CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Farmers make decisions about crop production under uncertainty due to variations in climate. Crop insurance is a device that can be used to stabilise their income against partial or complete crop loss due to this variability in climate (Halcrow 1949). The aim of such schemes is to mitigate the uncertainty facing farmers such as price variability and yield variability (Quiggin 1986). Premiums are paid by a farmer to an insurance company and, in effect, this transfers the risk of crop loss from the farmer to a pool of farmers' premiums held by the insurer (Nelson and Loehman 1987). Payouts are made when occurrences beyond the control of a farmer result in a partial or complete crop loss resulting in a loss of income.

Most schemes have had some government involvement. Voluntary schemes have failed due to not attracting enough farmers to adequately spread the risks and hence, to be self supporting (Halcrow 1949). To induce farmers to participate public subsidies have been needed due to the high cost of transferring risk from farmers to insurers (Nelson and Loehman 1987).

The benefits from sharing risks through crop insurance schemes are that there is both risk spreading and risk pooling i.e. where farmers with different probability distributions of loss place risks in a common pool for the benefit of all those insured (Nelson and Loehman 1987). Farmers will purchase crop insurance policies if they perceive that the expected loss is greater than the expected premium (Miranda 1991). However, in compulsory crop insurance schemes, farmers have no choice in making decisions about their individual situation and the decision regarding a farmer's expected losses versus the cost of their premiums is no longer applicable.

1.2 THE CASE FOR CROP INSURANCE IN TASMANIA

Since 1982 a compulsory crop insurance scheme has been operating for the Tasmanian apple industry. The Scheme is backed by legislation, the Apple and Pear Industry (Crop Insurance) Act 1982. The current scheme was put in place after the failure of two previous schemes and as a result of the severe hail and frost years in 1977-8 (T. Hocking, personal communication, 1994). At the time the Tasmanian government was

concerned with the cost of disaster relief payments to the apple industry which, in the late 1970s, was facing an uncertain future.

The decision for compulsory crop insurance was seen as one way of alleviating the pressure on the financial "tight-rope" of growers. With highly leveraged orchards, one crop failure resulting in minimal returns could have caused growers to leave the industry. A Government Inquiry in 1978 stated

> There appears to be a widespread desire amongst Tasmania's apple and pear growers that means should be devised that will provide them with adequate protection against the sharp reductions in income that may result from unforeseen adverse production conditions (Apple and Pear Marketing Advisory Committee (APMAC) 1978).

The results of these "unforeseen adverse production conditions" were a reduction in the amount of fruit packed and an increase in the amount of fruit diverted to the processing markets. By diverting more fruit to the processing market, there was a decrease in a grower's revenue and grower's returns because first grade fruit generally attracted higher market prices than processing fruit. The processing market was seen to be a dump market for the salvage of unsaleable fruit.

The payout from this crop insurance scheme is based on 90 percent of the difference between the actual fruit packed and the four-year rolling average of fruit packed (C. Bannister, personal communication, 1995). The level of payout is dependent on where the fruit is disposed of in the market place. Three classes of damaged fruit are used to determine the insurance payouts; totally destroyed where no fruit is marketed, juicing fruit and canning fruit which are diverted to the processing markets. Prior to 1994 the highest payout was for fruit totally destroyed - normally by a severe frost in October or November. In 1994 the payout for juicing fruit exceeded the payout for both fruit not packed and fruit diverted to the canning market .

Light frosts and hail damage will lead to some fruit, which otherwise would be first grade fruit, being diverted to the processing sector either as canning fruit or as juicing fruit.

The payout per carton of fruit for these classes of fruit is determined by the Fruit Crop Insurance Board. The Board meets in July to determine the level of compensation for the following season. The factors that determine the level of compensation are

- to maintain an incentive to sort fruit that is damaged;
- to allow for partial recovery of costs to enable a grower to remain in the industry and continue production (C. Bannister, personal communication, 1995).

In 1994 the payout for juicing fruit was higher than for destroyed fruit and canning fruit (Tasmanian Government 1994) due to a change in the structure in the Fruit Crop Insurance Board. Previous to 1994 there was only one grower on the Board but now there are two (Tasmanian Government 1993a). Hence growers have a greater influence determining the level of payouts.

Many varieties of apples are grown in Tasmania. Research by both Bright (1994a, 1994b, 1994c) and Van Putten (1995) have shown that the expected market value, varietal yields, packout percentages (See Glossary) and growing costs vary among varieties. New varieties that may yield lower amounts of high market value fruit cost more per carton to grow than high-yielding lower market value older varieties. Compensation for damaged fruit in this Scheme is the same per carton irrespective of per carton market value for the different varieties of apples.

Therefore growers who produce high-value/high-cost varieties receive a lower level of compensation as a proportion of growing costs under this compulsory scheme. This may be a disincentive for growers to adopt high-value, high-cost structure varieties but the annual revenue from growing successful crops of these varieties may offset the lower compensation as a proportion of growing costs when there is fruit damage.

1.3 CHANGES IN THE INDUSTRY

In the late 1970s the industry was stagnant with growers leaving the industry and the industry as a whole being seen to be close to bankruptcy. There was little development of new orchard blocks based on varieties suitable for the developing Asian markets. This low confidence was seen as a problem for the regional economy of the Huon Valley where most of the apple industry is centred. The apple industry is a major employer of both seasonal and full-time workers.

By 1994, the industry was growing in strength with large numbers of young trees, new varieties well accepted in the Asian markets, and an industry with a focus on the

marketing of dessert grade fruit. The varieties had changed from those suitable for the traditional markets of Europe to varieties suitable for the closer and more lucrative markets of Asia.

An Australian Horticultural Corporation Apple and Pear News article states that growers are better off having low yields of high value apples than maximising production (Anon. 1994).

There is a lag between when new orchard blocks are established and when the trees bear commercial quantities of fruit. The industry is currently investing in orchard blocks of new varieties suitable for the Asian markets. Total production is low but there is potential for growth in the industry in both production and value over the next decade. This is due to these new high value variety orchard areas coming into production.

There is widespread confidence in the future of the industry. All the case study farmers interviewed stated that they were either planting or planning to plant new orchard areas based on new varieties.

1.4 RATIONALE FOR THE STUDY

A term of reference that needs to be stated early on is that the author is aiming to study only the effects of insurance on a business that is growing only apples. Pears that are also covered under the Act are considered to be a very minor part of the pome fruit (apples and pears) industry in Tasmania. In 1991, 897 tonnes of pears were produced compared with 45,300 tonnes of apples (ABS 1992). As will be discussed in later Chapters there is a lack of economic data for apples. In the author's knowledge there has been no work done in Tasmania on the economics of pear production. As there is a comparatively small level of production compared with apple production, the author has decided to concentrate this study on apple production and the impact of the crop insurance scheme on apple growers.

The current crop insurance scheme operating in the Tasmanian apple industry is a compulsory scheme that was developed during a period when the industry was characterised by low confidence and in danger of decline due to growers leaving the industry. Thirteen years later, the industry has changed in many ways. New varieties have been adopted which are suitable for both the Australian domestic market and the export markets of Asia. Confidence in the industry has increased with a larger proportion of young trees coming into production than occurred in 1982.

As a result of these changes it is time to evaluate the Scheme to determine whether it still achieves its objectives in insuring growers against a proportion of their financial loss due to the vagaries of weather. A further issue is that the Tasmanian Government Insurance Office (TGIO), which has been the agent for the Tasmanian Government for the running of the Scheme has been sold to private enterprise (Tasmanian Government 1993a). TGIO no longer wants to be involved with the Scheme as there is no profit for their organisation in administering the Scheme (C. Bannister, personal communication 1995). The Scheme has moved from being administered by a government agent to being run by the Fruit Crop Insurance Board and private enterprise administering the day to day running of the scheme (T. Reid, personal communication, 1995).

An article by Bannister (1995) in a recent DPIF publication states that the Minister of Primary Industries requested the new Board to review the operation of the Scheme in the 1995/96 season.

Crop insurance has long been discussed as a risk reduction strategy to assist farmers who face uncertainty in crop yields due to variable weather. This Scheme seems to hinder the adjustment of growers in response to marketable apple varieties, its payouts are calculated on yield rather than market value and the Government wants to decrease its involvement in the running it. Therefore an evaluation is needed to assess the financial consequences of the compulsory scheme on orchard businesses.

1.5 AIM OF THE STUDY

In analysing a crop insurance scheme of this type there is the issue of efficiency. In the opinion of the author there are two types of efficiency that could be analysed. These are social efficiency and business efficiency. A brief outline of these two efficiency types and their methods of analysis are described in the subsequent paragraphs.

Social efficiency, where an analysis of social benefits and costs of the Scheme would need to be estimated and analysed to assess whether there should be government involvement in the scheme. As TGIO has been sold to private enterprise and the scheme is now run separate to TGIO, the Government is no longer involved in the administration of the scheme. The Tasmanian government does still underwrite the Scheme (T. Reid, personal communication, 1995) in the event of a disastrous year in which neither the balance of the cumulative premiums account nor re-insurance payments cover all claims made under the Act (see Section 2.4).

The fact that the Minister has asked for a review of the operations of the scheme in 1995/6 means that others are raising questions about the Scheme. Social efficiency questions would be answered using an economic surplus type analysis. This would be the next logical step in this general research area.

The approach used in this research work is to analyse the insurance scheme in the light of the business characteristics including the manager's perceptions to risk reduction strategies. The term used by the author for this research is business efficiency which differs from social efficiency in that it is concerned with the operations of an individual farm business. Questions that can be answered when looking at "business efficiency" are such things as maintenance of income, sustainable profitability and cumulative cashflow.

In this study the author intends to use a whole farm analysis that assesses only the business efficiency impacts of this insurance scheme on the individual farm business. A case study approach is used so that discussions can be held with apple growers on the perceptions to crop insurance and alternative risk management strategies, and the effects of crop insurance on their farm business management.

The impact of crop insurance on the business is a mix of technical, personal, socio-cultural and business performance issues. These are important issues that need to be addressed in developing information about the impact of this insurance scheme on the individual farm businesses studied. By assessing these issues the author is learning about the orchard business system, the issues that surround the production of apples and the insurance of the crop against climatic variability.

Specific questions could be answered but the author is more interested in the effects of crop insurance on the whole farm business. As there is a range of business sizes in the industry, insurance may a viable alternative to other crop protection methods for some businesses and not others. Generic questions that can be answered are

- Is the business insured against crop loss?
- Do growers differ in opinion on their perception of what crop insurance achieves for their business?
- What do growers want from the scheme in terms of premiums and payouts?

To answer these questions generic business tools will be used. An assessment of the net income after tax (NIAT) and cumulative cashflow will be used to compare business performance under the situations of insurance and no insurance.

A simulation approach has been used so that an analysis can be conducted of the whole farm business system. In this study a greater understanding of how the farm business system works in a crop insurance situation is a desirable outcome.

The analysis will be done using simulation as this is an appropriate method to evaluate crop insurance schemes. This method is suitable in the evaluation of alternative insurance schemes to compare the trade off between risk reduction and moral hazard effects (Ramaswami 1993). In this study there are certainly risk reduction issues but few moral hazard issues as will be explained in Chapter 3.

Much of the literature studied deals with broadacre crops that have a commercial life of one year. The nature of this crop insurance scheme is that it deals with a tree crop that has a commercial life of over ten years. Therefore once growers invest in young trees, there is no choice in making decisions about annual cropping. For a grower to maximise revenue, orchard managerial decisions need to minimise the biennial cropping (see Glossary) characteristic of apple trees and maximise fruit value. Maximising return differs from maximising the production of apples as high production leads to a higher proportion of small fruit which are not in demand by most fresh fruit markets.

1.6 RESEARCH OBJECTIVES

The success of this research is in the gaining of knowledge by examining a real world issue and using farm management economics to assist in the modelling of the situation. The interpretation of the results will assist in making an assessment of the impact of the current scheme on individual farm businesses.

From a modelling aspect, success comes from the model simulating a real world situation. The model is a reflection of the real world rather than an accurate representation as the whole farm system is too complex to model effectively. The uncertainty in apple production stems from frost in the period October and November and hail events during the growing season from October to March.

If, as a result of modelling, growers are worse off under the existence of this compulsory scheme then further analysis is needed in suggesting ways of improving the scheme or improving the risk management alternatives open to growers.

1.7 OUTLINE OF THE STUDY

The study will evolve from this introductory chapter in the following way.

In Chapter 1 the author has outlined briefly the crop insurance issue and the scheme that operates in the Tasmanian apple industry. The author has given the rationale for the study, the aim of the study and has set a research objective which will be the focus of this research work.

In Chapter 2 a more detailed outline of the characteristics of the Tasmanian apple industry is made. The characteristics of the industry and the features of the various crop insurance schemes in the last 30 years will be discussed. This is an important step in this research work as the author surmises that the current crop insurance scheme comes from a history of a reliance by the apple industry on the State Government to underwrite the risks of crop failure.

In Chapter 3 the theory of crop insurance will be discussed. In this Chapter the author will develop discussion on where the theory and the real world experience in the Tasmanian apple industry link. Issues such as grower participation, moral hazard and adverse selection will be discussed.

In Chapter 4 the data sources, the data values for each farm business and the modelling process will be outlined. The problems that the author faced in collecting and collating these data sources will also be summarised.

The modelling process will also be outlined. An explanation of distributions used for various parameters will be made so that the impact of insurance can be assessed in isolation from other business dealings. The major assumptions used in the modelling process will be listed.

In Chapter 5 the financial results will be analysed and discussed for each of the case study businesses. Two scenarios will be analysed for each case study business; insurance under the existing scheme and no insurance. The basis of comparison will be whether business profitability, shown by Net Income After Tax (NIAT) and cumulative cash position after ten years of business, is affected by the operations of the scheme.

As well as tabulating and graphing the results of the simulations, stochastic dominance analysis will also be used to assess the efficient strategy - whether it be the insurance or the no insurance situation for each of the case study businesses.

In Chapter 6 the managerial perceptions that arose from discussions with the case study growers will be discussed and add weight to the conclusions reached by the author.

In later sections of this Chapter a discussion will be made in the light of the research objectives outlined in Chapter 1. It is not expected that this research be the only analysis of the crop insurance scheme operating in Tasmania, there are aspects of this issue that are beyond the terms of reference for this work. The author will suggest future research topics.

In the last part of this final chapter a conclusion will be reached on whether the Scheme is beneficial to the case study growers' businesses.

A Glossary of Terms is also provided as some readers may be unfamiliar with the technical terms used by the author.

Information additional to the main text is found in the Appendices.

CHAPTER 2

CHARACTERISTICS OF THE INDUSTRY

2.1 INTRODUCTION

In undertaking this research topic and analysing the impact of the current crop insurance scheme on orchard businesses in the industry it is important to note the characteristics of the Tasmanian apple industry.

In this chapter the author will outline the relevant characteristics of the Tasmanian apple industry. Over the past thirty years the industry has undergone change in various ways. The number of orchard businesses has been decreasing, the main markets served have changed and the varieties of apples grown are different. There have been previous crop insurance schemes that have failed and other means of government assistance that have helped the restructuring of the industry.

In the last part of the Chapter an outline of the current scheme is made. In these sections the attributes of the scheme are discussed.

This Chapter will assist the reader in gaining knowledge of the industry and its history, both past and present. In later Chapters the author will discuss the theory of crop insurance and the characteristics of the compulsory crop insurance scheme in the Tasmanian apple industry. It is important for the reader to gain an understanding of the Tasmanian apple industry and the three insurance schemes from this chapter.

2.2 THE TASMANIAN APPLE INDUSTRY

2.2.1 Size and Location

The Tasmanian apple industry is located mainly in the Huon Valley Region of Tasmania, south west of Hobart. Approximately 85 percent of all apples grown in Tasmania are grown in this region (J. O'Loughlin personal communication 1995). This amounts to some 2,250 hectares of orchard (ABS 1993). Smaller areas of orchard are found in the north west of the State centred inland of Devonport at Spreyton.

Table 2.1

Characteristics of the Tasmanian Apple Industry in 1982,1988 and 1993

YEAR		1982 1.	1988 2.	1993 3.
Value	$m	25.6	30.2	41.0
Crop size	tonnes	67,376	52,857	56,213
Orchardists	no.	294	209	175
Trees				
Producing >6 yrs		1,022,000	832,000	933,000
Non producing <6 yrs		151,000	419,000	573,000
Total trees		1,173,000	1,251,000	1,506,000
Apple exports				
Europe tonnes		7 840	5 957	1 466
Other tonnes		12 841	3 376	19 330
Main Varieties Produced				
Golden Delicious	tonnes	7,492	7,050	7,911
Red Delicious	tonnes	not available	13,220	24,522
Democrat	tonnes	13,209	11,007	8,303
Red Fuji	tonnes	not available	not available	1 629

Source: ABS various publications as quoted in (DPIF 1992).
O'Loughlin (1994).

Notes

1. Expected Value of Agricultural Output (EVAO) minimum of $2,500.
2. EVAO minimum $20,000
3. EVAO minimum increased to $22,500.

EVAO is a classification used by ABS in determining the cutoff for agricultural businesses included in the statistics. A business with an EVAO of less than the cutoff value would not be included in that years statistics.

The characteristics of the industry in 1982, 1988 and 1993 are shown in Table 2.1. This Table shows that the industry characteristics have changed since the current scheme was set up in 1982. The value of the industry has increased and is continuing to do so as young trees of new high-value varieties come into production. The prospect for a continued increase in value over the next decade is good due to 495,000 young trees (DPIF 1992) of new high value varieties coming into production. This is in contrast with an industry in 1982 that had few trees coming into production, 151,000 (DPIF 1992).

The number of orchardists has been falling over the last two decades. A tree pull scheme from 1972-5 allowed for some structural adjustment in the industry (see Section 2.3.1). At the time it was a stagnating industry with many small orchardists eking out an existence producing old varieties suitable for the European market, the major export market for fruit in the 1960s and 1970s.

Despite orchardists leaving the industry, the average size of orchard for the remaining growers has been increasing and so the area under orchard has remained relatively stable. The average sized orchard has a productive area of 12 hectares but orchard size ranges from just a couple of hectares through to large corporate farms of 25 hectares or more (ABS 1994).

2.2.2 Production and Value of the Industry

The total production of apples in Tasmania has declined since 1965 when 159,300 tonnes were produced (ABS 1987). In 1991 production had slumped to 45,287 tonnes (ABS 1994). Since then production has increased to about 56 thousand tonnes in 1993 (ABS 1994).

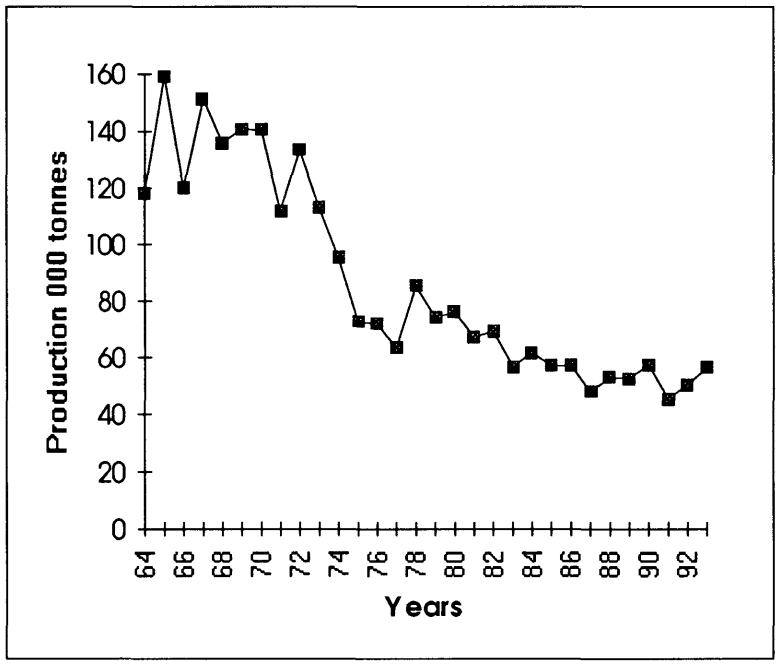
In the 1960s production of apples followed a two year cycle due to the biennial bearing nature of apple trees. In Figure 2.1 this cycle is shown in the total values of production in the years from 1964 to 1968.

In the 1960s and 1970s apples suitable for the European markets were grown in large quantities. As the European Community emerged as a trading and production bloc, the export of apples to these markets, especially Great Britain, decreased. The varieties of apples suitable for the European market were not suitable for the markets of Asia and, hence, adjustment was needed to refocus the industry to new markets where different varieties of apples were demanded.

Government assisted adjustment schemes operated in the 1970s. The total tonnage produced continued to decrease but the downward trend was less dramatic in the 1980s. In Table 2.1 and Figure 2.1 it can be seen that, despite production falling in the period 1982 to 1986, the value of the industry had increased. As newer high value varieties such as Red Delicious increased in importance in the industry and other new varieties such as Red Fuji became available for commercial orchard production, both tonnage and value of the industry started to increase in 1991 and 1992.

Figure 2.1

Tasmanian Apple Production 1964-1993



Source: ABS (1987, 1993,1994)

Trees that are less than six years old that will come into production over the next few years are mainly Red Delicious with a significant proportion also being Red Fuji. The Red Fuji being an apple suitable for north Asian markets in which Tasmania may gain access as phytosanitation protocols are satisfied. The main north Asian market is Japan which, if access is gained, will assure a profitable future for the industry. One market that has increased in importance is the Taiwanese market where Australia's quota has increased to approximately 500 tonnes. Although small compared with other Asian markets such as Malaysia and Singapore, it does show that there is a large market potential.

2.2.3 Characteristics of orchard production

There has been significant change in the industry since the current Crop Insurance Scheme was set up in 1982. The industry is now characterised by a small number of orchardists that have larger orchard holdings. The number of larger holdings has shown an upward trend over the last ten years. In 1993 orchards with more than 20 thousand trees made up 8.6 percent of the number of establishments growing apples and had 45.8 percent of the production. In the same year orchards of less than 2 thousand trees made up 18 percent of the establishments and had 2.4 percent of the production (ABS 1994).

The varieties grown now are suitable for export to the Asian markets and domestic consumption. In 1982 the main varieties grown were Democrats, Granny Smith, Jonathan and Sturmer Pippin (totalling 68 percent of producing trees) (ABS 1983). By 1991 the importance of these varieties had fallen to 43 percent of total producing trees. A new variety Red Delicious had been adopted by orchardists and, in 1992, this made up 47 percent of the total trees (ABS 1993).

A problem that occurred in the 1995 season was that the proportion of Red Delicious as a percentage of the whole crop was so high that fruit could not be picked at the ideal time leading to overripe fruit which do not have good storage characteristics (J. O'Loughlin, personal communication, 1995). Hence other new high value varieties need to be adopted by the industry to maximise the possibility of maintaining the quality and ripeness of fruit picked.

As more market access is gained in Asia, varieties suitable for those markets will increase in importance for the industry. In general, these varieties are of high value but, compared with the older varieties, yield per hectare may be lower and growing cost per hectare is higher. This is a major implication for the current crop insurance scheme which insures growers based on packable fruit with a fixed payout rate per carton - irrespective of the costs of production for each variety.

2.2.4 Costs of production

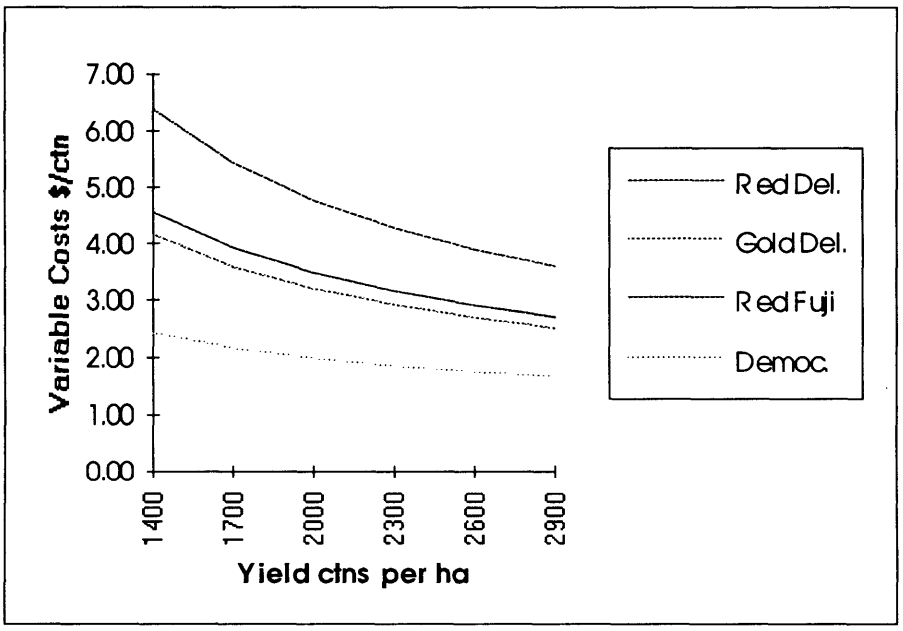
Work by Bright (1994a, 1994b) and more recently Van Putten (1995) has shown that there are differences in the growing costs of different varieties of apples. The costs of production per hectare is a stepped function. Some costs, such as picking costs, are proportional to yield; others, such as spray costs, are fixed per hectare and decrease as yield increases.

High value varieties that have a low yield may cost up to $6 per box to grow; older varieties which have relatively high yields per hectare may cost in the order of $3 per box to grow.

In Figure 2.2 the growing costs at different yields for each of the representative varieties, Red Delicious, Golden Delicious, Red Fuji and Democrat, are shown. This Figure shows that there is a decrease in growing cost per carton as yield increases for each variety and that there are differences in growing costs between varieties. From this Figure it can be seen that out of the four varieties for which Van Putten has calculated gross margins, Red Delicious is the most expensive to grow irrespective of yield. As will be seen in Chapter 4, the case study growers varied in their opinion of which variety was most expensive to grow.

Figure 2.2

Variable Costs of Production for Four Selected Varieties



Source adapted from Van Putten (1995)

2.2.5 Saleable fruit, markets and prices

There are several end uses for apples. First grade fruit (free of skin blemishes and diseases) are sold in the fresh fruit market in either bins or cartons. Second grade fruit that may be smaller than the market demands and deformed fruit which may not be as "typey" (see Glossary) as first grade fruit receive a discount in the fresh fruit market.

Fruit with significant skin blemishes such as branch rub marks, hail damage, russet (see Glossary) or skin dimples are destined for the processing markets. Fruit that is too small for the fresh fruit market will also be diverted to the processing markets. These small fruit will normally be used for juicing as it is not economic to peel and process small second grade fruit (W. Lawrence, personal communication, 1995) The processing market has two parts; juicing fruit where only the juice is extracted, and the canning market where the apple may be dried or canned as pulp. The Red Delicious variety is unsuitable for processing and so is only juiced.

The processing market could be considered as a "dump market" where waste fruit are utilised and little return to the grower is made from sale of fruit. The main processors are Cascade and Port Arthur Cider Company, Clements and Marshall, Huon Canning Company and Franklin Evaporators (Van Putten 1995). At times there is demand for Tasmanian processing apples by mainland processors which may affect where fruit is sold (T. Reid, personal communication, 1995). The price paid for fruit sold to these processors is dependent on the supply; in years with significant frost and hail damage, price per carton can drop to $0.25 per carton for juicing and $0.75 for processing fruit, as occurred in 1994 (Van Putten 1995). Normally price is approximately $2.00 per carton for juicing fruit and $3.00 per carton for processing fruit (J. O'Loughlin, personal communication, 1995).

For fruit covered under the Scheme, damaged fruit would be diverted to the processing sector and an insurance claim would be made. The claim would be made on 90 percent of the difference between the number of cartons of packed fruit and the four year rolling average of packed fruit for that orchard area (C. Bannister, personal communication, 1995). Payouts under the Act are not made until a proportion of the fruit is packed so that an assessment of damage level at the packing house can be made (C. Bannister, personal communication, 1995). This is an advantage over the visual assessment of fruit damage in an orchard which was a feature of the 1957 crop insurance scheme (see Section 2.3.2).

2.2.6 Gross Margins of Varieties

Work by Gordon (1994) found that the main drivers to the gross margins of Red Delicious apples were price, yield and packout. The most important of these was price. As yield increased gross margin increased at a greater rate because marginal cost was lower per box of additional yield. For a given yield, the higher the percentage of first grade fruit the higher the gross margin.

Research by Bright found that market price was also affected by the variety grown (1994c) For the Red Delicious variety, which is the main variety grown in the industry in Tasmania, the full count range (see Glossary) can be sold - from very small fruit (216 apples per 18 kg carton) to very large fruit (60-80 apples per 18 kg carton). Larger fruit are destined for markets on the Australian mainland and smaller fruit are exported to the Asian markets.

In a six month period from July to December 1993 the author undertook a study on the average prices paid per carton at the Flemington Fruit Markets in New South Wales. Tasmanian Red Delicious averaged $23.93 per carton and Golden Delicious averaged $19.65 per carton for first grade fruit over this six month period (Bright 1994c).

Older varieties such as Democrat receive a comparatively low price in the market place and, as will be seen in Chapter 4, make up a small proportion of the case study growers total crops. There is still demand for these types of apples in specific export markets.

2.2.7 Changes in the Nature of the Risks Faced by Growers

The risk from climatic occurrence of crop failure which is insured under the scheme has not changed. The chance of complete crop loss is very low (P. Jotic, personal communication, 1995). Historically, the last devastating frosts and hail events that caused widespread crop damage were in 1977 and 1978. In discussions with the case study growers, one was told by his grandfather of a hail event at the turn of the century that devastated whole areas of orchards but another of this magnitude has not occurred since.

The climatic data points used in the simulation model are from the DPIF Grove Research Station. In collating the data the author noted that there has been a decrease in the number of frost events in the last ten years. The case study growers also said that the incidence of frost was lower in the last decade than previously. Whether this a short term aberration or a general trend is unknown and further proof is needed before the statement can be made and proved that the incidence of climatic occurrence has changed in the last decade - this is beyond the scope of this study.

Although the risk of crop loss is determined by the timing and severity of climatic events, the result of these climatic events to growers is financial loss due to fruit being downgraded. When new varieties such as Red Delicious are adopted by growers, the

costs of production increase and the yield of such varieties may be lower than traditional varieties such as Democrat. The magnitude of the financial loss for growers from growing these newer varieties may be higher than from those growing high yielding low cost of production varieties. For insurance claims made under the 1982 Act compensation is paid at the same rate per carton irrespective of variety grown.

Growers who produce Red Delicious and other high value varieties stand to make more profit when there is no crop failure than when growing traditional varieties. In the event of partial or complete crop loss, with a fixed level of compensation per carton of first grade fruit, a grower or Red Delicious is compensated for a lower proportion of variable costs than a grower with varieties that have a lower variable cost structure.

2.3 CROP INSURANCE IN THE TASMANIAN APPLE INDUSTRY

In Tasmania there have been three crop insurance schemes operated in the apple industry. The Tasmania apple industry has been a strong agro-political force (T. Hocking. personal communication, 1995). In times of crop failure the industry has been given assistance from the State government. This assistance has been of many forms.

2.3.1 Significant Events in the industry.

Before the Insurance schemes that have been operated in the Tasmanian apple industry are discussed in the next section, the types, timing and aim of government assistance that have been given to the industry are helpful in setting the context in which the current insurance scheme has been operated. It is important to note the number of government assistance "packages" that have been used.

1957-66	Voluntary insurance scheme.
1964	Record production of over 8 million cartons with exports of 7 million cartons mainly to European markets.
1967	Devaluation of UK pound leading to a collapse in this market.
1967-77	Voluntary crop insurance scheme.
1968-70	Devaluation compensation paid to orchardists paid at the rate of 50 cents per bushel for fruit exported in 1968 and 40 cents per bushel for 1969 and 1970.

1971	Commonwealth support to the apple industry in the form of Apple and Pear Stabilisation Scheme which replaced devaluation compensation and was of the form of a price support scheme.
1972	Apple and Pear Crop Price Guarantee. Stabilisation payments funded by Tasmanian government to guarantee a return to growers of $2.60 per bushel so as to restore confidence in export market prices to the United Kingdom.
1972-75	Fruit Growing Reconstruction Scheme. A tree pull scheme funded by Commonwealth Government $4.6 million and State government $2 million. Resulted in 3 200 hectares of orchard removed.
1972-74	Rural Reconstruction Scheme - growers failed to meet the conditions set for sheep and wheat industries. Growers applied for debt reconstruction but were declined due to growers having no reasonable chance of becoming viable following assistance. Land values of orchard areas crashed.
1977	Creation of Tasmanian Apple and Pear Marketing Authority (TAMA) - a single-desk seller that operated as an agent for financing orchard development in the industry.
1977-82	Tasmanian Apple and Pear Marketing Authority fails to avert collapse of export markets.
1982	TAMA fails to win support from large orchardists who start exporting their own fruit by sending interstate then exporting from Sydney or Melbourne. TAMA no longer in charge of disposal of the State's apple crop.
1982	Apple and Pear Industry (Crop Insurance) Act 1982.
1981-84	Orchard Adjustment Scheme to encourage adjustment in industry and enable it to stand alone without continued government assistance. Encouraged reworking (see Glossary) and planting of new varieties.
1984	Apple and Pear Stabilisation Scheme phased out.
1984	Exports fall to 350 thousand cartons.
1985	Red Delicious variety adopted by industry.
1989	Exports to Asia greater than exports to Europe.
1994	Sale of TGIO.

(Adapted from Department of Agriculture 1982 and Van Putten 1995).

From the above summary it can be seen that the Tasmanian apple industry has relied heavily on government assistance as a source of funding for structural adjustment and price support through the formation of TAMA and subsidised exports.

Other significant changes that occurred in the industry were by way of changes in the main markets supplied and new varieties being adopted by the industry.

The Tasmanian climate is well suited for the growing of Red Delicious resulting in well formed, sweet fruit free of skin blemishes. There are various strains of Red Delicious that have different physical characteristics. The strain grown most in Tasmania is Hi Early Red Delicious which is an apple with a striped green and red skin. Other Red Delicious varieties may have a solid or "block" red coloured skin. The Hi-Early Red Delicious is one of the preferred striped red apple varieties in the export markets of south east Asia (Pullar et al 1993).

The adoption of other new varieties suitable for the Asian markets has been slow compared with other major exporting countries such as New Zealand. Red Fuji, an apple favoured by north Asian markets, is held in mixed regard by the industry (J. O'Loughlin, personal communication, 1993). Some orchardists can grow these apples well and receive a high price in the market place; many have problems with russet (see Glossary) which results in lower packout percentages and profits. New varieties trialed by the industry include Braeburn, Gala, Royal Gala, Pink Lady, Lady Williams and Sundowner. If adopted, these varieties would be high value varieties suitable both for domestic and export markets.

From the timeline on the previous page it can be seen that there have been three crop insurance schemes run for the Tasmanian apple industry. The Sections below describe these schemes and, for previous schemes, the reasons for their failure.

2.3.2 Hail Insurance

In the mid 1950s the Government began to look at ways to offset state funded assistance to the industry and developed a hail insurance scheme.

From 1957 to 1967 a voluntary hail insurance scheme was operated by TGIO. The premiums were calculated at the rate of 2 cents per bushel (see Glossary) of the base production figure for each orchard. Compensation was paid out when damage was greater than 20 percent of production at the rate of 42 cents per bushel (APMAC 1978), the payout premium ratio being 21. (The payout premium ratio is calculated by

the amount of payout divided by the premium paid. For example, if payout was $1.00 and premium was 10 cents, the payout premium ratio would be 10.)

Damaged fruit remained the property of the grower and could be disposed of to gain further revenue. Assessment of the hail damage was made by official inspectors on the basis of one tree chosen at random and the damage assessed on this particular tree (APMAC 1978). In the opinion of the author this method may have been cost effective for making an assessment but ineffective in assessing the true damage to the orchard as there may be differences in fruit damage in different parts within the orchard block.

Premiums were paid into a compensation fund. If claims exceeded the premiums in this account the shortfall would be made from the Government's consolidated revenue. Over the period of the Scheme claims totalled $2 million, premiums totalled $0.65 million (APMAC 1978).

The scheme failed due to a number of reasons:

- The scheme was not self supporting as claims exceeded collected premiums;
- There were problems determining the appropriate ratio between payout and premium;
- With a fixed payout/premium ratio there was a danger of over/under estimation of production potential (APMAC 1978).

2.3.3 Crop Insurance 1967

After the failure of the first hail insurance scheme a second scheme was developed. This was a voluntary scheme. Only dessert grade fruit could be insured and a payout would only be made when the actual amount packed was less than the insured amount. The base figure for this calculation was 75 percent of the four year rolling average of the quantity of dessert grade fruit packed for each grower (APMAC 1978).

Initially premium was paid at the rate of 2.5 cents per bushel and payouts were based on 30 cents per bushel; a payout premium ratio of 12. In 1973/4 orchardists were offered a variety of premium and payout options based on the number of claims made. If an grower made less than three claims in a six year period, there was an option of increasing premium for an increased payout.

Research was conducted by Ferguson (1968) on the expected benefits of this scheme. He found that this scheme had advantages over the previous failed scheme but that TGIO had underestimated the problems involved in introducing this scheme (Ferguson 1968). One of his conclusions was that there was no optimum insurance scheme for all Tasmanian orchardists and that this particular Scheme had poor prospects of success for the future.

This Scheme was seen by growers as an improvement over the previous scheme but it also failed due to the reasons listed below.

- The scheme was not self supporting as payouts exceeded premiums paid in most years of operation.

- The number of growers participating in the scheme decreased from 473 in 1967-8 to 65 in 1977-8. This was thought to be a reflection of the growers' attitude toward the scheme in place not the growers' general attitude toward crop insurance schemes.

- The compensation was only paid out on a maximum of 75 percent of the fruit packed and payouts were considered too low. When the "few claim bonus" scheme was introduced most orchardists chose the higher premium payout ratio. The guidelines for this option may not have been stringent enough to prevent higher risk orchardists taking the higher premium payout ratio. This would exacerbate the problem of payouts exceeding premiums.

- A further short coming of the scheme was it reduced the incentive to pack. For a payout to be made fruit could not be packed and so even if the fruit was processing grade it had to be dumped as no payout was made if fruit was salvaged (APMAC 1978).

After the failure of this scheme orchardists pressed for a Ministerial Inquiry to be set up to investigate ways of assisting the apple industry. Three possible ways of assisting the industry were

- Better orchard management and the use of Income Equalisation Deposits (IEDs).
- Government funded disaster assistance.
- A new crop insurance scheme (APMAC 1978).

The recommendation of APMAC was the development of a comprehensive crop insurance scheme that should be made compulsory.

2.3.4 Issues for Consideration for a New Crop Insurance Scheme

After the failure of two previous voluntary schemes, there was still perceived to be a need for crop insurance in the late 1970s due to several factors:

- TAMA was unwilling to support loan applications by orchardists if there was no crop insurance as they may become bad debts if there was crop failure. It was argued that the cost of growing a crop of apples was a high proportion of the overall capital of an orchard and that one crop failure may force businesses to fail.

- The industry needed consolidation and insurance was seen as one way of stopping orchardists leaving the industry. With large numbers of orchardists leaving the industry this was seen as a hindrance to the development of export markets and to the continuity of supply of fruit for these markets.

- If there was to be continued development of export markets, the industry could not afford to lose numbers of orchardists and supplies of fruit. Insurance was seen as one way of terminating this trend (APMAC 1978).

The State Government took into account these factors and, in 1982, passed the Apple and Pear Industry (Crop Insurance) Act (see Appendix 1).

2.3.5 Competitive Advantage of the Tasmanian Apple Industry.

The Tasmanian apple industry has several sources of competitive advantage operating in the world market. The sources of this competitive advantage are wide, ranging from a historical reputation as the "Apple Isle" to fruit varieties and apple characteristics perceived by consumers.

Tasmania has traditionally had the reputation in Australia as the "Apple Isle". There is a perception by some Australians that apples are Tasmania's sole export. This perception is a source of competitive advantage as Tasmanian producers can build their product image on the long-held belief that Tasmania is the Australian "home" of apples. It is questionable whether the statistics of the total Australian apple crop support this perception. There are other states such as Victoria having a higher total

annual production than Tasmania. However, Tasmania produces some 80 percent of apple exports from Australia (ABS 1993).

A source of competitive advantage in the export of fresh apples is that Tasmanian has a "fruit fly-free" status. The lack of fruit fly enables Tasmanian exporters to access markets closed to other Australian states. Being fruit fly free also enhances the "clean green image" of Tasmanian produce.

The "clean green image" ploy has been used by many Tasmanian primary industries in the marketing of produce in export markets. However other states are also starting to promote the "clean green image" which may lessen the marketing advantage of Tasmania (D. Munro, personal communication, 1995).

An advantage due to the climate and soils of Tasmania compared with other growing areas is fruit firmness which is important in how consumers value apples; sweet and crunchy (T. Reid, personal communication, 1995).

A further source of comparative advantage is that the Tasmanian climate is suitable for the growing of the striped Red Delicious strain Hi-early. Compared with other mainland states, Tasmanian orchardists may average above 85 percent packout for this variety (see Section 4.6.2). Work by Gordon (1994), based on the Batlow region of New South Wales for the Red Delicious variety, has packout set at 70 percent for semi intensive orchard production but there is some "what if" gross margin analysis for a packout percentage range from 50 to 80 percent.

2.4 THE CURRENT SCHEME

The current Scheme started with the backing of the Apple and Pear Industry (Crop Insurance) Act 1982. The Scheme was administered by TGIO until 1995. TGIO acting as an agent for the Tasmanian Government. Premiums were paid into a trust account separate from TGIO's insurance portfolio. This differs from most other types of insurance where the insurer's portfolio of assets is used to offset claims made in any one type of insurance.

Decisions regarding the annual base premium and payouts for different categories of fruit were made by the TGIO Board in the July preceding the apple season that was to in the following February. These decisions were incorporated in the Statutory Rules of the Office of the Parliamentary Council. Infringements and prosecutions under the Act were initiated by the TGIO Board and then carried out through the Office for Public

Prosecution. Prior to 1995, subpoenas had to be signed by the Secretary of the Department of Primary Industry and Fisheries.

An Amendment to the Act in 1995 has moved control, administration and the issuing of subpoenas to the Fruit Crop Insurance Board comprised of two orchardists and two executives. The Scheme's administrator from TGIO remained on the Board until the administration of the Scheme was tendered to private enterprise in late 1995. TGIO no longer has any controlling interest in the Scheme.

2.4.1 Fruit Insured

All orchardists growing more than 20 tonnes of apples in the preceding season, destined for marketing as packed fruit, must insure 90 percent of their base insurable quantity of fruit. The base insurable quantity is the average quantity of packed fruit during the preceding four year period grown on the land occupied by an orchardist (Act 1982). An grower that owns orchard areas in different geographic locations will pay a premium for each separate orchard area (C. Bannister, personal communication, 1995).

Where there have been substantial changes in the level of packed fruit produced by an orchardist, the amount of fruit insured could be varied by the Fruit Crop Insurance Board "as appears to it to be just and equitable" (Act 1982). If an orchardist is dissatisfied with the base level insured, an appeal can be made to the Chairman of the Fruit Crop Insurance Board.

2.4.2 Premiums

When the Scheme started in 1982, the base premium was 8.5 cents per carton (Tasmanian Government 1982). The level of base premium has increased and, in the period 1992-1994, it remained constant at 16 cents per carton (Tasmanian Government 1993b, 1994).

An grower may pay less premium based on their claim history. The schedule for premiums is shown in Appendix 1. The premium paid by growers ranges from 60 to 160 percent of the base premium set for each season by the Fruit Crop Insurance Board. If a claim is made, the premium in the following year increases by 20 percent to a premium level of 150 per cent. The maximum premium payable is 160 percent.

If a claim is not made there is a decrease in the next year's premium payable by 10 percent of the base annual premium. There is no further reduction in premium paid when a grower is paying 60 percent of the base premium rate.

The above system is known in Tasmania as a "bonus/malus" scheme where there is a bonus for not claiming in the preceding year and a cost or malus for claiming in the previous year. In the opinion of the author it is similar to a no-claim bonus.

For the 1994-5 season, despite the base premium level being set by the Fruit Crop Insurance Board at 16 cents per carton, the average premium paid by growers was 10.8 cents per box due to most growers having a no claim bonus (Bannister 1995).

Premiums are determined by the Fruit Crop Insurance Board and are required to be kept low (C. Bannister, C. Hansen, personal communication, 1995). This seems at cross purposes to having an actuarially-fair scheme that allows growers to recoup growing costs so that they can prepare for a crop in the following year.

An actuarially fair premium would be one based on a combination of factors including the magnitude of the loss and the frequency of possible losses. The costs of annual administration could also be built into the calculation of the annual premium. This may be necessary at a full cost recovery rate now that private enterprise is administering the day-to-day operations of the Scheme.

It would be expected that under an actuarially fair insurance scheme, the payout premium ratio would have only minimal variation between years as it would be dependent on the probability of the insured events. The actual payout premium ratio since 1982 is discussed in Section 2.4.7.

2.4.3 Insurance of Occurrences

The current crop insurance scheme is comprehensive in the risks that are covered. The fruit is insured against frost, wind, hail, fire, flood, storm sunburn and drought damage (Act 1982). Of these risks hail and frost are seen as the major risks faced. The actual breakdown of the proportion of claims made each year for each occurrence is unknown as the records of claims are not kept as part of a computer database but as manual records.

2.4.4 No payment of Claims

Compensation under the Act is not possible if:

- The fruit is destroyed as a result of war, warlike operations, riot or civil commotion;
- That the grower fails to make a claim before 15 July in the next year after the year in which the policy was issued;
- That the grower fails to provide proper husbandry of the land resulting in a reduction of quality or quantity of fruit packed. (Act 1982).

The last point may be difficult to enforce as mistakes can be made in management practices that do result in variations of crop yield but proving it may be quite difficult. Some climatic events may only have been of short duration and may not have been observed by a grower. Thus an event has occurred, that will cause fruit damage, but no climatic event notification has been made. This failure will render a subsequent claim invalid. One case study grower said that he had been told that there was a frost early one morning but when he got up there was no evidence of a frost event. It was only by inspecting his fruit some weeks later he realised that there was damage caused by this climatic event.

2.4.5 Claims Exceed the Premiums Paid

If claims exceed the balance of the premium account, then the shortfall would have to be met by the State government prior to 1992.

Since 1992, re-insurance has been sought in preparation for a large claim year - which, as yet, has not occurred. The formula for when reinsurance would be used is when claims exceed 200 percent of the annual premium paid and the upper limit of payout would be 600 percent of the annual premiums paid (C. Bannister, personal communication, 1995).

In the development of this scheme, the State government had provisions for subsidising the scheme. In the event of total claims under the Act exceeding the cumulative balance of the premium account, the government would underwrite these claims. Thus in 1982, when the scheme was set up there was government involvement both by legislation and provision of subsidising claims in the event of a disastrous damage year.

The author is unaware of whether the Tasmanian government still underwrote the Scheme in 1995. A comment was made by a representative of the industry that there is still the expectation that the State Government would continue to provide funding in the event of there being a disastrous damage year in which neither the cumulative

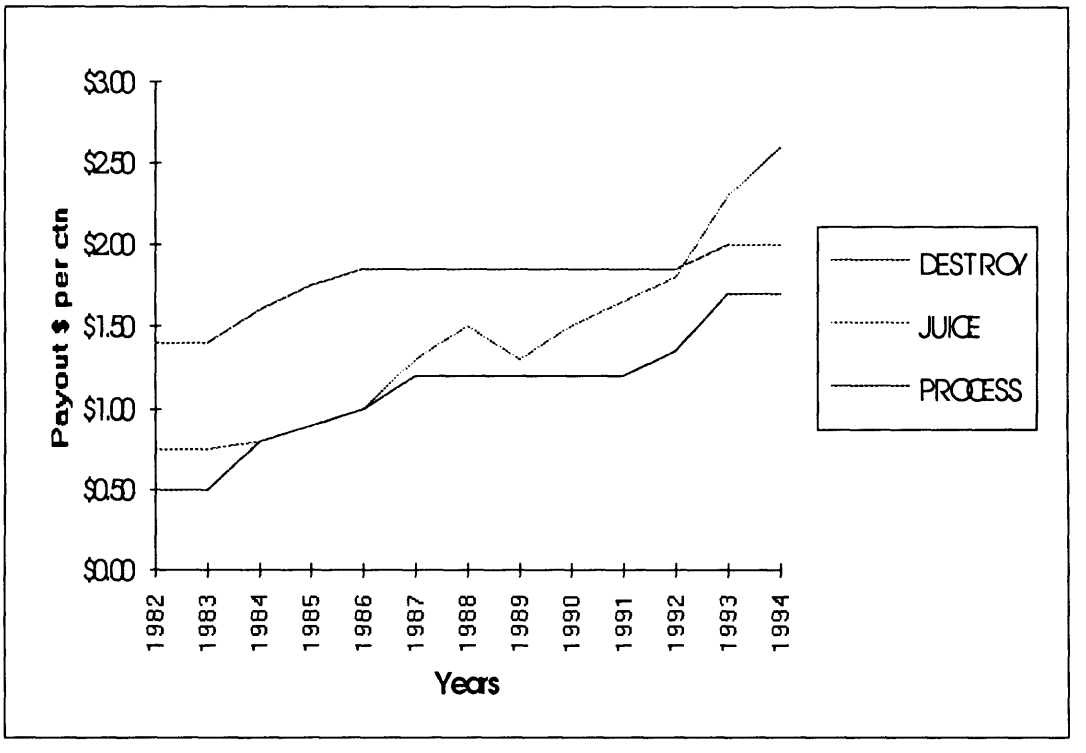
premium account nor reinsurance would cover all the claims made. It would be expected that any funding from government would be in the form of a loan for which interest would be charged until repayment by the fund to the State government was complete (T. Reid, personal communication 1995).

2.4.6 Payouts

The payouts are based on whether the fruit is completely destroyed or damaged and diverted to the processing sector which includes juicing. In 1982 the expected payout for fruit destroyed was $1.40 per carton, for fruit diverted to the juicing market the payout was $0.50 per carton and for fruit diverted to the processing market the payout was $0.75 per carton. In 1992 these payouts were $1.85 for totally destroyed, $1.80 for juicing fruit and $1.35 for processing fruit (Bannister 1994).

Figure 2.3

Insurance Payouts 1982-94



In Figure 2.3 the payouts for each damaged fruit class is shown. It can be noted from this Figure that there has been a variation in the payouts over the years. Generally the trend has been upward but compared with the market value of some varieties (see

Section 2.2.6), payout is very low, and compared with the variable costs of production of Red Delicious, at no yield does it cover all the variable costs of production calculated by Van Putten (1995) (see Figure 2.2 in Section 2.2.4).

There are costs additional to the variable costs of production before fruit can be diverted to the processing market. These are freight costs and sorting costs at the packing shed which may amount to $1.50 per carton. With these additional costs the relatively low payout compared with the variable costs of getting fruit to the processing market is magnified despite there being a salvage value for these damaged fruit.

Payouts for each season are set in the previous July. The level of payout is determined by the balance of the premium account so that the account has sufficient funds for any normal amount of claims made. A secondary consideration is to equalise the returns between the juicing and canning prices (C. Bannister, personal communication, 1995). From Figure 2.3 it can be seen that this has generally been the case except in the years of 1984-1986 when the level of payout for canning and juicing fruit were the same.

In 1994, the payout for juicing fruit exceeded the payout for both canning fruit and fruit destroyed. This trend has continued in the 1995 season. The reason for this change is that there has been a change in the composition of the Board members with an increase in the number of grower representatives (Tasmanian Government 1994a). This enables the industry to have greater say in determining the levels of compensation.

The payout is kept low to encourage orchardists to salvage fruit that are damaged during the season. An implication is that apples left on the trees to rot could be a source of disease (C. Bannister, personal communication, 1995).

In the opinion of the author there is a fine line in determining the level of compensation for claims made under the Act. On the one hand, payout must enable growers to recover a proportion of their growing costs to enable them to be able to continue fruit production in the following year. On the other, the level of payout must be kept low to encourage growers sort fruit rather than leave them on the trees to rot. Additionally, industry representatives stated that a consideration in determining the compensation level was the balance the cumulative premium balance account.

Another aspect in setting the payouts is that the probability of hail and frost are not taken into account. It is hard to forecast the severity of frosts and hail in the previous

July and thus set payout to accommodate the probable variation in the processing and juicing prices due to quantity of fruit sent to these markets. In the opinion of the author it would be harder to set payouts to equalise the returns between the juicing and processing sectors when the price or quantity of fruit diverted to these markets is unknown. An implication of this is that this scheme is not actuarially fair.

The price paid for fruit diverted to the processing markets is dependent on amount sent. As the quantity increases, the price paid falls. Thus in a bad hail year where large amounts of fruit are diverted to the processing markets, such as 1994, the price for processing fruit was 75 cents per carton and 50 cents per carton for juicing fruit. Even with an insurance payout under the Act, growers face to hold a large proportion of the loss associated with crop failure due to the lower price received from the processors.

2.4.7 Payout premium ratios

Over time the payouts for totally destroyed, juicing and processing fruit have changed. The payout premium ratio varies for each class of damaged fruit. There seems little logic in the changes from year to year. In 1984 the payout premium ratio for totally destroyed fruit was 15.2, in 1987 it was 16.8 and in 1992 it was 11.6.

The payout premium ratio for juicing and processing fruit in 1984 was the same at 7.6 but then there was a divergence. In 1987 the ratio for juicing fruit had increased to 11.8 but for processing fruit it had increased to 10.9. In 1994 the juicing fruit payout premium ratio was 16.3 and the ratio for processing fruit was 10.6.

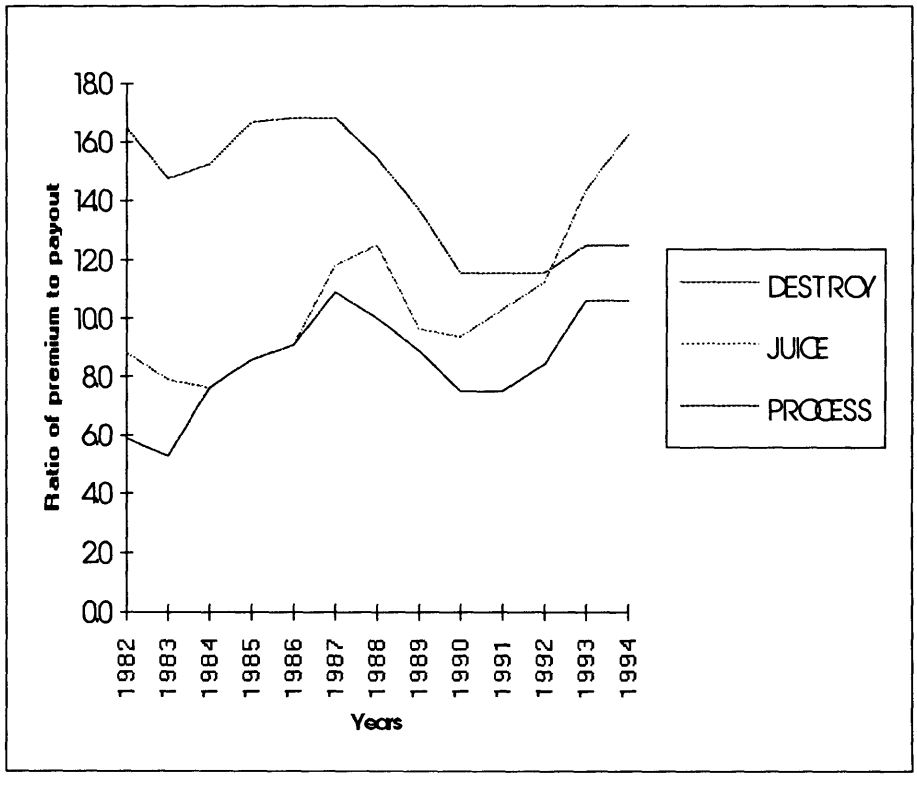
The calculation of the payout premium ratio varies considerably due to the premium and payout being determined on a basis other than the probability of climatic occurrence as discussed in Section 2.4.6. It would be expected that if the Scheme was set up using actuarially fair data that these payout premium ratios would not change over time unless the underlying climatic data showed significant variations.

In Section 2.3.2 one of the failings identified by APMAC of the 1957 Insurance Scheme was the fixed payout premium ratio of 21. In the 1967 Insurance Scheme the payout premium ratio was fixed at 12, as mentioned in Section 2.3.3, and this was considered too low (APMAC 1978). In the current Scheme it has never gotten as high as the 1957 payout premium ratio, but has varied both above and below the 1967 value of 12 which was considered too low by growers.

From studying Figure 2.4 it can be seen that over the 1982-1994 period the premium payout ratios for all classes of damaged fruit have changed. The difference between totally destroyed premium payout ratio and the two damaged fruit premium payout ratios has decreased. This raises the issue of how these ratios are calculated. The author has no answer to this but asks that this variation be noted. The author can see no logical explanation to this unless a fixed payout premium ratio would lead to an over or under estimation of production by an grower as mentioned in the above paragraph and in Section 2.4.1.

Figure 2.4

The Payout Premium Ratios 1982-94



2.5 CONCLUSION

An outline of the current Scheme has been given in the above sections. From the discussion it can be seen that there are various issues in this Scheme that make it an interesting topic of research. In Chapter 3 the theory of crop insurance will be discussed and some of these issues will be outlined using the literature studied. Reference will be made to the problems the author envisages in the operation of the current compulsory Scheme.

CHAPTER THREE

THE THEORY OF CROP INSURANCE

3.1 INTRODUCTION

In this Chapter the theory of crop insurance schemes will be discussed. Reference is made to the literature the author studied in the development of this research topic. Particular aspects of the theory of crop insurance will be discussed in relation to existing crop insurance schemes and the scheme that operates for the Tasmanian apple industry.

As mentioned in the Introduction of Chapter 2, it is important for the reader to develop an appreciation of the issues that surround this crop insurance scheme. In Chapter 2 the characteristics of the industry and the insurance schemes that have been run for this industry were discussed In this Chapter, the author will discuss the features of crop insurance theory and existing schemes with the aim of familiarising the reader with the Tasmanian scheme.

3.2 FEATURES OF CROP INSURANCE SCHEMES

3.2.1 The Aim of Crop Insurance

As briefly outlined in Chapter 1 the objective of crop insurance is to enable stabilisation in the returns from cropping in the event of climatic uncertainty (Ferguson 1968). In theory crop insurance is an efficient risk sharing device where a group of farmers "share" the risk of a bad season by paying a premium into a common pool. Compensation claims are made in the event of partial or complete crop loss where the actual yield is less than the insured yield. In practice the cost of transferring this risk between farmers and insurers has been a costly exercise (Nelson and Loehman 1987).

Much of the literature studied deals with the Federal Crop Insurance Act 1980 that operates in the US. The aim of this scheme is to replace disaster relief measures on an actuarially-sound basis with limited government intervention (Goodwin 1993). It insures farmers against income loss due to crop failure by having coverage available for proportions of normal yield (50 percent, 65 percent and 75 percent) at one of three price elections (Miranda 1991).

The aim in the Tasmanian Fruit Crop Insurance is to insure growers against crop loss due to climatic events beyond the control of the grower. The level of compensation is based on a partial recovery of the variable costs of production whilst maintaining the incentive to sort damaged fruit (C. Bannister, personal communication, 1995).

The aims of both the Tasmanian scheme and the Federal Crop Insurance Act 1980 is to insure farmers against yield variability. The method by which this objective achieved is quite different. The nature of cropping is quite different; broadacre cropping in the US and perennial orchard production in Tasmania. In the US system, insurance claims are based on the difference between insured yield and actual yield. In the Tasmanian scheme claims are based on 90 percent of the difference between insured yield of packable fruit and actual yield of fruit packed at a set rate per carton.

In the American scheme the payout is based on the value of the crop grown represented by the crop price. In Tasmania, the payout is based on a proportion of variable costs. In Section 2.2.4 the statement was made that the variable cost structure was different for four representative varieties. As the payout per carton is fixed irrespective of the variety grown and its variable cost structure, this Scheme is dissimilar to the American Federal Crop Insurance Scheme.

3.2.2 Participation in Insurance Schemes

Participation of a large pool of farmers in a crop insurance scheme is needed to offset the risks of crop failure to the insurer (Miranda 1991). In the US there have been requests for the repeal of the 1980 Act due to poor farmer participation (Miranda 1991). In Tasmania a contributing factor to the failure of the 1967 voluntary crop insurance scheme was lack of grower participation (APMAC 1978). To maintain grower participation, the current crop insurance scheme was made compulsory under the 1982 Act. Making the current Scheme compulsory may have led to a reduction in the problem in the previous voluntary schemes where only adversely selected growers participated (see Section 3.2.6).

A further problem in making crop insurance compulsory is that it may result in crops being grown on sub-marginal land and resulting in adverse effects on the efficiency of resource allocation (Halcrow 1949). Although a possibility, the Tasmanian scheme's payout is low and the presence of a no claim bonus and a claim penalty in the Scheme may alleviate this concern of resource allocation inefficiency. A grower who has an apple orchard on marginal ground and has a history of claims may be paying the

maximum percentage of base premium but depending on the grower, this may be an acceptable business strategy.

As it is compulsory a few growers see the Scheme as an invasion of personal liberty and will not pay the set premium (L. Baxter, personal communication, 1995). Halcrow (1949) states that it may be necessary to make insurance schemes compulsory to maintain grower participation. A consequence of making insurance compulsory is that it may not be acceptable on the basis of socio-political grounds.

A further problem with this Scheme is that there are only a small number of growers in the industry and there is a lack of geographic distribution. Lee (1953) stated that the failure of private crop insurance schemes was partially due to lack of geographical distribution. Thus it is difficult to spread the risks between growers when most are in the same geographical area as occurs in the Huon Valley.

3.2.3 The Social Good Aspect of Crop Insurance

A major argument in favour of the existence of crop insurance schemes is that there is a social good aspect. The social good stems from having sustainable agricultural businesses and that a decrease in the risks that farmers face benefits the wider community. In a Bureau of Agricultural Economics submission to the Industries Assistance Commission on crop and rainfall insurance in 1986 it was stated that no substantial external benefits of crop or rainfall insurance had been identified with the exception of some public benefit from the knowledge that farmers and their families and livestock are protected against the hardship of drought (BAE 1986). It is also stated that this benefit is not peculiar to insurance but would also apply to existing disaster relief arrangements (BAE 1986).

An issue that has been raised in the last five years in Australia is that the Federal Government has changed its policy position in regard to assistance to the agricultural sector. This change in position is from giving assistance to farmers in risky situations to one that, in effect, states that as risk is a normal part of a farmer's operating environment, risk minimisation strategies need to be adopted by the farmer.

In other agricultural industries,such as wool and wheat, the Government seems to be playing a lesser role in insuring returns to farmers.

It is not known what the magnitude of the social good is to the wider community from running a compulsory insurance scheme in the Tasmanian apple industry. On a

regional level, the apple industry is a major employer in the Huon Valley region along with forestry and the aquacultural industries. In discussions with the industry, representatives said that a buoyant apple industry "flows through" to a buoyant regional economy including Hobart (Case Study Grower Three, personal communication, 1995).

The social benefit aspect of the scheme has not been measured in this evaluation as it is deemed to be outside the objectives of this research. This is a possible research topic as will be discussed in Section 6.5.

3.2.4 Development and Administration of Crop Insurance Schemes

In the last twenty years it has been discussed in the literature that competitive agricultural insurance markets have not emerged. This may be a question of "insurability" where both insurance companies and farmers are better off due to the presence of insurance schemes than in the absence of insurance (Chambers 1989). Quiggin (1986) writes that rainfall insurance would only be viable if backed by large pools of un-correlated assets such as those held by governments or large insurance companies.

Halcrow (1949) wrote that most crop insurance schemes nearly always involve government sponsorship or are made compulsory. To induce farmers to participate in crop insurance schemes, subsidies are needed due to the high cost of transferring risk from farmers to insurers (Nelson and Loehman 1987). It is unclear whether this "high cost" is the high administrative cost that needs to be built into the premium or that the risk of a payout is high therefore the actuarially fair premium is high. If Goodwin (1993) is correct in claiming that the demand for crop insurance is price elastic then government subsidies are needed to maintain participation by keeping the price relatively low otherwise, with a slight price increase, demand for crop insurance will fall.

Government assistance in promoting the setup of crop insurance schemes may take the form of subsidies. Subsidies in the Tasmanian Scheme are not easily identified except through which company administered the Scheme prior to 1995; TGIO. Therefore despite there having been no subsidies on premiums *per se* the Government did provide the means by which the Scheme was run by having TGIO act as an agent for the Government plus it still underwrites the Scheme in the event that neither the cumulative premium account balance nor re-insurance covers all claims made under the Act. (See explanation in Section 2.4.5.)

It is surmised that it was difficult for the insurer, TGIO, to maintain interest in the Scheme when there was no return other than the coverage of administrative costs. All interest earned from the cumulative balance of the trust account was added to the balance trust account rather than being "profit" for TGIO for providing the crop insurance scheme (C. Bannister, personal communication, 1995).

In researching this topic the author found reference to two commercial crop insurance schemes offered by private companies for apple growers in Australia. In Victoria, a voluntary hail insurance scheme is offered by the Government Insurance Office; there is an insurance broker in Queensland who offers a similar hail insurance scheme. In Gordon (1994) one of the variable costs of production is voluntary hail insurance.

The premium charged for hail insurance depends on the probability of hail in the geographic region. The payout is based on the variable costs of production (D. Cooke, personal communication, 1995). Gordon (1994) has a variable cost of production hail insurance at a premium of 16.5 percent of the payout of $5.00 per carton for apple production in the Batlow region of New South Wales.

3.2.5 Actuarial Basis for Insurance

There is much discussion in the literature regarding the actuarial soundness of crop insurance schemes. Lee (1953), in outlining the alternatives to frost insurance in the Californian orange industry, stated that there was a lack of actuarial data on the risk of crop loss due to hail - farmers do not maintain records that contain these data. He also stated that it was questionable whether 25 years of data were sufficient for a sound actuarial base for crop insurance schemes.

Miranda (1991) wrote of the problems of tailoring coverage to the individual's yield loss experience leading to a lack of actuarial fairness in the operation of the US Federal Crop Insurance Scheme. Goodwin (1993) stated that the objective of the US Scheme was to create an insurance scheme that replaces disaster relief measures on an actuarially sound basis with little government intervention. Whether it does this is questionable given the requests for repeal of the Act as quoted by Miranda (1991).

The need for actuarially fair data is important in the development of a scheme so that the payout does reflect the chance of loss and the magnitude of loss. This is a necessary condition for both the insurer to maintain a profit incentive and for the grower to have compensation based on the magnitude of loss.

For the Huon Valley region of Tasmania there is a lack of climatic data available. In researching this topic, the author found that there was only one Bureau of Meteorology weather station in the Huon Valley at the DPIF's Grove Research Station. The Bureau of Meteorology supplied the author with a summary of the climatic data since 1956 for this weather station. At this station the minimum overnight temperatures, important in establishing frost events, are not taken. Rather the minimum temperature is taken 1 metre above the ground at 9 a.m. (D. Shepherd, personal communication, 1995). Some frost events may have dissipated by this time. Frosts occur if temperature is below 1.1 degrees Celsius (D. Shepherd, personal communication, 1995).

Payouts are due to fruit damaged by climatic occurrences. These occurrences may be at a specific time, such as a frost early in October, and also be area specific such as a localised hail storm. Frost may differ in its impact on fruit damage depending on where and when it occurs and its severity. A severe frost may result in 100 per cent crop loss but less severe frosts may result in lesser amounts of fruit lost. Early frosts may affect varieties that blossom earlier than other varieties. Later frosts may affect fruit set but be negated by adaptation of thinning practices - such as no chemical thinning and a light hand thinning of fruit (see Glossary). In the opinion of the author there is scope for orchardists to adapt orchard management practices to alleviate fruit damage when the apple crop is not totally destroyed.

A grower may suffer due to a localised hail storm or frost on the lower parts of the orchard area. Hail damage may depend on whether the hail is hard and has jagged edges (maximising fruit damage) or soft and mushy (lowering the amount of fruit damage) (C. Bannister, personal communication, 1995).

As mentioned above, frost and hail can be a patchy occurrence. The Research Station being in the centre of the Mountain River Valley, (a tributary of the Huon River) and having few steep slopes, may face slightly different climatic conditions to other orchard areas. Observations by Department of Primary Industry personnel in the 1960s found that there was no regular pattern to areas affected by climatic occurrences such as hail and frost in the Huon Region (APMAC 1978, J. O'Loughlin personal communication 1995). This has important implications in the development of data for the case study farms which will be discussed in Chapter 4.

Lee (1953) suggested that temperature insurance may be a viable alternative to frost insurance to circumvent the problem of inadequate frost records. Farmers being able to insure against low temperatures that result in frost damage. This would be an alternative in Tasmania if detailed weather station data were available. As stated above there is only one Bureau of Meteorology weather station in the Huon region and this may not be representative of the rest of the Valley. Hence developing an actuarially sound basis for this type of crop insurance scheme is difficult. A further problem that was discussed by Lee (1953) is that it may be hard to isolate the cause of a specific risk that results in damage.

Lee (1953) stated that one of the prerequisites of a temperature insurance scheme is a wide geographic area to decrease the concentration of indemnity payments in any one year. In the opinion of the author there is no scope for this to occur in a widespread damage year as 85 percent of the Tasmanian apple production occurs in the Huon region. A further problem in temperature insurance is the difficulty in determining the relationship between temperatures taken at a weather station and temperatures within groves of trees (Lee 1953). The weather station at Grove Research Station is some 20 metres from the nearest orchard block and, for some parts of the orchard, may be 20 metres in altitude above the trees and of a different aspect. This may impact on the severity of frost and hail damage in the orchard being different to that recorded at the weather station.

3.2.6 Adverse Selection

Adverse selection is a problem with most crop insurance schemes where insurers have difficulties in assessing each participant's actual chance of loss. Producers with a higher chance of loss will be more likely to insure in a voluntary scheme than low risk producers.

In a voluntary scheme such as the 1967 Tasmanian crop insurance scheme participation dropped from 473 growers in 1967-8 to 65 growers in 1977-8. It was thought at the time that this was due to the low compensation rates (APMAC 1978) but may also, in the opinion of the author, have been due to adverse selection; participants being the growers who perceived themselves to have high risk production areas and so had a greater chance of loss. It may also be due the difference in risk attitude of the growers and that the more risk aversethey were the higher the demand for crop insurance.

In the current crop insurance scheme operating in the Tasmanian apple industry there is a bonus malus plan in operation (See Section 2.4.2.). This has meant that each

grower pays a premium relative to their individual chance of loss based on their previous claim history rather than the chance of loss of the whole industry where low risk growers would subsidise the claims of high risk producers. Thus the occurrence of adverse selection is decreased by having a bonus malus plan and multi year policies as the basis of the Scheme.

3.2.7 The Basis of Policies: Area Yield versus Actual Production History

In America there has been debate on the relative merits of area yield, based on county data, versus actual production history. For area yield insurance schemes each farmer in the same area pays the same premium for the same indemnity (Miranda 1991). Where actual production history is used a farmer pays a premium based on their own yield experience and their own probability of loss.

Miranda states that an area yield basis for crop insurance policies does mean that farmers are unable to adjust their inputs to increase indemnity which is a problem of moral hazard (see Section 3.2.8).

This compulsory Scheme in Tasmania mirrors the actual production history basis for the writing of policies. Growers pay premiums based on their previous years' production and packout figures for their whole orchard areas. There is no consideration of the varietal mix of an orchard area which will affect both total yield, total packout and crop revenue (See Section 2.4 and Chapter 4) and the variable costs of production (see Figure 2.2 in Section 2.2.4).

3.2.8 Moral Hazard and Changing Management Practices

Moral hazard occurs when insured farmers take decisions toward riskier crops or management procedures. This course of action, although not considered illegal, does lead to a possible alteration of a grower's potential crop by a change in management practices of different inputs. These actions are not observable by an insurer and may lead to an underestimation of rate setting and a change in the probabilities of losses (Nelson and Loehman 1987, Miranda 1991).

In Tasmania as a result of moral hazard growers could rationally alter their vector of inputs as a result of climatic occurrence. In taking this course of action growers must ensure the change in their input vector does not affect production in subsequent years. This issue is one of the major differences between annual crops such as broadacre crops and tree crops where what happens next year is affected by what is done this year. In broadacre crops the life of a crop is one year; in orchards the commercial life

could be up to 50 years but is normally in the order of 20 years (B. Cockerill, personal communication, 1995).

In the Tasmanian situation, some growers do change their management practices if they perceive that their orchards are susceptible to climatic occurrences. For example, a grower may put in frost sprinklers when the chance of frost is high for that orchard area. In this situation a grower is taking steps to improve the chances of undamaged fruit crops. A grower who does take these steps may benefit from these practices in paying a lower annual premium than would otherwise be the case. Once a grower has made the decision to grow apples in a risky area, they are "locked in" to orchard production for many years. The use of other risk reduction strategies assist in achieving a profitable orchard block.

If the current Scheme is assumed to be actuarially fair and is perfect in information there would be little incentive for growers to alter their inputs. However the presence of physical devices that alter the potential of losses, due particularly to frost, implies that the current Scheme is not perfect and that there is an incentive for growers to minimise their insurance claims and the impact of frost on their crops. Although not widespread, some growers do use frost sprinklers that operate on the basis of temperature sensors in orchard areas.

In the last season several claims of damage due to climatic occurrences did appear when fruit were packed after being in cold storage but, on investigation, the damage was found to be the result of incorrect management decisions. However the potential for false claims under the current Scheme is said to be low (C. Bannister personal communication 1995).

One of the techniques used in the Federal Crop Insurance Act in the US is to limit coverage of a crop to no more than 75 percent of a farmer's normal yield to decrease the incentive for farmers to alter their input vector (Miranda 1991). In Tasmania the coverage in the current scheme is based on 90 percent of packable fruit. As the packout percentage decreases, a grower's insurable base declines.

As was discussed in Section 2.4.6, payout is low compared with the growing costs of high value varieties so growers do need to adjust their input vector to minimise loss due to crop damage. There are two factors operating in this situation, minimising expenditure on the variable costs of production after the climatic occurrence has resulted in crop damage and maximising the resultant insurance payout. The author

was shown a crop that was hail damaged and the grower was not willing to use any more sprays than necessary to minimise financial loss.

In this discussion of moral hazard and changing management practices, there have been several issues raised; moral hazard, "moral benefit" and changing management practices. The issue that arises from such a discussion is that there is theory and there are practical considerations that go beyond the theory such as those actions taken by growers due to their perception of risk exposure to fruit damage resulting from climatic occurrences.

3.3 OPERATIONAL PROBLEMS IN THE CURRENT INSURANCE SCHEME

3.3.1 The Premium as a Proportion of Variable Costs

The annual premium payable for orchardists is dependent on their claim history. In Section 2.2.4 and Figure 2.2 the aspect of decreasing production costs as yield increases was shown. As the annual premium payable for each grower is dependent on previous claims, the amount is constant per box irrespective of yield per hectare. However, when the annual premium paid is measured as a proportion of variable costs it varies depending on yield per hectare. Some variable costs are fixed on per hectare basis. Costs that are of this nature are fertiliser costs, spray costs, As yield increases these "fixed variable costs" decrease on a per carton basis as yield in cartons per hectare increases.

For low yields, the base premium payable amounts to 3 percent of growing costs assuming growing costs are $5.00. As yield increases the proportion of the premium payable increases relative to the fixed variable growing costs described in the above paragraph. If a grower was producing 3,000 cartons per hectare at a packout of 85 percent, crop insurance is some 5 percent of growing costs and exceeds growing costs such as fertiliser, herbicides, and mowing on a per carton basis.

3.3.2 Problems with Payout

The payout levels for the various classes of fruit damage are set in the July prior to the season. The price paid in the processing market is dependent on amount of fruit supplied, in a year of high hail damage, a claim plus any market return may not cover the costs of growing and picking. Therefore in a year where there is high damage, market returns plus claims under the Act may not insure orchardists for a high proportion of the variable costs of production and they would still have difficulty in producing an apple crop the next year due to financial constraints. This problem in particular is seen as a major limitation to the current Scheme's operation.

When the Government Inquiry was held in 1978 to assess options on assistance to the apple industry, prices per carton of first grade fruit were around $2.50 (APMAC 1978). The recommended payout for damaged fruit was $1.40 per carton or 56 percent of expected market return. In 1995 where there has been adoption of high value varieties, prices per carton of first grade fruit ranged from $14 to $28 per carton. The maximum payout for juicing fruit is $2.30 per carton or 8-16 percent of expected market return.

In the opinion of the author the level of compensation under the Act has not kept pace with changes in the industry including the value of fruit grown.

3.3.3 Set-up of Insurance Schemes

In the above Sections some of the problems with the operation of the current Scheme have been outlined. A further problem was that the Scheme was set up in 1982 after there had been two extremely bad hail and frost years in the late 1970s. The setting up of the Scheme may have been a "knee jerk" reaction (T. Hocking, personal communication, 1994) to the liability incurred by the Government in assisting the industry which was suffering low prospects for the future.

3.3.4 The Role of TAMA

When the current insurance scheme was set up in 1982, the export of fruit was done under the control of (Tasmanian Apple and Pear Marketing Authority) TAMA, a single desk seller for all exported first grade apples. In the 1978 Government Inquiry, it was stated that TAMA was unwilling to forward loans to growers unless their crop was insured.

In 1982, TAMA lost the support of some large exporters and became non-profitable. This led to many packing sheds doing their own marketing for both domestic and export first grade fruit (C. Bourke, personal communication, 1995).

The effect on the industry of this failure was that there were free market conditions and no government intervention into the disposal of the Tasmanian apple crop. Loans were no longer the role of TAMA but rather the role of banks.

If TAMA was a factor in putting forward the case for the development of the 1982 Insurance Scheme, when it ceased to exist was there still the demand for crop insurance?

3.3.5 The Compulsory Nature of the Scheme

Much work has been done in promoting competitive advantage in Australian primary industries. Compulsory insurance schemes such as the one for the Tasmanian apple industry seem to work at cross purposes to this. A grower has no choice in whether insurance should be paid - it is a variable cost of production that is covered by an Act of Parliament. Goodwin (1993) states that the demand for crop insurance increases after a year when many claims have been made. Growers will support the Scheme when there has been a bad hail or frost year.

3.4 CONCLUSION

In this Chapter, the theory that underlies crop insurance has been discussed. The theory has been discussed in its application to the compulsory insurance scheme that operates in the Tasmanian apple industry. Some of the operational problems that occur in the Tasmanian scheme have been outlined and cross referenced to Sections in earlier Chapters. The intention of the author in this chapter has been to hi-light some of the background to crop insurance schemes in general.

The theory, relevant to the approach taken in this research, has been outlined so that in the remainder of this work, the reader has an appreciation of the theory and the issues surrounding this Scheme.

In the next Chapter the author will outline the data used in the development of simulation models that assess the impact of this Scheme on the operations of several case study farms.