

# Insurance of crops in developing countries

by  
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## **Foreword**

Risk management is of crucial importance in the investment and financing decisions of farmers in developing countries and in transition economies. Basic risk management measures in agriculture include choice of plant varieties and animal breeds, crop and animal husbandry practices, diversification of farm enterprises as well as taking precautionary prevention measures against adverse weather events such as using mulching and shelter belts and, perhaps most important of all, securing access to supplementary irrigation facilities.

Agricultural insurance, although one of the most often quoted tools for risk management, can only play a limited role in managing the risks related with farming. The applicability of insurance in any given situation is based on consideration of whether it is a cost-effective means of addressing a given risk. In practice, agricultural insurance is almost invariably a adjunct to a whole set of risk management measures of which adequate farm management practices constitute an important element. The acid test of developing and operating an insurance programme to complement other risk management measures depends on the cost/benefit ratio - to the farmer and to the potential insurance providers.

Agricultural insurance is nevertheless a growing business driven by increasing commercialisation of agriculture, international trade, and foreign direct investment, and the development of new insurance products. The changing economic environment has also triggered a renewed interest in crop and agricultural insurance programmes and products among governments and development practitioners.

The precursor of the present publication, the AGS Bulletin 86 - "Strategies for Crop Insurance Planning", was intended to serve as a guide for the design of crop insurance programmes or for improving already existing insurance operations. Although the book was written more than 10 years ago and some of

the case studies may not be anymore up to date, FAO believes that the identified 11 key issues for crop insurance design described in Chapter 2 of the publication are still valid today. The present publication is intended to be a supplement to the AGS Bulletin 86 and in particular to provide insight into some of the more recent developments in terms of new insurance products and programmes. Despite the limited experience with some of these products, FAO believes that they will create an opportunity to offer practical solutions to many of the barriers to classic crop insurance for small-scale, dispersed farmers in less developed areas of the world.

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# 1. Introduction

## 1.1 TARGET READERSHIP

Natural disasters hit hard. They may cause heavy losses to farmers and forest owners. Insurance can assist in managing these losses, and crop insurance is that branch of this financial mechanism that is especially geared to covering losses from adverse weather and similar events beyond the control of growers.

This publication is primarily concerned with risks to arable and horticultural crops, and the applicability of insurance to managing these risks. However, some issues concerning the closely associated field of forest insurance are also discussed. Essentially this book is intended to be a supplement to an earlier FAO publication, Roberts & Dick (1991) *Strategies for Crop Insurance Planning* FAO, Rome

While some of the example material is taken from developed agriculture and forestry, the basic target group of readers is expected to be those concerned with crop and forest risk management in developing parts of the world. As such, the booklet may be of interest to:

- Farmer unions, officials and members;
- Producer/commodity groups;
- Processors, marketing firms and others contracting with farmer producers;
- Officials of Ministries of Agriculture, Planning, Commerce and Health;
- Bankers with farming and forestry clients;
- Insurers with farming and forestry clients.

## 1.2 KEY INTRODUCTORY POINTS

First, and basic to the understanding of insurance, is the reality that insurance does not and cannot obliterate risk. It spreads risk. There are two dimensions to

this spread. The first dimension is the spread across an industry or an economy, extended in the case of international reinsurance to the international sphere. The second dimension of spread is through time. Most insurance programmes operate on both dimensions. The important fact to note is that insurance does not directly increase a grower's income. It merely helps manage risks to this income.

Second, insurance is a business. An insurance indemnity only becomes payable in the event of a claim under a policy. The policy must be in force, with premium paid, by the time of the loss event. Most policies incorporate an element of risk sharing, by means of a deductible (also known as an 'excess'). This amount is the percentage of the loss which is borne entirely by the insured.

Third, premiums must cover several areas of cost in addition to meeting the cost of paying indemnities under policies in force. The components commonly used by insurers to calculate premiums are explained in the Annex at the end of this publication.

A glossary of terms commonly used in crop and forestry insurance is also included in the Annex.

### **1.3 PURPOSE**

The purpose of this booklet is to provide an introductory overview of crop and forestry insurance. In doing so it opens by defining the boundaries for these types of insurance products. The setting of boundaries is very deliberate. It is intended to assist those interested in exploring and exploiting this financial mechanism to do so in a realistic and satisfactory manner.

Secondly, this booklet sets out how to proceed with planning for crop insurance, within the established boundaries.

There have been many attempts to establish crop insurance programmes in developing countries. A few of these have succeeded in laying the foundation for a sustainable risk management service. But there have also been many failures. Most of those programmes that have not proved durable were set up on the basis of unrealistic expectations.

#### **1.4 THE BUSINESS OF INSURANCE**

In any business arrangement, both sides of the transaction must expect to benefit. Crop insurance transactions are no different. This defines the first boundary: **crop insurance is sold and bought in a market**. The purchasers must perceive that the premiums and expected benefits offer value; the sellers must see opportunity for a positive actuarial outcome, over time, and profit. The implications of this condition will be outlined in some detail later in this publication.

Crop insurance is not the universal solution to the risk and uncertainties which are part and parcel of farming. Rather insurance can address part of the losses resulting from some perils. The second boundary then is, **insurance has a limited role in risk management in farming**. Again, the implications of this will be explored below.

The third boundary is that any limitations to the scope for **effective and economic crop insurance**, though real at any given moment, **can change over time**. Farming enterprises and systems are dynamic. They change over time, and in so doing present different patterns of risk and new ways by which farming technology, and farm management techniques, can cope with production and other risks. The design of insurance solutions is an equally dynamic field of research and development. New techniques of ascertaining that loss-causing perils have occurred, together with more efficient and economical methods for measuring losses, mean that new types of insurance products can be developed. When companies see a business opportunity here, with an evident demand, then these products will be refined, funded and marketed. This dynamism will be reflected later on in this booklet.

Before looking into the future, it is useful to take a bird's eye view of the business of crop insurance in the world today. Although this booklet is concerned primarily with crop insurance, which accounts for the bulk of farm-related production insurance, some data will include livestock and aquacultural cover. These areas of insurance will be the subject of a companion FAO booklet to the present publication.

### **1.5 CROP INSURANCE TODAY – THE GLOBAL PICTURE<sup>1</sup>**

The total annual agricultural and forestry insurance premiums, worldwide, in 2001 amounted to some US\$6.5 billion. Of this amount 70 percent is accounted for by crop and forestry products. This sum must be compared with the estimated total farm gate value of agricultural production globally, which is US\$1 400 billion.<sup>2</sup> In this case the insurance premiums paid represent just 0.4 percent of this total.

Geographically these insurance premiums are concentrated in developed farming and forestry regions, i.e. in North America (55 percent), Western Europe (29 percent), Australia and New Zealand (3 percent). Latin America and Asia account for 4 percent each, Central/Eastern Europe 3 percent and Africa just 2 percent.

These figures present a snapshot view of agricultural and crop insurance. A dynamic rather than static view indicates a changing situation. Agricultural insurance is a growth business area. This growth is driven not only by the increasing commercialism of agriculture and the availability of new types of insurance products, but also by international trade policy developments. These points are covered in greater detail in Section 2, Growth in Demand for Crop Insurance Products.

### **1.6 CROP INSURANCE TODAY – IN SOME DEVELOPING COUNTRIES**

The previous section makes it clear that crop insurance is primarily a business which involves developed country farmers. However, some 13 percent of global premiums are paid in the developing world. Where do these business arrangements take place, and what are the characteristics of the farmers who are insured?

It is not the purpose of this publication to provide detailed country by country information. This is given, albeit in summary form, in the 1991 FAO publication *Compendium of Crop Insurance Programmes*. Rather the aim of

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<sup>1</sup> For certain information provided in this chapter the author is indebted to William Dick and his colleagues in PartnerRe Agricultural Services.

<sup>2</sup> Economist, March 2000

this brief section is to illustrate the types of situations where insurance is used, or is being considered as a risk management mechanism, across a number of countries, and involving a variety of both farming systems and agricultural enterprises.

### **Argentina**

This country has many of the features of developed agriculture, so it is not surprising that some 25 percent of the total crop area is insured – mostly just against hail damage, though a start has been made to introduce multi-peril policies. The crops concerned include soybean, wheat, sunflower and maize (corn). Insurance on grapevines and other fruits is also important.

The agricultural insurance business is competitive. Some 25 companies and mutual entities operate in this area. Some of them have invested significantly in technical expertise. For example, one company, with about 12 percent of the market, employs eight fulltime agriculturalists in order to have an in-house team, both to design policies and to manage the insurance products being sold.

### **Brazil**

This major agricultural producing country has had a crop insurance programme subsidized by the government. This has gone through some serious problems, originating from its desire to cover too much risk too quickly. The result was that the insurer bearing the risk had insufficient understanding of that risk – a major error for any branch of insurance.

More recent developments have progressed in a slower and better informed manner, and have been largely led by the private sector. New style apple cover started in 1998, wine and table grape covers in 1999, and broad acre crops such as soybean, wheat and maize in 2000. Despite these developments, crop insurance business is very small in relation to the size of the agricultural sector in the country. Some recent developments include moves to introduce crop-revenue products, under area-based determination of loss (see under New Insurance Products, below).

**Cyprus<sup>3</sup>**

The Agricultural Insurance Organization of Cyprus (OGA) was established under an Act in 1977, following earlier attempts to structure relief payments for farmers affected by adverse climatic events. After investigation, the format of a parastatal insurance corporation was adopted. A wide variety of crops are covered, against a range of perils. Some examples:

Cereals:	drought, rust, hail
Deciduous fruits:	hail
Grapes and citrus:	frost, hail

There is continuous demand from growers to extend the range of risks covered, especially windstorm, excessive rain and excessive heat. The OGA employs professional agriculturalists, both for product development and for supervision of loss assessment.

**India**

The crop insurance scene in India is two-pronged. One of these prongs, a government programme that has a strong social objective, loses vast sums each year.<sup>4</sup> Officials are believed to be attempting to re-design this programme, in order to make it more efficient and sustainable. The task is immense. In 2000 the programme insured 10.5 million farmers, with a total sum insured of US\$1.8 billion on 15.7 million ha of crop land.

On the other hand, a few insurance companies are active in offering commercially sound insurance products, especially geared to producers of high quality fruits, and much developmental work is being done in India on new

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<sup>3</sup> For further details see Roberts & Dick (1991) pp 61-78

<sup>4</sup> The social dimension is illustrated by a quote from a government official, describing the aims of the programme as being to “provide significant benefits not merely to the insured farmers but to the entire community, directly and indirectly through spillover and multiplier effects in terms of maintaining levels of production and employment, generation of taxes etc., and net accretions to economic growth”.

products and approaches, following actuarially sound underwriting practices. The General Insurance Corporation (GIC) of India has formed a specialist subsidiary, Agricultural Insurance Corporation (AIC) in order to provide a company/institutional focus for this class of business.

An interesting example of a new product is “Failed Well Insurance”, the demand for which is not surprising in a country which has in excess of 10 million pump sets, most of which pump from boreholes and wells, and which are therefore vulnerable to significant falls in the water table.

A recent development is that private sector banking/insurance interests, with some advisory assistance from the World Bank, now offer index insurance, an insurance product covering non-irrigated farmers against the risk of insufficient rainfall during key parts of the cropping season. The policies are offered by a commercial firm, ICICI Lombard General Insurance and are marketed to growers through micro-finance banks which are linked to an apex micro-finance entity known as BASIX (Bhartiya Samruddhi Finance Ltd.). Further details of this Indian initiative are given below in Section 2.5.2.

### **Malaysia**

Malaysia’s agricultural sector combines large-scale, plantation enterprises with large numbers of small-scale producers. Both types have access to crop insurance, but the larger scale farms are more likely to buy insurance. Cover is available for oil palm, cocoa, rubber, for several species of timber trees, as well as for tropical fruits such as durian, mango and mangosteen.

As with many other countries, the Malaysian experience with crop insurance has been mixed, but companies are taking a professional attitude to understanding the risks, and to the design of policies accordingly. A new initiative is a possible pool of commercial insurers to develop insurance for paddy rice.<sup>5</sup>

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<sup>5</sup> For information on this and other recent developments in a number of countries, the author is indebted to William Dick and his colleagues in PartnerRe Agricultural Services.

**Mauritius**

A parastatal agency, the Mauritius Sugar Insurance Fund (MSIF) was established some 50 years ago in order to provide protection to the island's sugar farmers against losses from cyclones. As experience has been gained, and staff trained, this programme has gradually taken on the coverage of other risks. For example, fire and excessive rain were added in 1974, and losses from yellow spot disease (only in conditions of excessive rain) in 1984.

The programme has also developed a sophisticated method for rewarding growers whose claims experience has been good for the insurer. All growers are placed, for each insurance/growing season, somewhere on a 100 point scale. Their position on this scale determines the level of premium to be paid, and the indemnity level they will receive in the event of a claim for that insurance period. The scale is dynamic, with movements up and down being dictated by claims experience.

**Philippines<sup>6</sup>**

Some 22 cyclones, on average, strike the Philippines each year, and of these four cause significant damage. The northern and central parts of the county are more affected than is the south, where the main perils for farmers are drought and pests. The present crop insurance programme grew out of an agricultural guarantee fund, which was operated by the Land Bank of the Philippines, the principal government bank servicing the agricultural sector. The insurance is operated by a parastatal entity, the Philippines Crop Insurance Corporation (PCIC), which began business in 1981, after a three year preparatory period.

Designed initially to provide risk management to borrowing farmers and their lenders, the PCIC also offers policies to self-financed farmers. Participation in insurance is compulsory for farmers in the higher-potential agricultural areas, for two crops, maize and rice. This element of compulsion has not resulted in a negative reaction by growers – probably because the

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<sup>6</sup> For further details see Roberts & Dick (1991) pp. 117-127

premiums paid to PCIC, at approximately 8 percent for rice and 7 percent for maize, are heavily subsidized, by the government and by institutional lenders, so farmers pay only a proportion of these amounts.<sup>7</sup>

### **Syria**

The Syrian government has investigated introducing crop insurance, and is still (in 2004) understood to be undecided as to whether to direct the state-owned insurance company, a monopoly insurer, to develop and market crop policies.

A major constraint to the introduction of crop insurance is that the most important peril by far is drought. As is well known, drought is perhaps the most difficult peril to include in any insurance cover, especially in the early years of a programme, when procedures are still being developed, and when staff are gaining experience.

The Syrian position illustrates a classic dilemma that has fairly general applicability in arid and semi-arid countries. Officials understand that drought will be difficult to include at the start of any crop insurance programme, yet are well aware that unless insurance products cover this peril, then there will be a very negative reaction from farmers. This may justify investigating the applicability of one of the new developments in crop insurance, namely index (coupon) insurance products. For further details see section 2.5, New Insurance Products, below.

### **Windward Islands**

*The major agricultural export crop of the Windward Is. is banana. The industry is made up of some 5 800 growers, the vast majority of whom are smallholders, cultivating between 0.5 and 5 ha. The number of active holdings is around 8 200 – some growers have more than one holding.*

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<sup>7</sup> These are the actuarially determined premiums required to meet expected indemnity payments. They are 'pure premium' figures, i.e. they do not include an administrative overhead. The costs of administration are met from income produced by the investment of funds of the PCIC, both from premiums paid, and, especially, from the fund initially provided by the government to establish the PCIC. The latter acts as an endowment fund for the Corporation.

The main peril faced is windstorm. After some earlier attempts to establish insurance, the Caribbean Development Bank funded a feasibility study in 1983, which eventually led to the formation of WINCROP (Windward Is. Crop Insurance (1988) Ltd.). The ownership of WINCROP is vested in the industry itself, through Banana Growers' Associations in the three participating islands. The company structure means that it has underwriting freedom and responsibility. WINCROP enjoys a good international reputation, and is able to negotiate re-insurance (to cover the risk of major hurricanes) on the international market.

## **2. Growth in demand for crop insurance products**

The expected growth in demand has its origins in changes in the farming sector. Powerful influences here are summarized below, and discussed briefly in this section.

- Evidence is accumulating of connections between climate change, and the increasing incidence of **crop damaging weather events** of extreme severity.
- Farming is becoming steadily more **commercialised**, with greater levels of financial investment. Farmer/investors and their **banks** will frequently examine the feasibility of using a **financial mechanism** i.e. insurance, in order to address part of the risk to their financial investment. As a part of this trend to commercialisation greater use is now being made of **contract farming** arrangements, where insurance is one of many services provided, along with inputs, to growers. In summary, there is a trend to formalise risk management in farming, with insurance being one obvious mechanism which can be harnessed for this task.
- The **World Trade Organization (WTO) regulations** generally forbid governments from subsidizing agriculture directly; however, they permit the subsidization of agricultural insurance premiums. For those countries wanting and able to effect transfer payments into their farming sectors, insurance provides a convenient channel for doing so. In the face of this WTO regulation, it is clear that demand for crop insurance will increase in those economies that wish to implement a policy of permitted subsidization of their farmers.

- The dynamism of the farming sector, and its environment, is reflected in developments in the design of **new insurance products**. In the last decade two types of new products have been introduced. In some cases these have partially displaced existing covers; in others they have resulted in demand from new clients. The products are firstly, Crop Revenue products, secondly, Index or Derivative products.
- **Accidental introduction of exotic pests/diseases** is something which concerns all countries where agriculture is an important part of the economy. Insurance can address the risk of a breakdown of these measures.
- Insurance can also assist in managing the on-farm production risks consequent to changes in pest management practices. Such changes are increasingly required in order to address **environmental protection** and **food safety** concerns.

Many of these apparently diverse influences have a major common theme. This is that any insurance arrangement will involve not only the farmer and the insurer, but also important third parties. Consideration is now given to these changes to the business of farming, and to how they have increased demand for crop insurance, or might be expected to do so in the future.

## **2.1 INCREASING INCIDENCE OF CROP DAMAGING WEATHER EVENTS**

One major reinsurer has calculated that the economic losses (adjusted for inflation) of weather-related events in the period 1985-1999 amounted to some US\$707 billion. Over a longer period, 1950-1999, the average annual losses (again adjusted for inflation) have increased by more than ten times, while the global population has increased by a factor of 2.4.<sup>8</sup> While crop and forest losses

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<sup>8</sup> MunichRe (1999)

are only a part of this, the same reinsurer estimates that the costs associated with crop damaging weather events are doubling each decade.

The scientific community is not unanimous in attributing the increases in extreme weather events to global warming. However, there is a strong body of opinion which holds that this is the case. Their thesis is that global warming means more energy in the system. A consequence of this is a rise in the frequency and magnitude of extreme weather events.<sup>9</sup> This is considered one of the causes of the increases in losses noted in the previous paragraph. The other major cause is linked to socio-economic factors such as increasing wealth (so there is more to be lost), and movements of populations to coastal areas which, although more productive in some senses, are more vulnerable to windstorm, storm (tidal) surges and flood damage.

The increasing incidence of crop damaging weather events is likely to continue to push demand for insurance coverage of losses. At the same time the insurance industry is mindful of increasing exposures, and is exploring new financial instruments to assist in managing this exposure.

## **2.2 GREATER COMMERCIALISATION OF FARMING / CONTRACT FARMING**

Implementation of technology developments in farming usually involves investment. Such changes also frequently alter the risk profile of the enterprise. A common example is in minor irrigation. The availability of low cost pump sets has greatly increased the productivity of small farms in much of rural India, and has brought a boom in irrigated vegetable production in semi-arid areas of the Middle East, for example in Syria. But in both areas there is now vulnerability to falling water table levels.

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<sup>9</sup> "The frequency and magnitude of many extreme climate events increase even with a small temperature increase and will become greater at higher temperatures (high confidence). Extreme events include, for example, floods, soil moisture deficits, tropical cyclones, storms, high temperatures, and fires. The impacts of extreme events often are large locally and could strongly affect specific sectors and regions." UNEP/WMO (2001)

Investor/farmers who have a substantial interest in the success of a given crop are likely to have borrowed from a bank in order to make the necessary investment. Banks with a heavy concentration of loan assets in farming face the prospect of substantial losses through systemic risk – i.e. risk that affects many at the same time. An example is unfavourable weather conditions over a wide geographical area. In both cases, i.e. borrower and lender, there is an interest in managing the risk of crop failure through the most economic means. There are occasions when insurance can be a key component in a range of risk management strategies.

This type of link, crop insurance and loans, is already very common, both in developing and developed agriculture. The vast, heavily subsidized scheme in India, mentioned above, is largely linked to bank lending. A more recent crop insurance initiative, in Morocco, is primarily motivated by a desire to safeguard the loan asset portfolio of the government agricultural bank, the *Caisse Nationale de Crédit Agricole*.

From an administrative point of view bank/insurer linkages make a lot of sense, since both these providers of financial services require similar client data. Moreover a bank can readily act as an agent for selling insurance. This means significant cost savings in obtaining data and in making financial transactions (payment of premiums and paying-out indemnities).

Also known as “inter-linked transactions” contract farming arrangements are one of the fastest growing business arrangements in both developed and developing countries.<sup>10</sup> They are becoming particularly common in countries which were formerly centrally planned, and where liberalised marketing arrangements under structural adjustment have meant the closing down of marketing boards and the loss of a known, secure market for small scale farmers. The impetus for the further development of contract farming has come from the increasing number of fast food outlets, the growing role of

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<sup>10</sup> For further information on contract farming see Eaton and Shepherd (2001), *Contract Farming*, FAO, Rome

supermarkets, and the continued expansion of world trade in fresh and processed products.

In contract farming both the grower and the buyer expect to benefit financially from a crop which is up to normal expectations in terms of both quantity and quality. Both therefore have an “insurable interest”. This means that an insurance product could be structured so that each party receives an indemnity in the event of an insured loss.

Since contract farming arrangements are generally renewed annually, a record of production is built up over the years. This availability of accurate records, coupled with the existing financial linkages between contractor and grower, mean that insurance can be included in the range of services covered by the contract at minimal operational cost.

Some examples of contract farming arrangements in developing countries:<sup>11</sup>

- many thousands of outgrowers produce tea under contract to the Kenya tea industry;
- 2 200 farmers from 164 villages in India grow maize and soybeans for a major poultry producer;
- 30 000 farmers in Northern Thailand grow vegetables for local exporting firms to export to Japan;
- banana production by smallholders in Central America is very commonly arranged under contract with major fruit corporations;
- fast food chains in the Philippines and elsewhere frequently contract with local farmers for supplies of potatoes for French fries, and also for salad vegetables;
- 44 growers in Northern India grow tomatoes for paste under contract to Hindustan Lever.

In many of these cases insurance protection could be arranged against major weather perils as part of the contractual arrangement.

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<sup>11</sup> Eaton & Shepherd (2001) *op.cit*

### **2.3 WORLD TRADE ORGANIZATION REGULATIONS**

One of the policy-making priorities of governments is to facilitate trade. For most developing countries agricultural exports are important, and it is vital therefore that WTO's regulations are respected. Subsidization of crop insurance premiums is permitted by the WTO. They are considered as falling into the 'Green Box' of measures by which a government can support its producers. Whereas this development is still relatively new, the commercial insurance industry has experienced an upsurge in demand for information, from governments, on crop insurance.<sup>12</sup> The nature of these enquiries makes it clear that they are prompted by awareness of this apparent avenue for permitted assistance to the farming community.

There are several types of assistance by which a government can facilitate crop insurance. Among these are the following:

- Provision of information, on weather patterns, incidence of perils, evidence of past losses following adverse weather events, numbers, areas and locations of farms/crops, historical crop yields (data and trends). Most countries do this on a regular basis. Some charge for information. The quality of the data varies greatly.
- Meeting the costs of the research needed before any crop insurance programme can be started. Often this responsibility is shared by development organizations such as FAO – e.g. in the case of Pakistan in 1995 and Syria in 2000, and the World Bank – e.g. in the case of Morocco in the late 1990s.
- Subsidization of premiums payable by farmers. This is very common, with Canada, Cyprus, India, Japan, the Philippines and the United States being examples.
- Providing a layer of reinsurance. Although less common than premium subsidy, it is practised, for example, in the United States, Cyprus and India.

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<sup>12</sup> The insurance clause was part of the Agreement signed in Marrakech in 1994 and implemented from 1 January 1995.

## **2.4 CLASSIC CROP INSURANCE PRODUCTS**

These crop insurance products account for by far the bulk of all crop insurance written globally. There are two main types, damage-based and yield-based products respectively. These are introduced below.

### **2.4.1 Damage-based Products e.g. Hail/Named-peril Products**

Insurance against crop losses from hail have been insured for more than 200 years. This type of crop insurance still accounts for a considerable proportion of crop insurance worldwide. The particular features of hail damage are discussed in Chapter 3 below. Suffice it here to note that hail policies are based on a measure of the actual damage which results. Other named-peril policies, such as those for frost and fire, are very similar to hail cover in essentials. The key features are:

- Damage resulting from the peril is localised;
- low degree of correlation of risk over a given area;
- sum insured is agreed when the policy is purchased;
- loss adjustment and eventual indemnity based on measurement of the percentage of damage after the incidence of the loss event;
- this type of insurance is not suitable for perils which can impact over wide areas, e.g. drought, pest, disease.

### **2.4.2 Yield-based Products, e.g. Multi-peril Crop Insurance (MPCI)**

Multi-peril crop insurance (MPCI) products have the defining characteristic that insurance is geared to a level of expected yield, rather than to the damage that is measured after a defined loss event. Other features are:

- MPCI policies are suited to perils the nature of which mean that their individual contribution to a crop loss is difficult to measure;
- similarly these yield-based policies are suited to perils which impact over a period of time;
- establishing a farmer's yield history provides the basis for determining the percentage of shortfall after a loss event;

- the yield is measured at harvest; insured yield may typically be in the range of 50 to 70 percent of historic average yield;
- yield shortfall may be determined on either an area or individual farmer basis.

## **2.5 NEW CROP INSURANCE PRODUCTS**

In the first section of this booklet mention was made of the dynamism of research and development into new methods of managing risk through insurance mechanisms. Two fairly new products warrant brief descriptions. These are (i) products based on insuring a level of crop revenue, and (ii) products where insurable damage is determined in the basis of an index derived from data external to the insured farm itself.

### **2.5.1 Crop-Revenue Insurance Products**

The essence of this product is to combine production and price risk, the combination of production and price being the determinants of gross revenue from a given crop. Under normal supply/demand conditions a production shortfall might be expected to result in a rise in price. To some extent such a rise will cancel out the financial loss for the grower who suffers a production shortfall. But this will only be the case if he harvests sufficient crop and sells it at sufficient premium over the expected price. Crop-revenue insurance is designed to meet any remaining shortfall in revenue from crop sales. Frequently, too, crop-revenue products involve the determination of loss on an area basis, introducing important economies in the loss assessment process.

At present crop-revenue products are marketed mainly in North America, where they first became available to all corn and soybean growers in Iowa and Nebraska in 1996.<sup>13</sup> Here their use is facilitated by commodity markets being highly developed and by related information being reliable and readily

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<sup>13</sup> By 2000 the number of states in the USA offering this type of product had risen to 47, with the inclusion of crops such as cotton, grain sorghum, wheat and rice. In 2001 crop revenue products accounted for 43 percent of the insured acreage in the country.

available. In this connection it is important that the price element of the policy be market based, that is, on futures prices for the coming season. The alternative, to use some sort of target price, could lead to a distortion of supply. Furthermore, it is unlikely that a crop revenue product based on a target (i.e. non-market price) would find underwriting support.

Crop-revenue products have now (2002) spread beyond North America. The extent to which they could apply to developing countries will depend on the development of local crop futures markets, as well as on the availability of the necessary local expertise. However, these changes are really only a matter of time. Given the advantages to the grower and to the insurer, this type of insurance product is likely to grow in importance, though for smaller crop areas, as with yield assurance, it will always suffer from the problem of high administrative cost per unit of value.

The crop revenue approach follows from a new trend in agricultural insurance. This is to define the **insurable interest** as an income stream rather than as the intrinsic value (or expected value) of the biological item at risk. This redefinition leads readily to a consideration of farm loan and insurance linkages, since the servicing of interest and principal payments on an agricultural loan depend on the income stream produced. As already noted, some crop insurance programmes have been administratively arranged so that the insurance element is made a part of the loan, with the bank being the first recipient of any indemnity paid by the insurer, while the premium is a working capital item that is packaged with the loan itself.

A more recent development is that some banks are believed to be interested in direct coverage of portions of their loan portfolios, more particularly for catastrophic losses following a systemic peril. At the time of writing this development must be noted as an area where much future development is likely.

### **2.5.2 Index-based Insurance Products**

#### **The Concept**

In a classic crop insurance policy, evidence of damage to the actual crop on the farm, or in the area of the farm, is needed before an indemnity is paid. But

verifying that such damage has occurred is expensive, and making an accurate measurement of the loss on each individual insured farm is even more costly.

An index (also known as ‘coupon’) policy operates differently. With an index policy a meteorological measurement is used as the trigger for indemnity payments. These damaging weather events might be:

- a certain minimum temperature for a minimum period of time;
- a certain amount of rainfall in a certain time period – this can be used for excess rain and also for lack of rain (drought) cover;
- attainment of a certain wind speed – for hurricane insurance.

The classic insurance policy is replaced with a simple coupon. Instead of the usual policy wording, which would give the indemnity, or range of indemnity levels, on say a per hectare basis for a given crop, for losses from specific causes, the coupon merely gives a monetary sum which becomes payable on certification that the named weather event, of specified severity, has occurred. The face value of the coupon may be standard, to be triggered once the weather event has taken place for the area covered. Alternatively it could be graduated, with the value of the coupon then being proportional to the severity of the event.

Clearly this type of trigger operates over an area, encompassing many insured farms. Again, a trigger such as this cannot be used for certain perils, such as hail, where the adverse event normally impacts on a very limited area of land. On the other hand, it is suited to weather perils which impact over a wide area, for example drought. (See below under Key Perils – Section 3.4.1.)

Since there is no direct connection between a farming operation and the coupon, even those without crops at risk could theoretically purchase risk cover of this type. This is not a disadvantage. On the contrary, there are many persons besides farmers who stand to suffer financial losses from adverse weather events. Fishermen, tourist operators, outdoor vendors are among the many categories making up the potential clientele for index insurance products.

**Examples of Index Products**

Index-based crop insurance is a very new product. It has only started recently in a small way in a few parts of the developed world and it is still too early to be able to report much useful experience.

Examples to date include index insurance against drought on pasture land in the provinces of Alberta and Ontario, in Canada. Some preparatory work has been done for another coupon scheme, for drought in Morocco. This exercise, funded by the World Bank, is understood to be still at the stage of consideration by the Moroccan authorities and by insurers.

A recent development in India involves a pilot programme, by the private sector, with some involvement of a banking NGO. The risk being insured is insufficient rainfall, and the growing season for the crops in question, groundnuts and soybean, has been divided into sections, so that a critical shortage of precipitation in one part of the growing season will still trigger the index policy, even if ample rainfall at other times in the growing season means that the overall, aggregate precipitation would appear to be satisfactory for crop growth. In this pilot programme some 200 farmers are involved. At the time of writing no details of experience with the pilot are known.

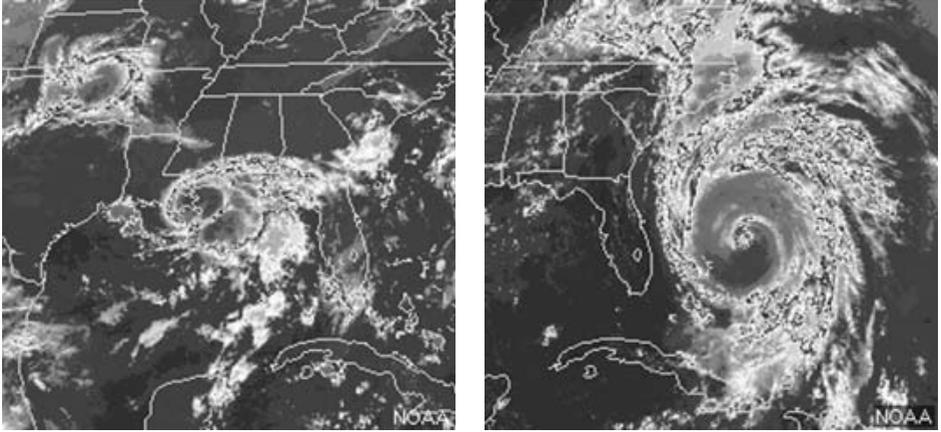
A further example, on which FAO has done some preliminary work, illustrates some of the limitations of index insurance, when an attempt is made to apply it to a peril which does not impact evenly on the area to which the coupon relates. The data now given are simply proposals, and do not reflect a fully prepared business plan, let alone an actual index product. The estimates of uptake for farmers and fishermen respectively are the informed estimates of Bahamian officials who have been closely associated with past hurricane losses, and with government compensatory measures.

The outline given above conceals a major area of difficulty. This relates to the operation of the trigger. The aim with index-based insurance, as with other types of risk-sharing mechanisms, is maximum fairness to participants. With hurricanes there are three problems relating to the trigger. Firstly, hurricanes vary greatly in size, as illustrated in the comparative images below of Hurricanes Danny (1997) and Fran (1996). This means that defining a trigger

<b>Region:</b>	Caribbean
<b>Country:</b>	The Bahamas
<b>Peril:</b>	Hurricane
<b>Trigger:</b>	Evidence of Category 1 hurricane “wall” passing within 50 km
<b>Insured area:</b>	Each major island would have its own coupon
<b>Coupon value:</b>	US\$ 500 (once the hurricane is declared for the zone to which the coupon relates)
<b>Target clientele:</b>	1 000 farmers (estimated coupon sale: 5 each) 3 000 fishermen (estimated coupon sale: 10 each)
<b>Tentative coupon price</b>	US\$ 50

as being activated when the hurricane eye passes within 100 km of a coupon zone will be fair for some, but if the hurricane is a large one, then there will be coupon holders who will not be compensated since they fall outside of the 100 km band.

The second major problem is the tendency for wind strength (and therefore damage) to vary along the track of the hurricane. This can impact on the categorization of the event, including the crucial shift from tropical storm to hurricane, and vice versa. These relatively quick shifts are not always recorded in the official reports, as the recording devices (ground, sea buoys and airborne instruments) do not always pick them up, as the network of devices is not as complete as might be desired.



Hurricane Danny (left) in 1997 and Hurricane Fran in 1996 show the variability in hurricane size. (Images: U.S. National Hurricane Center/NOAA)

The third area of difficulty is the fact that the track itself, as recorded by meteorologists coordinated in the Caribbean area by the National Hurricane Center in Miami, is only an approximation of the real path. In effect it is a best fit curve through a series of points recorded at intervals of six hours.

These three problems introduce the concept of Basis Risk, i.e. the potential mismatch between insurance payout and actual insurance losses. It is possible that this could be reduced to some extent by introducing the concept of a twin trigger. The first part of this twin would be the declaration of a hurricane for a given zone. The second would be evidence of storm damage gained from aerial photography soon after the passage of the hurricane.

Clearly hurricane is a difficult peril for index insurance. On the other hand, drought impacts more evenly over a given land area, and may well be more suited to this type of risk management mechanism. See Section 3.4.1 for further discussion on drought cover.

Despite the paucity of experience with index insurance, there is a high level of interest in both development and insurance circles in this risk management mechanism for developing countries. This interest is prompted by the belief that

index insurance products offer an apparently practical solution to many of the barriers to classic crop insurance for small-scale, dispersed farmers in less developed areas of the world. These barriers, which will be discussed in more detail below, include:

- Adverse selection – only those farmers more at risk will buy cover;
- moral hazard – the insured farmer may not do everything possible to avoid or minimise a loss;
- transactions costs – the huge costs of marketing individual insurance policies, coupled with the administrative costs involved in calculating and collecting individual premiums and paying claims;
- loss assessment expenses – if loss assessment is done on an individual farm basis the costs can be very large in comparison to the premium paid.

## **2.6 ACCIDENTAL INTRODUCTION OF PESTS AND DISEASES**

The economic consequences to farmers of the accidental introduction of crop pests and diseases into a country or an area where they had not been known to exist can be very severe. Australia and New Zealand are among the most effectively isolated countries in which agriculture is a major part of the economy. Yet even in these island nations, the border protection personnel are a major force, and consequently an important cost item for the public sector.<sup>14</sup>

As long as protection protocols work effectively, then all is well. However, when they do not work then costs of eradication can be huge. New Zealand is currently (December 2002 and again in October 2003) trying to cope with the

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<sup>14</sup> It is estimated that the losses to the New Zealand economy of the accidental introduction of either foot and mouth disease or bovine spongiform encephalopathy (BSE) would be in excess of US\$5 billion over just two years. This potential loss has prompted the introduction of legislation allowing very heavy penalties for persons convicted of deliberately infecting New Zealand livestock. (Source, Hon. Phil Goff, Minister of Justice, New Zealand, 23 October, 2003)

accidental introduction of the painted apple moth *Teia anardoides* – an Australian *Lepidoptera* sp. in a programme involving very costly aerial spraying of large areas. This insect has the potential to damage the country's forest industry, as well as native forest reserves. There is a growing demand for insurance mechanisms to act as safety nets for at least some of the costs incurred when unwanted organisms are introduced, despite stringent border protection structures and procedures.

## **2.7 FOOD SAFETY AND ENVIRONMENTAL PROTECTION CONCERNS**

Safety in the food chain is a major concern in all countries, and increasing resources are being directed in many if not most countries to safeguarding domestic consumers. Whereas livestock and livestock products come readily to mind here – foot and mouth and BSE being recent and costly examples in Europe – safety is also vital in crop products. Aflotoxins and other mycotoxins in leguminous crop products, and moulds in cereals are among the crop-related diseases which can cause problems with the safety of food products, quite apart from their direct economic importance to growers and to the food industry.

Vigilance starts with setting up an appropriate structure at governmental level.<sup>15</sup> It continues with the application of correct on-farm practices, and is particularly important during harvesting, storage, processing and marketing. Many of the control measures are matters of appropriate procedures being followed in the food chain. However, where the appropriate measures are unknown, or when

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<sup>15</sup> As a recent (July 2002) example, in New Zealand, the Ministry of Health and the Ministry of Agriculture and Forestry established the New Zealand Food Safety Authority (NZFSA) as a joint responsibility between these two organs of government. The role of this Authority is to administer legislation covering food for sale on the domestic market, primary processing of animal products and official assurances related to their export, exports of plant products and the controls surrounding registration and use of agricultural compounds and veterinary medicines. NZFSA is the New Zealand controlling authority for imports and exports of food and food related products.

accepted controls prove to be inadequate, then large quantities of food could still be condemned for consumption, resulting in heavy losses. These losses could well be insurable with policies designed for the purpose. This is expected to become a growth area in the insurance industry.

Insurance can also assist in managing the on-farm production risks consequent to changes in pest management practices. There is clearly a community (and export trade) interest in phasing out the use of agricultural chemicals known to be harmful (e.g. the use of methyl bromide as a soil sterilant<sup>16</sup>). Growers may be reluctant to use more benign techniques because of their perception that the risk of infection might increase. This risk could be addressed by crop insurance.

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<sup>16</sup> The Montreal Protocol on Substances that Deplete the Ozone Layer has been signed by over 160 countries. This protocol has set targets for the phase-out of ozone depleting substances. Developed countries are expected to have phase out the use of methyl bromide by 2004, developing countries by 2015. In 1998 10 countries accounted for 81 percent of methyl bromide use with the USA the largest at 40 percent of the total. In this same year Italy was the second largest user at 12 percent.

## **3. Crop insurance: steps in the development process**

### **3.1 DECISION AND ACTION STEPS**

Any decision-making process on crop insurance involves many stages. These stages and certainly the priorities will differ, depending on which type of body is doing the investigation. This may be a government ministry, a farmers' organization, an insurer, a bank or a group of marketing/processing agencies. In any case, some of the more important issues and steps are:

- Demand assessment – ensuring that any initiatives are in response to real risk management needs;
- identification of the key insured parties; automatic or voluntary cover?
- determination of key perils – a key factor in insurance design;
- decision on crops to be covered – another key factor in insurance design;
- analysis of insurance options, administrative models and loss assessment procedures, together with determination of associated costs;
- rating – determining the pure premium required, plus administrative and loss adjustment overheads to derive the initial premium level to be charged;
- identifying possible complementary roles for the government and for the private sector.

In any given situation the results of investigating these issues will determine whether or not crop insurance is the most efficient and effective mechanism to manage a particular area of risk. The results will also indicate the type of insurance product which is optimum for a given situation.

The sections below set out some of the arguments, and illustrate, with examples, how some insurance solutions have been developed.

### **3.2 DEMAND ASSESSMENT**

This must come first, but is always difficult, as before a detailed investigation of the incidence and effect on crops of perils, and an assessment of operating costs, it is impossible to give more than a very vague estimate of the likely cost of the insurance. Unless farmers know the details of the product and its price, they are not likely to indicate whether or not they will buy.

Closely linked to this is the need for any crop insurance programme to respond to real needs. As stated in the introduction, crop insurance is a business, and both parties must want to participate. Real needs must be met for this condition to be satisfied.

These needs are changing, as new opportunities arise. An example comes from the increasingly accepted (and, often, trade-mandated) policy to reduce of the use of certain crop pesticides and soil sterilants. In order to overcome growers' fears that alternative and safer techniques and products could be used, insurance has a potentially important, if temporary, role to play.

In the face of these needs, the services of an experienced crop insurance team are required when crop insurance is under consideration. Such a specialist team would be able:

- to examine the risk structure of certain key crop sectors;
- to identify the extent to which the involved parties are vulnerable to these risks;
- to draft an outline of an insurance programme, with indicative costs and benefits, and responsibilities; it would also include details of further investigative, publicity and lobbying work required before insurance business could commence.

This team would consult closely with several sectors in the economy, and follow up in detail the issues which are described below.

### **3.3 NATURE OF THE INSURED PARTIES – AUTOMATIC OR VOLUNTARY COVER?**

Farmers are one obvious party to crop insurance. Those who depend on a supply of farm produce for their business are another. The latter group includes processors and crop product buyers. These firms often stand to lose financially if crop product is not available from their local farmer suppliers. In this case they may face increased product acquisition costs; they therefore have an insurable interest in the growing crops. In Canada a baked bean cannery buys insurance where the trigger for an indemnity payment is a shortfall in supply of beans from local growers. The indemnity payment assists the factory in sourcing raw beans from elsewhere - usually at higher cost.

One of the factors identified earlier as leading to an increased demand for crop insurance is the growth of contract farming arrangements. When insurance can economically address some of the production risk involved, risk which affects both growers and contractors, then there may be a case for making crop insurance automatic. This is the same as making it compulsory, but “automatic” is a better description of the process when insurance becomes just one of a range of services being provided, as a package, to contracted growers.

The Mauritius Sugar Insurance Fund (MSIF) has operated for some 50 years. It provides automatic cover against the main peril to the industry, namely windstorm (cyclone), for all sugar growers on the island. The compulsory nature of the cover has always attracted some criticism from a few growers, but the parastatal MSIF has countered this by appointing strong representation of growers to the Board which oversees the operations of the Fund. Over the years the growers’ representatives have been responsible for several improvements to the product bought by farmers. This is now generally regarded as being both fair and highly useful. A similar, automatic programme operates for the large numbers of small-scale banana growers in the Windward Islands, in the Caribbean.

In New Zealand crop insurance against frost and hail was automatic for all growers of kiwifruit for several years, from 1988. After a few years with just these two perils included in the policy, some losses were experienced in the industry from geothermal activity. On grower demand an additional peril –

damage from volcanic ash – has been added to those included in the policy. The cost of administering kiwifruit insurance is extremely low, as the insurer pays only a very minor amount for the acquisition of the business i.e. advertising expenses and brokers' commissions. On the other hand, the nature of the perils being covered mean that individual loss assessment has become the norm, and indeed is necessary. This is costly for the insurer, leading to a higher premium than would be the case if an index type of policy could be designed.<sup>17</sup>

### **3.4 KEY PERILS/RISKS**

A listing of key perils and risks for agriculture across the world would be long. For the present purposes it is useful to focus on those which are of major concern to developing countries. Further, they can be clustered into a number of groups. One such clustering would produce a list as follows:

- Production risks;
- natural resource risks;
- financial risks;
- marketing and price risks.

Production and natural resource risks are relevant to this discussion of crop insurance, and are discussed in greater detail below. Financial and marketing/price risks fall outside the scope of the present publication, except in the case of crop/revenue insurance products, as discussed above.

#### **3.4.1 Production Risk Perils**

This is the main category of insurable risks. Both quantity and quality losses can result. Perils included are:

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<sup>17</sup> The policy calls for a premium of 2.5 percent of the insured value, with a deductible of 15 percent, which rises to 30 percent in the event of two successive years of claims from a given grower.

- Adverse climate conditions: drought, excessive rain, flood, windstorm, frost, hail, sunburn, snow;
- pest and disease attack;
- fire.

These warrant separate discussion, under the headings below.

### **Drought**

Drought is both a major concern of many developing countries, and the natural weather event which causes most problems for insurers. The reasons for this are many. Firstly, insurers feel most confidence when an adverse event has a clearly defined time of impact, coupled with a clearly defined geographical area. The classic example is hail, which may do its damage in a matter of a few minutes, or even seconds, and will typically impact an area confined to a few hundred square metres up to a few square kilometres. Hail damage is clearly attributable to the adverse weather event, and is readily verified as such provided that a field inspection is undertaken.

By contrast drought has a vague beginning, its effects linger for a very long time, and can extend over more than one growing season. Moreover it typically impacts a very wide land area. Production loss caused by drought can be aggravated by the incidence of other problems, e.g. diseases attacking plants weakened by water stress.

From a purely underwriting point of view drought poses great difficulties for a standard crop insurer offering what is in effect a yield guarantee. Firstly, because drought affects a large number of growers in the same season – perhaps the whole of a country – the production losses are very large. This systemic or catastrophe exposure means there are problems in mobilising sufficient insurance capacity to cover the sum at risk, even with recourse to substantial reinsurance. Secondly, droughts in recent years, at least in many parts of Africa, have tended to extend over more than one year. This experience means that it is extremely hard for insurance companies to obtain reinsurance for crop insurance portfolios which carry drought risk. Thirdly, the magnitude of the risk in most developing countries means that actuarially

calculated premiums would be very high – too high perhaps to attract all but the most at-risk growers. No insurer wants to build a portfolio based entirely on such a clientele.

For these reasons insurers are very wary of covering drought as an inclusion in standard crop insurance policies. This is particularly the case in those parts of the developing world where drought is the major weather constraint to crop production: Southern and Eastern Africa, Sahelian Africa, Horn of Africa, North Africa/Near East, Eastern Europe, Central and East Asia, South Asia, Central and South America. The list illustrates the key role which drought plays in the lives of much of the developing world's rural population.

Given the almost insurmountable problems involved in including drought in standard crop insurance policies for developing areas, attention in recent years has turned to examining whether index (coupon) policies could provide a useful measure of security. Initial developmental work in this field is promising.<sup>18</sup>

As described in Section 2.5.2 above, index insurance involves using a meteorological measurement as the trigger for indemnity payments. In the case of an index policy covering drought, the most likely form would be a series of indemnity steps, each step corresponding to a given level of rainfall deficit. The assumption is that growers could select a level of indemnity suited to individual circumstances. Thus the indemnity payable would increase as the rainfall shortfall increased from a defined “drought trigger” amount. At the time of writing, index policies covering drought or other climate risks cannot be described as being a standard product for developing countries. Rather they are in the nature of a promising new insurance technique, attracting much interest among risk management professionals.<sup>19</sup>

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<sup>18</sup> Skees *et al* (2001) suggest that a rainfall index insurance product for Morocco would overcome the high costs of the present experimental yield assurance programme, where losses are adjusted individually.

<sup>19</sup> One of the major objections to index insurance for drought is the practical difficulty of ensuring that rainfall readings are genuinely accurate. This requires rain gauges that are tamper-proof. Various methods for tackling the problem of tampering are being developed. Hazell (2001) reports

**Excessive rain**

Crops need water, and much of the developing world's arable and horticultural production relies on rainfall. Too much rain at any time can damage a crop, but there are periods of special vulnerability, described below.

The first danger point is excessive rain just after germination and emergence. Entire crops can be washed out of the ground, necessitating re-sowing. This is an insurable risk, where the indemnity which would be written into the policy would be the costs of re-sowing, plus a possible additional amount in those cropping situations (common in tropical, rainfed agriculture) where a delay in sowing means that the eventual harvested crop is smaller than would have been the case had the crop been able to take advantage of the whole of the normal growing season.

The next common point of vulnerability is at or near to harvest. Maize and other grains can sprout prematurely while still growing in the field. Various fruits (e.g. cherries) can be damaged by excessive rain or even any rain just prior to harvest. Other crops can be lost when excessive rain prevents harvest. An example is a crop such as tomatoes grown for processing. The processing factory schedule of crops for harvesting means that the date of harvest is fixed. Moreover, it is now common practice with commercial tomato crops to spray with ethrel (ethephon) in order to accelerate the ripening (reddening) of fruit which are still green, in order to allow once-over harvesting. If excessive rainfall is experienced just when the critical readiness for harvest is achieved, then harvest may be prevented, and the crop lost.

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on the availability of a system of multiple rain gauges, which can be sited on the top of telegraph poles, and which measure rainfall by means of tiny buckets which trip a measuring device. These have the advantage that they do not store the rainfall, merely record the volume falling at that point. The data can be downloaded to a computer. Remote access to the data could be readily arranged, and a pattern of rainfall readings built up from the multiple measuring points. Satellite imagery over the insured period could also be utilised to confirm an insurable weather event.

**Flood**

Flood damage may be due to on-site excessive rainfall, but it can also be caused by excessive precipitation elsewhere, and the subsequent rise of river and lake levels, to cause flooding of crop land. The risk is usually insurable. Exceptions would be crop land which is insufficiently drained or where existing drains are not maintained, and also flood plains exposed to a very high risk of flooding.

Flood is sometimes one of the results of severe storms. Examples are the frequent tropical cyclones experienced in the Bay of Bengal. These usually cause flooding of low-lying farmland along the affected coastal zone. Records indicate that although the fundamental peril is windstorm, the actual losses on farms – to livestock as well as to crops, have been due to flood damage resulting in turn from wind-induced high sea levels, which are known as *storm surges*.

**Windstorm**

Crop insurance programmes in the Windward Islands (bananas) and in Mauritius (sugar cane) have already been mentioned. Both were set up to assist in managing the losses from excessive wind – cyclones in Mauritius and hurricanes in the Caribbean.<sup>20</sup> High wind speeds affects nearly all crops – and can cause serious damage in forests.

As with other weather perils, the first move in risk management lies in appropriate farm management – correct attention to plant density (for mutual support), to the provision of shelter belts for those crops highly sensitive to wind (e.g. kiwifruit), and care with harvesting in the case of forests. It is not uncommon for problems to arise when partial harvesting takes place in forests.

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<sup>20</sup> A tropical cyclone originates over tropical or subtropical waters, with organized deep convection and a closed surface wind circulation about a well-defined centre. Once formed, a tropical cyclone is maintained by the extraction of heat energy from the ocean at high temperature and heat export at the low temperatures of the upper troposphere. Tropical cyclones are known as hurricanes in the Atlantic/Western hemisphere, and as typhoons in the Asia/Pacific region. They circulate counter-clockwise in the Northern Hemisphere, and clockwise in the Southern Hemisphere.

Those trees that are too immature to harvest are suddenly exposed, and may be blown over by high winds.

In writing wind-storm insurance, insurers take these sorts of management practices into account. They make certain that it is only exceptional events that will trigger the insurance, when normal practices are insufficient to prevent damage.

Windstorm is associated with catastrophic losses to life and property, as well as to crops. Hurricane Andrew, one of the most destructive storms ever recorded, hit Florida and Louisiana on 25 August, 1992.<sup>21</sup> Storms of this magnitude, and lesser but still serious weather events of this nature are believed to be increasing in frequency.

### **Frost**

Although not at all common in developing countries generally, there are some regions where this is an occasional risk, especially to vegetable and fruit crops. This applies especially to Eastern Europe and the Middle East.

Frost causes damage by the freezing of the water content of plant cells, and their subsequent rupture. It will be evident that it is not only the temperature which matters; it is also the time when the temperature is below a certain minimum level which causes a damaging event. Crop insurers write policies accordingly, sometimes constructing a damage point (i.e. insurance trigger) curve which plots temperature against time.

Frost conditions can impact a wide area, causing extensive damage. However, the micro-climate in a given site can increase the likelihood of frost damage. For example, fruit and vegetable production often takes place in valleys because of the presence of deep topsoil, washed down from surrounding hills, together with the availability of water from surface or groundwater sources. These same valleys can also be 'frost-pockets' because freezing, still air accumulates readily in this type of topography.

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<sup>21</sup> Total damage from Hurricane Andrew was estimated at US\$26.5 billion, of which all but US\$1 billion occurred in Florida. The greater part of this was wind damage, and the value quoted includes all damage- not just crop losses.

Again, an insurer may expect growers to take normal precautions against frost damage, through the use of devices to move the air (burning frost pots as commonly used in Eastern Europe, propellers mounted on towers, as being introduced in some of the fertile fruit growing valleys in Syria). Perhaps the most effective preventative of frost damage for horticultural crops especially is the use of sprinkler irrigation.

It will be clear to the reader that all of these measures involve a cost. Design of an insurance policy to respond to frost damage will take into account the inevitable trade-off between the costs of physical and financial measures of managing the risk. Usually the most cost-effective approach is a blend of the two, with insurance acting as a final safety net, to be triggered if the physical devices fail to prevent damage.<sup>22</sup>

## **Hail**

Hail holds a special place in the history and also the current practice of crop insurance. It was the first crop peril to be insured by a modern insurance company – the first policies being issued, in Germany, in 1791. It is also the simplest of weather perils to handle from an insurance point of view. Its incidence is readily confirmed by observation of damage, and compensatory growth factors are reasonably well understood for most major insured crops (see also under Loss Assessment below).

Moreover, over time, the likelihood of hail events in any given agricultural area can be estimated in a manner that permits actuaries to confidently set premium levels at values which both sides, insured and insurer, find reasonable. This is due also to its long history, and the manner by which records of damage

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<sup>22</sup> At the high-cost end of physical frost damage prevention, kiwifruit and other fruit growers in New Zealand occasionally hire helicopters at crucial times – usually in the early hours of the morning in the late spring, when exceptional weather conditions are indicated by forecasts, and in-orchard temperature recording instruments, linked to alarms, warn of an imminent danger. The helicopters hover over an orchard, selecting the warmest layer of air, then use their rotor blades to blow this relatively warm air downwards. The cost is high, but the procedure is usually effective. In other countries, e.g. France and Syria, propellers set on towers are used to circulate air.

have been prepared and retained over the years. This means that there is a wealth of data on the incidence of the peril, and of the crop damage which has been caused as a result.

Again, when hail strikes it is usually very confined in terms of the damage zone. This can be just a few square metres, a few hundred square metres, or, more rarely a few square kilometres. It is seldom larger than this.<sup>23</sup>

There is little that a grower can do against hail damage. Lengthy research has proven that injecting hail clouds with silver iodide via rockets or planes is not very effective. Areas with very high hail exposure and expensive crops can resort to hail nets.<sup>24</sup>

#### **Sunburn (sunscauld):**

Sunscauld, under exceptionally adverse conditions, causes damage to fruits such as pip and stone fruit, grapes and nuts. It is associated with the premature loss of foliage from the plant. The risk is insurable, often as an extra-cost option under multi-risk policies.

#### **Snow**

Snow can damage all types of crops, including fruit trees and it also a peril of note in forests, where excessive weight loading can cause breakage of parts of trees, or even toppling of the whole tree. Developing countries vulnerable

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<sup>23</sup> A notable exception is the worst hailstorm of modern times in Western Europe. This struck Southern Germany, including the area of the city of Munich, on the 12<sup>th</sup> July 1984. Several swathes of hail struck across an area some 250 km long by 15 km wide. Total damage was estimated at US\$3 billion, with the insured portion of this being US\$750 million. Several hailstones of 300g in mass were registered. Agricultural damage was severe, as was damage to vehicles, aircraft and glasshouses/plastic houses.

<sup>24</sup> Hail nets are used by some apple growers in the Granite Belt zone of Queensland, Australia. The cost of the structures is high, but those who use this form of management against hail risk do so because they have marketing contracts to fulfil, and need an annual apple crop, and not just an indemnity payment, in order to maintain a valued outlet for their fruit. In many countries cherries are protected with netting, to protect against hail and birds. Hail netting is also in widespread use in France and Italy.

include those in Central Asia, Eastern Europe and the Middle East regions. Snow is an insurable peril in many circumstances. In forests damaged by breakage through snow loading, the presence of broken tree parts can facilitate the build up of pest and disease organisms.<sup>25</sup>

### **Pest and disease attack**

Insurance cannot substitute for sound management of the risk of pests, parasites and diseases. Indeed, this is a significant area of modern farm and forest management, with very substantial losses resulting from failures in this area. Moreover the growing importance of international trade in agricultural commodities impacts on the pest and disease issue in developing country farming in several ways:

- Phytosanitary regulations mean that any evidence of pest or disease in a consignment may disqualify produce from entry to the country of destination;
- similarly, pesticide residues are subject to very tight limits under the standards for international trade;
- competition in the market is fierce, and even if produce is allowed to enter, blemishes on fruit etc. mean the produce is unlikely to find a buyer.

Insurance implications can similarly be summarised in a brief list:

- It is sometimes possible for growers to obtain cover against pests and diseases where there is no generally accepted management control;<sup>26</sup>

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<sup>25</sup> Among the provisions under the Finnish *Forest Insect and Fungal Damage Prevention Act* is the requirement that "in areas of high blow down, snow breakage etc., trees must be harvested so that the risk of insect damage to living trees is minimized".

<sup>26</sup> An example comes from Mauritius. The Mauritius Sugar Insurance Fund (MSIF) was established to provide automatic windstorm (cyclone) damage insurance for all the island's sugar growers. After 27 years of experience losses from fire, and from excessive rain, were included in the policies. After a further 10 years of operations (i.e. in 1984) the MSIF recognised that yellow-spot disease could not be controlled by normal farm management practices in conditions of excessive rainfall. Therefore the MSIF agreed to indemnify losses from yellow-spot when excessive rain also occurs.

- in an attempt to reduce the adverse environmental impact of some well-established chemical spray routines for pest and disease control (e.g. certain chlorinated hydrocarbons) alternative, benign regimes have been developed. Insurance may be utilised in the future in order to provide temporary risk assurance to growers using the new routines;
- frequently damage to fruit and other crop products provides an entry point for disease organisms. Perforation of the skin due to hail damage is a common example. In this case any hail policy needs to be clear as to whether the consequential loss from disease is also covered.

### **Fire**

One of the oldest perils to be covered in property insurance, fire is a major peril for many crops (especially broad field crops such as grains) and for virtually all forests. It is commonly included in multi-peril crop insurance, and is frequently the key peril under forestry covers (which may also include wind and snow damage).

Fires are caused by human action (and carelessness) and also by lightning strikes during electrical storms. Whatever the cause, there are control measures to reduce any losses. These may be through early detection and the subsequent means to take action and/or through the use of cleared firebreaks.<sup>27</sup>

Insurance policies will normally state the expectations under the policy of the means to control fire losses. Again this is an example of insurance being just a part of a cluster of measures used to control risk.

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<sup>27</sup> In Central Italy, in the peak fire risk (summer and autumn) seasons, it is a requirement that owners of pasture land keep a ploughed margin around the perimeter of their land, to act as a fire break. In many countries large commercial forests are watched over by fire wardens sited in high towers, linked by radio to a control centre which has command over equipment which can be sent to the scene. This may mean the use of aircraft to drop water, and/or bulldozers to fell trees in the path of the fire, thus creating an additional firebreak.

### **3.4.2 Natural Resource Risks**

These include:

- Adverse soil conditions, e.g. salinity, erosion of topsoil and loss of soil nutrients;
- deterioration in water quality e.g. due to pollution of the water table or natural water courses;
- lack of water from the irrigation source.

In the main these risks are best addressed by farm management practices. However, some of the underlying causes of these problems may themselves be insurable. For example, soil erosion may follow excessive rainfall and/or wind. Pollution of water may be beyond the control of the farmer drawing from wells or rivers.

Related to this is the risk that a water source used for irrigation may fail. Prolonged drought means that water tables fall, necessitating the boring of deeper wells. Similarly rivers and streams can dry up, due again to drought, or to an increase in uptake of water upstream. Where this involves another country then this falls into the political risk zone, something that many insurance policies specifically exclude.

## **3.5 WHICH CROPS CAN BE INSURED?**

### **3.5.1 Benefit/Cost Issues**

As with most assets or production processes, virtually any crop can be insured, against virtually any peril, but only at a price. At the time of writing, with squeezed profit margins on the production of many crop commodities, a paradoxical situation arises. The tight margins highlight the need for risk management, including insurance, but also reduce the ability of growers to buy the desired level of protection.

The discussion below will focus on four main groups of crops, annual field crops, perennial crops (including horticultural tree crops), glasshouse crops and

finally, forests. The focus will be on identifying those areas of risk which the nature of the crop, and of its common perils, could predispose it for insurance as part of a risk management strategy. In this discussion, 'crop insurance' relates to the various types of contract which make up the more traditional type of cover, as opposed to index policies. With the latter, the nature of the crop is not an issue, since the insurance contract relates just to a given weather event.

Insurance of crops and forests involves insurance of an expected future value. This sets this type of insurance apart from other property covers (e.g. motor vehicle, buildings, machinery) when the value (frequently maximum value) exists at the commencement of the insurance.

One of the factors which can determine whether or not a particular crop/peril combination is suitable for insurance is the ease and economy by which losses can be satisfactorily assessed. This will be touched on below, with some of the more general loss assessment issues discussed in greater detail under the section, Loss Assessment.

### **3.5.2 Annual field crops**

Wheat, maize, rice, soybeans, sorghums, cotton, beans etc. are all insured in various parts of the world. As annuals, any loss or damage is just to one season's crop – unlike for perennial crops and forests. This simplifies loss assessment, in contrast with the situation of Perennial Crops, taken up below.

As a general rule, the more commercial the nature of the crop, the greater will be both the potential demand for insurance, and the likelihood of a cost-effective role for crop insurance in risk management. Crops of the high value input – high value output variety are often financed with the assistance of banks, and lenders increasingly insist on insurance coverage, when this is available.

Another important issue in commercial crop production is the marketing chain. With crops such as sugar cane, coffee, tea and cotton, virtually all of the harvested production enters the commercial market, and requires processing. This means that there is control over quantities produced, year after year, together with an opportunity for establishing a strong database of producers and of details of production enterprises. Information management of this sort is vital

to creating the climate of confidence necessary for efficient and economical insurance transactions.

It will be evident from the above that food crops, especially those for which there is an active, unrecorded local market, are difficult to trace after harvest. This means that insurance assessments are similarly difficult for this type of crop.

### **3.5.3 Perennial crops**

Perennial crops pose a special problem. In the event of a loss event, should the loss be calculated solely on the basis of the current season's expected production, or should reduced production levels for the next season(s) be included? The difficulty of making accurate assessments for future years will be evident, and crop insurers in Chile and Cyprus, for example, include only the current season's lost production.

On the other hand, when a peril such as windstorm causes serious damage to tree crops such as oil palm, coconut, rubber, and mango or to temperate fruit crops such as pip and stone fruit, growers naturally expect the longer term loss to be indemnified. Technically, when losses are severe, it is possible to make assessments. These could even include the costs of replanting and/or re-grafting. Paradoxically, the problem is greater when the damage to the wooded parts of the plants is less severe, but still sufficiently serious to mean a diminution in the following season's crop. In such cases the approach taken by Chile and Cyprus appear to be appropriate. An alternative is to formulate wording such that fruit and trees are separate parts of the same policy. This is done in the British Columbia Ministry of Agriculture crop insurance programme.

### **3.5.4 Glasshouse crops**

Crops grown under glass, plastic or other coverings generally fall into the "high value input – high value output" category. As such, risk management planning is very important, since loss of the crop and/or the structures can mean a heavy financial blow. In fact in those countries where glasshouse and plastic house cultivation is important, insurance is usually an integral part of the production

financial plan, and the potential liability for insurers is very substantial. Sometimes insurers offer policies which cover the structure together with the growing crop. Generally these also specify minimum standards for construction and the materials used in the structure.<sup>28</sup>

### **3.5.5 Forests**

The economic role of forests is undergoing a partial change. This change affects risk management, and also insurance as part of risk management.<sup>29</sup> The transition of national economies from a commodity to a service orientation, and stream of products, also affects forestry. This is because a forest today is not just a source of timber, for paper, for building and for furniture, but is also a provider of environmental services. Increasingly it is becoming possible for forest owners to generate income from the sale of carbon credits.<sup>30</sup> This opens up forestry to a new, more commercially oriented class of investor, and this change will affect developing and developed countries similarly.

A further change is the move towards the certification of forests as environmentally sound entities, under some sort of recognised certification system. The implications for forest managers are twofold. Firstly, such certification opens up access to markets which will only accept timber from forests certified as being sustainably managed. Secondly, when insurance is involved, such certification, since it is based on the achievement of a high standard of management, including risk management, could lead to substantial reductions in insurance premiums.

The major risks to forests, namely fire and windstorm, will affect virtually all species of timber trees, although some are more at risk than others. For

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<sup>28</sup> As an example, in France, the cooperative farmers' insurer, Groupama, publishes a manual setting out construction standards for glass and plastic houses in which crops are grown. These standards must be adhered to for Groupama insurance contracts to be valid. The standards and the manual are frequently updated.

<sup>29</sup> Cottle, Phil (2001).

<sup>30</sup> Also known as CERUs – carbon emission reduction units.

example, in recent years there have been extensive commercial plantings, in many parts of the world, of various types of *Eucalyptus* species. This tree type is popular because it is very fast growing and has considerable drought resistance. However, it also has a high content of oily, volatile sap, meaning that it burns readily.

When forests are insured against fire risk then considerable attention is given to management procedures to reduce the possibilities of loss in the event of a fire outbreak. Some of these points have been made above, under the heading, Fire.

In summary, the changes to the forestry scene, worldwide, mean greater commercialisation of tree cultivation, and therefore greater opportunities for introducing insurance as a risk management device.

## **3.6 LOSS ASSESSMENT ISSUES**

### **3.6.1 A key design constraint**

Loss assessment is a key element of standard insurance.<sup>31</sup> With crop and forestry insurance it is essential that loss assessment procedures can be designed for the crop and the perils involved. This is not always the case. A common problem is when a loss occurs which could have been caused by more than one peril. When the policy is not ‘all-risks’ but rather ‘named-perils’ then any loss assessment process should be able to ascertain as to whether the loss was caused by an insured peril. Unless this is possible then the crop/peril combination may be impossible to insure.

In any insurance contract it is vital that the process of loss assessment is made clear, so that in the event of a loss, the assessment process can start in a

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<sup>31</sup> Loss assessment is not a part of the operations of an index policy. This pays out a pre-determined indemnity, on the basis of weather or other records. The state of the crop of the insured is not a factor affecting the eventual payout. Because loss assessment in the field is a very expensive process, this is a major advantage of index policies.

manner which has the prior agreement of both insurer and insured. The first element is to check that the loss falls within the scope of the policy. This is not always a straightforward issue, since some losses have more than one cause, and some of these might be covered by the policy, others not.

The loss must then be measured, and the indemnity to be paid determined. The whole process of assessing the loss, determining the indemnity and paying it is known as *loss adjustment*.

Unlike other types of property insurance, when a loss can be assessed without the “biological factor”, crops and trees have the capability of compensating for damage. This is covered in section 3.6.2 below, which is followed by a brief note on the closely associated issue of salvage.

### **3.6.2 Compensatory growth**

Compensatory growth is a plant’s response to damage. Some examples will illustrate how this can impact on insurance and on the assessment of losses. Hail can do devastating damage to grapevines. If the hail event is in the spring, fruiting parts can be knocked off. However, the plant will normally grow new fruiting parts from existing buds, and a crop will result. The loss in this case is likely to be a reduction in the quantity and also in the quality of the fruit, but there will be something to harvest.

On the other hand, late summer hail damages the grape bunches themselves, and can cause an almost complete loss of the season’s production. It is too late for compensatory growth, so an insurer, working with the grower, will assess whether or not any salvage can be undertaken. Table grape market values are heavily hit by partial hail damage to the shoulders of the grape bunches. In such cases, even though the bulk of the fruit in the bunch may be undamaged, the prominence of hail damage on the shoulders of the bunch means that the grapes may not find a market. This may lead a loss assessor to declare a *constructive total loss* (see under Salvage, below).

Cotton and maize are among other economically important field crops which will compensate for damage by a peril like hail. But the new growth will not completely replace the lost parts, so some diminution of yield can be expected, depending largely on the stage of growth at the time the damage occurs.

Compensatory growth is something that a crop loss assessor will take into account, drawing on the considerable research which has been done on the more important field crops, which gives an indication of the extent to which some of the loss is made up by natural processes.

### **3.6.3 Salvage**

Salvage is the human equivalent of compensatory growth. Sometimes salvage of a damaged crop will involve sale into a different market. For example, apples grown for whole fruit sale, which are damaged by hail, might find a market at a juicing factory. Similarly, a forest damaged by fire or windstorm may yield timber which is marketable, although the extraction cost might be high.

Again, salvage possibilities are taken into account by assessors in calculating the indemnity. In the event of a “constructive total loss” the insurer pays a full indemnity to the insured grower, and then may try to salvage some value from the damaged crop or forest.

## **3.7 INSURANCE ADMINISTRATION**

### **3.7.1 Cost containment**

The management of insurance, as a business, has several stages. These are: market identification; product development, marketing, setting indemnity and premium levels, collecting premiums, handling claims. The over-riding aim in the design of administrative structures and procedures is to lay a foundation for minimising costs. Since the potential clientele comprises small and often widely dispersed growers, costs can easily escalate to the point of non-viability of the business, unless special care is taken. In this connection, the new insurance products, mentioned earlier, offer much scope for drastically lowering the costs of administering a financial risk management mechanism.

The various stages of standard insurance administration offer some scope for economies. The tasks involved in these stages are briefly described below, with mention of particular examples where efficient procedures have been developed in order to save costs.

The extent of involvement of the public sector varies from country to country, but it always has a role, even if this is exercised in the main through setting supportive and regulatory policies. It may be particularly important in the early stages of developing crop insurance, and in situations where financial support is considered both desirable and possible.

### **3.7.2 Market identification**

This is a vital stage. Buying insurance involves increasing the up-front costs for a grower. The advantages of buying cover must be clear, with careful positioning of any proposed insurance product. Firstly, this means recognising that insurance as such may not have a legitimate role in a particular industry for the major perils, as seen by the owners. Secondly, where there is believed to be a role, it means that careful attention must be paid to benefit/cost considerations for both contracting parties – the insured and the insurer. These two conditions can best be met by identifying the real points of financial risk in an enterprise type, and examining whether a financial risk-sharing mechanism can be economically applied. In general, the more commercial the operation, the more likely is it that insurance could be designed to address certain of the risks involved. This applies, in particular, to the intended market for the produce of the grower. A formal, commercial market implies the ability to collect information on quantities of production from particular growers. Time series data of this type, since they are based on transactions involving payment, is likely to be highly accurate. A market outlet may also facilitate administrative economies in arranging the cover, or even in paying premiums.<sup>32</sup>

At this stage too it is important to identify the insurer. Is it to be a local insurance company, perhaps one that has no previous experience with crop insurance? This is the model which is commonly found in Latin America, and

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<sup>32</sup> From the beginnings of the frost and hail insurance on the New Zealand kiwifruit crop, the cover was arranged by the export authority which handled all export kiwifruit. This meant that cover was automatic for all growers, and only one premium payment was made. The administrative cost economies were very significant.

which was recently proposed for Syria, by an international team of specialists. Or is it to be handled by a special agency, as is the case in Iran, and in Mauritius. A third possibility is that a special farmer's cooperative structure be formed to handle the insurance, as is done in France and in South Africa. It is not possible to give an opinion on which of these alternatives is the best. One can, however, note that if an existing company were to take on crop and forestry cover as an additional line of business, then it will start a number of advantages:

- It will already have staff trained in insurance;
- it will have, in place, the necessary systems to handle information concerning the sums insured, and claims;
- it will have accounting systems in place;
- it is likely to have existing business relationships with re-insurers;
- it will have a capital base, one which may be sufficient for it to enter into a new area of business.

However, crop and forestry insurance in developing countries is not likely to be any more attractive to existing insurers than lending in these sectors is to most commercial banks. This may then call for additional inducements or alternative administrative arrangements.

The establishment of crop insurance as a new line of business, whether in an existing company, or in a new entity, can benefit from the best experience available. At the time of writing the required expertise is most likely to be found within the reinsurance industry, and with specialized consultants/researchers. There is a role here for international agencies in making the necessary contacts, and assisting with the costs.

### **3.7.3 Product development**

Once the administrative business structure is in place, attention must be given to developing a product or line of products to meet the already identified demand. It is at the stage of product development that it is necessary to identify the point at which insurance could most economically impact on and contribute to growers' risk management strategies.

Whereas each industry will have its own special features, problems and opportunities, one general point can be made. Product development is a highly skilled task, requiring both detailed knowledge of farming and/or forestry, coupled with a sound appreciation of the principles and operational imperatives of insurance. As such, this can be an expensive stage in the process, and one with which international agencies can often assist. This assistance might be in the form of direct partnership in product design, or training existing insurance staff to handle the new challenges. In practice it is likely to start with both approaches. What is important to note is that the design of insurance products, like the design of products for other financial services, is an ongoing task.

#### **3.7.4 Marketing**

Implicit in any moves to start crop insurance is the assumption that there is a demand for the product. Whereas automatic insurance has many advantages, as noted earlier, it is not always possible to design this type of policy. Marketing therefore is important. Several factors are important here:

- Close links with the representatives of farmers and foresters, and speedy response to new needs for insurance;
- similar linkages with banks, farm product buyers and others with business connections with insured growers. The possibility of insurance being rolled into a seasonal cropping loan has already been mentioned. In this type of arrangement the marketing is automatic, at very low cost;
- attention to appropriate publicity;
- scrupulous fairness in loss assessment and claims handling;
- speedy payment of claims.

#### **3.7.5 Setting indemnity and premium levels: deductibles**

In standard, traditional insurance, the basic issue to be addressed is whether the insurance is meant to substitute for farm income in the event of a loss event, or whether the indemnity would merely cover the cost of inputs lost, because of crop damage. The second option is certainly the easier and lower cost alternative, as the level of overall coverage would be significantly less.

With index policies the choice would be more flexible, since an insured individual could choose the level of coverage, purchasing the number of units which suits his or her needs.

In any case, it is vital that an actuarial balance is struck between premium and indemnity levels, and that this balance be continually checked in order to ensure the financial sustainability of the programme, and its ability to meet commitments to insured growers. A key issue is the level of deductible (excess) which applies. The effect is twofold. Firstly, and more obviously it impacts directly on the premium level through an inverse relationship between the quantum of deductible and the pure premium required for a given level of insurance protection. Secondly, it also impacts through economies in loss assessment and adjustment costs, a deductible means that minor losses will not prompt a claim, and therefore no loss assessment will take place.

A major area of difficulty in setting indemnity and premium levels is the lack of data linking the incidence of adverse weather events and actual losses in the field. Experience has shown that historic newspaper reports are unreliable (they usually exaggerate the losses) and that reports kept by government ministries are similarly inaccurate, since in the absence of insurance there is little incentive, or need, for precision.

In any case, insurance products in agriculture are seldom launched on the basis of all the data an actuary would wish to have in order to set premiums at the level required to meet expected indemnity liabilities. Experience must be gained during the early years of a programme. During this period adjustments can be made to the indemnity and premium levels, and also to the percentage of deductible applied.

One of the oldest crop insurance programmes in the developing world, the Mauritius Sugar Insurance Fund, has already been mentioned. It is hardly surprising, given its maturity, that this programme has developed a sophisticated and very fair system for setting indemnity and premium levels. It has been able to do this through the availability of detailed and accurate data of cropped areas, ownership, tonnages delivered as well as data generated in the course of settling claims.

### 3.7.6 Collecting premiums

The main objective here is to keep costs as low as possible, so there is a strong incentive to build linkages with existing providers of services to the farm and forestry sector. In Cyprus the Agricultural Insurance Organization utilizes the connections that processors, wholesalers and exporters already have with growers. In Mauritius the Sugar Insurance Fund taps into the linkages that its 35 000 grower clients have with the 19 sugar mills in the industry. Similarly, in the Windward Islands, all registered growers have an ongoing account with the centralised, single channel marketing system. This provides a ready means for the collection of insurance premiums.

Perhaps the most obvious linkage is between the insurer and banks serving the same clientele, with the loan included as a component of the seasonal cropping expenses. Since the premiums in such cases are paid in bulk by the banks to the insurer, costs are minimized.

### 3.7.7 Handling claims

Again, cost containment is very much an objective in designing procedures for the notification of claims, for assessing the losses and for paying indemnities. Clearly the big divide is between the older, traditional type of policy, in which losses need to be assessed on each farm or forest, and the newer types of policies in which a more wholesale approach is possible (see Section 2.5, New Insurance Products, above). It has already been mentioned that some perils, e.g. hail, still require *in situ* inspection in order to determine the loss, as the incidence of this peril is very geographically confined.

A further potent field for cost economies is through building linkages with entities already providing services to growers. These include banks, input suppliers, processors and other buyers. Sometimes, when loss assessment is done on an individual basis, the process can be made more efficient by the ready availability of detailed information. In the Windward Is. an assessor is provided by WINCROP with all details of the claim on which he is to work – including data on the cropped area and full cropping history.

## **3.8 ROLES FOR GOVERNMENT AND THE PRIVATE SECTOR**

### **3.8.1 The dilemma**

Whereas, as a business, insurance belongs in a business setting, the very nature of crop and forestry insurance means that there is bound to be strong governmental involvement. Most governments have a close interest in risk management in agriculture, both for productivity reasons, and concern for the wellbeing of rural populations. This often means, in practice, that governments are active not only in an overall policy sense, but can be more intimately involved in various ways. These can range from initial investigation of the feasibility of introducing crop and/or forestry insurance products, leading to eventual promotion, and even financial participation.<sup>33</sup>

At the same time, and as stated above, there are strong reasons for the business operations in insurance to be handled by a commercial concern, for reasons of efficiency and convenience in terms of insurance operations complementing other commercially-run services to farming.

This dual parentage of crop insurance can lead to tensions. The most crucial areas of concern lie in the areas of premium setting and claims handling. In these areas experience has shown that undue and inappropriate political influence on an insurer can be very damaging.<sup>34</sup>

### **3.8.2 Towards a solution**

Accordingly, much attention is given during the design of crop insurance programmes to avoiding these tensions to the extent possible. Such avoidance is aimed at optimising the role of the public sector, while harnessing the drive and efficiency of the private industry sector.

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<sup>33</sup> It has already been noted above that insurance is one area of governmental assistance to the farming sector which is permitted under WTO regulations.

<sup>34</sup> In India the premium levels for the major state-run crop insurance programme were set by government, on political rather than actuarial grounds. In Cyprus the premium rates were written into the Act establishing the parastatal insurer. In both cases the inflexibility has resulted in problems for the insurance entities involved.

Several steps are involved. One listing might suggest the following as important:<sup>35</sup>

- Ensure that any existing company or new entity has a sound legal basis on which to offer insurance products, with the required level of business competence.
- Clarify the government's objective in promoting crop insurance. Is it purely an additional risk management mechanism, or is it also an avenue of subsidy to the farming sector? If the latter is the case, then the avenue for financial support has to be ring-fenced from day-to-day political interference.<sup>36</sup> This is not easily done, yet it is essential if there is to be the required continuity of financial conditions in order to build efficiency and fairness into the system.
- Establish strong linkages, at an early stage, with international re-insurers. These companies can assist not only with technical advice, but can also be instrumental in ensuring the necessary adherence to correct application of premium setting procedures, and settlement of claims. Although the opportunity for profit may be some years away, such companies are often prepared to become involved in a new geographical field of business. They operate with long term time horizons, and this can work very much to the benefit of a nascent crop insurer – whether this is a new company or a new section within an established company.
- The financial base for the insurer must be adequate. This must be sufficient to survive initial years in which weather conditions might be such that

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<sup>35</sup> See also Section 2.3 above.

<sup>36</sup> Some years ago the then Government of The Philippines provided a substantial fund to establish the Philippines Crop Insurance Corporation (PCIC). A substantial part of the fund was invested in order to provide a regular adjunct to the premium income of normal insurance operations. Establishing this endowment fund was a long-sighted move on the part of the then government. It has provided the PCIC with a valuable degree of autonomy and responsibility.

underwriting profits are sharply negative. On top of this loss, administrative expenses have to be met. In many developing countries there may have to be public sector participation in ensuring a sound financial base.

- Work closely with representatives of the farming and/or forestry sectors. This will help ensure that the service and products are popular and therefore in demand.

## **Annex**

This Annex comprises:

**I List of References**

**II Note on Premium Calculations**

**III Glossary of Common Insurance Terms**

## I LIST OF REFERENCES

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## **II NOTE ON PREMIUM CALCULATIONS**

A premium payment must cover a number of costs. These are expressed as a percentage of the sum insured. Insurance is very much a data-driven business, and as such careful records are kept of costs of all types. Some costs can be estimated with a great deal of accuracy. These include;

- internal administrative costs, office premises, staff, equipment and running costs;
- external administrative costs, mostly associated with the acquisition of clients, i.e. advertising, farmer education etc.

Other costs are not so readily estimated, especially in the early years of a given insurance product. These are the costs of meeting claims. The term for this is 'loss cost', and is the sum of indemnities plus adjustment expenses, divided by the total sum insured. Historic data is the basis for the calculation. Naturally in a new programme this base figure can only be an estimate, based on loss histories for similar ranges of perils in equivalent agricultural areas.<sup>37</sup>

The base figure is then adjusted by the addition of 'loadings'. These are sums which insurers need to set aside for factors which can increase the likelihood and/or the size of claims under the policy, or the costs of mitigating fluctuations through the purchase of reinsurance. In crop and forestry insurance these factors are:

- Catastrophe loading: to make prior allowance for the incidence of perils which have a very low frequency, but which are marked by high severity, that is, they are potentially very damaging and therefore very costly for insurers involved. An example would be the Munich hail storm of July 1984 (see Footnote 21 above);
- volatility loading: to make prior allowance for marked changes in the type and frequency of perils;

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<sup>37</sup> Some recent work in the Ukraine has utilised data from the Mid-West United States as an indicator of likely losses, as the agro-climatic conditions are similar.

### **III GLOSSARY OF COMMON INSURANCE TERMS**

#### **Accumulation**

The concentration of similar risks in a particular area such that an insured event may result in several losses occurring at the same time. Monitoring accumulation risk is an important part of insurance company management.

#### **Act of God**

An event arising from natural causes without human intervention and which could not have been prevented through reasonable care or foresight, e.g. floods, earthquakes, windstorm.

#### **Actuarial**

Describes the calculations made by an actuary. Essentially this is a branch of statistics, dealing with the probabilities of an event occurring. Actuarial calculations, if they are to be at all accurate, require basic data over a sufficient time period to permit likelihood of future events to be predicted with a degree of certainty.

#### **Actuary**

A person with a mathematical and statistical background who is responsible for the application of probability and statistical concepts to insurance aspects such as rating, premium, reserves and dividend calculations.

#### **Adverse selection**

The tendency of individuals with poorer-than-average risks to buy and maintain insurance. Adverse selection arises when insureds select only those coverages which are most likely to result in losses. In agricultural insurance, this can arise when:

- high-risk farmers or farmers using backward practices participate, while other farmers, with more certain production expectations, do not;

- farmers apply for insurance only on their high-risk crops or plots, withholding other units. An example would be buying insurance only for crops grown on flood-prone areas of a particular property.

**Agricultural insurance**

Insurance applied to agricultural enterprises. Types of business include: crop insurance, livestock insurance, aquacultural insurance and forestry insurance, but normally exclude building and equipment insurance although these may be insured by the same insurer under a different policy (see “Aquacultural insurance”, “Crop insurance”, “Forestry insurance”, “Livestock insurance”).

**All risk insurance**

A term used to describe a policy which covers the insured property against any fortuitous cause including acts of God, accident, disease, fire, theft and pilferages. In agricultural insurance, all risk policies may cover all weather risks, fire, theft etc. It excludes those perils defined as exclusions in the policy and inevitabilities such as wear and tear or depreciation. Typically such policies are yield-based, rather than damage-based, i.e. loss assessment following an insured event centres on measuring the yield against a pre-determined, historic yield expectation.

**Anti-selection**

Same as adverse selection.

**Aquacultural insurance**

Protection for fresh water or salt water fish farming enterprises against mortality to fish stocks. This is distinct from insurance which may be contracted against risks to cages and other structures from storms, marine accidents etc., though in individual cases the policies may be linked.

**Arbitration clause**

A provision in a policy stating that any differences between the insurer and the insured shall be settled by arbitration. Each party shall appoint an arbitrator and these shall select a neutral umpire.

**Area approach (area-yield basis)**

An agriculturally homogeneous area may be insured as one unit, or form the basis for standardizing loss assessments across the area. This unit may comprise several blocks of land farmed by the same farmer or different farms farmed by different farmers. For loss adjustment, in this approach, the actual average yield is assessed by sample survey through crop cutting or other methods, and compared with the normal (insured) yield. The average yield loss is applied to all land of all insured farmers within the defined area, disregarding individual differences in actual damage and crop yield. The aim of this approach is speed and cost-containment.

**Assessor**

A person appointed to assess and settle any claim made under an insurance policy. (see loss adjustor).

**Assurance**

Same as insurance. Usually applied to life and marine policies and not to agricultural insurance.

**Attachment**

The commencement of an insurance policy i.e. start of insurance coverage.

**Automatic insurance cover**

A grower participating in a bulk marketing operation, or contract farming situation may be covered automatically by a crop insurance policy which is arranged by the crop marketing agency, or crop buyer/processor. This type of arrangement conveys considerable cost economies since the expenses of marketing the insurance, collecting premiums and issuing policies are minimized.

### **Average**

If the property value has been under-insured, then the insured's claim for a loss is reduced proportionately to the undervaluation. This is a basic principle of insurance contracts.

### **Basis of evaluation**

The basis on which the potential insured property is valued, the established value being used to determine the Total Sum Insured. In crop insurance policies, often the basis of valuation is the production cost of growing the crop.

### **Basis risk**

This is the potential mismatch between insurance payout and actual insurance losses.

### **Blanket policy**

A policy in which a single sum insured covers a number of individual items, for example, several buildings in a fire policy, or a glasshouse plus its contents, including crops and production equipment.

### **Bonus**

(See no claims bonus).

### **Bordereau**

There are two types of bordereau, one for premiums and one showing details of losses. Both are submitted to insurers/reinsurers at regular intervals. 1) The premium bordereau gives details of the insureds, sums insured, location of risks and premium rates. 2) The loss bordereau provides such details as date of occurrence of insured peril, date and amount of claim, amounts paid and amounts outstanding.

### **Burning cost**

Burning cost is a term used in excess of loss reinsurance to describe the amount of claims paid above the excess level, expressed as a percentage of the total premium.

**Business interruption insurance**

The insurance of losses resulting from unforeseen circumstances which reduce the output, both physical and financial, of a business. Business interruption policies may be used for the insurance of agricultural processors, and may cover, for example, additional expenses resulting from any shortfall in delivery to the processing plant of the crop to be processed.

**Capacity**

The maximum amount of insurance or reinsurance that the insurer, reinsurer or insurance market will accept.

**Captive insurance company**

This is an insurance company established and owned by a large conglomerate, or commercial group, or by trade, professional and other associations. It writes the insurance business of its parent company or of its affiliates/members.

**Catastrophe**

A severe, sudden and unexpected disaster which results in heavy losses.

**Cede**

To purchase reinsurance.

**Ceding company**

A direct insurer who places all or part of an original risk on a reinsurer.

**Claim**

The application for indemnity (payment) after an insured event has occurred.

**Compulsory Scheme**

Any form of insurance required by law. In agricultural insurance this relates to a scheme which has the legislative authority to compel participation by farmers growing crops or owning livestock covered by the scheme. (See also “voluntary scheme” and “automatic insurance”.)

**Consequential loss insurance**

Insurance against monetary loss other than material damage caused by the insured peril(s). This type of policy is often applied to irrigated agriculture, where cover is purchased against loss or damage to the crop consequent to breakdown of irrigation equipment, leading to loss of ability to irrigate the crop.

**Constructive total loss**

When the insured property has been damaged to such an extent that it is uneconomic to salvage it, a constructive total loss may be declared. A constructive total loss is not the same as an actual total loss, in which the insured property is totally destroyed. In crop insurance, a constructive total loss may be declared when damage levels exceed a pre-determined percentage of the crop making it uneconomical to harvest the remaining crop, i.e. harvest costs are greater than the value of the undamaged crop which would result from the harvesting operation.

**Coupon insurance**

Sometimes used in reference to what is more correctly known as index insurance. In index insurance a simple coupon replaces an insurance policy. (See “Index insurance”.)

**Crop credit insurance**

In crop credit insurance the coverage is based on the amount of the production loan for individual farmers. Often the premium is paid by the lender, and any indemnity goes first to that lender so that in the event of a crop loss from an insured event the loan is extinguished and the borrower is left with no further obligation, for this loan, to the bank.

**Crop insurance**

Provides protection against loss or damage to growing crops including perennial crops such as tree crops against specified or multiple perils, e.g. hail, windstorm, fire, flood. Measurement of loss could be by “yield” basis, production costs basis, agreed value basis or rehabilitation costs basis. While

most crop insurance is geared towards loss of physical production or yield, cover may also be provided to loss of the productive asset, such as trees.

**Cyclone**

Areas of low pressure around which wind blows clockwise in the southern hemisphere and anticlockwise in the northern hemisphere. The terms “hurricane” and “typhoon” are regional names for a strong “tropical cyclone”, with “hurricane” used in the North Atlantic and “typhoon” used in the Pacific Ocean. All originate in tropical or sub-tropical waters, and have sustained wind speeds in excess of 119 km. per hour.

**Deductible (Excess)**

An amount representing the first part of a claim which an insured has to bear as stated in the policy. The deductible is usually expressed as a percentage of the sum insured, but equally may be a monetary amount.

**Drought**

This is a peril which farmers often request for inclusion in a crop insurance policy, but it is also one of the most difficult perils to insure because of the problems of its definition, isolation and measurement of effects on crop production. In contrast to most weather perils, drought is a progressive phenomenon, in terms of an accumulating soil moisture deficit for plant growth, and its impact on crop production and yields is often extremely difficult to predict, then measure and isolate from other non insured causes. Because of these difficulties much attention has been given in recent years to imaginative approaches to dealing with this problem (see “Index insurance”).

**Earned premium**

Premium is said to be earned once the insurance has expired.

**Excess**

Same as deductible.

**Excess of loss policy**

This term, usually applied to re-insurance business, refers to a policy that covers claims once they have exceeded a certain amount. Here it is a non-proportional type of reinsurance, where the reinsurer agrees to pay the reinsured losses which exceed a specified limit arising from any risk or any one event. A reinsurer may decline to limit his exposure by setting an upper limit above which he will not pay claims. For example, a reinsurer may agree to pay claims of US\$200 000 in excess of US\$100 000. If the claims are more than US\$300 000, the reinsured (i.e. the insurer) will have to bear the remainder of the claims. Alternatively, he may take out further excess of loss reinsurance with other reinsurers until the total sum insured of the original risk is covered.

**Excess rain**

Definitions of this peril vary widely, but generally relate to abnormally high rainfall intensities over short periods of time which cause direct physical damage to crops (lodging, shedding of grain etc.) and this may extend to secondary losses caused by saturation of soil, and chlorosis and necrosis of plants. Some policies also provide protection against excess rain at the time of harvest which prevents access to fields in order to carry out the harvest operations in a timely fashion, resulting in yield loss and/or a reduction in quality.

**Excessive heat**

Excess heat caused by high temperatures which may cause severe damage or loss in crops, such as at the pollination stage when excess heat will inhibit seed set. Because of difficulties in isolating and measuring losses due to this peril it is seldom accepted by crop insurers.

**Experience rating**

Rating the risk using the insured's own loss/accident history and not taking into consideration general market loss ratios and rates.

**Facultative reinsurance**

This is reinsurance by offer and acceptance of individual risks (as opposed to clustered or grouped risks – see “Treaty reinsurance”). In facultative reinsurance contracts the reinsurer retains the “faculty” to accept or reject a particular risk offered by the ceding company. The method has the advantage that the ceding company can select which individual risks to reinsure, while the reinsurer can exercise his underwriting judgement on a case by case basis. These advantages are outweighed in most cases by the expense and inconvenience of such a method. However, facultative reinsurance is commonly used in crop insurance for specific crop insurance products, or for individual large projects, especially in the early years, until experience is gained by all parties.

**Flood**

The overflowing or deviation from their normal channels of either natural or artificial water courses, and the bursting or overflowing of public water and other flow of water originating from outside the insured property.

**Forestry Insurance**

Protection against loss or damage to trees (standing timber), most commonly against fire, catastrophic windstorm, snow, flood or earthquake events. Escalating valuation and indemnity systems are applied in order to reflect the increasing volume of timber and thus exposed values at risk with increasing age of the trees.

**Franchise**

An amount of loss that has to be reached before the insurer will pay a claim. Once this threshold is met, the insurer has to pay the claim in full. e.g. A farmer insured his crop for US\$1000 with a franchise of US\$100. If the claim is for US\$99, then this is borne by the farmer. If the claim is for US\$101, however, then the whole amount of the US\$101 is paid by the insurer.

**Freeze**

Damage to crops begins when temperatures fall below zero degrees Celsius, either through freezing of surface water or freezing of internal plant cell moisture. The degree of damage in most cases is a function both of the temperature and the time involved. In many crop insurance circles this term is used interchangeably with frost. In the US, however, the term “freeze” is commonly applied to advection caused by the invasion of low temperature air masses into an area, as distinct from “frost” which relates to radiative cooling. Advection cooling tends to occur on a widespread scale, and may last for many consecutive nights. It can result in severe damage to crops. Conversely, radiative cooling tends to occur only for a night or two, and frost prevention measures, notably increasing wind circulation, can have a strong warming effect on temperatures in the immediate vicinity of crops and trees.

**Frost**

Radiative cooling below zero degrees Celsius (see “Freeze”).

**Guaranteed yield**

The expected physical yield of a crop stated in the insurance policy, against which actual yields will be compared when adjusting any losses.

**Hail**

Precipitation in the form of ice granules which according to the size and quantity thereof can cause severe damage to livestock and crops.

**Hazard**

A physical or moral feature that increases the potential for a loss arising from an insured peril or that may influence the degree of damage sustained.

**Hurricane**

See Cyclone.

**Inception date**

The date on which the insurance cover commences.

**Indemnity**

The amount payable by the insurer to the insured, either in the form of cash, repair, replacement or reinstatement in the event of an insured loss, is termed the indemnity. The amount is measured by the extent of the insured's pecuniary loss. It is set at a figure equal to but not more than the actual value of the subject matter insured just before the loss, subject to the adequacy of the sum insured. This means for many crops that an escalating indemnity level is established, as the growing season progresses.

**Index Insurance**

This is a very new type of crop insurance in which an indemnity becomes payable upon the certified occurrence of the weather event to which the insurance relates. This is also known as "Coupon insurance" since coupons or tickets replace the normal insurance policies. The main difference between this and standard crop insurance is that crop losses are not measured, either on individual insured farms or on an area basis. Rather, reliance for triggering the coupon is based upon data generated by weather recording instruments, with the possibility of verification of the occurrence of the insured weather event by recourse to aerial or satellite photography.

**Insurable interest**

An insurance policy is only valid if the insured is related to the subject matter insured in such a way that he will benefit from its survival, suffer from loss or damage caused to it or may incur liability in respect of it.

**Insurable yield**

A term used in crop insurance to represent the maximum yield that will be insured under a policy. It is usually expressed as a percentage of the potential yield of a crop. The latter is established by reviewing previous production in the area to be insured, assessing the potential of the land to grow the crop and the

farmer's management capabilities, and by inspecting the actual growing crop to assess its potential yield.

**Insurance**

A financial mechanism which aims at reducing the uncertainty of loss by pooling a large number of uncertainties so that the burden of loss is distributed. Generally each policy holder pays a contribution to a fund in the form of a premium assessed by the insurer, commensurate with the risk he introduces, which is established and administered by the insurer and out of these funds are paid the losses suffered by any of the insured.

**Insurance agent**

This is one who solicits, negotiates or effects contracts of insurance on behalf of his principal (normally an insurer).

**Insurance broker**

A broker represents an individual or firm wanting to buy insurance. In most jurisdictions a broker may also be an agent of the insurer for collection of the premium and delivery of the policy.

**Insurance damage rate (IDR)**

$$\text{The IDR} = \frac{\text{indemnities paid}}{\text{total sum insured}}$$

Generally the insurance damage rate is expressed as a percentage and is applied for the sum total of one type of an insurer's business in a given year. For example, the IDR for paddy rice in Japan in 1976 was 8.3 percent. Other terms for IDR are "damage rate" and "loss cost".

**Insurance policy**

A formal document including all clauses, riders, endorsements and papers attached thereto and made a part thereof which expresses the terms, exceptions

and conditions of the contract of insurance between the insurer and the insured. It is not the contract itself but evidence of the contract. In compulsory schemes the individual insured may not hold a formal insurance policy document directly related to the insurance contract but an insurance certificate which gives a brief outline of the insurance terms and conditions.

**Insurance unit in individual approach**

A term used in crop insurance to represent the area of land to be covered by a policy. The area of land may either be a single plot or the total of several plots of the same crop type farmed as one unit by the insured. The spread of risk improves as the area to be insured increases.

**Insured**

The person or business entity covered by an insurance policy.

**Insured peril**

The cause of loss stated in the policy which on its occurrence entitles the insured to make a claim; e.g. hail, frost, wind, drought, excessive rain, pests and diseases.

**Insurer**

The company which issues an insurance policy and is named in the policy as being responsible for paying a claim should a loss event result in damage to the insured property.

**Livestock insurance**

This is a class of agricultural insurance which generally centres on the provision of mortality cover for livestock due to named disease(s), and accidental injury. Insurance cover is normally restricted to adult animals and may be taken out on an individual animal or herd basis. Major classes of insured livestock include beef and dairy cattle, sheep, goats and pigs and domestic fowl. A special type of cover is sometimes bought by owners of valuable sires, e.g. stallions, bulls, against loss of performance through accident.

**Loss**

An event giving rise to a claim under the insurance policy; a claim, or the disappearance of the insured property through an act such as theft as opposed to its survival in a damaged state.

**Loss adjuster**

A representative of the insurance or an independent person employed by the insurer to assess and determine the extent of the insurer's liability for loss or damage claimed by the insured.

**Loss adjustment**

Determination of the extent of damage resulting from occurrence of an insured peril and settlement of the claim. Loss adjustment is carried out by the appointed loss adjuster who works on the behalf of the insurer.

**Loss assessment**

The first stage of loss adjustment i.e. estimation of extent of loss caused by the insured peril.

**Loss cost**

Same as the insurance damage rate i.e. claims expressed as a percentage of the total sum insured or total liability.

**Loss frequency**

The rate of occurrence of losses, often expressed in terms of the number of incidents over a period of time. This measure can be used to assist in rating a policy and for judging the effectiveness of loss prevention facilities.

**Loss ratio**

The proportion of claims paid (or payable) to premium earned.

**Malus**

An addition to insurance premium as a result of previous claims.

**Maximum possible loss (MPL)**

The largest loss believed to be possible for a certain type of business. (See also “Probable maximum loss” – PML.)

**MCPI**

See “Multi-peril crop insurance”.

**Moral hazard**

The risk or danger to look for from human nature, both individual and collective. Moral hazard depends mainly on the character of the society, the character of the insured, and on the character of his employees and the manner in which they work and behave at work. Examples resulting from moral hazard include: carelessness, fraudulent claims, crime or arson, irresponsibility, gross over-insurance, general decline in moral climate due say to a period of recession, and unreasonable demands over claims settlements.

**Multi-Peril Crop Insurance (MPCI)**

A type of crop insurance in which a number of perils are covered and where the basis for establishing the sum insured is the expected yield, as determined by production history over a number of years. This has the advantage that there is no need, in loss assessment, to assign percentages of loss to individual perils. This type of policy is known as “yield-based”.

**Mutual company**

A company established to undertake insurance for its members, thereby receiving all benefits from profits. A mutual company has no risk capital provided by external parties. In agricultural terms a mutual company could be formed by a group of farmers who each pay a premium into a fund that they control, rather than paying to an insurance company.

**No claims bonus (discount)**

For an insured who in previous years of insurance has made no claims, underwriters may decide to reduce the renewal premium, the premium reduction being termed the No Claims Bonus or No Claims Discount.

**Normal yield**

This is that yield which a number of years' experience indicates can be expected from a particular plot under normal conditions, when no extraordinary natural disaster or unusual meteorological events occur. In practice the modal yield value (the yield most commonly occurring) is taken as the normal yield. The mode is also the yield most commonly conceived by farmers as being acceptable, since they generally ignore bad years when estimating future yields on the basis of past performance.

**Notification of claim**

Insurance policies usually contain a provision stating that any occurrence of an insured peril which could result in a claim must be reported to the insurer within a specified period of time.

**Off risk**

A term used when insurance has either expired or been cancelled.

**On risk**

A term used to describe the policy during the period of insurance.

**Partial loss**

The loss of part of the insured property. This is often experienced in crop insurance, but not so much in livestock insurance where mortality cover is the norm and an insured animal is either alive or dead. However, many livestock policies cover groups of animals – herds or flocks, and as such partial losses can be experienced.

**Peril**

A potential cause of loss or damage to the property. Perils can be insured or uninsured, both are normally named on the insurance policy. It is therefore important that loss adjustment procedures enable distinction to be made between damage caused by insured and by uninsured perils respectively. The main natural perils mentioned in agricultural insurance policies include: fire, flood, freeze, hail, wind, excess rain and drought.

**Period of insurance**

The period of protection for which the policy is issued. Any losses taking place outside this period are not indemnified. For annual crops this period of insurance normally commences at the time of sowing, sprouting, blooming or transplanting and ends at the time of harvest. For perennial crops, e.g. oil-palm, the period of insurance may be on an annual basis.

**Physical hazards**

A physical feature that increases the chances of a loss happening, for example, in crop insurance, if a disease is insured, the occurrence of a weather peril, such as continuous rain, may enhance the occurrence of the disease, just as hot, dry weather increases the fire risk in a forest.

**Policy**

A document setting out the terms of insurance for the insured property.

**Premium**

The monetary consideration payable by the insured to the insurers for the period (or term) of insurance granted by the policy.

**Premium rate**

The price per unit of insurance. Normally expressed as a percent or per mille of the sum insured.

**Probable maximum loss (PML)**

An estimate of the maximum loss that is likely to arise on the occurrence of a single event considered to be within the realms of probability. Remote coincidences and possible but unlikely catastrophes are ignored in the estimation of a PML. (See also “Maximum possible loss”.)

**Pure premium**

The amount required by an insurer to pay losses under an insurance policy prior to taking into account the insurer’s general expenses.

**Rate**

The amount charged by the insurer or reinsurer for the insurance. This is usually expressed as a percentage of the sum insured. The amount to which this equates is the premium.

**Reinsurance**

When the total exposure of a risk or group of risks presents a hazard beyond the limit which is prudent for an insurance company to carry, the insurance company may purchase reinsurance i.e. insurance of the insurance. This purchase is also known as ‘ceding’. Reinsurance has many advantages including (i) levelling out the results of the insurance company over a period of time; (ii) limiting the exposure of individual risks and restricting losses paid out by the insurance company; (iii) may increase an insurance company’s solvency margin (percent of capital and reserves to net premium income), hence the company’s financial strength; and (vi) the reinsurer participates in the profits of the insurance company, but also contributes to the losses, the net result being a more stable loss ratio for the insurer over the period of insurance.

**Retention**

1) The net amount of a risk that an insurer or reinsurer keeps for his own account and does not reinsure. 2) The premium kept by an insurer having paid any claims and expenses, which therefore equates to the insurer’s profit.

**Return period**

The time period between occurrences of the insured peril. For example, the return period for a hurricane may be once in every ten years. Return periods are established by analysing historical data on the insured peril.

**Risk**

In insurance this has several meanings: 1) the subject matter of insurance; the insured property. 2) uncertainty attached to the outcome of an event. 3) the probability of a loss. 4) the insured peril. 5) danger.

**Risk management**

Care to maintain income and avoid/reduce loss or damage to a property resulting from undesirable events. Risk management therefore involves identifying, analysing and quantifying risks and taking appropriate measures to prevent or minimise losses. Risk management may involve physical treatment, such as spraying a crop against aphids, using hail netting or planting windbreaks. It can also involve financial treatment, e.g. hedging, insurance and self-insurance (carrying sufficient financial reserves so that a loss can be sustained without endangering the immediate viability of the enterprise in the event of a loss).

**Specific risk insurance**

A policy that defines the perils to be covered by the insurance as opposed to an “All Risks” policy which covers a multitude of perils.

**Stop loss**

See “Excess of loss”. The term is usually reserved for reinsurance contracts.

**Storm surge**

An abnormally high sea level, caused by very strong on-shore winds. These are usually associated with hurricanes, and can cause greater damage than the windstorm itself.

**Sum insured**

The amount specified in the policy up to which the insurer will pay indemnities should the insured peril(s) occur and result in a loss to the insured property.

**Threshold of insurability**

In crop insurance this is the scale of a farm enterprise, level of husbandry skills and/or financial status, and degree of accessibility, below which a viable insurance contract cannot be administered by an insurer.

**Treaty reinsurance**

This is a contract between an insurer and one or more reinsurers to accept cessions of business, underwritten by the insurer, within pre-arranged limits. The reinsurer(s) cannot refuse to accept any ceded risk that falls within the terms of the treaty. The advantage of treaty reinsurance is that results on cost economies. Although many crop insurance programmes start off with facultative reinsurance, as experience is gained then gradual moves to treaty reinsurance can be expected. During treaty arrangements summaries of premiums due to reinsurers and claims due from them are given at periodic intervals.

**Tropical storm**

Any cyclone circulation originating over tropical waters having a distinct rotary circulation with wind speeds ranging between 63 to 118 km. per hour. Sustained wind speeds greater than 118 km/hr. bring a change of terminology to cyclone (or typhoon or hurricane, depending on geographical location).

**Typhoon**

See Cyclone.

**Underwriting profit**

Any profit resulting from an insurance or reinsurance before any interest has been added.

**Unearned premium**

Either premium of an insurance policy which never came to fruition or if an insurance policy has attached, the part of the premium which relates to the insurance period still to run.

**Value**

The value of the property to be insured. The basis of valuation varies depending upon the property to be insured. In crop insurance, the insured value may be based upon the production costs of the crop, market value of the crop, or re-establishment costs. The method of valuations is always set down at the time the insurance is purchased.

**Voluntary scheme**

An insurance programme in which individuals may choose whether or not to insure their property.

**Windstorm**

Currents of air of such a velocity that they cause physical loss or damage to the insured crops or agricultural buildings etc. See also cyclone, tropical storm and hurricane.

**Yield**

The production of the insured property per defined unit, for example in crop insurance the number of tonnes/ha. of crop product harvested.

**Zoning**

Dividing the geographical limits of an insurance programme into zones for rating purposes. For example, in crop insurance an area may be divided into zones according to climate, topography and natural vegetation. The premium rates vary between the different zones depending upon the frequency of occurrence.