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Articles

Risk Management Strategies in New Zealand Agriculture and Horticulture

Sandra Martin*

This study strengthens the empirical basis for risk analysis by identifying the importance which producers attach to different risk management strategies in New Zealand's deregulated farming environment. A nationwide survey covering eight farm types was conducted. A range of production, marketing and financial strategies used by farmers and growers were identified. Some strategies appear to be favoured by farmers and growers in all industries, others seem to be industry specific, and some are universally unpopular. The mix of strategies employed seems to vary by farm type. Possible reasons for variation are identified.

1. Introduction

The deregulation of the New Zealand economy which began in 1984 radically altered the economic environment facing New Zealand farmers and growers and they are now fully exposed to the vagaries of the market place (Tyler and Lattimore). This has increased the risk exposure facing them. As well as managing risks associated with physical factors such as unfavourable weather and pests and diseases, farmers and growers are now required to deal with greater market uncertainty. As a result, they have been forced to re-evaluate sources of risk which they face and to take measures to protect their businesses against these risks. This is likely to have resulted in changes to traditional patterns of risk management as farmers and growers have adjusted to the new risk environment. This phenomenon is not unique to New Zealand with Australian farmers also facing these deregulatory pressures. In the U.S.A. also, a complex risk environment has emerged over the last 15 years with the farm sector becoming more sensitive to a wide range of external forces (Eidman).

It is universally acknowledged that risk and uncertainty play an important role in agriculture world-wide, and it is not surprising that a substantial research focus on techniques for analysing risky decisions has emerged in the literature. Risk programming models such as linear programming, quadratic risk program-

ming, MOTAD programming, target MOTAD and stochastic programming approaches have all been used to generate risk efficient outcomes which can be used to aid decision-making under uncertainty (Hardaker *et al.*), and much research has been devoted to developing and refining these techniques.

Converting the reality of uncertainty in a farming system into a planning model requires skill in accurately perceiving this reality and then translating this perception into an appropriate model (Hardaker *et al.*). Hence, skill in model construction must be matched by an understanding of the farming system so that the boundaries of any risk problem can be specified widely enough so that solutions can be derived which make sense in the context of the overall farming system (Malcolm). For example, deriving the most efficient combination of enterprises and selling options may be of limited value if these strategies for managing risk are perceived by producers as much less efficient than the ability to remain flexible with respect to enterprise selection and marketing decisions so as to be able to respond very rapidly and opportunistically to changing weather and price conditions.

Concern has been expressed that the research effort expended on risk modelling has not been matched by a corresponding understanding of the importance

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which producers attach to the strategies being modelled, thereby increasing the risk of standardised modelling formulations producing spurious results (Boggess *et al.*, Patrick *et al.*). As a result, benchmark studies of producers' perceptions have been initiated (Boggess *et al.*; Patrick *et al.*; Scott). These confirm that decision-making criteria vary across geographic regions and by farm type (Patrick *et al.*).

The objective of this study is to strengthen the empirical basis for risk analysis by identifying the importance which producers attach to different risk management strategies in a deregulated farming environment. This may provide ideas or refocus direction for risk modelling efforts. Following a general discussion on risk and risk management, the results of a nationwide survey on risk management of New Zealand farmers and growers from a range of farm types are presented and discussed. The implications of these results for directions in risk research are considered.

2. Risk and Risk Management

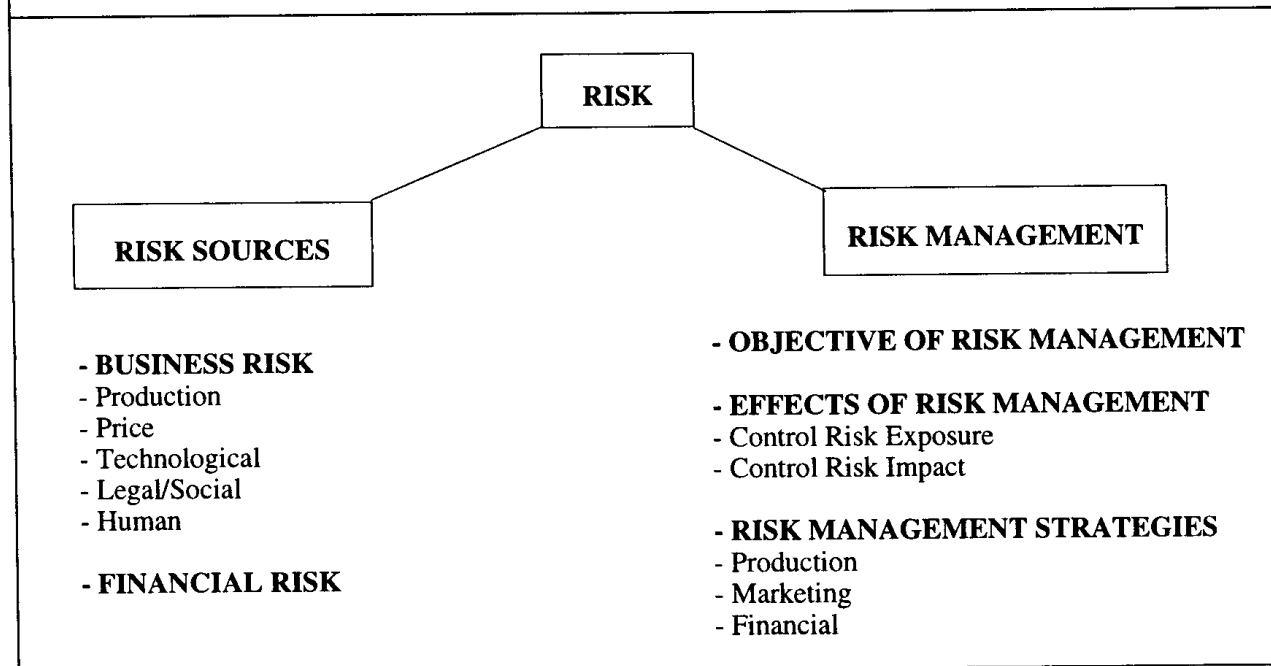
In this section, some concepts of risk and risk management are discussed. These are illustrated in Figure 1.

Risk can be classified as business or financial risk (Gabriel and Baker). Business risk incorporates production risk (which impacts on yields) and market risk

(which impacts on input and output prices). This business risk is reflected in the variability of the net operating income (or the net cash flows) of the business. Financial risk is reflected in the added variability of the net cash flows to the owners of equity. It essentially represents the risk of being unable to meet prior claims on the business with cash generated by the farm. Debt servicing commitments usually account for a large component of these prior claims.

The classification of risk into business (or production and price) risk and financial risk allows the impact of each of these sources of risk on the farm operation to be clearly monitored by observing their influence on yield, output prices and input costs, and residual cash flows to equity owners. However, it may obscure the subtle forces which impact on these yields, prices and residual cash flows. Sonka and Patrick identify three additional categories of business risk, these being technological, legal/social and human. They argue that risk may be termed technological if it is possible that current investments in assets may be offset by technical improvements in the future or if new technologies impact on the profitability of farming systems. Legal and social risks may arise with the use of non-farm sources of capital and contractual mechanisms such as forward contracts. Similarly, human risk may be associated with the labour and management functions of farming and could include the vulnerability of the sole farm operator and the availability and reliability of

Figure 1: Concepts of Risk and Risk Management



labour. More recently, Anderson argues in similar vein that any categorisation of risk should include social, health and policy risks as well as the traditional yield and price risks which are so familiar to agricultural economists.

If the net operating income of a farm business consistently fails to exceed prior commitments, then the survival of the business is threatened. The objective of risk management is to reduce the chances of a vulnerable situation such as this while achieving the highest possible returns for the owners of equity consistent with their attitudes to risk.

Strategies to manage risk can have two broad effects. There are those strategies which can be used to control risk exposure, and those which aim to control the impact of risk on the farm business (Jolly). Business risk exposure can be controlled by manipulating the probability distributions facing the farm business so that variability is reduced. This can be done by either smoothing out yields and prices or by cutting off troughs in these. Examples of risk responses which smooth out yields and prices are enterprise selection, enterprise diversification and marketing strategies which smooth out price fluctuations. Insurance is an example of a strategy which can be used to cut off troughs. Controlling the impact of risk on the farm business does not influence the underlying distributions faced by the business. Strategies in this category impact on the capacity of the farm business to absorb unfavourable downturns. They could include raising the level of yields and prices so that the level of net operating income is higher, as well as strategies for alleviating financial risk, such as lowering leverage, matching debt repayment to income generation and maintaining cash or credit reserves.

Risk management strategies can be classified as production, marketing or financial and a large number of possibilities within each of these categories are cited by Barry and Fraser and Sonka and Patrick. Although a range of risk-reducing strategies are possible in principle, the number which are actually used by individual farmers in practice is likely to be much more limited. Strategies may be inappropriate because of farm size, type, location or ownership structure. In this study, the strategies for managing risk considered most important by different groups of farmers and growers in New Zealand are identified.

3. Methodology

A questionnaire was prepared with questions on farmer and property attributes, the importance attached to different risk sources and the use and importance attached to different risk management strategies. The theoretical framework proposed by Sonka and Patrick was used to frame nineteen questions on risk sources. The resulting questions and their wording was checked against the survey instrument used by Boggess *et al.*, in a similar study. Two open-ended options allowed respondents to specify any other risk sources affecting them. The relative importance attached to different risk sources was captured using a Likert format 1-5 scale. A list of 22 potential risk management responses was gathered from the literature (Barry and Fraser; Sonka and Patrick; Boggess *et al.*, Patrick *et al.*), and the wording checked against Boggess *et al.* Once again, open-ended options were included. Respondents were asked to assess the importance of each management response on a Likert scale (which included a 'Not Applicable' option) and to indicate whether they used the method. The questionnaire was thoroughly pretested on a range of farm types in both the North and South Islands, with particular emphasis placed on the interpretation of the wording of questions and the adequacy of coverage of risk sources and responses. Changes to questions were made if necessary and further pretesting was then done.

The population chosen [to sample from] covered 8 farm types including all major farm types and a number of minor farm types which illustrate the diversity of New Zealand farming activity. In total, they included 84 per cent of the total number of farms (excluding idle land and research/educational farms) (New Zealand Department of Statistics). Farm types included were sheep and beef (46 per cent of the total number of farms), dairy (23 per cent), deer (3 per cent), pipfruit (2 per cent), kiwifruit (4 per cent), cropping (2 per cent), vegetables (3 per cent) and flowers (1 per cent). Farm types with less than 1 per cent of the total number of farms were excluded. Also excluded were farm types where it was judged too difficult to administer a common survey instrument, such as horse breeding and training (3 per cent) and plantations (2 per cent) and farm types where activity was vaguely specified, such as mixed livestock (4 per cent).

A nationwide postal survey was then conducted. It covered 2780 farmers, consisting of a random sample of 750 dairy farmers, 850 sheep and beef farmers, 150 deer farmers, 200 pipfruit growers, 200 kiwifruit

growers, 200 vegetable growers and 150 flower growers from the Department of Statistics master file. The survey of 280 cropping farmers was restricted to the Canterbury region where the majority of cropping is conducted. The survey was sent out in July 1992. Usable responses were received from 1384 respondents, these being 327 dairy farmers, 504 sheep and beef farmers, 54 deer farmers, 93 pipfruit growers, 65 kiwifruit growers, 126 cropping farmers, 48 vegetable growers, 61 flower growers and 106 farmers who classified their operation as other than the above. The overall response rate was 53 per cent varying from 41 per cent for kiwifruit growers to 57 per cent for sheep and beef farmers.

A telephone survey of 30 non-respondents in each group (except dairy and sheep and beef farmers where 35 non-respondents in each category were surveyed) was conducted in October 1992. For kiwifruit orchardists, there was evidence to suggest that those growers who think they carry more risk than average were under-represented in the postal responses. No evidence of non-respondent bias other than this was found.

Farm types were divided into three groups for analysis. The first was pastoral and included dairy, sheep/beef and deer. The second group covered the perennial horticultural crops of pipfruit and kiwifruit, while the third included cropping, vegetables and flowers. Comparisons between farm types within each of the groups with respect of the importance attached to different risk management strategies were made using χ^2 tests. In a few cases, the χ^2 tests may not be reliable because of low counts in some cells. In these instances, differences are discussed only if they are clearly obvious from visual inspection of the data.

4. Results and Discussion

In this Section, the importance attached by farmers and growers to different risk sources is initially discussed. This is necessary to put the importance attached to different risk management strategies into context.

Farmers and growers perceptions of the importance of different risk management strategies and their use of these are then described and discussed separately for each of the three groups. Within each group, results are presented and these are then discussed for each property type. This allows the mix of strategies used by each property type to be clearly illustrated, with differences between them being explained in the con-

text of similar farming systems and industries. A general discussion on the survey results follows after all property types have been examined.

4.1 Risk Sources

Market risks were ranked as very important by all farmers and growers (Table 1). Changes in product prices were ranked as the most important risk source in almost every case with kiwifruit orchardists and vegetable growers showing a higher level of concern than other groups. All groups except vegetable growers ranked changes in the world economic and political situation as important. Changes in New Zealand's economic situation and changes in input costs were also considered important, although deer farmers were less concerned about input costs than other producers. The importance attached to these market risks suggests that New Zealand producers are well aware of the vagaries of the international market place and are concerned about the impact of this on their businesses.

Producers' assessments of production risks were not quite so uniform. Rainfall variability was considered an important risk by dairy, sheep and beef and cropping farmers and vegetable growers but was not so critical for deer farmers, pipfruit and kiwifruit orchardists and flower growers. On the other hand, other weather factors were critical for pipfruit and kiwifruit growers but of more moderate importance for all other groups except deer farmers who were not so concerned about them. Diseases and pests were ranked highly by pipfruit and kiwifruit orchardists and vegetable and flower growers, but were of lower but still significant concern to all other groups. These differences in the importance attached to production risks reflect the different characteristics of the different regions, farm types and products.

Changes in interest rates were viewed as a moderate risk source across all farm types although flower growers viewed this as slightly less important. This suggests that most farmers have now made the necessary adjustments to bring financial risk under control and to a level appropriate for a deregulated environment.

Even though deregulation was supposed to remove risks associated with government policies, producers still had some concerns about regulatory risk with changes in government laws and policies being considered a moderate risk across all groups. However, deer farmers were more concerned about this regulatory risk than other groups while vegetable and flower

Table 1: A Comparison of the Importance Attached to Different Risk Sources^a

Risk Source	Dairy (N=325) Mean	Sheep & Beef (N=500) Mean	Deer (N=53) Mean	Pipfruit (N=92) Mean	Kiwifruit (N=65) Mean	Cropping (N=126) Mean	Vegetables (N=48) Mean	Flowers (N=60) Mean	Range	Sig ^d
Market Risks:										
Changes in Product Prices	4.2 ^b (0.9) ^c	4.3 (0.8)	4.3 (0.7)	4.0 ^b (0.9) ^c	4.7 (0.6)	4.0 ^b (0.9) ^c	4.6 (0.6)	4.2 (1.0)	4.2 - 4.7	***
Changes in World Economic and Political Situation	3.8 (1.0)	3.7 (1.0)	3.9 (1.0)	3.8 (1.1)	4.0 (1.1)	3.5 (1.0)	2.8 (1.3)	3.4 (1.4)	2.8 - 4.0	***
Changes in New Zealand's Economic Situation	3.7 (1.0)	3.7 (1.0)	3.3 (1.1)	3.3 (1.0)	3.4 (1.1)	3.6 (1.1)	3.6 (1.2)	3.2 (1.3)	3.2 - 3.7	***
Changes in Input Costs	3.6 (1.0)	3.7 (1.0)	3.2 (1.2)	3.5 (1.0)	3.6 (1.0)	3.7 (1.1)	3.8 (1.1)	3.6 (1.2)	3.2 - 3.8	*
Financial Risks:										
Changes in Interest Rates	3.4 (1.3)	3.3 (1.4)	3.1 (1.4)	3.1 (1.4)	3.2 (1.3)	3.3 (1.4)	3.1 (1.4)	2.8 (1.5)	2.8 - 3.4	**
Changes in Land Prices	2.7 (1.7)	2.6 (1.2)	2.3 (1.2)	2.2 (0.9)	2.5 (1.2)	2.7 (1.2)	2.5 (1.2)	2.0 (1.2)	2.0 - 2.7	***
Production Risks:										
Rainfall Variability	3.9 (1.1)	3.6 (1.2)	2.9 (1.3)	3.0 (1.1)	3.0 (1.2)	3.9 (1.2)	3.4 (1.4)	2.5 (1.4)	2.5 - 3.9	***
Other Weather Factors	2.9 (1.2)	3.0 (1.2)	2.5 (1.2)	4.7 (0.6)	4.4 (0.8)	3.8 (1.0)	3.9 (1.3)	3.8 (1.1)	2.9 - 4.7	***
Diseases or Pests	3.2 (1.2)	3.2 (1.2)	3.5 (1.2)	3.9 (1.2)	3.8 (1.2)	3.5 (1.2)	4.0 (1.2)	4.0 (1.0)	3.2 - 4.0	***
Disasters	2.5 (1.5)	2.2 (1.2)	1.8 (0.9)	2.3 (1.5)	2.0 (1.2)	2.7 (1.3)	2.7 (1.6)	2.2 (1.3)	1.8 - 2.7	***
Regulatory Risks:										
Changes in Government Law and Policies	3.4 (1.1)	3.4 (1.1)	3.8 (1.1)	3.6 (1.2)	3.3 (1.1)	3.4 (1.1)	3.0 (1.2)	3.1 (1.4)	3.0 - 3.8	***
Changes in Local Body Law and Regulations	2.8 (1.1)	2.8 (1.1)	2.6 (1.1)	2.8 (1.1)	2.5 (1.1)	2.7 (1.1)	2.8 (1.2)	2.7 (1.3)	2.5 - 2.8	N.S.
Changes in Producer Board Policies	3.5 (1.2)	3.2 (1.1)	3.3 (1.2)	4.1 (1.1)	4.2 (0.9)	2.8 (1.2)	2.3 (1.2)	2.1 (1.3)	2.1 - 4.2	***
Human Risks:										
Accidents or Health Problems	3.5 (1.2)	3.6 (1.2)	3.4 (1.2)	3.4 (1.3)	3.0 (1.3)	3.6 (1.2)	3.8 (1.3)	3.8 (1.3)	3.0 - 3.8	N.S.
Changes in Family Situation	2.7 (1.3)	2.9 (1.3)	2.5 (1.3)	2.7 (1.3)	2.5 (1.3)	2.9 (1.3)	3.0 (1.5)	2.7 (1.5)	2.5 - 3.0	N.S.
Miscellaneous Risks:										
Theft	2.5 (1.2)	2.4 (1.2)	2.7 (1.2)	2.4 (1.0)	2.0 (1.1)	2.3 (1.1)	2.7 (1.2)	2.1 (1.0)	2.1 - 2.7	N.S.
Problems with Hired Labour and Contractors	2.3 (1.1)	1.9 (1.0)	1.7 (1.1)	2.7 (1.0)	2.8 (1.1)	2.1 (1.0)	2.4 (1.3)	2.0 (1.0)	1.7 - 2.8	***
Changes in Technology and Breeding	2.2 (1.2)	2.0 (1.0)	1.9 (1.0)	2.5 (1.1)	2.6 (1.0)	2.3 (1.1)	2.4 (1.3)	2.3 (1.3)	1.9 - 2.6	***
Being unable to meet Contracting Obligations	1.8 (1.0)	1.7 (1.0)	1.7 (1.0)	2.2 (1.1)	2.1 (1.2)	2.2 (1.1)	1.9 (1.3)	2.0 (1.1)	1.7 - 2.2	***

^a Ranking on a scale of 1 to 5 with 1 = Not Important to 5 =Extremely Important.

^b Mean ranking.

^c Standard deviations in parentheses.

^d χ^2 tests on the distributions underlying the means were conducted;
N.S. means Not Significant; *, ** and *** mean significant at the 1%, 5% and 10% levels respectively.

growers were less concerned. This may be a result of changes to velveting, deer handling and deer marketing regulations being proposed at the time of surveying. Not surprisingly, changes in producer board policies were of particular concern to farmers in those industries with highly regulated marketing structures where changes have been contemplated. Pipfruit and kiwifruit growers in particular ranked this risk source highly, while dairy farmers viewed it as a moderate risk. Sheep and beef, deer and cropping farmers showed a lesser level of concern while vegetable and flower growers who operate in an unregulated marketing system had few concerns.

The human risk associated with accidents or health problems was also a moderately important risk for all farm types. This concern reflects the vulnerability of sole operators in much of New Zealand's primary production.

4.2 Risk Management Strategies by Pastoral Farmers

It appears that pastoral farmer concerns about rainfall variability are not met by having irrigation capacity but by maintaining feed reserves and having the short-term flexibility to adapt to changing circumstances (Table 2). In combination with routine spraying and drenching, these strategies help to maintain high yields and to reduce yield variability. In addition, sheep and beef and deer farmers place greater importance on having more than one breed or production technique and not producing to full capacity, with dairy farmers using these strategies less than other pastoral farmers.

Variation exists between pastoral farmers in the importance attached to marketing strategies. Because of the single desk marketing structure in the dairy industry, individual farmers are unable to meet their fears about market risks by employing marketing strategies in an attempt to influence either their price level or variability. However, sheep and beef and deer farmers are able to meet these concerns by employing farm level strategies to improve price performance. Their use of market information in conjunction with an ability to react quickly to price changes allows prices to be enhanced, while spreading sales and having more than one enterprise can smooth out price fluctuations. For all pastoral farmers, enterprise flexibility is used to maintain market responsiveness, with sheep and beef farmers using this strategy more often. Forward contracting is not considered an important risk management strategy of sheep and beef and deer farmers, which suggests that they want to maintain the ability

to enhance price performance as much as they can while using other strategies to smooth out prices.

All pastoral farmers ensure that they have the ability to absorb any unfavourable price falls through the use of financial strategies such as keeping debt low, managed capital spending, and a range of auxiliary financial strategies such as financial reserves, insurance, debt management and arranging overdraft reserves. Deer farmers use managed capital spending less than other groups, while dairy farmers make greater use of financial reserves.

Dairy farmers attach less importance to enterprise diversification, off-farm investment and off-farm work than other pastoral farmers. The rigid demand for labour in dairying may be one reason for this. This gives the impression of a tight on-farm focus on one enterprise where efforts are made to ensure high and stable yields while maintaining the financial ability to absorb unfavourable downturns. Sheep and beef farmers also have an on-farm focus, although greater importance is attached to off-farm work by family members and this occurs more often than in dairying. Unlike dairy farmers, this on-farm focus can encompass more than one enterprise. On the other hand, deer farmers rank off-farm investment and off-farm income more highly than other pastoral farmers and over half of the main farm operators work off the farm even though they do not view this as a particularly important risk management strategy. This is likely to be a historical reflection of the fact that many deer farmers were working off farm before they got into deer farming.

4.3 Risk Management Strategies by Pipfruit and Kiwifruit Growers

There are many similarities between pipfruit and kiwifruit growers in their responses to risk, although there are some differences which can be explained by product and industry characteristics (Table 3). Both groups emphasise high yield, high quality and stable yields by a variety of production strategies such as routine spraying and monitoring pests, crops and climate. Because moisture is a less critical factor in determining fruit size, irrigation is less important for kiwifruit growers.

The single desk marketing structure and the perennial nature of the product in both industries means that growers are unable to use short-term marketing strategies to alleviate fears about price risk. In the longer term, having more than one variety is an important response which pipfruit growers use to enhance and

Table 2: A Comparison of the Importance Attached to Different Risk Management Responses and Their Use by Pastoral Farm Types

Risk Response	Importance Attached to Response ^a							% Using Response			
	Dairy (N=315)		Sheep/Beef (N=488)		Deer (N=52)		Sig ^d	Dairy	Sheep/ Beef	Deer	Sig ^d
	Mean	Rank	Mean	Rank	Mean	Rank					
Production Responses:											
Routine spraying and drenching	3.9 ^b (1.3) ^c	1	4.0 (1.0)	1=	4.1 (1.0)	1	N.S.	92	95	94	N.S.
Maintaining feed reserves	3.8 (1.1)	2	4.0 (1.0)	1=	4.0 (1.1)	2	* ^e	96	94	92	N.S.
More than one breed or production technique	1.8 (1.5)	14	2.8 (1.4)	13=	3.1 (1.6)	9=	***	39	69	74	***
Not producing to full capacity	2.2 (1.5)	12	2.8 (1.4)	13=	2.7 (1.5)	12=	***	43	63	51	***
Monitoring pests,crops, climate	2.3 (1.7)	11	2.2 (1.6)	16	2.0 (1.7)	18	N.S.	49	47	39	N.S.
Irrigation	0.7 (1.4)	21=	0.8 (1.5)	21=	0.9 (1.5)	21=	*** ^c	10	15	14	N.S.
Marketing Responses:											
Market information	2.0 (1.8)	13	3.6 (1.3)	3=	3.8 (1.2)	3	***	51	89	94	***
Spreading sales	1.7 (1.9)	15=	3.6 (1.3)	3=	3.5 (1.3)	5	***	41	85	86	***
More than one enterprise	1.7 (1.5)	15=	3.4 (1.5)	6=	3.3 (1.6)	6=	***	34	79	68	***
Forward contracting	0.9 (1.4)	19=	1.6 (1.5)	18	1.8 (1.6)	19	***	15	31	29	***
Futures markets	0.7 (1.3)	21=	0.8 (1.1)	21=	0.9 (1.3)	21=	*** ^c	9	6	10	N.S.
Financial Responses:											
Keeping debt low	3.7 (1.3)	3	3.6 (1.5)	3=	3.6 (1.5)	4	N.S.	85	82	83	N.S.
Managed capital spending	3.5 (1.4)	4	3.4 (1.5)	6=	3.2 (1.6)	8	N.S.	86	83	70	*
Arranging overdraft reserves	2.7 (1.6)	10	2.7 (1.7)	15	3.0 (1.5)	11	N.S.	75	67	73	N.S.
Debt management	2.8 (1.8)	9	2.9 (1.8)	12	2.7 (1.9)	12=	N.S.	68	69	58	N.S.
Financial reserves	3.1 (1.5)	6=	3.0 (1.6)	10=	2.6 (1.5)	14=	N.S.	72	62	59	*
Insurance	2.9 (1.6)	8	3.0 (1.7)	10=	2.6 (1.8)	14=	N.S.	77	75	61	N.S.
Off-farm investment	1.6 (1.6)	17	2.0 (1.7)	17	2.3 (1.8)	17	**	36	42	49	N.S.
Main farm operator working off farm	0.9 (1.3)	19=	1.1 (1.5)	20	2.5 (1.9)	16	*** ^c	13	20	54	***
Family members working off farm	1.0 (1.3)	18	1.4 (1.6)	19	1.6 (1.8)	20	**	19	30	34	**
Overall Responses:											
Short-term flexibility	3.2 (1.5)	5	3.4 (1.4)	6=	3.1 (1.5)	9=	N.S.	80	80	71	N.S.
Long-term flexibility	3.1 (1.6)	6=	3.3 (1.4)	9	3.3 (1.5)	6=	N.S.	73	81	70	*

- ^a Ranking from 1 = Not Important to 5 = Extremely Important; 0 = Not Applicable is included in the mean.
- ^b Mean ranking.
- ^c Standard deviations in parentheses.
- ^d χ^2 tests on the distributions underlying the means were constructed; N.S. means Not Significant; *, ** and *** mean significant at 1%, 5% and 10% levels respectively.
- ^e χ^2 may not be a valid test.

Table 3: A Comparison of the Importance Attached to Different Risk Management Responses and Their Use by Pipfruit and Kiwifruit Growers

Risk Response	Importance Attached to Response ^a					% Using Response		
	Pipfruit (N=91)		Kiwifruit (N=55)		Sig ^d	Pipfruit	Kiwifruit	Sig ^d
	Mean	Rank	Mean	Rank				
<u>Production Responses:</u>								
Routine spraying	4.6 (1.1)	1	4.5 (0.9)	1	N.S.	97	92	N.S.
More than one variety, breed or production technique	3.9 (1.6)	3	2.4 (1.5)	15=	**	87	33	**
Not producing to full capacity	0.8 (1.4)	19=	1.8 (1.5)	19	**	18	32	*
Monitoring pests, crops, climate	3.8 (1.4)	4	3.4 (1.3)	6	N.S.	85	78	N.S.
Irrigation	4.0 (1.4)	2	3.3 (1.7)	7=	**	91	76	*
<u>Marketing Responses:</u>								
Market information	3.0 (1.9)	10=	2.8 (1.6)	11=	N.S.	78	57	**
Spreading sales	1.8 (1.9)	15	2.4 (1.9)	15=	N.S.	42	39	N.S.
More than one enterprise	3.0 (1.7)	10=	2.7 (1.5)	13	N.S.	64	39	**
Forward contracting	0.8 (1.5)	19=	1.5 (1.7)	20	N.S.	15	15	N.S.
Futures markets	0.5 (1.2)	21	1.4 (1.8)	21	**	8	13	N.S.
<u>Financial Responses:</u>								
Keeping debt low	3.5 (1.6)	7	4.1 (1.3)	2	N.S.	78	87	N.S.
Managed capital spending	3.6 (1.4)	5=	3.9 (1.2)	3	N.S.	92	86	N.S.
Arranging overdraft reserves	2.6 (1.7)	12=	3.0 (1.6)	9=	N.S.	68	65	N.S.
Debt management	2.6 (1.9)	12=	3.5 (1.6)	4=	*	62	77	*
Financial reserves	3.1 (1.5)	9	3.5 (1.2)	4=	N.S.	75	72	N.S.
Insurance	3.2 (1.6)	8	2.9 (1.4)	10	*	79	69	N.S.
Off-farm investment	2.0 (1.7)	14	2.8 (1.7)	11=	N.S.	52	48	N.S.
Main farm operator working off-farm	0.9 (1.4)	18	2.3 (1.8)	17	**	23	32	N.S.
Family members working off-farm	1.2 (1.5)	17	2.0 (1.8)	18	N.S.	28	31	N.S.
<u>Overall Responses:</u>								
Short-term flexibility	1.6 (1.9)	16	2.5 (1.9)	14	*	39	39	N.S.
Long-term flexibility	3.6 (1.5)	5=	3.3 (1.5)	7=	N.S.	86	68	**

^a Ranking from 1 = Not Important to 5 = Extremely Important; 0 = Not Applicable is included in the mean.
^b Mean ranking.

^c Standard deviations in parentheses.

^d χ^2 tests on the distributions underlying the means were constructed;
 N.S. means Not Significant; *, ** and *** mean significant at 1%, 5% and 10% levels respectively.

^e χ^2 may not be a valid test.

stabilise prices. This is possible because the New Zealand Apple and Pear Marketing Board has a policy of seeking a varietal edge in the international market place and structures its buying prices to encourage production of its preferred varietal mix. On the other hand, the kiwifruit industry made a decision to initially support one variety only as a part of its strategy of establishing a new product in the market place. This strategy may partly explain why kiwifruit growers use market information less than pipfruit growers as a risk management strategy even though they recognise its importance. Both groups emphasise long-term flexibility in their operations so they can make major changes if necessary in order to reduce risk. This is supported by enterprise diversification. However, significantly fewer kiwifruit growers use these strategies despite recognising their importance. This difference is likely to be a reflection of the stage of development in the two industries. Most kiwifruit plantings tend to be single enterprises set up relatively recently during a period of buoyant prices while New Zealand still had dominance in the international market. Prices have since declined and although growers recognise the importance of flexibility and multiple enterprises, some may not be able to put these strategies into place because of financial pressures.

Both groups employ financial strategies such as managed capital spending, keeping debt low, insurance and financial reserves to absorb the impact of low yields and price downturns. Because the range of available production and marketing strategies are more limited for kiwifruit growers, they rank a number of financial strategies more highly, and place importance on a greater number of them. An interesting difference is the high ranking attached by them to debt management and financial reserves, and the significant difference in the importance attached to, and use of, debt management. When the survey was conducted, many growers who bought properties at high prices when kiwifruit prices were high faced severe financial pressure and have since had to adjust financially to falling prices and property values which have resulted from the product of international competitors coming on-stream.

The lack of importance attached to off-farm investment and off-farm income by pipfruit growers suggests a strong on-farm risk management focus. Kiwifruit growers have slightly less of an on-farm focus with off-farm investment being more highly ranked and greater importance being attached to the off-farm earnings of the main operator even though this is a very low ranking strategy. This is not surpris-

ing given the single enterprise status of many kiwifruit operations and the financial pressure they were under at the time of the survey. It may also reflect the historical development of a new industry where outside investment was a significant force.

4.4 Risk Management Strategies in Cropping, Vegetables and Flowers

All groups employ a wide range of production strategies to alleviate yield risk (Table 4). All enhance yield by routinely spraying and monitoring pests, crops and climate, with flower growers placing significantly greater emphasis on the former and less on the latter. This reflects the nature of the product, where appearance is critical and small blemishes can lead to a catastrophic drop in value. For cropping farmers, yield variability is reduced by having more than one enterprise, using more than one variety and being very flexible in the short-term. Such strategies seem logical in an environment where a large number of annual crops can be grown on good soils in a relatively benign climate. Vegetable and flower growers react similarly although they place less emphasis on enterprise diversification. One interesting result is the lower importance attached to irrigation by cropping farmers who, on average, did not rank it highly. However, perusal of the distribution underlying the mean for this variable revealed that it was bimodal with one group having no irrigation and ranking it of little importance as a strategy and the other group ranking it as very important. Hence, dryland farmers will produce a restricted range of crops which can minimise the impact of water deficit at critical times, whereas irrigated farmers will have access to a greater range of production techniques and crops.

The cornerstone marketing strategies used by cropping farmers to enhance and stabilise prices are having more than one enterprise, using market information and being flexible in the short-term to capitalise on market opportunities. They rank these strategies more highly than vegetable and flower growers, reflecting the wider variety of short-term opportunities for producing different crops quickly to meet market demands, and the wider range of selling options available to them. Back-up marketing strategies are spreading sales and forward contracting. Forward contracting is considered more important by cropping farmers than by other groups. One explanation for this may be that there is a more concentrated buying structure in many of the industries using the crops produced which may mean that forward contracts are more readily available.

Table 4: A Comparison of the Importance Attached to Different Risk Management Responses and Their Use by Cropping, Vegetable and Flower Respondents

Risk Response	Importance Attached to Response ^a							% Using Response			
	Cropping (N=121)		Vegetables (N=48)		Flowers (N=59)		Sig ^d	Cropping	Vegetables	Flowers	Sig ^d
	Mean	Rank	Mean	Rank	Mean	Rank					
<u>Production Responses:</u>											
Routine spraying	4.1 ^b (1.1) ^c	1=	4.0 (1.4)	1	4.5 (0.9)	1	*** ^c	93	89	95	N.S.
Maintaining feed reserves	3.4 (1.6)	10=	0.8 (1.5)	22	0.4 (1.1)	21	*** ^c	83	28	13	***
More than one variety, breed or production technique	3.7 (1.3)	6	3.1 (1.7)	9=	3.3 (1.5)	6	N.S. ^c	87	73	76	**
Not producing to full capacity	2.3 (1.4)	18	1.9 (1.8)	16	1.1 (1.5)	19=	***	50	54	23	***
Monitoring pests,crops, climate	3.9 (1.1)	3	3.6 (1.6)	4=	3.5 (1.6)	2	N.S. ^c	90	84	74	**
Irrigation	2.7 (2.2)	17	3.3 (2.0)	7	3.4 (1.9)	3=	* ^c	58	73	79	**
<u>Marketing Responses:</u>											
Market information	3.8 (1.2)	4=	3.4 (1.6)	6	3.0 (1.8)	10	*** ^c	88	89	76	N.S.
Spreading sales	3.1 (1.5)	13	3.6 (1.6)	4=	3.1 (2.0)	7=	***	76	78	72	N.S.
More than one enterprise	4.1 (1.4)	1=	3.7 (1.7)	3	3.1 (1.6)	7=	*** ^c	89	85	69	***
Forward contracting	3.4 (1.2)	10=	1.5 (1.7)	18	1.1 (1.5)	19=	***	88	32	24	***
Futures markets	0.7 (0.8)	22	1.0 (1.5)	20=	0.3 (1.0)	22	*** ^c	5	21	6	*** ^c
<u>Financial Responses:</u>											
Keeping debt low	3.6 (1.5)	7	3.9 (1.3)	2	3.4 (1.7)	3=	N.S. ^c	82	86	79	N.S.
Managed capital spending	3.5 (1.5)	8=	3.1 (1.7)	9=	3.4 (1.6)	3=	N.S. ^c	87	72	86	*
Arranging overdraft reserves	2.9 (1.6)	16	2.9 (1.8)	13	2.0 (1.8)	13=	***	75	77	50	***
Debt management	3.0 (1.8)	14=	2.6 (1.9)	14	1.8 (1.9)	15	***	72	61	34	***
Financial reserves	3.2 (1.6)	12	3.1 (1.7)	9=	2.7 (1.7)	12	N.S.	67	70	59	N.S.
Insurance	3.0 (1.6)	14=	2.5 (1.8)	15	2.9 (1.7)	11	N.S.	77	57	70	N.S.
Off-farm investment	1.7 (1.6)	19	1.7 (1.6)	17	1.6 (1.7)	17	N.S.	38	30	27	N.S.
Main farm operator working off-farm	0.9 (1.3)	21	1.1 (1.7)	19	1.7 (1.9)	16	*** ^c	13	19	40	***
Family members working off-farm	1.2 (1.5)	20	1.0 (1.5)	20=	1.5 (1.7)	18	N.S. ^c	29	23	39	N.S.
<u>Overall Responses:</u>											
Short-term flexibility	3.8 (1.3)	4=	3.1 (1.7)	9=	2.0 (1.8)	13=	*** ^c	87	74	44	***
Long-term flexibility	3.5 (1.2)	8=	3.2 (1.6)	8	3.1 (1.7)	7=	* ^c	85	77	73	N.S.

^a Ranking from 1 = Not Important to 5 = Extremely Important; 0 = Not Applicable is included in the mean.

^b Mean ranking.

^c Standard deviations in parentheses.

^d χ^2 tests on the distributions underlying the means were constructed;

N.S. means Not Significant; *, ** and *** mean significant at 1%, 5% and 10% levels respectively.

^e χ^2 may not be a valid test for difference.

In the vegetable and flower industries, the market for the majority of growers tends to be characterised by many buyers and sellers interacting through agents or auctions. Vegetable growers use similar strategies to cropping farmers with some differences in the relative ranking of strategies. They attach greater importance to spreading sales, which is likely to be a reflection of the fact that market gardeners will supply a vegetable throughout the season with successive crops rather than producing one crop. The lesser importance attached to market information and short-term flexibility suggests that the opportunities for gain by being highly responsive to the market are not as great in the vegetable industry. Flower growers do not rank marketing strategies as highly, and attach less importance to enterprise diversification and short-term flexibility. One explanation for this is that many flower growers have a specialist crop because different flowers require different environments, often controlled, and growers try to make optimum use of one large controlled facility rather than trying to manage several smaller ones. Another reason for the lower importance and use of short-term flexibility may be the perennial nature of many flowers. This may also account for the slightly lesser importance attached to the use of market information, which is also a feature of pipfruit and kiwifruit growers who also produce perennial crops.

The most highly ranked financial strategies by all groups are keeping debt low and managed capital spending. For cropping farmers and vegetable growers, these are supported by financial reserves, debt management, insurance and arranging overdraft reserves. Off-farm investment and income are not important although the ability to be flexible in the long-term is. Flower growers stress fewer supporting financial strategies. They consider debt management and arranging overdraft reserves to be of little importance and use these strategies less. A reason for this may be that flower growers are more likely to have off-farm income, which can give them the steady cash flow needed for flower production.

With respect to risk management in general, the impression gained is that cropping farmers have an on-farm multiple enterprise focus and are extremely flexible and responsive with respect to weather conditions in the short-term and market opportunities in both the short and long term. Vegetable growers also have this on-farm multiple enterprise focus on risk management, being flexible and responsive to market opportunities in both the short and long-term, though with less short-term responsiveness than cropping farmers.

On the other hand, flower growers have more narrowly focussed operations with respect to risk management with less short-term flexibility but greater reliance on off-farm income.

4.5 Discussion

This study identified a range of production, marketing and financial strategies perceived as important by New Zealand farmers and growers in managing risk, and a range of hypotheses on these perceptions can be generated with respect to the patterns observed. Some strategies appear to be favoured by farmers and growers in all industries, others seem to be more industry specific, and some are universally unpopular. These producer perceptions do not necessarily imply optimal risk management since producers may not have access to full information on alternative strategies. However, they do give an indication of what farmers actually do, and as such should be evaluated to determine the extent to which they reflect efficient or inefficient risk management practice or rapid or slow adoption because of information characteristics associated with different strategies.

All farm types use a number of production strategies. The importance attached to most of them, such as holding feed reserves, having more than one variety, breed or production technique, monitoring pests, crops and climate, irrigation and maintaining short-term flexibility seems to vary by farm type. This may be a reflection of product characteristics and climatic realities. For example, pipfruit, kiwifruit and flower growers may place less emphasis on short-term flexibility because of the perennial nature of their products. Similarly, irrigation is essential for fresh vegetable production and is an important risk reducing strategy for these growers, whereas pastoral farmers can exercise the alternative option of managing yield risk resulting from inadequate rainfall by maintaining flexibility in their farming operation.

One production strategy, precautionary input use through routine spraying and drenching, is universally popular, being ranked as the most important risk management strategy by all groups. This is obviously viewed as a very efficient form of risk management. Even with this strategy, however, there appears to be variation in its degree of importance with flower growers rating it more highly than other groups. This difference seems to be related to the nature of the product also, since appearance is critical in the flower industry and residues are not the issue that they are for

food products such as vegetables or most crops. One method which is not ranked very highly by any group was not producing to full capacity, suggesting that more explicit buffer strategies are preferred by those farmers in a position to use this strategy.

Although there is no specific marketing strategy ranked highly by all groups, the ability to remain flexible in the long-term is moderately important for all types of farmers and growers, reflecting a desire to be able to meet changing long-term market trends. As with production strategies, most marketing strategies such as the use of market information, spreading sales, having more than one enterprise and maintaining short-run flexibility vary by farm type. Such variations appear to be explained by product characteristics, resource realities under different farming systems and differences in the marketing environment. For example, spreading sales is ranked more highly by fresh vegetable growers than by other producers, and a likely explanation for this is that this is a feature of the product and market where several plantings allow supply to be spread more evenly over the season to meet consumer demand. Similarly, enterprise diversification is very important for cropping farmers but less popular for dairy farmers, who face labour constraints, or flower growers, who may have to trade off the benefits in risk reduction from enterprise diversification against the managerial problems associated with growing more than one crop in a controlled environment. One obvious example of product characteristics and marketing environment influencing the choice of risk management strategy is illustrated by the difference in importance attached to the use of more than one variety by pipfruit and kiwifruit growers who face single desk marketing structures in both industries. In the former case, the importance attached to more than one variety arises from the policy of the New Zealand Apple and Pear Marketing Board to seek a varietal edge for an established product in the international marketplace, whereas the kiwifruit industry made the decision to initially support one variety only as part of its strategy of product uniformity for establishing a new product in the market.

Two marketing strategies which are almost universally unpopular are the use of forward contracting and futures, although the use of forward contracts is ranked as moderately important by cropping farmers. The emergence and importance of forward contracting as a risk management measure may be related to market structure. In the processed vegetable industry, there is a concentrated buying structure with processors offer-

ing forward contracts to relatively small cropping farmers. As concentration increases in the production sector of the fresh vegetable and flower industries, it is possible that forward contracting and more integrated marketing will assume greater importance in risk management, but it is not an important method for most current growers. Rather than pricing before delivery using mechanisms such as forward contracting or futures markets to reduce price uncertainty, farmers and growers prefer where possible to enhance price performance through the use of market information and short-term flexibility. However, these strategies cannot be used by dairy farmers and pipfruit and kiwifruit growers who must sell to single desk buyers of their product, and is not a preferred method of operation by flower growers who tend to grow perennial crops.

There was remarkable uniformity between farm types in the importance attached to different financial strategies. All stress keeping debt low and managing capital spending. Backup strategies of more moderate importance are arranging overdraft reserves, insurance, debt management and financial reserves. However, kiwifruit growers rank debt management and financial reserves more highly than other groups, which appears to reflect the structural adjustment which was occurring in that industry as international prices fell in response to increased supply. It is possible that financial strategies for managing risk assume greater importance when producers in an industry are facing financial stress. Similarly, when the scope for managing risk through production and marketing strategies is limited, as in dairying, financial strategies may assume greater significance. Conversely, in industries characterised by a high proportion of part-time producers, such as the flower industry, financial strategies to buffer yield and price risk may not be so important, as this buffer could be provided by off-farm income. In general, however, off-farm financial strategies for reducing risk, such as off-farm investment or income, are not favoured by any group, which suggests that these are not perceived as particularly efficient strategies for managing risk. In fact, off-farm interests seem to be related to the pattern of entry into particular industries rather than being a conscious strategy for managing risk.

The results of the survey suggest that all groups of farmers and growers rely on a mix of strategies to reduce risk. In industries such as cropping where there are many production possibilities utilising a common resource base and a wide range of marketing alterna-

tives, a broad mix of strategies occurs. This pattern was also observable in a U.S. study (Patrick *et al.*). However, other groups operating in more restricted situations stress a narrower range of strategies. For example, dairy farmers employ a small number of production strategies to enhance and stabilise physical performance and place greater emphasis on a range of financial strategies to absorb downturns. Even though they rank changes in product prices as their most important source of risk, they can do nothing to manipulate milksolids prices because the single desk structure in the industry precludes most marketing strategies. Enterprise diversification is not a preferred option and one reason for this may be the relatively rigid pattern of labour demand in dairying.

It is hypothesised that the importance attached to the use of some strategies will be quite stable both spatially and temporally where the climatic, market structure and regulatory environments and product characteristics are similar. Mixed cropping tends to occur under favourable climatic conditions and enterprise diversification based on a range of annual crops is likely to be a highly important strategy for this farming system. This is shown in this study where it ranks as the most important strategy and is supported by Patrick *et al.*, in the U.S. study. However, differences are likely to be observable where the environments and product characteristics differ. For example, New Zealand kiwifruit growers rank debt management as a highly important risk strategy, but this importance is likely to recede over time as growers adjust debt to levels more compatible with the long-term market outlook for kiwifruit. Similarly, forward contracting may assume greater importance in the vegetable and flower industries if producer concentration increases. Differences in the regulatory environment may also lead to the use of different strategies for managing risk. For example, government commodity programmes were seen as an important risk strategy by U.S. cropping farmers (Patrick *et al.*) but are not an option in New Zealand's deregulated market environment. It is also likely that the strategies currently used by New Zealand farmers and growers have changed since the period prior to deregulation when government assumed much of the price risk in some industries.

5. Implications

This research suggests that the use of different risk management strategies in agriculture and horticulture varies for a number of reasons. These include climatic realities, the nature of the product, market factors and

market structure, the full or part time status of farmers, the industry life cycle, dynamic risk adjustment considerations and the regulatory environment. These factors preclude the use of certain strategies for producers in given situations. However, when such constraints are not present, they then seem to use a large number of the strategies potentially available to them, with some strategies being of primary importance while others are viewed as supporting strategies. Hence, farmers place importance on a mix of strategies rather than relying heavily on one strategy. This implies that a focus on the most efficient mix of risk strategies in a given situation would be a fruitful area for research, since optimising one strategy does not imply optimal risk management of the whole farm business.

This study also demonstrates that there is not necessarily an automatic linkage between specific risk sources and the use of particular risk strategies to alleviate that risk. In New Zealand's deregulated environment, farmers and growers are most concerned about market risk. However, obvious marketing strategies which can reduce this risk, such as forward contracting and the use of futures, were not even considered as viable risk responses by them. More preferred marketing strategies were the use of market information in conjunction with short-term flexibility to enhance prices, though in some cases, no marketing strategies were important, with financial buffers to absorb downturns being more widely used. Therefore, researchers should be wary of using concern about a particular risk source as a rationale for studying the mechanics of a specific strategy which is aimed at reducing this risk source, since there may be impediments to the adoption of this strategy which are not obvious to them, with farmers perceiving other strategies which are less directly related to the risk source as more efficient risk strategies.

It was concluded in this study that some risk strategies were universally popular with New Zealand farmers, some were universally unpopular and some were more important for some farm types than for others. It would be interesting to know if this conclusion is universal and, if so, what the characteristics are of risk strategies which are widely used and rarely used and to isolate the conditions under which particular risk strategies are likely to be widely adopted by farmers. More fundamentally, the research demonstrates that skill in model development must be matched by an understanding of the unique conditions of the farming system under scrutiny. This is necessary to avoid an

unconscious bias in risk modelling on particular strategies which may have a low probability of adoption in a particular regional farming system. Hence, risk analysis should have a strong empirical base.

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