

A Conceptual Report

for

# Revolutionary Crop Insurance in Australia

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# 1. Introduction

Crop hail insurance has been available “since the early years of this century”<sup>1</sup>. Despite this, when I started underwriting crop insurance six seasons ago, the crop insurance market was still an immature one, in which the only perils available were hail and fire. During the last eight decades the crop insurance market has failed to cover the major perils that continually confront growers in this country.

Shortly after starting to underwrite crop my vision was to evolve crop insurance to ultimately cover all weather and natural perils beyond the control of the individual grower. My current vision has been focused through six seasons of crop underwriting experience and has become more revolutionary.

This report has three sections: *the way it is*, which looks at the existing crop insurance market; *the way it ought to be*, which looks at my revolutionary vision for crop insurance and; *how to fund it*, which looks at the funding issues associated with realising this revolutionary concept.

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<sup>1</sup> 1993 Survey of Crop Insurance in Australia - Mercantile & General Reinsurance prepared by Colin Packham and Jeanene Hill.

## 2. The way it is

When I started underwriting crop insurance one of my peers took me aside and said “you will never make money out of crop insurance” and still today, with no understanding or experience in crop underwriting, other managers are convinced that I should stop insuring crops. This attitude towards crop insurance comes from its bad reputation and this has three causes. In order of importance, they are: the failure of many crop insurance schemes; established crop insurers monopolising loss statistics; and sensational reporting of crop losses in the media.

### 2.1. The failure of many crop insurance schemes

Insuring crops against weather perils is difficult, and the lack of sound underwriting makes failure inevitable. Lack of sound underwriting has been the cause of the failure of many crop insurance schemes. To the general insurance market, these failures are attributed to crops being uninsurable against weather perils. They discount the possibility that poor underwriting decisions and the more fundamental structural flaws in the crop insurance market could be to blame.

#### 2.1.1. A lack of sound underwriting

Like no other class of insurance, it is essential that the crop underwriter is skilled in applying underwriting techniques and understands their customer, the grower. It is the lack of understanding of the growers’ risk taking nature together with the informed basis on which growers’ choose to insure or not, which causes most failures.

Growers are risk takers. They annually risk significant financial loss to produce a crop from which they hope to prosper. In good seasons they do but in a poor season or a series of poor seasons they could lose everything.



This level of risk taking is foreign to most modern urban dwellers that live secure lives on steady incomes. Urban dwelling underwriters are risk takers too, but with crop insurance they are pitting their risk assessment skills against those of the grower. When it comes to insuring a grower's crops, the grower has a home ground advantage.

Most growers have a better understanding of the risks they face than the crop underwriter because they have lived on the properties all their lives. This makes successful crop underwriting very difficult. If an average rate for a region is offered, growers with a lower than average exposure will not insure, as they are able to discern the premium as poor value, but a grower with a higher than average exposure will grab the bargain.

#### **2.1.1.1. Adverse selection**

In underwriting terms this process is known as adverse selection. In crop insurance adverse selection can be extremely high due to the growers superior local knowledge of their exposure to weather events and their management practices. A relevant definition<sup>2</sup> of adverse selection is:

*“Adverse selection occurs when:*

-  *insurers offer insurance at a premium reflecting the average loss experience of a group of potential policy owners; and*
-  *only or mainly those individuals who have expected losses, which are greater than the average, take out the policy. This increases the probability that insurer's payments will exceed the premium received.*

*Adverse selection is likely to be a significant problem in crop insurance. The limited information available for setting premium rates makes it particularly difficult for insurers to have knowledge of expected losses*

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<sup>2</sup> Australian Industries Assistance Commission Report on Crop and Rainfall Insurance, June 1986.

*compared to that possessed by the individuals. There is also likely to be a wide range of loss experiences amongst growers. For example, some growers live in areas prone to hail and wind while others live in areas, which are less prone to those events. In many cases the insurer has insufficient information for these differences to be reflected in premiums.”*

If this is universally so, why has any form of crop insurance survived, let alone for over eighty years? The answer is that the ability of growers to adversely select against insurers rating is dependent on the frequency and severity of the peril insured. To see how this operates in practice let us look at a survivor, *winter crop hail insurance* and a failure, *peanut harvest rain insurance*.

#### **2.1.1.2. Winter crop hail insurance**

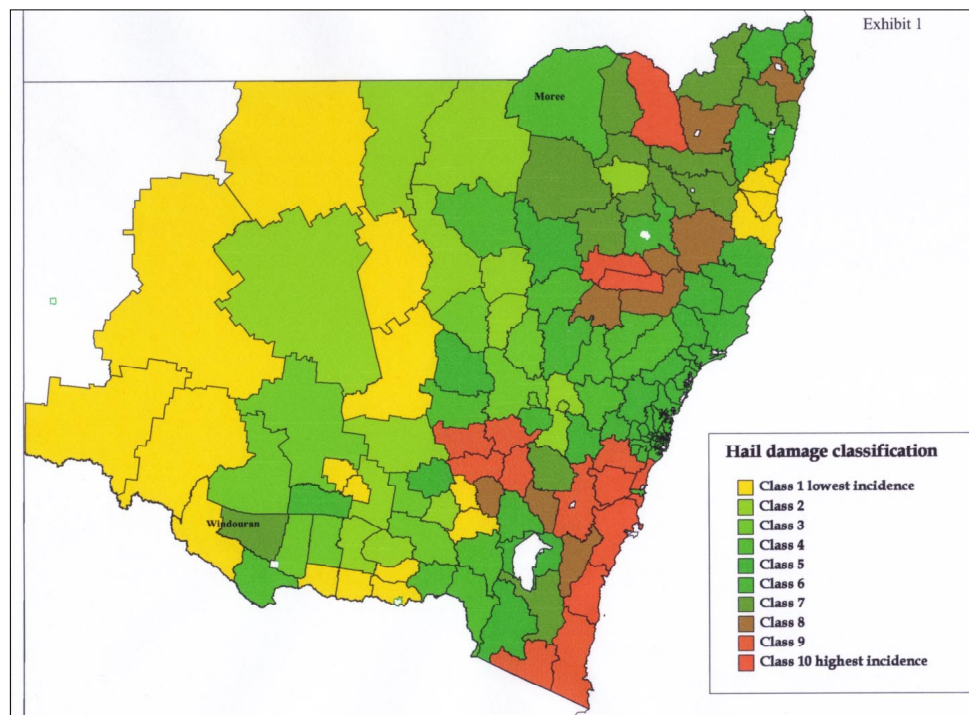
Winter crop hail insurance has been with us since the early years of the century and yet rating is still done on a community or shire basis, which should give the grower the opportunity to adversely select against the insurers rating. In this case rates are calculated based on a Loss Cost Ratio<sup>3</sup> for each shire with loadings applied to different crop types, determined by their different susceptibility to hail damage. Adverse selection should operate to make winter crop hail insurance unprofitable, but the opposite has been the case.

Although, some areas of Australia are hail prone they tend to be in the higher altitude and rainfall areas where winter crops are not widely grown. In the arable plains of Australia where winter cropping dominates farming, (in the absence of any local topographic feature), the frequency of hail is low for the individual grower. This low frequency increases gradually as average rainfall increases and in moving from winter rainfall to summer rainfall climatic zones.

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<sup>3</sup> Loss Cost Ratios are calculated by dividing the total tonnes of insured crop lost over a period of time for the shire by the total tonnes of crop insured over the same period of time for the same shire.

Premium rating averaged on the scale of a shire succeeds because the frequency of hail varies gradually on the plains where most of the winter crop is grown. Severity is only dependent on the severity of the storm and the growth stage of the crop. It doesn't work so well in the higher country where local topographic features remove the random nature of hailstorms found on the plains. Shire rating can be seen in Exhibit 1, which is a map of shire rating in New South Wales in 1991.



However, this time proven method of rating has had problems which sound underwriting techniques could have solved. Sound techniques for determining the Loss Cost Ratios were suggested in the article<sup>4</sup> from which Exhibit 1 was copied. The Windouran shire rate in southern NSW was highlighted in this article as an anomaly compared to surrounding shires and gave reasons why the rate was high. This should have been obvious to any crop underwriter.

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<sup>4</sup> Australian Insurance Institute Journal in September 1991 article titled "Setting premium rates for crop hail insurance" by Heather McMaster and Russell Blong of Macquarie University.



Evidence of growers not insuring in the Windouran Shire as a result of the higher rate was mentioned in the article:-

*“Perhaps as a consequence of a continuingly high premium rate, the percentage of the wheat crop insured in Windouran shire has fallen below the percentage insured in the shires of Murray, Wakool and Conargo [neighboring shires].”*

The fact that any growers still insured highlights that hail is a severe peril. Although very limited in the area it effects, hail can be very destructive with the potential to destroy an individual growers entire crop. Without a large group of similarly affected growers to lobby for government support, growers may feel more inclined to insure against a severe peril like hail, particularly as the premium rates are affordable and there is a long established buying pattern.

The fact that hail and fire losses are infrequent for the individual grower also explains why these are the only perils insurable. As the next example shows, when a more frequent peril like untimely rainfall is insured, adverse selection does operate against the insurers rating. This also occurs with horticultural crops, as hail is more frequent, which is why these crops are far more difficult to insure against hail losses than winter crops.

#### **2.1.1.3. Peanut harvest rain insurance**

Peanut harvest rain insurance has been attempted based on an insurance broker scheme. Unlike hail, the individual grower can influence their exposure to rain at harvest time through their planting program. The more plantings and the more time between plantings the lower the exposure as a smaller percentage of the crop is ready for harvesting at any one time. Thus exposure to harvest rain is reduced so any loss will be less severe in terms of their total income.

The frequency of rain is much higher than hail and more varied so appropriate rating is very difficult to achieve over an area the size of a shire where average rainfall can vary greatly. The more varied frequency of rain together with the grower's control of the severity of loss makes adverse selection inevitable. Combining this with an insurance broker scheme designed to facilitate distribution rather than adequate underwriting of the individual risk, results in an underwriting disaster.

Regional rates were used with no allowance for the number of plantings. Although the average number of plantings for peanut growers is four, the average of those insured was two. The loss ratio<sup>5</sup> in an average rainfall season was 211%.

Obtaining better information to underwrite the individual growers exposure to harvest rain was suggested to the broker but the administration cost for them were too great. This was partly due to the added burden of collecting the information but mainly due to not being able to close the sale at the time of completing the proposal, this necessitated two meetings per sale. This scheme only lasted one season.

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<sup>5</sup> In simple terms a loss ratio is calculated by dividing the claims by the premium. In this case the loss ratio is 211% or \$2.11 was paid in claims for every \$1.00 collected in premium. In the insurance market we tend to use the term loss ratio very loosely and could mean one of several different methods of calculating the loss ratio. In this report I will use the following definitions. This loss ratio is actually the Gross Loss Ratio as total claims have been divided by total premium. However, this is not a very useful ratio, as it does not reflect the insurers true position. As the insurer incurred a cost of 15% to distribute the product, in the form of a commission paid to an insurance broker, a more representative loss ratio would be the Net Loss Ratio, which is calculated by dividing the total claims paid by the net premium after commission. In this case the Net Loss Ratio is 248%. The most representative loss ratio is the Combined Loss Ratio, which also takes into account the insurers administration expense. In this case if we assume expenses of 10% then the Combined Loss Ratio, claims paid divided by net premium after combined distribution and administration costs, is 281% or \$2.81 paid in claims for every \$1.00 left over from the premium. With these levels of loss ratio it is little wonder that the growers affectionately knew a similar harvest rain scheme in New Zealand as the Christmas scheme (cherries are picked prior to Christmas with the claims paid around Christmas).

### 2.1.2. Structural flaws in the crop insurance market

The peanut harvest rain example above failed not as a result of a lack of sound underwriting but as a result of the complete absence of a crop underwriter at all. The scheme was devised by an insurance broker, rated and supported by a reinsurance underwriter and fronted<sup>6</sup> by an insurer. It was a creation of the distributors and capital providers.

To draw an analogy, this would be like General Motors asking the distributors to design and their bankers to price the next model car they manufacture. This would never be allowed to happen in the motor industry but this process occurs regularly in the crop insurance market. Insurance distributors are out in the fields and do know what the growers want however a crop underwriter must be involved to create a crop insurance product that gives the grower what is needed at a price that is affordable for the grower and sustainable for the insurer, not a Rolls Royce at a Holden utility price.

Most new crop insurance developments have come via insurance brokers and insurer intermediaries<sup>7</sup>. As a consequence these schemes usually failed due to adverse selection. As the insurer retains little of the risk, they have little interest or ownership of the

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<sup>6</sup> A fronting company is one that merely “fronts” for reinsurers and retails little or no risk and earns a commission for fronting.

<sup>7</sup> By insurer intermediary, I mean any insurer that derives more than half their income from commissions rather than risk premium. This definition would include many schemes in Australia as they only retain around 5% of the risk and earn up to 20% commission from reinsurers for the premium they pay to reinsurers, called ceding commission (e.g. 20% of 95% is 19% of the total premium in commission against 5% of the premium for the risk retained, in this case about 21% of the insurers income is for risk taking and 79% in commission). The other 95% odd is reinsured so that reinsurers are the principal risk takers and insurers just another layer of intermediary. It could be argued that this structural floor in the crop insurance market explains why the market is stuck in adolescence and why insurance brokers construct schemes by first getting reinsurance support before finding a fronting insurance company.

underwriting as they are more interested in commission levels and so leave the underwriting to their reinsurers.

This lack of ownership has made insurers reluctant to be innovative and create new crop insurance products, frustrating insurance brokers and farming groups. However, the answer is not to bypass the foundation of any insurance product, sound underwriting. Both insurance distributors and reinsurance underwriters have vital skills to add to crop insurance but direct underwriting is not one of them.

Distributors will inevitably design a product with a distribution focus. Reinsurers, used to underwriting insurers, will be drawn into underwriting growers, one of the most difficult insured's to underwrite due to their risk taking nature. Without a crop underwriter involved, sound underwriting techniques will not be employed which increases the likelihood of failure.

The bad reputation that crop insurance has earned is not totally deserved. Underwriting crop insurance is probably one of the most difficult classes of general insurance but everything is insurable at the right premium. The general insurance market should admit that the real reasons for the bad reputation are poor underwriting decisions and a flawed market structure, if indeed the crop insurance market as a whole does operate at a loss.

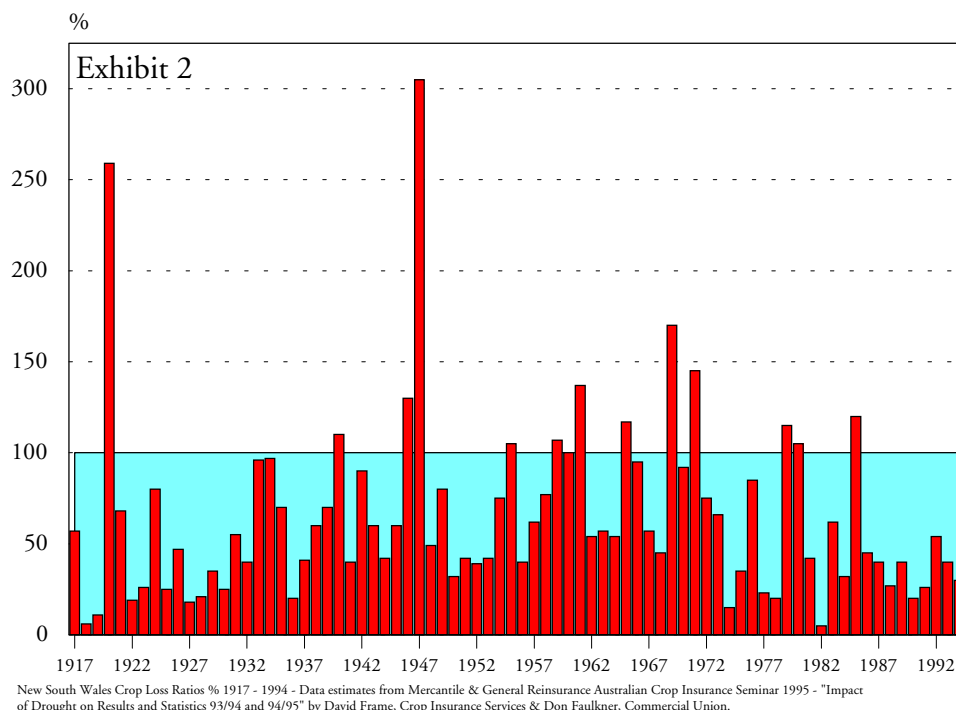
## 2.2. Established crop insurers monopolise statistics

Proving that the largest and longest surviving crop insurance product, winter crop hail insurance, has been profitable would instantly destroy this bad reputation. However, the statistics that would provide this answer are controlled by a group of established crop insurers who use Crop Insurance Services in all states except Western Australia and Queensland. They refuse to share this information.

This leaves nonmembers of this cartel with only media reports and market gossip to form a view on the viability of crop insurance. As bad news travels fast and good news would only encourage new entrants to the market it is

not surprising that the market gossip is full of doom and gloom. The bad reputation is perpetuated by the established crop insurance markets reluctance to make their statistics public.

As a nonmember of the cartel, the best information about the profitability of winter crop hail insurance I have is shown in Exhibit 2. This produces an average Gross Loss Ratio of 65% for the 77-year period from 1917 to 1992. For example if average distribution costs were 15% and administration expenses were 10%, this would result in a Combined Loss Ratio of 86% leaving a good profit margin of 14%.



This good performance from only one state is at odds with the general perception of the general insurance market. With a greater spread of risk<sup>8</sup> in all states you would expect this loss ratio to improve if only by becoming less volatile<sup>9</sup>. This lack of information for nonmembers of Crop Insurance

<sup>8</sup> Spread of risk is necessary in all classes of insurance to spread the losses of a few amongst the many. In crop insurance it is critical to have a good geographic spread of risk. Ideally, this would be a uniform accumulation of risk spread over the entire crop growing areas.

<sup>9</sup> The volatility of the NSW loss experience can be seen in the two seasons when the gross loss ratio exceeds 200%, a terminal loss ratio, or less than 10%, an exceptionally good loss ratio. If the other

Services is at best protecting the interest group's information and at worst a deliberate attempt to restrict entry to a profitable market segment.

Winter crop hail insurance represents about 75% of the total crop insurance market. So this absence of statistics makes forming a view on the viability of crop insurance impossible. As long as market gossip is the basis for the measurement of the performance of crop insurance then it will remain vulnerable to a bad reputation.

### 2.3. Sensational reporting of crop losses in the media

The media tends to sensationalise news. This is particularly true with natural disasters affecting grower's crops. Scenes of distraught growers in flood, frost or drought ravaged crops helps urban dwellers identify with our rural heritage forged in an unyielding and unforgiving land.

It does wonders to support the already bad reputation that crop insurance has. Every flood report this year yielded several enquiries from colleagues as to the cost of my losses. I pointed out that crops that are underwater neither get damaged by hail nor burn very well.

All adverse events on the land get interpreted as losses to the crop insurance market by the ill informed and fuel the bad reputation of crop insurance. The fact that the cost of reported losses are more likely to be overestimates than underestimates does not help. Proposing a new form of crop insurance in this environment can be very courageous.

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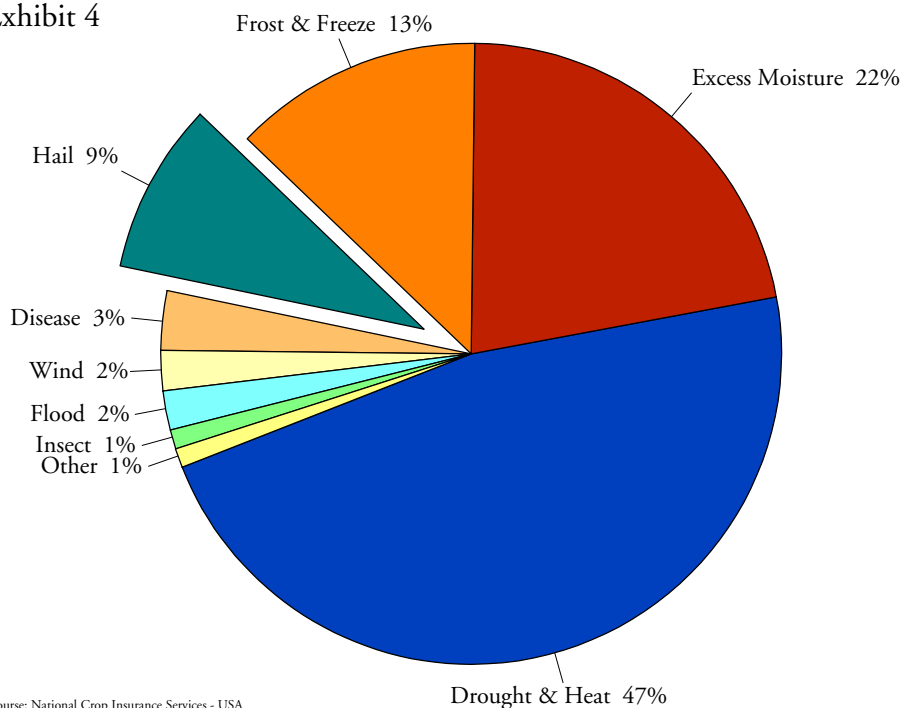
states were included it would be expected that not all areas suffered from the same extreme event and therefore the lower loss ratio in other states would reduce these extreme seasons. It would also be expected to increase the loss ratios in the lower loss ratio years as it is unlikely to be universally good.

### 3. The way it ought to be

The way it ought to be is quite different. In a perfect world complete information about the performance of crop insurance would be accurately reported by the media but we do not live in a perfect world. However, a revolutionary new crop insurance product that is soundly underwritten to avoid adverse selection and which is securely funded to avoid the structural flaws in the current market can be created.

Sadly, the established crop insurers have failed to respond successfully to the calls from growers for a more comprehensive crop insurance product. Exhibit 4 shows how little growers lose due to hail compared to the other perils they face which demonstrates how irrelevant the established insurers contribution is to growers. One attempt at a multi peril crop insurance and two attempts at insuring frost as an additional peril are all that has been tried, even though multi peril crop covers have existed overseas for decades.

Exhibit 4



This failure of the crop insurance market has resulted in unnecessary hardship for rural Australians. By not providing a cover for a wide range of

perils, financiers have been unwilling to provide crop credit thus retarding the development of agriculture in this country. With the availability of a more comprehensive crop insurance product, growers would be more confident in planning their futures and financiers could provide crop credit with the knowledge that a more comprehensive insurance product covered the loan and interest — and that's the way it ought to be.

However, the crop insurance market has shown that it is unlikely to spontaneously develop a comprehensive crop insurance product. Opposed to this is the pent up demand from growers for a better type of crop insurance, particularly after this seasons frosts, proving that the time for an evolutionary product from crop insurers has past and what is now needed is a revolutionary product. Grower groups will have to apply considerable pressure to insurers to generate the will needed for insurers to create what growers need.

Government has a role to play in encouraging insurers as well. One of the reasons the only attempt at a multi peril crop cover failed was that Governments are also in the business of compensating growers for losses through the exceptional circumstances relief scheme. For a multi peril crop product to be viable, the Government must withdraw completely from any direct compensation for growers following insurable losses. If growers support insurance ahead of Government relief then this should be acceptable to growers.

Assuming that grower groups can force insurers into action then there are three underwriting issues that need to be addressed to create a viable insurance product that is soundly underwritten. These are: scope of cover, what perils are to be compensated; basis of cover, what compensation is to be provided; and rating of the cover, how is an appropriate premium to be calculated for each individual grower. Without a comprehensive approach to these three issues this revolutionary new crop product will risk the same fate as the many failed crop insurance schemes that have gone before it.



### 3.1. Scope of cover

Some of the crop insurance failures in the past have been due to the insurer trying to cover single perils or a couple of perils only. As was seen in the peanut harvest rain insurance example, adverse selection was made easy for the grower by only giving him one peril to think about. Venturing into frost cover has proven that offering a single additional peril only makes it easier for the grower to adversely select against the insurers rating.

With the benefit of hindsight<sup>10</sup>, frost is probably the most difficult peril to insure. Growers are in a better position to know their exposure to frost as they know when the crop was planted and how staggered their planting dates were, together with the different season lengths of the different varieties, if any, they planted. If cover is not provided until a few weeks before flowering, they will also know how the season has developed, (was the growing season mild and the crop now advanced for the time of season or was the season cold and the crop now delayed).

This will be the case with offering other stand alone perils so it would be better to offer a wide range of perils, rather than just frost. A suggested wording for such a wide range of perils is shown in the scope of cover set out in the definitions of Insured Events and Excluded Events.

#### 3.1.1. Insured Events

*The specified events during the Growing Period are any events other than excluded events, which result in loss or damage.*

#### 3.1.2. Excluded Events

■ cyclone on plantings located North of latitude 28 degrees South,

■ flood, except flash-flood caused solely by a severe storm,

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<sup>10</sup> In 1996 I offered the cover for cereal crops. This covered income loss. The gross loss ratio was 1,440%. Since then I have offered production cost cover only.

- *action of the sea, tidal wave or high water,*
- *earthquake, soil movement including landslide, erosion or subsidence,*
- *genetic defect in any specified planting,*
- *water bursting, leaking or overflowing from dams, canals, pipes or any other structure designed to hold, control or transport water,*
- *any accidental or unintentional application or escape of any chemical agent,*
- *animals, birds, termites, vermin, larvae or insects, except for plague locusts or mice plague moving onto the Specified Crops in uncontrollable numbers.*
- *disease, including disease arising as a consequence of a specified event, or*
- *incompetent or negligent farm practice. Incompetent or negligent farm practice includes, but is not limited to*
  - *over watering, under watering or untimely watering of the plants;*
  - *over application, under application or untimely application of fertiliser, growth accelerant, growth retardant, fungicide, herbicide, insecticide or any other chemical treatment of the soil, plants or crop;*
  - *untimely or incompetent harvesting.*

*There is no cover for any damage caused by war or warlike activities, including the use of military power, invasion, other hostile acts of a foreign power whether war be declared or not, insurrection, rebellion, revolution and usurping power.*

*There is no cover for any damage caused by the use, existence or escape of nuclear weapons material, or ionising radiation from, or contamination by radioactivity from any nuclear fuel or nuclear waste from the combustion of nuclear fuel, including any self-sustained process of nuclear fission or fusion.*

*There is no cover for consequential loss or loss of any kind not specifically referred to in this Policy.*

An all or nothing approach has a greater likelihood of success for two reasons. Firstly, as a wide range of perils are insured, the grower will have to insure at planting to get the full benefit of the scope of cover provided, making it more difficult for the grower to select whether to insure or not based on the seasonal trend. Secondly, the more perils the more complex the risk assessment becomes for the grower.

This complexity comes from the multitude of perils that need to be considered and how these perils interact. Some perils are mutually exclusive (like water logging of crops and drought) and others change the exposure to other perils (like rain that delays and interrupts sowing, which potentially reduces the yield but also delays the crop thus reducing the frost risk). Increasing the complexity of the risk assessment by including a multitude of risks reduces the potential for adverse selection, as there are too many variables involved.

In addition to added complexity sound underwriting techniques will have to be employed to prevent adverse selection. To do this underwriting rules for participation in this scheme will need to be set to prevent adverse selection as growers must be prevented from entering and exiting from the program based on their assessment of the seasonal risk (e.g. as drought is covered growers must be prevented from entering the program in dry years only). To overcome this, participation should be limited to growers that participated in the previous season, thus introducing a waiting period of one season before cover can be arranged (this would apply from the second season cover was available to the individual grower). Also new business

should not be written in every season. If the seasonal outlook is poor then new business should not be written.

Other rules will have to be considered to protect the program for the growers that participate over many seasons and use the program as an ongoing risk management tool. Opportunistic growers must be prevented from jumping in and out of the program thus destroying the average rating through adverse selection. The objective of the underwriter of this program is to protect the prudent grower from nature as well as the opportunist grower.

So far we have only focused on adverse selection but an equally important issue is moral hazard. The reason for this is that adverse selection can be used against an underwriter by potential insured's so that the portfolio of insured's is worse than expected. It is logical to first prevent this from happening. However, once a grower has insured the scope of cover and the basis of cover must be designed to minimise the potential of an insured grower manipulating them to create or increase a claim.

The nature of existing crop insurance cover has limited moral hazard to a grower setting fire to an over insured crop. With the increase in the range of perils insured, the potential for moral hazard to exist also increases. Again a relevant definition<sup>11</sup> exists to help explain moral hazard in the context of crop insurance:

### 3.1.3. Moral hazard

*“Moral hazard is said to exist when the insured can influence the outcome of an event which is covered by insurance. Moral hazard can arise from an asymmetry of information where the insured knows his level of preventative activity but the insurer does not. For example if a grower is totally insured against a crop loss there will be no incentive for him to undertake efficient management practices or ‘preventative acts’ to limit that crop loss. In fact there is an incentive to reduce costs by not*

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<sup>11</sup> Australian Industries Assistance Commission Report on Crop and Rainfall Insurance, June 1986.

*performing, or partly performing, recovery operations. In many instances the insurer will have difficulty in distinguishing between avoidable and unavoidable damage. Further, growers may decline to salvage a crop if they consider there would be an equal or greater remuneration from claiming insurance.”*

This ability to influence the outcome of an event can arise from the scope of cover and the basis of cover. In respect of the scope of cover by limiting cover to weather and natural perils beyond the growers control the potential for this to create an environment for moral hazard to exist is limited. By selecting a basis of cover, which removes the grower’s ability to profit if a loss occurs, then the potential for this to create an environment for moral hazard to exist is also limited.

The last four excluded events have been included to limit moral hazard from the scope of cover. These are the use of a chemical agent, animal and insect damage, disease, and incompetent or negligent farm practice. All these can be influenced by the grower and thus introduce an element of moral hazard as indicated by the IAC report. However, where part of the damage could be beyond the control of the individual grower, such as plague locusts, this is removed from the exclusion.

The moral hazard associated with drought also needs to be considered carefully. If drought were fully covered then there would be no disincentive to growers planting all the country they could. There would be an incentive to do this, even if in the absence of drought insurance they would not plant any country at all, as they can recover all their costs from insurance if the crop failed. If this form of drought cover was in place then rules on when planting could occur would have to be in place to protect the program from this moral hazard.

These rules would be very difficult to administer and enforce. An alternative approach would be to only cover a lack of “in crop” rain. Under this approach drought cover would only start when the crop achieved a pre-agreed growth stage. This would leave the risk and decision on when to

plant to the skill of the individual grower while still removing the unknown risk of an established crop failing due to the lack of “in crop” rain.

An exclusion that will concern some growers is that of flood. The reason for this is timing and the fact that only flood-prone growers will want to pay for the flood cover. Actuarial rating for the insured perils will fully occupy any resources applied to this task. To cover flood detailed flood maps will have to be incorporated into the rating module and this would not be ready for this season. Next season, flood could be covered as an optional extension for an additional premium.

### 3.2. Basis of cover

Some crop insurance schemes have failed because they started too ambitiously by insuring growers for their income loss. These schemes would have stood a better chance of success if they had compensated production costs only. If this new crop product is to have the best chance for success it must be on the basis of production costs only.

From bitter experience I have learnt that when venturing into a new form of crop insurance it is best to do so in a way that limits your exposure while still giving real protection to your insured growers. In practical terms this means insuring growers for their production costs rather than their income. This basis of cover gives the grower protection against not recovering their production costs from the remaining crop income.

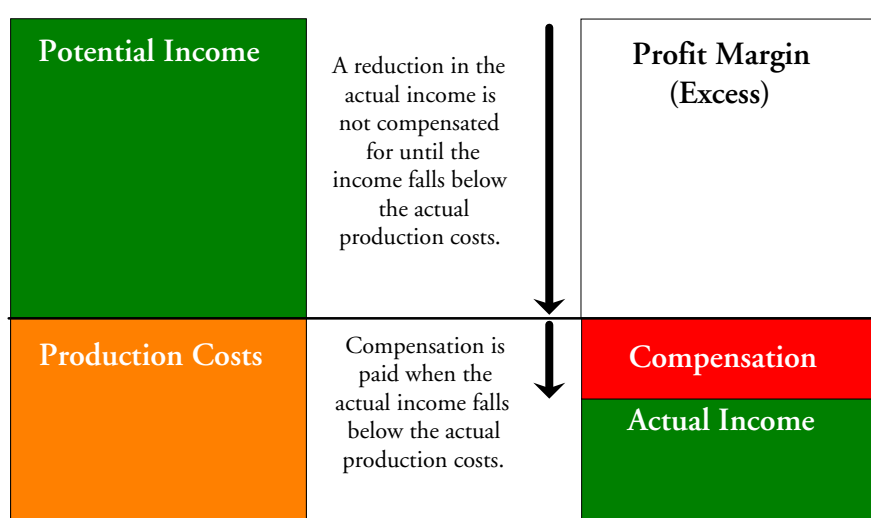
The major worry for most growers is the possibility of total crop failure with the real prospect of not having sufficient funds to plant a crop in the following season. Most farm enterprises are viable over time but cannot survive negative cash flow in one poor season or a series of poor seasons. Production cost cover gives the grower the peace of mind that if this season's crop fails then they will be cash flow neutral and will be able to use the same funds to plant a crop next season.

The advantage from the insurers perspective is that the total exposure in any one season is about two-thirds to a half of what it would be if the basis of cover were for full income protection. This is critical in the early

seasons of a new crop scheme as it reduces the capital required to support the insured exposure<sup>12</sup>. It also reduces the premium required to cover the reduced exposure thus making the cost as a proportion of a grower's income more affordable and more likely to be taken up by many growers thus improving the spread of risk and the likelihood of reaching critical mass<sup>13</sup>.

Exhibit 5

### Basis of Cover



A production cost basis of cover could be structured to pay compensation to growers once the income they receive from the remaining crop falls short

<sup>12</sup> This has been the evolutionary path taken by cotton hail insurance. After failing 12 years ago, an “Industry Scheme” was developed based on a production cost cover. This has now evolved so full income cover is available from six different insurers.

<sup>13</sup> Critical mass as an insurance portfolio management concept and relates to the size the portfolio must reach before it can sustain single large risk losses and large event losses. Using a production cost basis of cover reduces the amount of a single risk loss and the event loss exposure as these losses are calculated using the production costs not recovered rather than the income lost. Reaching critical mass is crucial if any new product is to survive. If this product had been available last season in Western Australia only then the frost losses would have produced a loss. If this product had been available to all states then the frost losses would have been funded from the premium collected from all states. In the second scenario the portfolio would have a better spread of risk and have reached or at least be closer to reaching critical mass.

of the production costs as a direct consequence of an insured event or events. Under this structure the profit margin of the individual grower acts as a deductible or excess under the cover, as shown in Exhibit 5.

### 3.2.1. Basis of Cover definition

*Subject to all other provisions of the Policy, we will provide compensation for your Production Costs if your specified crops are affected by any number of specified events. The compensation payable is one of the following, as appropriate, and is adjusted for any premium payable.*

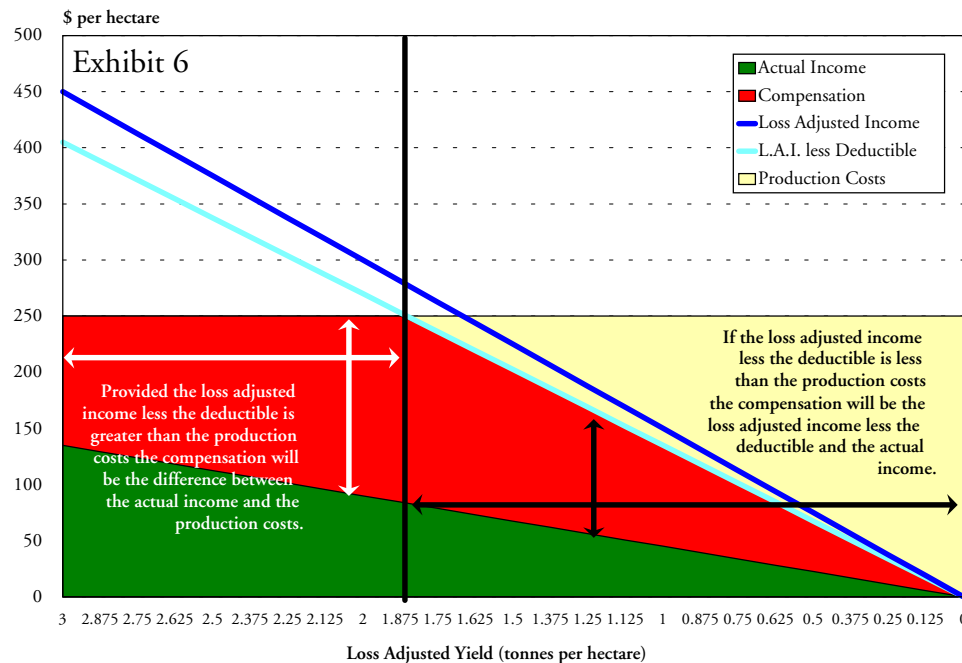
■ *If the aggregate Production Costs nominated in your Proposal are lower than your Loss Adjusted Income less the Deductible, the compensation payable is the aggregate Production Costs nominated in your Proposal less any Production Costs not incurred plus any Increased Costs, up to the Increased Costs Sum Insured less your Actual Income.*

■ *If the aggregate Production Costs nominated in your Proposal are greater than your Loss Adjusted Income less the Deductible, the compensation payable is your Loss Adjusted Income less any Production Costs not incurred plus any Increased Costs, up to the Increased Costs Sum Insured less your Actual Income less the Deductible.*

*The total compensation payable is subject to our Policy Limit of Liability. If we find that you have not insured the Complete Crop, the amount payable will be reduced. If you fail to meet your responsibilities under the Policy, the amount payable may be further reduced.*

Loss Adjusted Income refers to the loss adjuster's estimate of the potential income of the crop if no insured event or events had occurred. The two different bases of compensation are required to protect insurers from paying compensation on a crop that was never going to cover the production costs even if the insured event had not occurred. How this would work is illustrated in Exhibit 6.





This example is based on a 70% loss of income, a loss adjusted value per tonne of \$150, production costs of \$250 per hectare and a deductible of 10% of the loss adjusted income..

The deductible structure under this method of cover is quite different from most forms of crop insurance. It is a two-tiered deductible structure. The deductible that applies is determined by the underlying profitability of the grower's crop had the insured event or events not occurred.

In Exhibit 6 the first tier operates if the production costs are less than or equal to 90% of the potential of the crop income had the event or events not occurred. In this case the intention is to only compensate growers for the production costs not recovered from the remaining crop income. This deductible structure limits the insurers compensation to the amount needed by the grower to cover their actual production costs and also improves the chances of the products success.

In Exhibit 6 the second tier operates if the production costs are greater than 90% of the potential crop income had the event or events not occurred. In this case the intention is to indemnify the grower putting him in the same position as he would have been had the loss not occurred less the deductible of 10% of the potential income. This basis of cover is required to deal with the grower who was always going to lose money even if an insured event did not occur.

Market price fluctuation causes one complication with this basis of cover as the Loss Adjusted Income is based on the potential yield of the crop and the market value. An increase in the market value works to the insurers advantage as the actual income will be higher and the chance of a claim lower. A higher yield loss will be required to reduce the actual income to a level lower than the production costs. A decrease in the market value has the opposite effect, making a claim more likely unless a limitation on the level of reduction in price is introduced.

For example, a limitation on the fall in market price could be introduced at the 10% level. In this case the loss adjuster would value both actual price and potential price at a price not lower than 90% of the provisional price nominated by the insurer. The basis of cover would be calculated on this agreed value of 90% of the nominated price set at the beginning of the season or a higher market value.

Another option that should be considered for next season is to offer a market risk optional cover. This option could more efficiently and effectively manage an individual growers market risk within the pool of insured growers that selected this option. This would remove the existing difficulty experienced by many individual growers attempting to protect themselves by forward selling with no guarantee of having the physical commodity at the end of the season.

This production cost suggested approach to the basis of cover would be similar to the Catastrophic Coverage option under the United States of America (U.S.A.) Multiple Peril Crop Insurance (MPCI). “[This] was originally created as an affordable replacement when the government crop disaster assistance programs were eliminated”<sup>14</sup>. Although, this is now what we want to do in Australia the level of government involvement will be much lower so a private underwriter focused program will need to be implemented to protect against any potential moral hazard.

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<sup>14</sup> American Agrisure, Inc. - [www.amag.com/html/inatypes/mp\\_cover.asp](http://www.amag.com/html/inatypes/mp_cover.asp) 22/01/99.

Our production cost basis of cover provides this focus by minimising moral hazard. It will only compensate growers actual production costs not recovered from the remaining actual crop income. The MPCCI is interested in compensating a reduction in the remaining crop income below an agreed percentage of the average farm yields (this ranges from 50% for catastrophic coverage to 75%). By moving away from only compensating actual production costs, to covering an amount of profit, the MPCCI program in the U.S.A. has suffered from moral hazard. By denying the growers an opportunity to profit through a production cost indemnity, we would avoid many of the problems of the U.S.A. MPCCI program identified below.

*The moral hazard and adverse selection problems that have plagued the U.S. Federal crop insurance program may well be artifices of program design. In the past, the government gave insurers little authority or incentive to combat against these problems. The Federal Crop Insurance Corporation (FCIC), not insurers, set the premium rates and specified the provisions of the crop insurance contract. Growers readily and legally exploited contract design flaws through a variety of practices, including selective reporting of historical yields, dividing farms into distinct insured units, or waiting to enroll in the program until the effects of pre-planting weather were better known. The liberal provisions of the government reinsurance agreement, moreover, undermined insurer incentives to police against fraudulent practices such as growers abandoning marginal crops late in the growing season to collect the indemnities.<sup>15</sup>*

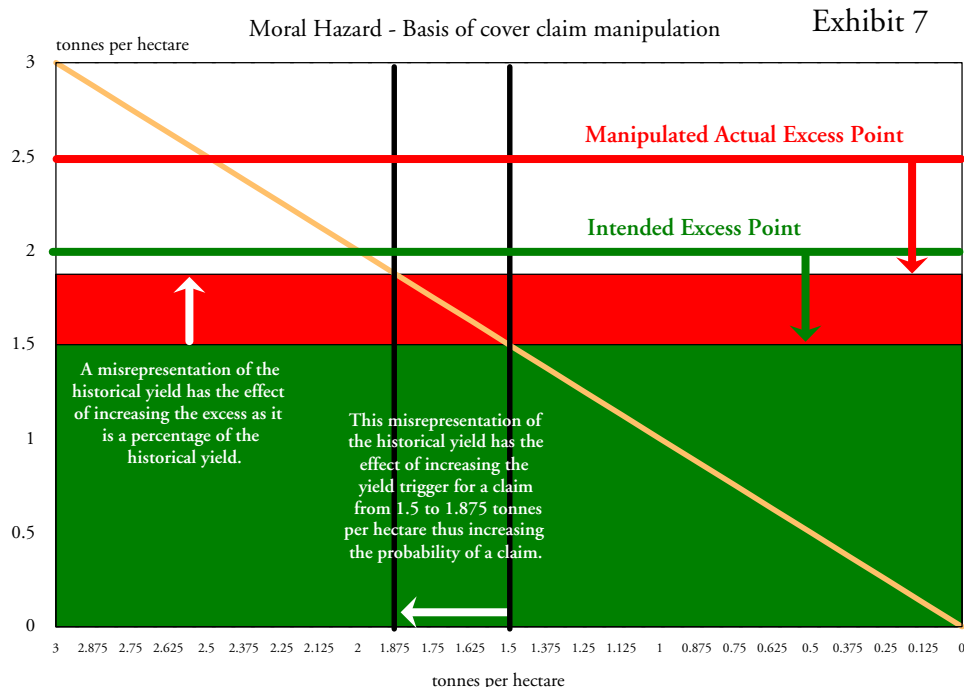
The moral hazard in the U.S.A. program arises out of there being a level of profit cover, so it is in the growers interest to manipulate the program to produce a high probability of a claim being paid. Under our basis of cover all the farmer is able to claim is the actual production costs not recovered by the actual crop income. As the grower is only entitled to recover costs

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<sup>15</sup> Systemic Risk, Reinsurance, and the Failure of Crop Insurance Markets by Miranda, Mario J. and Glauber, Joseph W. - American Journal of Agricultural Economics, Vol. 79, No 1.

that have been incurred there is no financial advantage to manipulating the program.

Here is an example of moral hazard associated with the MPCI basis of cover. As noted in the above article, if the grower selectively reports high historical yields then the average yield increases making a claim more likely as the excess point of say 75% is also artificially increased. The misrepresentation of the historical yield makes the probability of a claim higher (see Exhibit 7). The basis of cover must be designed to minimise the possibility of this type of manipulation.



Under our basis of cover, the farmer will also have to report historical average yield and there will be some incentive for them to report high yields as the higher the yield the higher the excess and the lower the rate.

However, any manipulation of the historical yield will not set the level of compensation as this is set by the actual production costs, it will only set the premium rate. As the deposit premium will be based on the estimated income, which will use the historical average yield, there is an opposing incentive not to over estimate the historical average yield. In addition, if at the time of a loss the loss adjuster identifies an overestimation of the historical yields then prior premiums can be adjusted to reflect the true

historical average yields and any extra premium deducted from any claim payment.

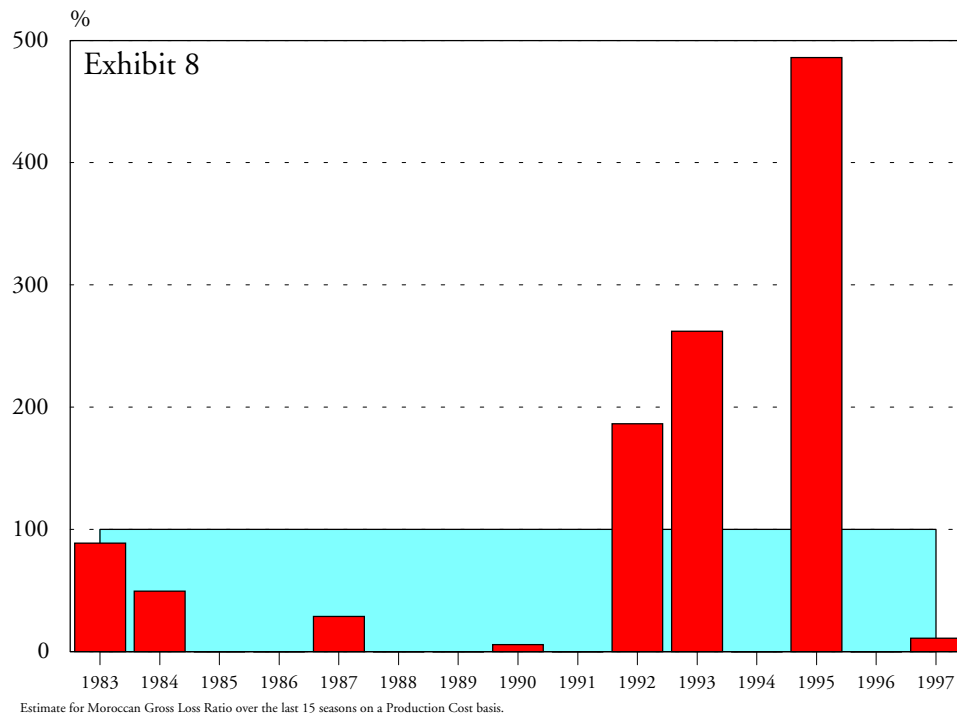
Wherever possible the basis of cover must be structured to remove any potential moral hazard. In addition care must be taken to ensure that any element that potentially provides an incentive to manipulate the program is opposed by a disincentive as shown in the above example. Skill at avoiding moral hazard creation is as important as avoiding adverse selection.

### 3.3. Premium Rating

Most crop insurance failures have resulted from community rating that allows growers to adversely select against the insurers rating. Sound underwriting techniques must be employed to prevent adverse selection destroying the rating of this program. A sound scope and basis of cover is a good start but the rating must be right.

The increased complexity of the growers risk assessment created by wider scope of cover mentioned above is not shared by the crop underwriter as the complexities of arriving at an appropriate rate have historically arisen from the difficulty in determining an estimated claims experience with no previous insurance. With a wide range of perils insured the actual yields achieved in prior seasons represent an approximation of the actual yield after any losses. By using average market prices and average production costs an estimate of the claims experience can be calculated to a degree of accuracy not possible if only one peril out of many was to be insured.

By modeling on different rates, an estimate of the losses over previous seasons can be made allowing an estimate of the average rate needed to cover losses and expenses over many seasons. I carried out this type of analysis in Morocco in November last year and on this basis produced the results shown in Exhibit 8 on the next page. At a rate of between 5% and 6% of income, this scheme would have been profitable over the last 15 seasons.



**This analysis assumes an average risk profile has been insured. This is where sound underwriting techniques have to be employed to prevent adverse selection by developing a rating method that differentiates between good and bad risks. To do this we need to develop rating that determines the average rate for the region and then modifies it based on the individual growers experience.**

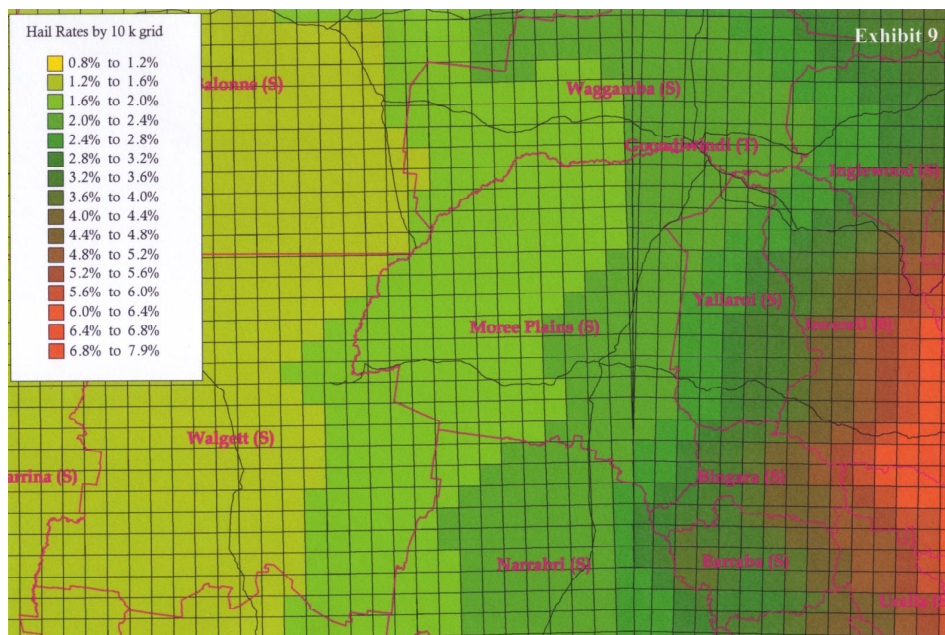
### 3.3.1. Regional rating

**As suggested above, rating a scope of cover that includes all weather related and natural perils beyond the individual growers control is easier than trying to rate a stand-alone peril such as frost. Regional rating could be developed based on yield per hectare figures from historical statistics for all receival points. Regional rating would be based on the nearest receival point adjusted for climate factors.**

**With a broader scope of cover, regional premium rating needs to be dragged into the twentieth century before it is too late. Shire boundaries are simply administrative lines on a map. The risk of**

drought does not change when you cross a road or a river but changes more gradually.

I have developed an improved method of regional rating, based on a 10 by 10 kilometre grid rating system. This reduces the region down from the size of a shire to a 10 by 10 kilometre grid. Exhibit 9 on the next page shows how this rating method compares to the shire rating method in northern NSW.



The longitude and latitude of the individual farm is all that is needed to determine the farm's rate. The advantages of this regional rating are that the smaller regions allow more gradual rate changes plus the uniform regional areas allow for risk accumulations to be monitored and compared to equal size regions. The gradual rate change that the smaller grids achieve more accurately reflects the real risk change and thus reduces the potential for adverse selection.

To calculate the regional rates, the receival point data going back as many years as possible needs to be collected. The area grown to the crop in the catchment area for each receival point needs to be determined so an average yield per hectare can be calculated. The

average production costs and the average price received for each season for the region also needs to be determined.

The average price and average yield will give the average value per hectare of the crop in each season. By subtracting the average production costs from the average value per hectare the average claims experience for many seasons can be determined and the required rate for the receival point calculated. The grid rate will be determined using the receival point rate.

### 3.3.2. Experience rating

As the grid rate will be based on the average performance for the receival point, the regional rate will need to be adjusted for the individual grower to compensate for the variation in performance from the average. To ensure this, sufficient information will need to be collected from each grower to identify their individual exposure. This will need to focus on collecting past income per hectare and production cost per hectare.

The income per hectare and the production costs per hectare will also provide the profit margin. With the excess based in the profit margin, efficient growers will have a higher excess and deserve a lower rate while inefficient growers will require a higher rate as their excess is lower. Seven years of prior information will be sufficient to determine the claims experience rate needed to adjust the grid rate and to determine the loading or discount for the excess.

Although this appears a complicated rating formula it can be computerised to provide individual rating quickly. This level of individual rating is required to reduce the potential for adverse selection. It also increases the fairness of the rating for individual growers by reducing any cross subsidisation.

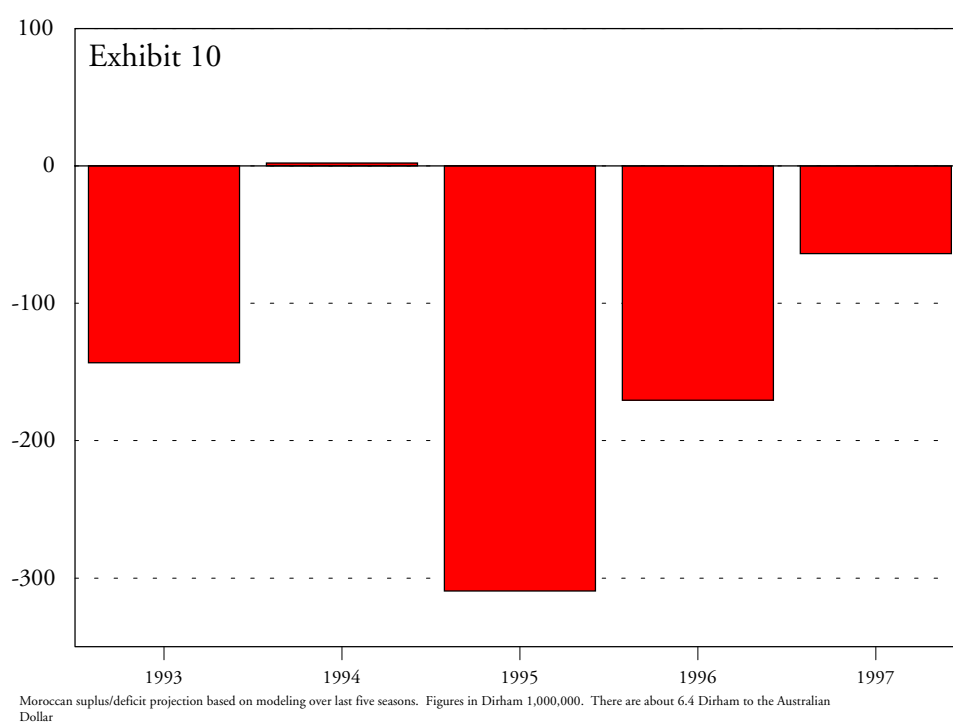


## 4. How to fund it

The structural flaws that have caused problems with previous crop insurance schemes would be avoided by correctly structuring the program. This means that insurers are involved as underwriters and real risk takers not as an insurer intermediary. Reinsurers must also be involved to spread the claims of high loss seasons amongst the international reinsurance community and the Governments role must at least be defined.

Insurance is a capital business. Capital is required to top up the premium in the event claims exceed premiums collected. The amount of capital required is dependent on the volatility of the portfolio.

To demonstrate this, the Moroccan scheme shown in Exhibit 8 was profitable over 15 years but in 1992, 1993 and 1995 the scheme suffered bad droughts. Sufficient funds had been accumulated in the earlier seasons to cover these losses so the scheme could have been set up with no capital and funded from policyholder's funds. However, Exhibit 10 shows what the accumulated losses would have been for a 300,000-hectare pilot program if the scheme had started in 1993 after the first bad season.



In 1995 it is estimated that a one in one hundred year drought event occurred. The accumulated loss would have been A\$48.3 million. This accumulated loss was for the pilot program only with 243,300 hectares out of a total area of 2,242,000 or 10.85% of the total area in the 1995 season. If the total area had been insured the accumulated losses would have been A\$445 million.

For the total scheme not to fail, capital of A\$445 million or 5 times the premium paid by growers in a season would have had to have been available to pay the claims. For the purposes of comparison, if we assume that the Moroccan experience occurred in Australia, then an accumulated loss of \$1,500 million could be expected (this is based on the estimated volatility of 500% of premium). However, Australia has a better climatic and geographical spread of risk than Morocco and any full analysis of past experience could be expected to show lower volatility and therefore a lower proportional level of required capital.

Capital is essential to any insurance scheme and the amount in this case is set by the catastrophic peril of widespread drought. If sufficient capital is unavailable to be drawn upon for claim payment, even the best-planned and rated scheme could fail in the first season if the first season is a bad one. The funds to pay crop claims can come from four sources: growers, insurers, reinsurers and governments. The objective of the underwriter is to optimise the use of these different sources of funds.

These sources of funds can be divided into two types. They are premium and capital and are provided by policyholders and shareholders respectively. The growers will pay policyholder's premium and shareholders capital will be lent by the insurers, reinsurers and in a catastrophe season the Government.

#### 4.1. Policyholder's premium

Over the long term, policyholders should expect to fund all losses. An American colleague described this as "chronological stabilisation". In plain English this means that over time the premium paid by growers should

balance out the losses in bad seasons by reducing the growers profit in good seasons.

In addition to paying for losses, the grower's premium pays for the costs to distribute the product (to them) plus the administration costs to run the program plus the costs of the shareholders capital. The cost of distribution should be limited to between 5% and 7.5% and the administration costs should be limited to about 7.5% in the first season and reduce to 5% in the subsequent seasons. The cost of shareholders funds will depend on the volatility of the Australian experience and the source of the shareholders funds.

In total these costs will range from 15% to 25% leaving between 85 cents and 75 cents in each dollar of premium to pay claims. The acceptance of this program will depend on growers accepting this as value. If the average premium rate is 5% of income then the average proportion of the growers total income that will go to the running costs of the program will be between .75% and 1.25%.

For this cost they get two benefits. Firstly, they secure their future by guaranteeing their cash flow position. Secondly, crop credit will become available as financiers loans and interest can be insured. The provision of this insurance product should reduce the financiers' risk and therefore the interest rate charged for crop credit. These benefits should compensate for the running costs of the program.

If growers come to the table expecting cover for nothing then the program will not appeal to them. The existing Government support has been something for nothing but growers are realising that they get close to nothing and no guarantee of that. To an increasing number of growers the ability to guarantee their cash flow, independent of the political mood and electoral cycle, is worth something.

Grower attitudes towards the program will also be a key element to the success or failure of the program. The potential for a morale hazard to exist with the program is also high. Morale hazard is closely allied with

moral hazard but arises from the attitudes of the people insured by the program.

There may evolve an attitude towards the program that it is able to bear losses far easier than growers. The attitude “we do it tough” and insurers can afford to pay may result in an acceptance of fraudulent claims. Even with the scope and basis of cover outline, growers who choose to hide grain will be hard to detect and could do so easily in an environment of grower acceptance. To counter this potential morale hazard grower interests should own the program and that theft from the program was theft from them.

## 4.2. Shareholders capital

The premium rate that will set the policyholders funds can only be determined by an actuarial evaluation of historical data. This will also provide the information required to determine the portfolio volatility caused by the perils insured and therefore the amount of capital required to support the program assuming all growers participate. However, as this program is not going to be compulsory the take up rate is unknown. The amount of capital required to support the growers who elect to insure can not be determined until the actuarial evaluation is complete the potential volatility is known and an estimate made of the take up rate.

As a result, making any worthwhile comment on the capitalisation requirements of this program at this stage is impossible. The only useful comments that can be made relate to considering overall capital structuring. Three questions need to be considered at this stage and they are:

- how is the insurers capital to be engaged?
- how is the reinsurers capital to be engaged? and
- what role is the government to take?

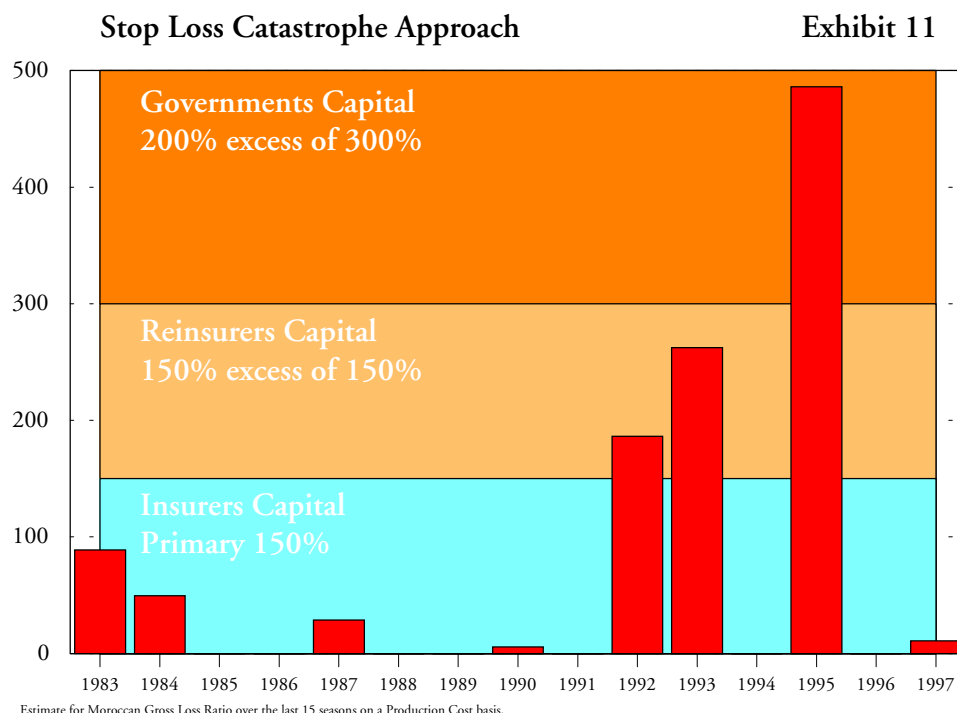
No single insurer has the capital, the ability to deliver, nor the inclination to offer this program. Even assuming as I have in this report that only winter crop growers will be offered the program in the first season, the capital required to be committed by an insurer to engage reinsurers interest is too

great for a single insurer. The only way to engage sufficient insurer capital is to pool several insurers capital. The easiest way to achieve this is to establish an underwriting agency which is open to all who want too participate.

This underwriting agency could be charged with the responsibility to hire the necessary staff, to complete the product design and actuarial evaluation on behalf of participating insurers. When these details have been finalised to the satisfaction of the participating insurers they could commit their capital to the underwriting agency who would rate individual risks and issue policies. Participating insurers would deliver the product to the individual growers.

Reinsurers capital could be engaged by reinsuring the participating insurers pooled risk. This is the easiest approach as reinsurers are not burdened with having to underwrite individual insurers portfolios and will benefit from the total spread of risk.

The government already funds exceptional circumstance payments and it would be pivotal to the success of this program that the current level of funding be redirected to providing catastrophe protection to the program. By removing the high volatility through cover for catastrophic seasons the government would remove a significant need for capital and therefore the cost of capital burden on growers. There are many different approaches that can be adopted. The simplest would be to provide a catastrophe stop loss reinsurance cover. Part of the premium could be paid to the government as a stop loss reinsurance premium. In return the government would accept a portion of the worst seasons losses. This approach is illustrated in Exhibit 11.



**Whatever approach is taken the government must withdraw from direct compensation and declare the only source of compensation will be via the program.**

### 4.3. Conclusion

**Much work has to be done and done quickly to make this revolutionary crop insurance a reality for this season. All the crucial elements to make it work have now come together and will not do so again for several more seasons. This program is right for every one, the grower, insurer, reinsurer, financier and the Australian taxpayer. It must not be allowed to fail.**