite evenly split between the average (38%) and above average (36%) categories.

Table 18
Self-reported Financial Intensity of Farm Operation

	GMO Intenders		Organic Intenders		Conventional Intenders		All Intention Groups		Chi Square test
	No.	%	No.	%	No.	%	No.	%	
High	26	19	12	9	53	12	91	12	37.3*, df 8 P<0.001
Above Average	72	51	51	36	202	46	325	45	
Average	38	27	54	38	158	36	250	34	
Below Average	4	3	14	10	22	5	40	6	
Low	0	0	11	8	9	2	20	3	
Total	140	100	142	100	444	100	726	100	

*Two cells have expected counts less than five. The minimum expected count is 3.86

Table 19 reports the incomes that farmers reported to be earning from their farms and from other sources. Information on the annual gross income from the farm is also presented and all results are broken down by intention group. The data show that for mean personal incomes, the GMO Intention farmers earn the most from their farms with a mean income of \$62,704 and this income is significantly different from the level for Organic Intention farmers and Conventional Intention farmers. The data from four individuals (two GMO and two Conventional Intenders) reporting personal incomes greater than \$800,000 were removed from the sample because they were skewing the data and their inclusion distorts the overall mean of the two groups. Prior to their removal the GMO Intender's mean income was \$76,776 with a standard deviation of \$123,408 and the mean income of Conventional Intenders was \$54,244 with a standard deviation of \$174,147 and the t-test between the two groups was not significant.

Farmers reported their personal incomes from other sources. The means for these data show that GMO and Organic Intention farmers report earning very similar mean incomes from other sources \$39,279 and \$39,130 respectively. While the two groups are not statistically distinct from one another they are statistically distinct from the Conventional Intention farms reporting mean incomes from other sources of \$27,190. Once again two individuals (both were Organic Intenders) reporting personal incomes from other sources of \$1 million or more were removed from the sample because they were skewing the data. Prior to the removal of these two individuals from the data the mean income for the Organic Intenders was \$66,826 with a standard deviation of \$174,094. The results of the t-tests for significance were not changed with the removal of the two outliers. This question could have been improved by allowing respondents to state specifically that they had no other income.

Table 19
Income by Intention Group (\$)

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	Entire Sample	t-test p>0.05
Personal Income from farm	Mean	62,704	34,654	42,708	46,434	1&2 1&3
	St. Dev.	58,613	44,683	43,435	48,413	
	n	117	98	337	587	
	Range	-1050 – 350,000*	- 4000 – 250,000	0 – 300,000*	- 4000 – 350,000	
Personal Income from other sources	Mean	39,279	39,130	27,190	33,198	1&3 2&3
	St. Dev.	53,936	52,034	35,971	46,993	
	n	77	71	244	415	
	Range	0 – 250,000	0 – 350,000**	0 – 250,000	0 – 350,000	
Annual gross income from farm	Mean	640,570	249,985	332,718	386,462	1&2 1&3
	St. Dev.	1,040,217	435,662	457,467	634,406	
	n	128	102	344	612	
	Range	0 – 10,000,000	0 – 3,000,000	0 – 4,000,000	0 – 10,000,000	

*Four individuals reporting personal incomes from the farm of greater than \$800,000 were removed from the sample because they were skewing the data (2 GMO and 2 Conventional Intenders).

** Two individuals reporting personal incomes from other sources of \$1 million or more were removed from the sample because they were skewing the data (both were Organic Intenders).

Table 20 reports the results of a question that asked farmers about the types of production undertaken on their farms. They were asked to indicate if the activities were “not undertaken” (1) or “undertaken” (2) on their farm. When asked about organic production on their farms GMO and Conventional reporting farmers reported that it was not undertaken on their farms (means 1.02 and 1.04 respectively) and the responses of the two intention groups were not statistically distinguishable from each other. Organic Intention farmers reported a higher incidence of organic production than the other groups with a mean score of 1.30 which indicates that a proportion of those farmers indicating that they were Organic Intention do not currently undertake organic production on their farms. Organic Intending farmers’ reports were statistically distinct from the other two intention groups.

The second item in the table reports the responses when asked if they undertook the production of green produce on their farms. Organic Intending farmers reported the highest proportion of farmers who undertake the production of ‘green’ produce with a mean score of 1.68, GMO and Conventional Intention farmers reported means of 1.24 and 1.32 respectively indicating that some of them undertake the production of ‘green’ produce but most do not. The response of GMO and Conventional Intention farmers are not statistically distinct for this question.

The final item in the table reports the responses of farmers who were asked if they undertook “production to meet the requirements of a quality assurance scheme or programme.” GMO Intending farmers reported undertaking production to meet the requirements of a quality assurance programme at the highest rate with a mean score of 1.82. A large proportion of Organic and Conventional Intention farmers also report undertaking this type of production (means 1.55 and 1.69 respectively). The responses of the three intention groups all showed statistical significance and are therefore distinct from each other for this question.

Table 20
Farming Activities by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	Entire Sample	t-test p>0.05
Organic Production	Mean	1.02	1.30	1.04	1.09	1&2 2&3
	St. Dev.	0.15	0.46	0.21	0.29	
	n	136	140	448	762	
The production of ‘green’ produce	Mean	1.24	1.68	1.32	1.38	1&2 2&3
	St. Dev.	0.43	0.47	0.47	0.48	
	n	136	141	441	757	
Production to meet the requirements of a quality assurance scheme	Mean	1.82	1.55	1.69	1.69	1&2 1&3 2&3
	St. Dev.	0.39	0.50	0.46	0.46	
	n	141	142	439	762	

Respondents completed the free text section relating to their definition of organic farming. A content analysis of respondent definitions showed that there were seven main categories used as shown in Table 21. Most consider organic farming to be farming without the use of artificial agricultural products (fertilizer, pesticide or herbicide).

Table 21
Definitions of Organic Farming

Category	n	%
Use of manure, green fertiliser, natural products, organic fertiliser, compost, homeopathic treatments.	16	15
Working with nature, the natural environment.	5	5
No use of chemicals, decrease use of chemicals, not man-made/artificial/modified inputs, no drench or pour-ons, no spray, less nitrogen.	56	52
Low inputs.	4	4
To meet Bio Gro standards.	16	15
Sustainable methods, permaculture, ideal methods	9	8
Not possible	2	2
Total	108	100

Table 22 presents the results relating to the characteristics of each intention type and thus gives a summary for each intention group. From the summary table we can begin to understand the distinctions between the types of farmers in each of the intention groups. The typical GMO Intending farmer would be a 54-year-old man, with a secondary school education. He is typically either a dairy or pastoral farmer and he believes that his farm has an above average financial intensity compared to other farms similar to his. His annual personal income from the farm is \$63,000 (higher than all other types) and he reports an annual gross farm income of \$640,000 (higher than all other types).

Table 22
Profile for Each Intention Group

	GMO Intenders	Organic Intenders	Conventional Intenders
Proportion of Sample	18%	19%	58%
Age	54	49	51
Male	92%	77%	77%
Post Secondary Qualifications	33%	53%	38%
Type of farm	Pastoral 38% Dairy 40%	Pastoral 50% Horticulture 22%	Pastoral 58% Dairy 23%
Farm financial intensity	Top ten 19% Above Average 51%	Top ten 9% Above Average 36%	Top ten 12% Above Average 46%
Income from farm	\$63,000	\$35,000	\$43,000
Gross income	\$640,000	\$250,000	\$332,000
Activity	Not organic	Some organic	Not organic

The typical Organic Intending farmer is a 49-year-old male with a post secondary education. He is a pastoral farmer and believes that his farm is of average financial intensity compared to other farms similar to his. His annual personal income from the farm is \$35,000 and he reports an annual gross farm income of \$250,000. Only some of the members of this group engage in organic farming.

A typical Conventional Intention farmer is 51-year-old male with a secondary school education. He is a pastoral farmer and believes his farm to be of above-average financial intensity compared to other farms of the same type as his. This annual personal income for the farm is \$43,000 and he reports an annual gross income of \$332,000.

3.7 Attitudes and Responses of the Three Intention Groups

This section presents other results by intention type including attitudes and responses, some of which have been covered already in Section 3.3 for the sample as a whole. Table 23 illustrates the attitudes of farmers towards two issues of GMO use in New Zealand and one on the state of New Zealand's environment. The questions used a seven point scale from strongly disagree to strongly agree (-3 to 3). In all cases the means are statistically different. The table illustrates the responses of farmers to the statement "New Zealand should try achieve GE free status." Comparison of the results for each intention group and the entire group shows that the mean for the entire sample was -0.0025 or essentially neutral. Conventional intenders also appear quite neutral on this issue but the GMO Intenders and the Organic Intenders are at odds. As might be expected, GMO Intenders disagreeing with the statement and the Organic Intenders agree with the statement that New Zealand should try and achieve GE free status.

The second item in the table examines the responses of farmers to the statement "the GMO moratorium should be extended beyond October 2003." The mean of the entire sample for this statement is 0.36 or primarily neutral, likewise the Conventional Intenders group was quite neutral at 0.39. The GMO Intenders demonstrate some disagreement with this statement with a mean of -0.92 and the Organic Intenders demonstrate fairly strong agreement with the statement with a mean of 1.58.

Table 23
Attitudes towards New Zealand's use of GMO by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
NZ should try to achieve GE free status	Mean	-1.68	1.53	0.074	-0.0025	1&2,
	sd	1.16	1.59	1.60	1.81	1&3,
	n	142	151	457	786	2&3
The GMO moratorium should be extended beyond Oct 2003	Mean	-0.92	1.58	0.39	0.36	1&2,
	sd	1.81	1.52	1.68	1.84	1&3,
	n	142	151	457	784	2&3
NZ's environment is 'clean and green'	Mean	0.91	0.28	0.56	0.56	1&2,
	sd	1.18	1.47	1.24	1.29	1&3,
	n	143	149	457	783	2&3

Note: score range is from -3 to 3.

The third item in the below table examined farmers attitudes to the statement "New Zealand's environment is 'clean and green.'" The mean for the entire sample is 0.56 indicating a slightly positive average response; Conventional Intenders have the same mean at 0.56. Organic Intenders have the most neutral response to the statement with a mean of 0.28 and the GMO Intenders most strongly agree with the statement with a mean of 0.91.

Overall, these findings suggest that the GMO Intenders and the Organic Intenders have the most polarized responses to the statements and the Conventional intenders group tends to fall

into the middle ground. As might be expected, the GMO Intenders and the Organic Intenders are quite polarized on the issue of GE free status. The Organic Intenders are equally adamant about the moratorium extension, while the GMO Intenders soften on this issue perhaps expressing a degree of caution on the use of GMOs in New Zealand even by some of those farmers who plan to use GMOs themselves. Finally, GMO Intenders most strongly agree with the statement ‘New Zealand is clean and green’ and Organic Intenders express the highest degree of neutrality on this statement.

Table 24 presents the results to four questions that farmers were asked about potential on-farm and in the lab uses for GMOs and the results are broken down by intention group. The farmers were instructed to answer the questions using a five-point scale from totally opposed to totally supportive. The first statement that farmers were asked to rate was: “On-farm use of GMOs for human food production.” The mean for the entire sample was -0.29 indicating a relatively neutral response. Conventional Intention farmers demonstrated slightly higher opposition with a mean of -0.40 . The Organic Intention farmers voiced the strongest opposition to this statement with a mean of -1.19 meanwhile; the GMO Intention farmers had the strongest support for the statement with a mean of 0.90 .

The second statement asked farmers to indicate their support or opposition for: “The development of GMO products in the laboratory for medical applications.” The results for the entire sample suggested that farmers demonstrated a relatively high level of support for the idea with a mean of 1.04 . Closer inspection of the data broken down by intention groups suggests that GMO Intending farmers demonstrated the most adamant support for the idea with a mean of 1.66 , Conventional Intention farmers were also quite supportive of the idea with a mean of 0.97 . Organic Intention farmers demonstrated the lowest degree of support for the idea with a mean of 0.55 . Overall then, each of the three intention groups supported the idea of developing GMO products in the laboratory for medical application.

Table 24
Attitudes Towards GMO use on Farms and in the Lab by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test $p < 0.05$
On-farm use of GMOs for human food production	Mean	0.90	-1.19	-0.40	-0.29	1&2,
	sd	0.77	1.02	1.09	1.22	1&3,
	n	142	154	461	796	2&3
The development of GMO products in the laboratory for medical applications	Mean	1.66	0.55	0.97	1.04	1&2,
	sd	0.57	1.17	0.97	1.01	1&3,
	n	143	152	463	797	2&3
The on-farm use of GMOs for animal feed production	Mean	0.96	-1.11	-0.36	-0.23	1&2,
	sd	0.78	1.10	1.08	1.23	1&3,
	n	142	151	462	794	2&3
The harvesting of GMO products on the farm for medical applications	Mean	1.53	-0.41	0.48	0.53	1&2,
	sd	0.61	1.30	1.19	1.27	1&3,
	n	143	150	464	796	2&3

Range -2 to 2

The third statement that farmers were asked to indicate their support or opposition for was: “The on-farm use of GMOs for animal feed production.” The mean for the entire sample suggests that farmers are relatively neutral on the issue with a mean of -0.23 . Examination of the results broken down by farm intention group suggests that Conventional Intention farmers

demonstrate a slightly more opposition than the entire sample. Organic Intending farmers demonstrated the strongest opposition to the idea (mean -1.11) and GMO Intention farmers demonstrated the strong support for the idea (mean 0.96).

The fourth statement in the table presents farmers attitudes towards: “The harvesting of GMO products on the farm for medical applications.” Farmers as a whole demonstrated slight support for the idea (mean 0.53). Conventional farmers voiced slightly less support for the idea - with a mean of 0.48 - than the entire sample. Organic Intention farmers indicated the only opposition for the idea (mean -0.41) and GMO Intention farmers voiced relatively strong support for the idea with a mean of 1.53.

Overall, the results presented in the table suggest that farmers as a whole, and when divided by intention group, support the idea of developing GMO products in the laboratory for medical applications. Additionally, most farmers, with the exception of Organic Intention farmers, demonstrated guarded support for the idea of harvesting GMO products on the farm for medical applications. In general, farmers (excluding GMO Intenders) oppose the idea of the on-farm use of GMOs for human and animal food production.

Table 25 illustrates the responses of farmers to five statements about the potential affects of GMO use. Farmers were asked to rate the statements using a seven-point scale from very strongly disagree to very strongly agree. The results show statistically significant different means scores for each intention type. The first item in the table asked farmers to indicate their agreement or disagreement with the statement: “Farm GMO products are environmentally friendly.” The results suggest that GMO Intending farmers are in agreement with the statement (mean 1.09) while the Organic Intenders are in disagreement (-0.85) with the statement. Conventional intenders demonstrate neutrality on the issue with a mean score of (0.14).

Table 25
Attitudes towards the Potential Affects of GMO use by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
Farm GMO products are environmentally friendly	Mean	1.09	-0.85	0.14	0.15	1&2,
	sd	1.13	1.99	1.86	1.86	1&3,
	n	143	151	463	795	2&3
The spread of farm GMOs can be controlled	Mean	0.86	-1.28	-0.34	-0.26	1&2,
	sd	1.38	1.90	1.88	1.92	1&3,
	n	143	153	462	796	2&3
Farm GMO technology will solve the World's food problems	Mean	0.94	-1.12	-0.16	-0.11	1&2,
	sd	1.40	1.70	1.83	1.83	1&3,
	n	143	153	462	796	2&3
Other GMOs will cure the World's major diseases	Mean	1.03	-0.34	0.41	0.41	1&2,
	sd	1.33	1.86	1.75	1.74	1&3,
	n	143	152	461	795	2&3
Farm GMOs will improve the quality of life for animals	Mean	1.12	-0.94	0.03	0.07	1&2,
	sd	1.16	1.81	1.80	1.80	1&3,
	n	143	152	463	798	2&3

Range: -3 to 3.

The second item in the table illustrates farmers' attitudes to the statement: "The spread of farm GMOs can be controlled." GMO Intending farmers demonstrated moderate agreement with the statement (mean 0.86) meanwhile Organic (mean -1.28) and Conventional (mean -0.34) Intenders expressed disagreement with the statement.

The third item in the table reports farmers' responses to the statement: "Farm GMO technology will solve the World's food problems." Organic Intending farmers disagree with the statement (mean -1.12) while GMO Intending farmers agree (mean 0.94). Conventional intenders are essentially neutral on the issue (mean -0.16).

The fourth item in the table represents the responses of farmers to the statement: "Other GMOs will cure the World's major diseases." GMO Intending farmers agreed (mean 1.03) with this statement. Organic and Conventional intending farmers were both relatively neutral on the issue with Organic intenders demonstrating a slight shift toward disagreement (mean -0.34) and Conventional farmers showing low level agreement (mean 0.41).

The final item in the table reports farmers' responses to the statement: "Farm GMOs will improve the quality of life for animals." Conventional farmers, like the entire sample, were very neutral on this issue with mean of 0.03 and 0.07 respectively. GMO intending farmers were in agreement with this statement with a mean of 1.12 and Organic Intending farmers disagreed with a mean of -0.94.

In overview, these results show that GMO Intenders are positive about the potential effects of GMO use, seeing them as environmentally friendly, controllable, improving the quality of life for animals, solving food problems and curing diseases. Organic Intenders disagree with these ideas, while Conventional Intenders are midway between the other two positions.

Table 26 examines the results for seven statements about farmers' attitudes toward the necessity and principle of GMO on their farms. The farmers were asked to state their agreement or disagreement with the idea using a seven-point scale from very strongly disagree to very strongly agree. For all statements there is a statistically significant difference across each intention type. The first item asked farmers to indicate their level of agreement or disagreement with the statement: "Using GMOs fits with my cultural and spiritual beliefs." Organic Intention farmers' voiced the strongest disagreement with the statement (mean -1.52). Conventional Intention farmers also disagreed with the statement (mean -0.72). The GMO Intention farmers were the only group who indicated agreement with the statement and it was relatively weak agreement (mean 0.58). Overall then, farmers disagreed that using GMOs fits with their cultural and spiritual beliefs.

The second item in the table reports the responses of farmers to the statement: "I need to use GMOs on my farm." This statement garnered fairly strong disagreement from the intention groups, apart from GMO Intenders. Organic Intenders demonstrated the most marked disagreement with a mean of -1.86, with Conventional Intenders also registering disagreement with a mean of -1.09.

The third item in the table illustrates farmers' mean responses to the statement: "Using GMOs fits my basic principles." Organic Intending farmers indicated the highest level of disagreement with the statement (mean -1.77). Conventional Intenders also disagreed but to a lesser extent (mean -0.78). GMO Intenders were the only intention group that agreed with the statement (mean 0.80).

Table 26
Attitudes towards the Necessity and Principle of GMO use by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	Entire Sample	T – test p<0.05
Using GMOs fits with my cultural and spiritual beliefs	Mean	0.58	-1.52	-0.72	-0.58	1&2, 1&3, 2&3
	sd	1.19	1.38	1.34	1.50	
	n	143	151	458	795	
I need to use GMOs on my farm	Mean	0.42	-1.86	-1.09	-0.91	1&2, 1&3, 2&3
	sd	0.98	1.23	1.14	1.37	
	n	142	151	459	794	
Using GMOs fits my basic principles	Mean	0.80	-1.77	-0.78	-0.62	1&2, 1&3, 2&3
	sd	1.03	1.32	1.33	1.53	
	n	143	152	458	795	
Using GMOs is acceptable to me even if it causes harm to animals	Mean	-1.38	-2.39	-1.88	-1.87	1&2, 1&3, 2&3
	sd	1.13	1.09	1.06	1.13	
	n	142	153	459	796	
Using GMOs is acceptable to me even if it causes harm to the environment	Mean	-1.55	-2.46	-2.04	-2.03	1&2, 1&3, 2&3
	sd	1.10	1.06	1.02	1.08	
	n	142	153	458	795	
Using GMOs is acceptable to me even if it causes harm to people	Mean	-1.93	-1.93	-2.19	-2.20	1&2, 1&3, 2&3
	sd	1.08	-2.52	1.02	1.08	
	n	142	153	458	795	
Using GMOs is acceptable to me if it provides food for the hungry people of the World	Mean	1.15	-1.03	-0.13	0.05	1&2, 1&3, 2&3
	sd	1.16	1.62	1.53	1.64	
	n	142	152	459	794	

Range –3 to 3

The fourth item in the table illustrates farmers’ agreement or disagreement with the statement: “Using GMOs is acceptable to me even if it causes harm to animals.” Farmers in all intention groups disagree with the statement indicating a high level of disagreement with the idea of using GMO even if it is harmful to animals. Organic Intention farmers indicated the highest level of disagreement with a mean response of -2.39.

The fifth item in the table reports farmers’ agreement or disagreement with the statement: “Using GMOs is acceptable to me even if it causes harm to the environment.” Farmers in all intention groups disagreed with the above statement. Organic Intention farmers appear the most adamant on this issue as well with a mean score of -2.46.

The sixth item in the table reports farmers’ agreement or disagreement with the statement: “Using GMOs is acceptable to me even if it causes harm to people.” Once again farmers from all intention groups adamantly disagreed with the statement. In this case the conventional farmers indicated the highest mean score at -2.19.

The final item in the table reports the responses of farmers to the statement: “Using GMOs is acceptable to me if it provides food for the hungry people of the world.” Once again Organic and GMO Intending farmers were at odds with this statement with mean scores of -1.03 and 1.15 respectively. Conventional farmers had a neutral mean score on this issue (-0.13).

In overview, it can be observed that all farmers, regardless of intention group, disagreed with GMO use that may cause harm to animals, the environment and/or people. In a number of other cases both Organic Intention and Conventional Intention farmers reported disagreeing

with the statements, though to differing intensities. Finally, GMO Intention farmers seem to report opposite opinions to their Organic Intention counterparts except in the cases where there was perceived harm to living things. These results vindicate the partitioning of the sample into the three intention groups based on stated intentions regarding GMO and organic techniques.

Table 27 reports the responses of farmers to the statement: “GMOs can be used in New Zealand without adversely affecting organic farming.” The farmers were asked to indicate their level of agreement or disagreement with the statement using a seven point scale from very strongly disagree to very strongly agree. The responses of each of the three intention groups proved to be statistically distinct. Organic Intenders voiced the most adamant disagreement with the statement with a mean score of -1.59 . Conventional Intenders also indicated a moderate level of disagreement with the statement with a mean score of -0.46 . GMO intenders reported agreement with the statement with a mean score of 0.93 .

Table 27
Compatibility of Organic and GMOs in New Zealand by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	Entire Sample	T – test p<0.05
GMOs can be used in New Zealand without adversely affecting organic farming	Mean	0.93	-1.59	-0.46	-0.36	1&2
	sd	1.02	1.46	1.41	1.59	2&3
	n	142	152	459	796	3&4

Range -3 to 3

Table 28 reports the mean responses of farmers to four statements regarding the potential effects of GMO crop and food use. The farmers were asked to indicate their agreement or disagreement with the statement using a seven-point scale from very strongly disagree to very strongly agree. The responses of each of the three intention groups proved to be statistically distinct. The first item in the table reports the mean responses of farmers’ to the statement: “GMO plants are unlikely to become weeds.” Organic Intending farmers reported the strongest disagreement with the statement (mean -1.22) and Conventional Intending farmers also voiced a slight level of disagreement (mean -0.51). GMO Intending farmers indicated a slight level of agreement with the statement (mean 0.58). In this case it would seem that the majority of farmers recognize that GMO use may adversely affect organic farming.

The second item in the table reports the mean responses of farmers to the statement: “Genes from GMO crops may be transferred to other species where they may take on a negative role.” In this case the GMO Intending farmers in combination with the Conventional farmers express neutral opinions with means of -0.17 and 0.33 respectively. Organic Intending farmers indicated a moderate level of agreement with the statement (mean 1.04).

The third item in the table illustrates the mean responses for the statement: “GMO plants may have unforeseen effects on other species and ecosystems.” None of the farmer groups disagreed with this statement. The GMO Intenders voiced the most neutral response (mean 0.19). Conventional Intenders reported stronger agreement (mean 0.78) and Organic Intenders reported the strongest agreement with the statement (mean 1.60).

The final item in the table reports the mean responses from the statement: “There may be health benefits from eating food derived from GMO crops.” This statement drew support

from the GMO Intending farmers (mean 1.04), Conventional Intention farmers reported an overall neutral response (mean 0.14) and Organic Intending farmers indicated slight disagreement (mean -0.41).

Table 28
Beliefs About GMO Crops and Foods by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
GMO plants are unlikely to become weeds	Mean	0.31	-1.22	-0.51	-0.47	1&2,
	sd	1.05	1.57	1.24	1.37	1&3,
	n	143	152	459	796	2&3
Genes from GMO crops may be transferred to other species where they may take on a negative role	Mean	-0.17	1.04	0.33	0.36	1&2,
	sd	0.96	1.44	1.22	1.27	1&3,
	n	142	151	455	790	2&3
GMO plants may have unforeseen effects on other species and ecosystems	Mean	0.19	1.60	0.78	0.81	1&2,
	sd	0.93	1.48	1.30	1.36	1&3,
	n	143	152	457	794	2&3
There may be health benefits from eating food derived from GMO crops	Mean	1.04	-0.41	0.14	0.21	1&2,
	sd	0.80	1.55	1.23	1.32	1&3,
	n	143	153	458	797	2&3

Range -3 to3

Generally, GMO Intenders see few problems with GMO use while Organic Intenders take the opposite view and Conventional Intenders take a middle position.

Table 29 illustrates the mean responses of farmers to a series of four statements about farming practices to improve biodiversity and soil conditions. Farmers were asked to indicate how important that they felt each issue was using a five point-scale from very unimportant to very important.

Table 29
Attitudes towards Farming Practises to Improve Biodiversity and Soil Condition by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
The encouragement of biodiversity to enable pest control by natural agents	Mean	1.36	1.29	1.06	1.16	1&3,
	sd	0.76	1.07	1.01	0.99	2&3
	n	143	153	460	799	
Use crop and stock rotations to improve soil fertility	Mean	1.36	1.25	1.18	1.23	1&3,
	sd	0.72	1.08	0.99	0.97	2&3
	n	143	154	461	801	
Use mulch and no-till systems to improve soil structure	Mean	0.97	1.13	0.86	0.94	
	sd	0.93	1.08	1.00	1.01	
	n	143	154	460	799	
Promotion of biological activity within soils to improve fertility	Mean	1.32	1.31	1.11	1.19	1&3,
	sd	0.76	1.03	0.97	0.94	2&3
	n	143	153	462	801	

Range -2 to 2

The results in this table represent one of the few instances where the responses of GMO Intention farmers and Organic Intention farmers are very closely related. Statistical significance could not be drawn between the two groups for any of the four statements about farm practice. Both groups stated that all four practises were important. Conventional Intention farmers also indicated that these practices were important but indicated an overall lower level of importance than the other farmers. The third statement (relating to the use of mulch and no-till systems to improve soil structures) was rated the same by all farmers.

Table 30 reports the responses of farmers to their assessment of the sustainability of their farms now and in the future. Farmers were asked to rate the sustainability of their farms on a five-point scale from completely unsustainable to completely sustainable. The sustainability questions about farm sustainability now, in five years and in ten years, received a positive rating from each of the intention groups. In terms of sustainability now, Organic Intending farmers were the least optimistic about their sustainability (mean 0.80) while the GMO and Conventional Intenders were slightly more optimistic about their sustainability (means 1.28 and 1.16 respectively) with no statistically significant distinction between the latter two groups. Farmers were also all quite positive about their sustainability in five years and the same pattern applies. GMO Intending and Conventional Intending farmers were the most optimistic about five-year sustainability and slightly more so than Organic farmers. The latter, however, did record a more positive assessment than their previous rating. For the ten-year sustainability question, farmers rated this positively and there is no statistically significance difference in the scores.

Table 30
Farm Sustainability by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
Farming operation sustainability – now	Mean	1.28	0.80	1.16	1.10	1&2
	sd	0.64	0.79	0.63	0.69	2&3
	n	144	152	456	795	
Farming operation sustainability – five years	Mean	1.26	1.03	1.15	1.14	1&2
	sd	0.62	0.65	0.61	0.63	2&3
	n	142	149	454	787	
Farming operation sustainability – ten years	Mean	1.15	1.06	1.12	1.12	
	sd	0.74	0.80	0.70	0.73	
	n	143	148	450	783	

Range –2 to2

The results from these last two questions show that each intention groups rated ecological farming practices as important and there were no differences between GMO Intenders and Organic Intenders. Each intention group assessed their farming sustainability as positive but Organic Intenders were less optimistic that the other two types.

3.8 General Attitudes of the Three Intention Groups

The previous section has focused on specific attitudes and practices of the three intention groups. Here we take a broader view on farmers’ attitudes and include responses to questions that consider issues beyond the farm such as attitudes towards New Zealand’s environment, general environmental beliefs, attitudes towards technology and social issues.

Table 31 reports farmers’ responses to four questions about the state of the environment in New Zealand. The farmers’ were asked to rate the environment using a five-point scale from very bad to very good where the median score was adequate. The responses of each of the three intention groups proved to be statistically different. The first item in the table asked farmers to assess: “The condition (quality) of New Zealand’s natural environments in towns and cities.” Organic and Conventional Intending farmers rated that environment as adequate with mean scores of 0.007 and 0.18 respectively. GMO Intending farmers were somewhat more positive with their assessment (mean 0.61) indicating a moderately good rating.

The second item in the table reports farmers’ assessment of: “The condition or quality of New Zealand’s other natural environments.” Organic and Conventional Intention farmers rated New Zealand’s other natural environments as moderately good with mean scores of 0.68 and 0.88 respectively. GMO Intending farmers were most positive rating the other natural environments as good (mean 1.18).

The third item in the table reports farmers’ assessments of: “The condition (quality) of New Zealand’s air.” All intention groups (GMO Intenders, Organic Intenders and Conventional Intenders) rated the quality of New Zealand’s air as good with mean scores of 1.27, 0.81, 1.05 respectively.

The final item in the table reports farmers’ assessment of: “The condition (quality) of New Zealand’s natural environment compared to other developed countries.” Once again all intention groups (GMO Intenders, Organic Intenders and Conventional Intenders) rated New Zealand’s environment positively when comparing it to other countries with mean scores of 1.69, 1.23, and 1.48 respectively. GMO Intending farmers’ are edging towards rating the environment as comparatively very good.

Overall assessment of this table suggests that farmers from each of the intention groups agree that New Zealand’s air quality and comparative natural environments are, at a minimum, good. The GMO farmers are somewhat more positive about the state of the environment in cities and towns and other natural environments than their Conventional Intending or Organic Intending farmers.

Table 31
Attitudes about New Zealand’s Environment by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
The condition (quality) of NZ's natural environment in towns and cities	Mean	0.61	0.007	0.18	0.23	1&2, 1&3, 2&3
	sd	0.87	0.88	0.88	0.91	
	n	139	144	450	774	
The condition (quality) of NZ's other natural environments	Mean	1.18	0.68	0.88	0.90	1&2, 1&3, 2&3
	sd	0.75	0.91	0.87	0.87	
	n	141	145	454	782	
The condition (quality) of NZ's air	Mean	1.27	0.81	1.05	1.05	1&2, 1&3, 2&3
	sd	0.87	0.88	0.85	0.87	
	n	143	151	459	782	
The condition (quality) of NZ's natural environment compared to other developed countries	Mean	1.69	1.23	1.48	1.48	1&2, 1&3, 2&3
	sd	0.54	0.88	0.67	0.71	
	n	141	143	452	777	

Range –2 to 2

The design of the questionnaire reflected our belief that farmers with different views on novel technologies may have different environment attitudes. Consequently, the questionnaire included a commonly used instrument for measuring environment attitudes, specifically, those that identify anthropocentric and biocentric viewpoints. Table 32 shows responses to these eight environmental attitude questions broken down by intention type. The statements alternate from biocentric to anthropocentric going down the list. Many of the scores for each intention type are statistically significant. Highlighting has been used to show the highest score for each statement, even when the score may be negative. Looking at the first two columns shows that GMO Intenders and Organic Intenders gave alternatively highest and lowest scores for the statements except for the first and third last which received a similar score for each intention type. Thus of the eight statements, there were six that gave consistent results and indicate that GMO Intenders have anthropocentric environment attitudes while Organic intenders have biocentric environmental attitudes. As is usual, Conventional Intenders gave scores between the other two types.

Table 32
Farmers' Environmental Attitudes by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
We are approaching the limit of the number of people that the earth can support	Mean	0.29	0.13	0.33	0.29	
	sd	1.39	1.65	1.43	1.47	
	n	142	152	460	797	
Human have a right to modify the natural environment to suit their needs	Mean	0.72	-0.67	-0.22	0.09	1&2, 1&3, 2&3
	sd	1.13	1.45	1.35	1.41	
	n	143	153	460	799	
When humans interfere with nature it often produces disastrous consequences	Mean	0.21	1.29	0.82	0.79	1&2, 1&3, 2&3
	sd	1.13	1.53	1.23	1.32	
	n	143	153	460	799	
Human ingenuity will ensure that we do not make the earth unlivable	Mean	0.66	-0.88	-0.25	-0.18	1&2, 1&3, 2&3
	sd	1.24	1.46	1.43	1.50	
	n	143	153	460	798	
Human are severely abusing the environment	Mean	0.39	1.47	0.81	0.86	1&2, 1&3, 2&3
	sd	1.13	1.37	1.33	1.34	
	n	143	153	461	800	
The earth has plenty of natural resources if we just learn how to develop them	Mean	0.93	0.68	0.67	0.75	1&3
	sd	1.02	1.58	1.26	1.29	
	n	143	152	462	800	
Plants and animals have as much right as humans to exist	Mean	0.57	1.26	0.92	0.93	1&2, 1&3, 2&3
	sd	1.38	1.41	1.27	1.34	
	n	143	153	460	798	
The balance of nature is strong enough to cope with the impacts of modern industrial nations	Mean	-0.65	-1.54	-0.93	-1.02	1&2, 1&3, 2&3
	sd	1.13	1.39	1.25	1.28	
	n	143	153	459	798	

Factor analysis of the scores for the eight environment statements resulted in three distinct factors underlying the statements. The first factor represents anthropocentric attitudes, the second factor represents biocentric attitudes and the third factor represents sensitivity to resource conservation. The two statements in the above table that did not discriminate between intention types and formed the basis of factor 3 which agreed with: “We are approaching the limit of the number of people that the earth can support” and disagreed with:

“The earth has plenty of natural resources if we just learn how to develop them”. This scoring suggest the title of Resource Sensitivity for factor three.

Table 33 reports the results of farmers responses to four questions about the role that they see in New Zealand’s agriculture for four types of production: conventional, GMOs, organic and Integrated Pest Management or low input. They were asked to indicate the role they believed each type of production to have in New Zealand Agriculture using a four-point scale: no role, niche role, significant role, and dominant role. The first item in the table indicates that each of the intention groups indicated that conventional farming had a significant role in New Zealand agriculture. T-test results indicate that the responses of GMO Intending and Conventional Intending farmers are not statistically distinct from each other but that both groups report a statistically different response than the Organic Intending farmers.

The second item reports farmers’ mean rating of the role of GMOs in New Zealand agriculture. The role of GMOs in farming was rated as significant by GMO Intending farmers (mean 2.74). Conventional Intention farmers rated the role of GMOs as a niche role (mean 1.92) and Organic Intention farmers rated the role of GMOs midway between no role and niche role (mean 1.52). T-tests of these responses indicate that the responses of each intention group are statistically different.

The third item in the table reports the mean rating of the role of Organic farming in New Zealand agriculture. Organic Intenders are the most supportive of the role of organics indicting that they believed it represented a significant role (mean 2.80). The GMO and Conventional intention groups rated the role of organics as a niche role (means 2.07 and 2.30 respectively). Tests for statistical significance indicated statistically distinct responses from each of the intention groups.

The final item in the table reports the ratings given by farmers to the role of Integrated Pest Management in New Zealand agriculture. Organic Intending farmers rated the role as significant (mean 2.96) while the other two intention groups reported mean responses of midway between niche and significant role (means 2.50 and 2.57). The responses given between GMO and Conventional Intention farmers are not statistically distinct from one another.

Table 33
Role for Type of Agriculture in NZ Farming by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	Entire Sample	T – test p<0.05
Role in NZ Agriculture for: Conventional	Mean	3.49	3.15	3.47	3.41	1&2
	sd	0.60	0.77	0.58	0.64	2&3
	n	144	148	457	792	
Role in NZ Agriculture for: GMOs	Mean	2.74	1.53	1.92	2.04	1&2
	sd	0.58	0.75	0.75	0.84	1&3
	n	144	148	453	787	2&3
Role in NZ Agriculture for: Organic	Mean	2.07	2.80	2.30	2.35	1&2
	sd	0.51	0.68	0.56	0.63	1&3
	n	144	151	458	795	2&3
Role in NZ Agriculture for: Integrated Pest Management or low input	Mean	2.50	2.96	2.57	2.64	1&2
	sd	0.70	0.71	0.74	0.75	2&3
	n	142	142	428	754	

Range 1 to 4

Overall, these data show that each intention type sees a significant role for its own group although GMO Intenders and Organic Intenders acknowledge that conventional farming will play a significant role.

Table 34 illustrates the mean responses of farmers to five statements about the quality of representation they feel they receive from Federated Farmers. Respondents were asked to rate the Federated Farmers on a five-point scale from very poorly to very well. Farmers were also given the option of responding, “don’t know” for this set of questions. While for other questions of this type the response to the “don’t know” option was a very small proportion of the total sample (two per cent or less) in this case there was a substantial proportion of farmers who opted for it. As a result the number and proportion of farmers who have responded, “don’t know” have been included in this table. The mean and standard deviation reported are based on the farmers who indicated an opinion of the issue.

The first item in the table reports farmers rating on how well Federated Farmers resents their view on Free Trade. All farmers were generally positive about Federated Farmers representation on this issue. Organic Intenders reported the lowest level of satisfaction with a mean of 0.41. GMO and Conventional Intending farmers were more satisfied with the representation of Federated Farmers with mean score of 0.98 and 0.81 respectively. No statistical distinction can be drawn between the responses of GMO and Conventional Intending farmers on this issue.

The second item reports farmers’ rating of Federated Farmers on their representation regarding the Resource Management Act. GMO Intending and Conventional Intending farmers, who were not statistically different from each other, indicated that they felt Federated Farmers represented their interests “well” (means 0.93 and 0.72 respectively). Organic Intending farmers had a more neutral opinion of the Federated Farmers representation that they received (mean 0.38).

The third item reports the mean rating to Federated Farmers’ representation on genetic engineering. GMO Intending farmers gave a somewhat positive mean rating of 0.65, Conventional Intenders gave a very slightly positive rating with a mean of 0.32 and Organic Intention farmers gave a slightly negative mean rating of -0.44. All three scores have a statistically significantly difference.

The fourth item in the table reports the mean rating given by the farmers to Federated Farmers for their representation on organic farming, and all farmer groups rated this representation relatively neutrally. T-test results show that the three intention groups are statistically distinct on the issue. Organic farmers rated Federated Farmers representation the lowest with a mean rating of -0.23, and GMO Intending farmers gave the highest mean score at 0.57.

The fifth item in the table reports the mean ratings given to Federated Farmers representation of farmers on the issue of general farm policy. GMO Intending and Conventional Intending farmers rated the representation positively with mean scores of 1.05 and 0.88 respectively. The two groups are not statistically distinguished from one another, however, they are both statistically distinct from the Organic Intenders who gave a mean ranking of 0.57.

In overview, several interesting observations can be made about the data on Federated Farmers’ representation. First, GMO Intenders consistently gave the most favourable ratings of the representation of Federated Farmers. Second, the responses of GMO and Conventional Intention farmers can only be distinguished on three of the five issues, suggesting that on this

issue of representation the two groups demonstrate very similar attitudes. Finally, the GMO Intending farmers had a much lower level of “don’t know” responses than the other intention groups. GMO Intending farmers responded that they “don’t know” about Federated Farmer issues five to 18 per cent of the time when the other intention groups had much higher levels ranging up to 30 per cent of Conventional Intention farmers. These results suggest that the work of Federated Farmers is of less relevant or of less interest to Conventional and Organic Intention Farmers than the GMO Intention group.

Table 34
Opinions of Federated Farmer Representation by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
Free Trade	Mean	0.98	0.41	0.81	0.77	1&2, 2&3
	sd	1.03	1.16	1.00	1.05	
	n	130	104	364	634	
	Don't Know	n=8 6%	n=41 28%	n=87 19%	n=142 18%	
Resource Management Act (RMA)	Mean	0.93	0.38	0.72	0.69	1&3, 2&3
	sd	1.12	1.15	1.17	1.18	
	n	131	112	381	660	
	Don't Know	n=8 6%	n=36 23%	n=70 16%	n=118 15%	
Genetic Engineering	Mean	0.65	-0.44	0.32	0.24	1&2, 1&3, 2&3
	sd	1.02	1.09	1.02	1.09	
	n	123	107	316	580	
	Don't Know	n=15 11%	n=38 26%	n=134 30%	n=195 25%	
Organic Farming	Mean	0.57	-0.23	0.36	0.29	1&2, 1&3, 2&3
	sd	0.99	1.09	0.93	1.00	
	n	114	113	317	577	
	Don't Know	n=25 18%	n=31 22%	n=134 30%	n=199 25%	
Farming policy in general	Mean	1.05	0.57	0.88	0.86	1&3, 2&3
	sd	0.93	1.04	0.97	0.98	
	n	132	116	391	676	
	Don't Know	n=7 5%	n=28 19%	n=58 13%	n=97 13%	

Range -2 to 2

Table 35 reports farmers' attitudes about technology generally. Farmers were asked to respond to eight statements about using a seven point scale from very strongly disagree to very strongly agree. The statements were derived from the work of Paul Slovic (2000) on public perceptions of risk. T-test for statistical significance between groups were performed and was found to be significant in each case. The first item reports the mean responses of farmers to the statement: "Future generations can take care of themselves when facing risks imposed on them from today's technologies." Farmers from all intention groups disagreed with this statement, the most adamant disagreement came from the Organic Intention farmers with a mean score of -1.71. GMO Intending farmers were the most neutral on this issue with a mean score of -0.47.

The second item illustrates the mean responses of farmers to the statement: "If a risk from technology is very small then it is okay for society to impose that risk on individuals without their consent." All farmer groups demonstrated disagreement with this statement. The Organic Intenders once again voiced the most adamant disagreement with the statement (mean -1.71). GMO Intending farmers were the most neutral on the issue with a mean score of -0.11.

The third item in the table reports the mean response given by farmers to the statement: "Science can settle differences of opinion about the risks from a new technology." Organic Intention farmers voiced the highest disagreement (mean -1.27) with the statement,

Conventional Intention farmers also disagreed (mean -0.61). GMO Intention farmers indicated very slight agreement with the statement (mean 0.28).

The fourth item in the table reports the responses to the statement: “We can trust the experts who develop new technology.” Organic Intending and Conventional Intention farmers indicated disagreement with this statement with mean scores of -1.63 and -1.03 respectively. GMO Intention farmers expressed neutrally (mean 0.03) on this issue.

Table 35
Attitudes about Technology by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test $p < 0.05$
Future generations can take care of themselves when facing risks imposed on them from today’s technologies	Mean	-0.47	-1.71	-1.01	-1.05	1&2, 1&3, 2&3
	sd	1.33	1.36	1.32	1.39	
	n	144	154	460	800	
If a risk from technology is very small then it is okay for society to impose that risk on individuals without their consent	Mean	-0.11	-1.71	-0.97	-0.94	1&2, 1&3, 2&3
	sd	1.25	1.30	1.36	1.42	
	n	144	154	462	802	
Science can settle differences of opinion about the risks from a new technology	Mean	0.28	-1.27	-0.61	-0.56	1&2, 1&3, 2&3
	sd	1.11	1.45	1.30	1.38	
	n	144	154	460	800	
We can trust the experts who develop new technology	Mean	0.03	-1.63	-1.03	-0.93	1&2, 1&3, 2&3
	sd	1.05	1.28	1.30	1.37	
	n	144	154	462	803	
Technological development is destroying nature	Mean	-0.87	0.16	-0.21	-0.28	1&2, 1&3, 2&3
	sd	1.12	1.35	1.15	1.23	
	n	143	153	462	801	
Local residents should have authority to stop the use of a new technology if they think it is dangerous	Mean	-0.48	0.73	0.37	0.28	1&2, 1&3, 2&3
	sd	1.23	1.38	1.27	1.34	
	n	143	153	461	799	
A high technology society is important for improving our health and well-being	Mean	1.12	-0.19	0.33	0.40	1&2, 1&3, 2&3
	sd	1.19	1.43	1.21	1.33	
	n	144	154	462	803	
The public should vote to decide on issues such as the use of new technology	Mean	-0.42	0.61	0.25	0.20	1&2, 1&3, 2&3
	sd	1.32	1.35	1.25	1.32	
	n	144	153	464	804	

Range -3 to 3

The fifth item in the table reports the responses of farmers to the statement: “Technological development is destroying nature.” GMO Intending and Conventional Intending farmers expressed disagreement with this statement with mean score of -0.87 and -0.21 respectively. Organic Intention farmers reported neutral attitudes towards the statement with a mean score of 0.16 .

The sixth item in the table reports the responses to the statement: “Local residents should have authority to stop the use of a new technology if they think it is dangerous.” Organic Intention farmers reported the strongest agreement with this issue with a mean score of 0.73 , Conventional Intention farmers also agreed with the statement with a mean score of 0.37 . GMO Intending farmers expressed moderate disagreement with the issue with a mean score of -0.48 .

The seventh item in the table illustrates the responses of farmers to the statement: “A high technology society is important for improving our health and well-being.” GMO Intending farmers reported the highest degree of support for this statement with a mean score of 1.12. Organic and Conventional Intending farmers are more ambivalent to the statement with mean scores of -0.19 and 0.33 respectively.

The final item in the table reports the mean responses of farmers to the statement: “The public should vote to decide on issues such as the use of new technology.” The Organic Intention farmers voiced the strongest support for this statement with a mean score of 0.61; GMO Intention farmers voiced the strongest disagreement with a mean score of -0.42. Conventional Intending farmers reported neutral opinions with this statement (mean 0.25).

In overview, the results from the questions on technology show a consistent pattern of optimism from the GMO Intenders regarding technology. They agree that high technology is important and that science can settle differences, and they do not see technological development as destroying nature. They are least concerned about trusting experts and the risks from technology and, while they express concern about future generations, this concern is lowest among all intention types. Also in contrast to the other types, they do not agree that local residents or the public should have input into technology decision making. In contrast, Organic Intenders do not agree that high technology is important and that science can settle differences, and they slightly agree that technology is destroying nature. They definitely do not trust experts and see risks from technology. They have concerns about future generations, and want residents and the public to be able to intervene in technology development. Conventional Intenders occupy a position midway between the other two types.

Table 36 illustrates the mean responses of farmers to six statements about general social issues. The farmers were asked to rate the statements using a seven-point scale from very strongly disagree to very strongly agree. For most of the statements there is a statistically significant difference between intention types. The first item asked farmers to indicate their agreement or disagreement with the statement: “Decisions about health risks should be left to the experts.” GMO Intending farmers voiced slight agreement with the statement (mean 0.55) Organic Intention farmers expressed moderate disagreement (mean -0.68) and Conventional Intending farmers reported neutral feelings towards the issue.

The second item in the table reports the farmers’ responses to the statement: “In a fair system, people with more ability should be paid more.” Farmers from all intention groups agreed with this statement with the most adamant support coming from GMO Intending Farmers (mean 1.23). The Conventional Intending and Organic Intending farmers reported means of 0.85 and 0.70 respectively, and a statistical distinction cannot be drawn between these two scores.

The third item in the table reports responses to the statement: “If people were treated more equally, we would have fewer problems.” All intention groups indicated fairly neutral responses to his statement with the strongest disagreement coming from GMO Intending Farmers (mean -0.52) and the strongest agreement coming from Organic Intenders (mean 0.23).

The fourth item in the table reports the responses of farmers to the statement: “What the world needs is a more even distribution of wealth.” Organic Intention farmers voiced the strongest support for the statement with a mean of 0.57. GMO Intenders indicted slight disagreement

with the statement (mean -0.28) and Conventional Intenders indicated a neutral opinion of the statement.

The fifth item in the table illustrates the responses of farmers to the statement: “We have gone too far pushing equal rights in this country.” GMO Intending and Conventional Intending farmers reported agreement with the statement (mean 1.15 and 0.69 respectively). Meanwhile Organic Intending farmers indicated neutrality on the issue (mean 0.19).

Table 36
Attitudes about General Social Issues by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test p<0.05
Decisions about health risks should be left to the experts	Mean	0.55	-0.68	-0.05	0.07	1&2,
	sd	1.08	1.38	1.30	1.35	1&3,
	n	143	154	460	799	2&3
In a fair system, people with more ability should earn more	Mean	1.23	0.70	0.85	0.90	1&2,
	sd	1.06	1.08	1.04	1.08	1&3,
	n	142	153	459	796	
If people were treated more equally, we would have fewer problems	Mean	-0.52	0.23	-0.17	-0.15	1&2,
	sd	1.30	1.32	1.29	1.32	1&3,
	n	142	152	458	794	2&3
What the world needs is a more equal distribution of wealth	Mean	-0.28	0.57	0.07	0.11	1&2,
	sd	1.33	1.39	1.37	1.39	1&3,
	n	143	152	459	795	2&3
We have gone to far in pushing equal rights in this country	Mean	1.15	0.19	0.68	0.69	1&2,
	sd	1.33	1.45	1.33	1.39	1&3,
	n	142	151	457	792	2&3
We need more use of capital punishment	Mean	0.97	0.21	0.71	0.64	1&2,
	sd	1.60	1.60	1.67	1.73	2&3
	n	143	143	458	794	

Range -3 to 3

The final statement in the table represents the farmers’ responses to the statement: “We need more use of capital punishment.” GMO and Conventional Intending farmers reported agreement with the statement (means 0.97 and 0.71 respectively). The responses of GMO and Conventional Intending farmers are not statistically distinguishable on this item. Organic Intending farmers reported a lower mean agreement with the statement (mean 0.21).

In overview, the results from the above data on general social issues show that generally, the GMO Intenders express conservative values, accepting that health risks should be left to experts, ability should be rewarded, and not supporting the ideas that more equal treatment of people would lead to fewer problems or that the world needs more equal distribution of wealth. They agree that equal rights have been pushed too much and that capital punishment should be used more. Organic Intenders have contrasting views and thus illustrate a slightly more liberal position while Conventional Intenders hold a position mid way between the other two groups. It is important to note, however, that the Organic Intenders are, at most, centrist, rather than espousing strongly liberal or radical views.

Table 37 reports the findings of six statements about farmers’ attitudes towards influence and trust. The respondents were asked to report their level of agreement or disagreement with the statements using a seven-point scale from very strongly disagree to very strongly agree. For

most of the statements there is a statistically significant difference between intention types. The first statement asked farmers about their agreement or disagreement with the statement: “I have influence on the use of hazardous substances in New Zealand. Organic Intention farmers voiced the strongest level of disagreement with the statement (mean -0.65); Conventional Intention farmers also disagreed (mean -0.43). Statistical distinction cannot be drawn between the Organic and Conventional Intending farmers on this issue. GMO Intending farmers reported neutrally on the issue (mean 0.007).

The second item in the table reports the responses of farmers to the statement: “I have influence on the use of new technologies in New Zealand.” Organic and Conventional Intention farmers disagreed with the statement (mean -0.68 and -0.46 respectively). Statistical distinction cannot be drawn between these two groups for this statement. GMO Intending farmers reported neutrally on this issue (mean -0.01).

The third item in the table reports the responses of farmers to the statement: “I trust the government regulation and control of new technologies in New Zealand. Organic Intending farmers voiced the strongest disagreement with this statement (mean -1.10), Conventional Intenders also disagreed (mean -0.73) and GMO Intenders voiced neutrally with a mean score of -0.14 .

Table 37
Attitudes Towards Trust and Influence by Intention Group

		GMO Intenders (1)	Organic Intenders (2)	Conventional Intenders (3)	All Intention Groups	T – test $p < 0.05$
I have influence on the use of hazardous substances in NZ	Mean	0.007	-0.65	-0.43	-0.38	1&2, 1&3,
	sd	1.21	1.43	1.30	1.32	
	n	143	153	458	796	
I have influence on the use of new technologies in NZ	Mean	-0.01	-0.68	-0.46	-0.40	1&2, 1&3,
	sd	1.14	1.34	1.18	1.23	
	n	143	152	457	794	
I trust government regulation and control of new technology in NZ	Mean	-0.14	-1.10	-0.73	-0.69	1&2, 1&3, 2&3
	sd	1.24	1.29	1.33	1.34	
	n	143	154	461	800	
I trust policy development based on science and research	Mean	0.94	-0.34	0.32	0.32	1&2, 1&3, 2&3
	sd	0.96	1.40	1.25	1.32	
	n	143	154	459	798	
I trust the claims made by biotechnology companies	Mean	-0.20	-1.46	-0.86	-0.85	1&2, 1&3, 2&3
	sd	0.98	1.33	1.25	1.28	
	n	143	153	459	797	
I feel I have very little control over risks to my health	Mean	-0.46	0.27	-0.01	-0.04	1&2, 1&3, 2&3
	sd	1.23	1.49	1.33	1.37	
	n	143	154	460	799	

Range -3 to 3

The fourth item in the table reports the mean responses of farmers for the statement: “ I trust policy development based on science and research.” GMO Intending farmers demonstrated the highest degree of trust in policy based on science and research (mean 0.94). Conventional Intention farmers indicated a slight degree in the statement (mean 0.32) meanwhile Organic Intention farmers demonstrate a slight degree of mistrust (mean -0.34) of policy based on science and research.

The fifth item in the table reports the responses of farmers to the statement: “I trust the claims made by biotechnology companies.” All farmer groups demonstrated disagreement with this issue. Organic Intending farmers demonstrate a relatively strong disagreement with the statement (mean -1.46), Conventional Intention farmers report a mean score of -0.86 and even GMO Intending farmers demonstrate a degree of distrust in biotechnology companies (mean -0.20).

The final item in the table reports the responses of farmers to the statement: “I feel I have very little control over risks to my health.” GMO Intending farmers indicated the strongest degree of disagreement with the statement with a mean score of -0.46, while Organic Intending Farmers voiced slight agreement with the statement (mean 0.27). Conventional Intending farmers were neutral on the issue.

In overview, the results relating to the issues of trust and influence show a consistent pattern whereby Organic Intenders reported disagreement with all but one of the statements. They believe they have a low level of influence on hazardous substances and new technologies, do not trust government regulation or science-based policy development, nor trust the claims of biotechnology companies. In contrast, GMO intenders gave opposite scores or were near neutral. Conventional Intenders were in between the other two types.

3.9 Conclusion: Overall Profile of Each Intention Type

The tables already presented contain much data which can be used to draw together an overall picture of farmer types. Table 38 summarizes these attitudinal data. The typical GMO Intending farmer consistently disagrees with the opinions of Organic Intending farmers meanwhile the typical Conventional Intention farmer occupies the middle ground between the two. The three groups agree in principle on five issues. None of the groups would use GMOs if they caused harm to animals, people or the environment. Additionally, all of the groups rate the quality of New Zealand’s environment as good, they all believe that their style of farming is sustainable and that it is important to improve biodiversity and soil condition. Finally, each of the intention groups expresses at least moderate distrust of technology and biotechnology companies.

The typical GMO Intending farmer expresses conservative social views and is optimistic about the potential for GMOs to solve the world’s food problems and cure diseases. As a result he is in favour of GMO development for medical applications and for food production. He feels that New Zealand should not strive for GE free status and that the GMO moratorium should not be extended.

The typical Organic Intending farmer expresses centrist/liberal social views and is in opposition to almost every application for GMOs. He feels that there may be negative environmental consequences of GMO use. As a result he thinks that New Zealand should try to achieve GE free status and extend the moratorium on GMOs. He does not believe that the spread of GMOs can be controlled and believes that the use of GMOs will adversely affect organic farming.

The typical Conventional Intending farmer expresses moderately conservative social views and occupies the middle ground between the GMO and Organic Intention farmers. In most cases this farmer expresses a cautious attitude towards GMO use. He expresses no support for or against GE Free status but indicated moderate agreement with extending the

moratorium on GMOs. He does not support the development of GMOs for human or animal food but does support the idea of GMO development for medical applications. He expressed neutral opinions on the issues of the environmental friendliness of GMOs, the ability of GMOs to cure diseases and food problems and the potential for GMOs to improve the quality of life for animals.

Table 38
Summary of Attitudes by Intention Group

	GMO Intenders	Organic Intenders	Conventional Intenders
GE Free NZ	No	Yes	Neither
Moratorium extension	No	Yes	Moderate yes
NZ 'clean and green'	Yes	Moderate Yes	Yes
GMOs for food production	Yes	No	Moderate No
GMO development for medical applications	Yes	Depends if lab/farm	Yes
GMO environmentally friendly	Yes	No	Neither
The spread of farm GMOs is controllable	Yes	No	Moderate No
GMOs will cure diseases / solve food problems	Yes	No	Neither
GMOs improve the quality of life for animal	Yes	No	Neither
I would use GMOs if caused harm to animals/ people/ environment	No	No	No
GMO fits with my principles and beliefs	Moderate Yes	No	No
GMO can be used without harm to organic farming	Yes	No	Moderate No
GMOs will have negative environmental consequences	Moderate No	Yes	Yes
Quality of NZ environments	Good	Moderate Good	Good
Improving biodiversity and soil conditions is important	Yes	Yes	Yes
Farm is sustainable	Yes	Yes	Yes
Federated Farmers represents my view	Yes	Neither	Moderate Yes
I trust technology	Moderate No	No	No
Attitude towards social issues	Conservative	Liberal	Moderate Conservative
I trust government	Neither	No	No
I trust biotech companies	Moderate No	No	No
I trust policy based on research	Yes	Moderate No	Moderate yes

Chapter 4

Discussion and Conclusion

4.1 Introduction

This study set out to understand the attitudes of New Zealand farmers towards the use of genetic engineering in agriculture. There were two main research objectives. These were to measure any change in farmers' attitudes towards genetic engineering, GMOs and related issues, and to develop a better understanding of why particular intentions are held.

4.2 Overall Attitudes

Half of the farmers believe the GMO moratorium should be extended beyond October 2003. Sixty two per cent of farmers think that New Zealand's environment is 'clean and green.' These results suggest that farmers are still cautious about GMO use in New Zealand.

Farmers indicated fairly consistent and strong support (two thirds support their use) for the development of GMOs on the farm for medical applications. Just over 40 per cent of farmers oppose the use of GMOs for on-farm human or animal food production whereas only one third support this use. Farmer caution about GMOs extends to where they would like them used and it is clear that they have a strong preference for medical applications, preferably for products developed in the laboratory.

Farmer caution about GMOs appears to derive from their scepticism about the benefits from using GMOs. Farmers are ambivalent about GMO products being environmentally friendly, and they are ambivalent about farm GMOs improving quality of life for farm animals. However, farmers generally disagreed with the idea that the spread of farm GMOs can be controlled, that they will solve world food problems, and that they can be used in New Zealand without adversely affecting organic farming. They agreed that other GMOs will cure the world's major diseases.

4.3 Change in Attitudes

Comparisons of farmers' responses from 2000 and 2002 indicate that farmers' attitudes towards keeping New Zealand GE free changed between 2000 and 2002 so that, while still a majority viewpoint, fewer now disagree (down from 50 to 46 per cent) and more agree (up from 32 to 38 per cent). There was a change in farmers' intentions to use GMOs with fewer farmers, down from 45 to 35 per cent, now indicating a definite intention not to use GMOs while the proportion intending to use GMOs remains constant at 22 per cent. The majority (up from 35 to 43 per cent) now have no firm intention towards using GMOs. There are now more farmers with a definite intention not to use organic methods (up from 19 to 29 per cent) and fewer farmers indicating a definite intention to use organic methods (down from 38 to 23 per cent). Within these broad intention groups, the main shift has been observable in the strength of intention. Put simply, the number of farmers strongly committed to using GMOs has significantly decreased while the number weakly committed to using GMOs has increased. While the overall category of intention to use GMOs has remained constant, there has been a strong decline in the intensity of commitment for GMO Intenders. A similar shift occurred for

organic intenders. The number with a strong intention has significantly decreased, while those who are weakly committed to growing organically has increased.

One possible explanation for these two strong shifts is that there are now less polarised views among farmers. The negative sentiments about intentions to use GMOs have softened (fewer with a negative intention) and intentions regarding organic methods are less supportive (fewer intend to use and more intend not to use). Notwithstanding these changes, the proportion of farmers intending to use GMOs has held constant at 22 per cent. It would seem that the Royal Commission's report and continued public discussion of GMOs may have somewhat allayed farmer concerns about GMOs and made the option of organic farming less attractive or at least less attractive as a position to take regarding technological options for New Zealand agriculture. It is possible that GMO use has gained some measure of legitimacy in the last two years. Perhaps also, farmers feel less of a need to make a strong statement about each alternative. This is indicated by the increases in the proportions who recorded no intention when either GMO or organic farming were considered which means that there is growing support for conventional farming using neither technology. We are speculating about the possible effects of the Royal Commission. The questionnaire did not include questions on this topic so there are no data which can test these ideas.

Another possible explanation of the two strong shifts in intentions is the presence of buoyant commodity prices in agriculture in recent months, including the time at which this survey occurred. Buoyant prices are likely to make farmers less inclined to consider alternatives and they confirm the validity of their current approach to farming. In contrast, lower prices would make farmers look for and consider alternatives, especially those which offered increased profitability. High commodity prices are likely to have made use of organic methods less attractive and this would show up as a lower frequency of farmers selecting positive intentions to use such methods.

An important consideration when examining these changes over time is that the survey instrument in 2002 was different when compared to the one used in 2000. While most of the questions were the same, in the 2000 version farmers were asked to respond to the broad and undefined category of 'gene technology', while in 2002 the more specific subset of biotechnology relating to specifically GMOs was used and a clear definition of this was placed at the front of the questionnaire. This shift from broad to more specific definitions of the GMOs is very likely to have decreased the overall farmer responsiveness as it is clear that many farmer distinguish between GMOs and other forms of gene technology like those deployed in various rapid breeding applications. Consequently, the fact that the GMO intending category held on to its 2000 numbers in 2002 is actually an indication that the categorical support for GMO actually strengthened in the time since the Royal Commission on GM, with the more restrictive survey instrument curbing this result.

In a contrasting way the organic figures support this argument. The 2000 figures were considered to be high by many organic industry commentators, with many expressing scepticism that 38 per cent of farmers claiming an intention to use organic methods was too high. This is particularly pointed given that less than one per cent of growers actually are engaged in certified organic production. In response to this concern, the 2002 survey included a specific definition of organic production (and matched it with a clear definition of GM) that would then exclude that group of farmers who might claim that all or any farming techniques (including their own) were 'organic'. This tightening of the definition of organic would then be expected to result in a decrease in the number of farmers expressing an intention to use organic methods. Such a result does appear to have taken place in the organic data.

In conclusion, the inclusion of definitions of GMOs and organic production makes precise comparison between 2000 and 2002 difficult. Suffice to say that if the new tighter definitions of organic and GMOs did mute the response levels from 2000, then GMO intenders have done well to hold their own between the two years – indicating a positive outcome. The organic figure could be argued to have decreased from an unrealistic to a more realistic representation of support for organic production.

While such an effect would partly explain the shifts in overall support for organic or GMO intention, it would not explain the clear shift within both groups away from very strong support to rather more modest levels of enthusiasm. The explanation for that shift is much more likely to reside in the political climate of the 2000 sampling occurring during the polarised climate of the Royal Commission.

Counterbalancing the above considerations is the fact that while there are some interesting trends in the two extreme groups, the largest group of farming intenders were still the Conventional Intenders at 58 per cent. They demonstrated very little change over the two years of the survey. They were less convinced about GMOs than GMO intenders and were not positive about many of the dimensions of GMO use considered. They gave slight agreement with the idea that New Zealand should try to achieve GE free status and their large proportion meant that this contributed to the modest increase in support for GE free status registered in 2002 compared to 2000.

4.4 Intention Groups

While there are some confounding issues in analysing change behind the intention groups over the 2000-2002 period, there are much clearer indications from this survey of the motivations and composition of each intention group.

The majority of New Zealand farmers (nearly 60 per cent) intend to farm conventionally while nearly 20 per cent intend to use GMOs and nearly 20 per cent intend to use organic methods. The GMO Intenders are typically male, with less formal education, and who report high levels of farm financial intensity and incomes. Nearly one quarter of Organic Intenders are female, more formally educated, and who report lowest levels of farm financial intensity. The Conventional Intenders have some characteristics in common with each of the other groups.

This classification into three intention types was a valid way of analysing farmer characteristics because the breakdowns for many of the attitudinal questions yielded predictable and consistent findings. Generally, GMO Intenders were positive about GMO use while Organic Intenders and Conventional Intenders were either opposed or less supportive.

Some of the attitudinal questions allow us to gain some insight into the thinking of each intention position. The results from the environmental attitudes questions show that GMO Intenders have anthropocentric values. This means that they are comfortable with intervention in nature to achieve human goals. They believe that humans have a right to modify nature, are ingenious, and that nature is not fragile and can cope with these interventions. In contrast, Organic Intenders see that intervention in nature can have disastrous consequences, that in the past humans have abused the environment, and that plants and animals have as much rights as humans to exist. They do not believe that nature can easily cope with human interventions.

The question about technology showed results that are consistent with the above findings and which extend the picture of the intention types. GMO Intenders agree with the idea that high technology is important and that science can settle differences, and they do not see technological development as destroying nature. They are least concerned about trusting experts and the risks from technology and, while they express concern about future generations, this concern is lowest among all intention types. Also, in contrast to the other types, they do not agree that local residents or the public should have input into technology decision making. In contrast, Organic Intenders do not agree that high technology is important and that science can settle differences, and they slightly agree that technology is destroying nature. They definitely do not trust experts and see risks from technology. They have concerns about future generations, and want residents and the public to be able to intervene in technology development.

The results introduce a social responsibility dimension into understanding farmers and show that Organic Intenders demonstrate greater sensitivity to allowing other people to influence the technology decision-making process. Other data from the question on social issues show that GMO Intenders have conservative values. We also know that GMO Intenders recorded highest scores (but still low in absolute terms) for their perceived level of influences on use of hazardous substances or new technologies in New Zealand or risk to own health, and for trust of regulation, policy development and claims of biotechnology companies. In other words, GMO Intenders appear more confident about individual action.

4.5 Implications for Policy

The policy implications relate to both the changing proportions of the intention groups, as well as the specific implications for policy relating to different intention groups.

Change over time between 2000 and 2002 raises three issues. First, do farmers support the introduction of GMOs or do they want the moratorium extended? The position of some policy makers and farmer representatives has been that New Zealand farming strongly needs the ongoing development of GMO technologies to remain competitive. The majority of farmers do not support this idea, and have continued to show lukewarm or ambivalent support over the two-year period. Further, there is still only a minority of farmers who intend to use GMO technologies on their properties if or when they become available. Half of the farmers believe the GMO moratorium should be extended.

Second, the period of time during the Royal Commission on GM appears to have polarised farmer opinion with a minority strongly adhering to either pro-GMO or pro-organic positions. One expected effect of the post-Royal Commission period anticipated by some policy makers, was that more education and greater familiarity with GMO technologies and information about such technologies would lead to greater farmer acceptance of the technology. This has clearly not happened. While the disguised trend (caused by a more rigorous classification of GM in the 2002 survey) may have muted an increase in farmer support, the general trend was for those supporting GMOs to become less firm in their support, and the general norm was ambivalence and caution.

Third, farmer resistance and caution to GMO was primarily directed at GMOs in food and animal feed. Farmers are generally seeing considerable risk in pursuing such options. Instead, they are more confident about use of some GMO technologies, including the use of such technologies in bio-pharming (production of pharmaceuticals in farm settings).

Consequently, farmers will most likely be more comfortable with proceeding with developing GMOs in medicine, pharmaceuticals and bio-pharming, but will, in general, not be supportive of GMO use in food and animal feed within broad scale agriculture. In the 2000 survey, a strong factor in farmer ambivalence about GMO was due to perception of poor markets for GMO products. The same question was not repeated in 2002, but the same logic may still apply.

The characteristics about each intention group have important implications. First, regarding the Organic Intenders, while the opposition of this group to GMO technologies is not surprising, there are nonetheless important data on this group that might inform policy makers and industry strategists with a specific interest in wider issues in organic production. New Zealand currently has less than one per cent certified organic farmers. In the 2000 survey, the fact that 37 per cent of farmers showed support for moving towards using organic methods seemed disproportionate to the actual number of farmers engaging in organic farming. The 2002 figures seem more realistic, but are still very challenging for policy makers concerned with organic issues. Put simply, there is a massive failure of uptake of organic production given the existing and sustained levels of interest by many farmers in pursuing organic production. A total of eight per cent of farmers expressed a 'very strong' or 'strong' intention to use organic methods. Achieving this level of adoption would involve an eight fold increase in the number of farmers participating in organic production. There are clearly serious barriers to adoption which are preventing this group from making good on their intentions. Recent policy initiatives have suggested that New Zealand could achieve NZ\$1b in organic production. If the eight per cent of farmers showing a high degree of interest in organic production were able to be brought into organic production (not even including the 15 per cent of farmers showing modest interest in organics), then this target would be achieved with ease. This group of latent supporters of organic is most predominant in the pastoral sector followed by horticulture. It is least significant in dairy production.

Second, regarding the GMO Intenders, this group is still strongest in the dairy sector. They are on the wealthiest group of farms, but also with the lowest level of post-secondary education, and nearly all are male respondents. For the future development of GMO technologies in New Zealand, the broad findings of the survey show that while broad scale adoption of food and animal feed incorporating GMOs is generally rejected by farmers, there are some niche activities which find more support. Within the GMO Intenders group, there are five per cent of growers who show 'very strong' or 'strong' intention to use GMO technologies when they become available. This group is strongly centred in the dairy sector. If niche GMO technologies were to become available, there is clearly a small group of farmers who are ready to adopt them – particularly in dairy production. The findings of this survey clearly indicate what kind of farmers should be targeted by technology companies to enable successful adoption.

Finally, regarding the conventional farmers, the passing of two years has not shifted the great majority of farmers towards either GMO or organic technologies. What is clear from this group is that most of them feel sympathy towards ideas about ecological farming and that they should use some agro-ecological techniques on their farms. However, the great majority of them also basically consider that their farms are sustainable into the long term. This suggests that they do not see that they are facing problems into the medium term and that consequently neither GMO nor organic systems are required as a 'solution' to any problems. Farmers are clearly confronting 'greening' issues within the context of their existing production systems, and have not experienced a significant enough crisis in production to feel that either alternative is necessary as yet. Good commodity prices support this view.

This report provides important information about New Zealand farmers' attitudes to novel technologies such as GMOs and organic methods. The results provide useful insight into farmers' thinking, thus extending our knowledge of an important aspect of our society especially when it comes to technologies that in many cases have agricultural applications. The survey results bring to the fore the views of the farmers, whose views will be important in any technological developments, and this report presents results which will have important implications for our environment and for market access and performance.

References

- Conner, A. J. (1997), Genetically engineered crops: environmental and food safety issues. Wellington, Royal Society of New Zealand.
- Slovic, P. (2000), Risk Perception. Earthscan Publications, London.
- Cook, A. Fairweather, J. R, Campbell, H. R. (2000), New Zealand Farmer and Grower Intentions to Use Genetic Engineering Technology and Organic Farming Methods. AERU Research Report No. 243, Lincoln University.
- Fairweather J. R., Campbell H.R., Tomlinson C. J. and Cook, A. J. (2001), Environmental Beliefs and Farm Practices of New Zealand Organic, Conventional and GE Intending Farmers. AERU Research Report No. 251.

Appendix 1: The Questionnaire

FARMER VIEWS ON THE USE OF GENETIC ENGINEERING IN AGRICULTURE

Spring, 2002

Important Definitions

For the purpose of this study please assume that plants and animals or other farm inputs produced using genetic engineering may be available to farmers in the future.

‘Genetically modified organisms’ (GMOs), defined by ERMA, includes any plant, animal or microorganism developed through genetic modification. A GMO is any organism in which the genes have been modified by using in vitro (recombinant DNA) techniques, i.e., created in the lab. In this questionnaire, we are referring to GMOs, and offspring or products derived from them, for on-farm use. They do not include the use of genetic information to aid breeding programmes.

‘Organic farming’, defined by BIO-GRO NZ, means farming in harmony with nature, without the use of conventional fungicides, herbicides, pesticides or growth regulators. The aim is to achieve the optimum commercial harvest while enhancing the farm’s capital (the soil), and improving the local environment. An organic farm is different from a conventional farm on which some organic processes occur.

The term ‘farm’ refers to a farm, orchard or any other unit of primary production.

3. Which one of the following statements best represents your intention to either use or not use organic methods on your farm within the next ten years?

1 = I have a very strong intention to use organic methods

2 = I have a strong intention to use organic methods

3 = I intend to use organic methods

4 = I have no intention to either use organic methods or not to use organic methods

5 = I intend not to use organic methods

6 = I have a strong intention not to use organic methods

7 = I have a very strong intention not to use organic methods

We are interested in your views about Genetic Engineering.

1. What is your level of support for each of the following?

1 = Totally opposed

3 = Neither opposed
nor supportive

4 = Supportive

2 = Opposed

5 = Totally supportive

The on-farm use of GMOs for human food production.

The development of GMO products in the laboratory for medical applications.

The on-farm use of GMOs for animal feed production.

The harvesting of GMO products on the farm for medical applications.

2. Please indicate your level of agreement or disagreement with each of the following statements about GMOs:

1 = Very strongly disagree

4 = Neither

5 = Agree

8 = Don't know

2 = Strongly disagree

agree nor

6 = Strongly agree

3 = Disagree

disagree

7 = Very strongly agree

Farm GMO products are environmentally friendly.

The spread of farm GMOs can be controlled.

Farm GMO technology will solve the world's food problems.

Other GMOs will cure the world's major diseases.

Farm GMOs will improve the quality of lives for animals.

3. Please indicate your level of agreement or disagreement with each of the following statements about the use of GMOs on your farm:

- | | | |
|----------------------------|-------------|-------------------------|
| 1 = Very strongly disagree | 4 = Neither | 5 = Agree |
| 2 = Strongly disagree | agree nor | 6 = Strongly agree |
| 3 = Disagree | disagree | 7 = Very strongly agree |

- | | |
|--|----------------------|
| Using GMOs fits with my cultural and spiritual beliefs. | <input type="text"/> |
| I need to use GMOs on my farm. | <input type="text"/> |
| Using GMOs fits with my basic principles. | <input type="text"/> |
| Using GMOs is acceptable to me even if it causes harm to animals. | <input type="text"/> |
| Using GMOs is acceptable to me even if it causes harm to the environment. | <input type="text"/> |
| Using GMOs is acceptable to me even if it causes harm to people. | <input type="text"/> |
| Using GMOs is acceptable to me if it provides food for the hungry people of the world. | <input type="text"/> |

4. Please indicate your level of agreement or disagreement with the following statement about the use of GMOs in New Zealand:

- | | | |
|----------------------------|-------------|-------------------------|
| 1 = Very strongly disagree | 4 = Neither | 5 = Agree |
| 2 = Strongly disagree | agree nor | 6 = Strongly agree |
| 3 = Disagree | disagree | 7 = Very strongly agree |

GMOs can be used in New Zealand without adversely affecting organic farming.

5. Please indicate your level of agreement or disagreement with each of the following statements about GMO products:

- | | | |
|----------------------------|-------------|-------------------------|
| 1 = Very strongly disagree | 4 = Neither | 5 = Agree |
| 2 = Strongly disagree | agree nor | 6 = Strongly agree |
| 3 = Disagree | disagree | 7 = Very strongly agree |

- | | |
|--|----------------------|
| GMO plants are unlikely to become weeds. | <input type="text"/> |
| Genes from GMO crops may be transferred to other species where they may take on a negative role. | <input type="text"/> |
| GMO plants may have unforeseen effects on other species and ecosystems. | <input type="text"/> |
| There may be health benefits from eating food derived from GMO crops. | <input type="text"/> |

Please indicate your responses to questions about environmental attitudes.

1. Please indicate your level of agreement or disagreement with each of the following statements:

- | | | |
|----------------------------|-----------------------------------|-------------------------|
| 1 = Very strongly disagree | 4 = Neither agree
nor disagree | 5 = Agree |
| 2 = Strongly disagree | | 6 = Strongly agree |
| 3 = Disagree | | 7 = Very strongly agree |

We are approaching the limit of the number of people the earth can support.	
Humans have the right to modify the natural environment to suit their needs.	
When humans interfere with nature it often produces disastrous consequences.	
Human ingenuity will ensure that we do NOT make the earth unlivable.	
Humans are severely abusing the environment.	
The earth has plenty of natural resources if we just learn how to develop them.	
Plants and animals have as much right as humans to exist.	
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	

2. Please indicate your assessment of each of the following statements:

- | | | | |
|--------------|--------------|---------------|----------------|
| 1 = Very bad | 3 = Adequate | 4 = Good | 6 = Don't know |
| 2 = Bad | | 5 = Very good | |

The condition (quality) of New Zealand's natural environment in towns and cities is:	
The condition (quality) of New Zealand's other natural environments are:	
The condition (quality) of New Zealand's air is:	
The condition (quality) of New Zealand's natural environment compared to other developed countries is:	

Please indicate your response to the following general questions.

1. In your opinion, how well does Federated Farmers represent your views on each of the following topics?

1 = Very poorly 3 = Neither poorly 4 = Well 6 = Don't know
 2 = Poorly nor well 5 = Very well

Free trade.	
The Resource Management Act.	
Genetic engineering.	
Organic farming.	
Farming policy in general.	
Other, please specify below:	

.....

2. Please indicate your level of agreement or disagreement with each of the following statements about technology:

1 = Very strongly disagree 4 = Neither 5 = Agree
 2 = Strongly disagree agree nor 6 = Strongly agree
 3 = Disagree disagree 7 = Very strongly agree

Future generations can take care of themselves when facing risks imposed on them from today's technologies.	
If a risk from technology is very small then it is okay for society to impose that risk on individuals without their consent.	
Science can settle differences of opinion about the risks from a new technology.	
We can trust the experts who develop new technology.	
Technological development is destroying nature.	
Local residents should have authority to stop the use of a new technology if they think it is dangerous.	
A high technology society is important for improving our health and social well-being.	
The public should vote to decide on issues such as the use of new technology.	

3. Please indicate your level of agreement or disagreement with each of the following statements about general social issues:

- | | | |
|----------------------------|-------------|-------------------------|
| 1 = Very strongly disagree | 4 = Neither | 5 = Agree |
| 2 = Strongly disagree | agree nor | 6 = Strongly agree |
| 3 = Disagree | disagree | 7 = Very strongly agree |

- | | |
|--|--|
| Decisions about health risks should be left to the experts. | |
| In a fair system, people with more ability should earn more. | |
| If people were treated more equally, we would have fewer problems. | |
| What this world needs is a more equal distribution of wealth. | |
| We have gone too far in pushing equal rights in this country. | |
| We need more use of capital punishment. | |

4. Please indicate your level of agreement or disagreement with each of the following statements about trust and influence:

- | | | |
|----------------------------|-------------|-------------------------|
| 1 = Very strongly disagree | 4 = Neither | 5 = Agree |
| 2 = Strongly disagree | agree nor | 6 = Strongly agree |
| 3 = Disagree | disagree | 7 = Very strongly agree |

- | | |
|---|--|
| I have influence on the use of hazardous substances in New Zealand. | |
| I have influence on the use of new technologies in New Zealand. | |
| I trust government regulation and control of new technology in New Zealand. | |
| I trust policy development based on science and research. | |
| I trust the claims made by biotechnology companies. | |
| I feel I have very little control over risks to my health. | |

Please provide some information about your farm.

1. Please indicate which, if any, of the following are undertaken on your farm:

1 = Not undertaken

2 = Undertaken

Organic production.

The production of 'green' produce (e.g., using a low input or residue-free systems).

Production to meet the requirements of a quality assurance scheme or programme.

- **If any of the above are registered or certified, please identify the certifying organisation:**

2. If you use organic methods, or said earlier that you intend to, please tell us in your own words what you mean by organic farming.

3. Please indicate your predominant farming activity.

1 = Dairy - factory supply

2 = - town supply

3 = Pastoral - fattening

4 = - grazing

5 = - high country

6 = - stud

7 = Specialist livestock, including deer

8 = Forestry

9 = Arable

10 =

Horticulture

11 = Other - please specify below:

.....

4. **Approximately how many hectares is your farm?**

5. **We need to get an idea of the level of intensity (financial) of your farm operation. Please make an estimate in comparison to other farms of a similar type to yours.**

Intensity of Production

- 1 = High - Top 10%
- 2 = Above average - 60% to 89%
- 3 = Average - 40% to 59%
- 4 = Below average - 10% to 39%
- 5 = Low - Bottom 10%

Please provide some information about yourself. We need this information to check whether our sample is representative of the farming community.

1. Which one of the following best describes your position in relation to your farm?

- 1 = Owner
- 2 = Joint owner
- 3 = Share farmer
- 4 = Paid manager
- 5 = Paid farm worker
- 6 = Member of farming family (and not an owner)
- 7 = Paid spouse (and not an owner)
- 8 = Unpaid spouse (and not an owner)
- 9 = Other - Please specify below:

.....

2. **Sex:**

- 1 = Male
- 2 = Female

3. Age:

Years

4. What was your personal income over the past twelve months?

	(Approximate figures only)
Personal income from your farm	\$
Personal income from other sources	\$

5. What is the annual gross income from your farm?

(Approximate figures only)
\$

6. Please indicate the highest level of formal education you have completed either in New Zealand or the equivalent overseas.

1 = Primary school to Standard Six or Form 2

2 = High school without qualifications

3 = School Certificate

4 = UE or 6th Form Certificate

5 = Higher School Certificate, Bursary or Scholarship

6 = Diploma or Trade Certificate qualification from at least three months full time, or part time equivalent study

7 = Bachelors degree

8 = Postgraduate qualification

- Please indicate if you would like to receive a summary of the results of this survey.**

By post.

By e-mail.

E-mail address:

Please Turn Over

Further Research – Are you interested in participating?

Researchers at Lincoln and Otago Universities are setting up a study of what happens when farms or orchards convert to organic production. What the study will do is document farm level changes that are a result of converting to organic production and compare these to the performance of long term organic and conventional producers.

This study will cover all main farming types and will require three types of farmers: (1) those planning to convert to organic production (2) those intending to remain with conventional farming methods, and (3) those already established as organic farmers.

Involvement in this study will involve no additional work on your part although access to your farm will be required by research staff to measure a wide range of soil, plant, animal, economic and social variables. You would receive all the research results from your farm and, in addition, you would have access to results from the other farms participating in the study. The study will be very helpful for farmers who want to convert to organic production and for those who want to evaluate the performance of their conventional farming systems. The study will provide you with production, financial and environmental performance analyses and benchmarking.

If you would be willing to consider being included in this study, please indicate below. Just fill in one box on the grid by saying what type of land use would be involved. (While you have already indicated your farm type it is possible that you may want to convert only a part of your farm with only one particular land use.)

Please select <u>one</u> of the following:	Farm Type / Land Use (please specify)
I have a pre-conversion conventional farm but intend to convert to organic methods in the near future.
I have a conventional farm with no intention to convert to organic methods in the near future but wish to be included in the study.	
I am an existing organic grower (about five years standing or longer).	

Thank you for your time and attention given to responding to this questionnaire.

RESEARCH REPORTS

- 236 **Investigating Community: Imperatives for but Constraints Against Land Use Change in the Mackenzie/Waitaki Basin.** Morris, Carolyn., John R Fairweather & Simon R Swaffield, 1997
- 237 **A Comparison of the Structure and Practice of Dairy Farming in New Zealand and Japan.** Kazuaki Araki, 1998
- 238 **The Development of Organic Horticultural Exports in New Zealand.** Campbell, Hugh & Fairweather, John 1998
- 239 **A New Zealand Trade Share Database, 1966-96.** Cagatay, S & Lattimore, R 1998
- 240 **A Review of Economic Reforms in Bangladesh and New Zealand, and Their Impact on Agriculture.** Jahangir Alam, 1999
- 241 **Public Perceptions of Natural and Modified Landscapes of the Coromandel Peninsula, New Zealand.** Fairweather, John R & Swaffield, Simon R 1999
- 242 **Instruments for Internalising the Environmental Externalities in Commercial Fisheries.** Hughey, K F D., Cullen, R., Kerr, G N and Memon P A 2000
- 243 **New Zealand Farmer and Grower Intentions to Use Genetic Engineering Technology and Organic Production Methods.** Cook, Andrew J., Fairweather, John R & Campbell, Hugh R 2000
- 244 **Success Factors in New Land-based Industries.** Mayell, Peter J. & Fairweather, John R 2000
- 245 **Smallholders in Canterbury: Characteristics, Motivations, Land Use and Intentions to Move.** Fairweather, John R & Robertson, Nicola J 2000
- 246 **A Comparison of the Employment Generated by Forestry and Agriculture in New Zealand.** Fairweather, John R., Mayell, Peter J and Swaffield, Simon R 2000
- 247 **Forestry and Agriculture on the New Zealand East Coast: Socio-economic Characteristics Associated with Land Use Change.** Fairweather John R., Mayell, Peter J and Swaffield, Simon R 2000
- 248 **Community Perception of Forest Sector Development on the New Zealand East Coast: Likely and Acceptable Employment Activities, Infrastructure and Landscape Change.** Swaffield, Simon R and Fairweather, John R 2000
- 249 **Gisborne/East Coast Field Research on Attitudes to Land Use Change: An Analysis of Impediments to Forest Sector Development.** Tomlinson, Craig J., Fairweather, John R and Swaffield, Simon R 2000
- 250 **Criteria to Evaluate the Application of Policy Instruments Designed to Internalise Externalities from Commercial Fisheries.** Cullen, Ross., Hughey, Ken F D., Kerr, Geoffrey N and Memon, Ali 2000
- 251 **Environmental Beliefs and Farm Practices of New Zealand organic, Conventional and GE Intending Farmers.** Fairweather, John R., Campbell, Hugh R., Tomlinson, Craig J. and Cook, Andrew J. 2001
- 252 **An Assessment of the Economic Costs of Relapsing-Remitting Multiple Sclerosis in the Canterbury/Westland Region of New Zealand.** Jackson, Diana., Tomlinson, Craig J., Fairweather, J. and Donaldson, I. 2001
- 253 **Research on the Consequences of Converting to Organic Production: A Review of International Literature and outline of a Research Design for New Zealand.** Fairweather, J.R. and Campbell, H.R. 2001
- 254 **Lincoln Trade and Environment Model: An Agricultural Multi-Country, Multi-Commodity Partial Equilibrium Framework.** Cagatay, S. and Saunders, C. 2003

DISCUSSION PAPERS

- 142 **Papers Presented at the 2nd Annual Conference of the NZ Agricultural Economics Society. Blenheim 1995**
- 143 **The Implications of Government Reform in New Zealand for the Canadian Agri-Food Sector.** Storey, Gary G 1996
- 144 **Papers Presented at the 3rd Annual Conference of the NZ Agricultural Economics Society. Blenheim 1996**
- 145 **Papers Presented at the 4th Annual Conference of the NZ Agricultural Economics Society. Blenheim 1997**
- 146 **Papers Presented at the 5th Annual Conference of the NZ Agricultural Economics Society. Blenheim 1998**
- 147 **Papers Presented at the 6th Annual Conference of the NZ Agricultural Economics Society. Blenheim 2000**
- 148 **Papers Presented at the 7th Annual Conference of the NZ Agricultural Economics Society. Blenheim 2001.**