EVALUATING INDIA'S CROP FAILURE POLICY

FOCUS ON THE INDIAN CROP INSURANCE PROGRAM

DELIVERED TO THE SOUTH ASIA REGION
OF THE WORLD BANK

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Abbreviations and Acronyms

AICI	*Agricultural Insurance Company of India*
APH	*Actual Production History (U.S. Crop Insurance)*
BASIX	*Microfinance Institution operating in India*
CCEs	*Crop Cutting Experiments*
CCIS	*Comprehensive Crop Insurance Scheme*
FONDEN	*Mexican Disaster Relief Program*
FONDOS	*Private sector and farmer groups in Mexico who sell and service crop insurance policies*
GoI	*Government of India*
GDP	*Gross Domestic Product*
GRIP	*The Gross Revenue Insurance Product (U.S. Crop Insurance)*
GRP	*Group Risk Plan (U.S. Crop Insurance)*
IA	*Implementing Agency*
KBS	*The Krishna Bhima Samruddhi Local Area Bank*
MPCI	*Multiple-Peril Crop Insurance*
MSP	*Minimum Support Prices*
NAIS	*National Agricultural Insurance Scheme*
NASA	*National Agricultural Insurance Scheme*
NASS/USDA	*National Agricultural Statistical Service of the United States Department of Agriculture*
PDF	*Probability Distribution Function*
RBI	*Reserve Bank of India*
RFI	*Rural Finance Institution*
RRB	*Regional Rural Bank*
SI	*Sum Insured*
WMO	*World Meteorological Organization*

Executive Summary

Jerry R. Skees and Ulrich Hess[1]

This report reviews both the broader policy issues regarding government response to crop failures and specific issues related to the crop insurance program in India.[2] It is part of a larger World Bank review of rural finance in India. Given that nearly three-fourth's of India's one billion people live in rural areas with a heavy dependence on agriculture, it is appropriate that the Indian government be concerned about crop failures.

While governments respond in various ways to crop failure, one can classify those responses into two major categories: 1) actions that help mitigate the risk; and 2) actions that involve direct compensation. This report concentrates on actions involving direct compensation. Many of these actions can provide perverse incentives that adversely impact decisions regarding what farmers grow. Further, depending on how the crop insurance is structured, it can have either a positive or a negative impact on rural finance. India is focusing on expanding crop insurance services as the major policy to compensate those damaged after adverse conditions. In theory, crop insurance is an attractive alternative since farmers are required to pay for the risk protection. Properly functioning crop insurance should: 1) lead to better resource allocation given the risk environment; 2) allow for improvements in financial planning; and 3) allow for greater access to credit. With some careful attention, the Indian crop insurance program could more effectively contribute to the rural sector.

Basic Problems with the Current Crop Insurance Program

Many arguments have been advanced about how insurance markets could facilitate complete financial services. Yet, crop insurance in India is fraught with problems.

- Long delays in payment of losses are common; negating one of the primary goals of the program — to spur economic development via improved rural finance.
- Losses have exceeded premiums at a 5 to 1 ratio.
- Losses are heavily concentrated — more than half going to a single state.
- Only about 10 percent of the plantings in India are insured.

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[1] Skees is President of GlobalAgRisk, Inc. and The H.B.Price Professor at the University of Kentucky. Hess is Economist with the Commodity Risk Management Group of the Agricultural and Rural Development Department in the World Bank, Washington D.C. Skees and Hess have performed similar work together in Morocco and Ukraine.

2 The report benefited significantly from various interviews that were conducted from June 30 to July 11, 2003. Skees and Hess are grateful for the kind treatment and cooperation received while in India during this time. Niraj Verma provided invaluable assistance in organizing the interviews during this mission. Critical reviews from Olivier Mahul and Niraj Verma are also gratefully acknowledged. Nonetheless, any mistakes or omissions from the report are the responsibility of the authors. There have been two World Bank studies on crop insurance in India in 2003. Kalavakonda and Mahul conducted a very detailed study of crop insurance in Karnataka. There was close collaboration among the principals of both of these studies. Thus, it is likely that there will be similar ideas presented in both studies. Many of the ideas for both studies emerge from long collaboration with many professionals who have contributed to these developments, particularly Panos Varangis at the World Bank, Peter Hazell, now at IFPRI and Joe Glauber, USDA. We gratefully acknowledge everyone who has been involved in these developments over the past several years. Finally, we also thank Celeste Sullivan and Anne Goes of GlobalAgRisk for providing excellent editorial services.

- The fiscal exposure of the program is growing rapidly — without fixing the rating problems the program's expected costs for excess losses could easily exceed 3,000 Crore in five years with only 20 percent uptake.
- Reported abuses of the program at local levels are a problem of unknown magnitude. These abuses primarily involve discrepancies in area-yield estimates**.**

While these problems are serious and fixing them will require a strong commitment from the Government of India (*GoI*), there are many aspects of the current crop insurance program that provide reasons for optimism. The program is designed using estimates of area yield rather than individual farm yield as the base for payment. This design reduces the traditional problems of adverse selection and moral hazard. Furthermore, it means that the administrative costs of the program are significantly lower than traditional crop insurance. If the *GoI* has the discipline to fix the problems outlined in this study, the existing infrastructure provides the basis for unique solutions in India. Two aspects are critical:

1. Premium rates must reflect the contract design and the true risk by area and crop.
2. The timeliness of loss payments must be improved.

Given that the current crop insurance program pays nearly 5 rupees for every 1 rupee invested by the farmer it should be expected that bankers will loan more. Nonetheless, to the extent that the current program does spur more loans, this still begs the question regarding the opportunity cost for these government subsidies. Welfare economics would also carefully consider the dead weight losses that are generated from crop insurance subsidies to the farm sector. Such an analysis is beyond the scope of this study. Nonetheless, it is likely that there is a better use for limited government funds spurring more appropriate resource allocation decisions among farm households and enhancing access to rural credit.

The broader economic questions are particularly important given three limitations of the current crop insurance program: 1) long delays in payments; 2) the potential of a subsidized crop insurance program to restrict important resource allocation decisions; and 3) the unanswered questions regarding what households in India benefit the most. Long delays in payments add to interest payments for farmers with loans. For the poorest farm households such delays increase the likelihood that they will need to borrow in the expensive informal credit markets when there is a crop failure. A fundamental issue that should also be addressed is to what extent more subsidies on crop insurance will prevent farmers from making needed adjustments in what they grow or how they use their other resources. At some point, crop insurance subsidies will slow adjustments and cause farmers to continue to produce high risk crops that are almost certain to have problems given bad weather. Finally, since crop insurance subsidies are positively associated with the size of the farm, careful consideration is needed to prevent these programs from benefiting only the larger farms. Many of the rural poor in India have little or no plantings of crops and, thus, will not benefit from subsidized crop insurance.

Basic Policy Goals

After discussions with policy makers in India, two overall policy goals seem to be most important when considering government response to crop failures in India.

1. Risk Management. Improving rural financial services available to farmers, including their ability to manage commercial risk, is important for improving access to rural finance.

2. Social Response. Providing for social responses that assist the poor who stand to lose the most during severe crop failures is an appropriate goal for government.

These goals should be pursued with consideration of the fiscal exposure. Controlling the fiscal exposure of the government, both in terms of the average exposure as well as the peak exposure during disaster years is important for *GoI* given limited fiscal resources. It is believed that systems which improve risk management and help stabilize farm incomes will improve access to rural financial services — more broadly defined as savings, borrowing, and insurance. Nonetheless, it is not a foregone conclusion that providing government-sponsored crop insurance will improve the rural finance sector. This report raises serious questions about the extent to which India's current crop insurance program fails to improve the rural financial sector. If more complete financial services are made available to farmers, they would be in a better position to use more advanced and efficient production technologies that could spur economic development.

Core Recommendations to Reach Policy Goals

The government response should use limited government funds to achieve the most impact. Given this constraint, it is likely that the *GoI* would also do well to consider how this can be done by facilitating emerging markets. While this report goes through many details regarding how to improve the Indian crop insurance program, four specific areas of focus relate directly to the two basic policy goals outlined above:

1. Using area yields as a form of reinsurance to spur market innovation.
2. Developing weather index insurance products.
3. Improving ratemaking and product design for the current product.
4. Establishing a standing disaster program.

The first two areas relate directly to the risk management goal; the third relates to the fiscal exposure principle; and the fourth, to the social response goal. The *GoI* has publicly stated the intent to improve the crop insurance program by moving to actuarial pricing, move coverage options, and smaller unit areas to reduce basis risk for the crop insurance. There have also been discussions about making estimates of yields available on a more a timely basis. Thus, some of the suggestions made in this report may already be underway.

Using Area Yields as a Form of Reinsurance

The basic products offered and being developed by National Agricultural Insurance Scheme (NAIS) could be used to motivate and reinsure much innovation in new markets in India. For instance, the *GoI* could allow providers of risk management services the right to allow the farmer to assign the area-yield indemnities payment to the risk provider in exchange for new tailored risk management products better suited to the individual farmer's risk management needs. This innovation could prove pivotal in addressing many of the problems with the current program. Among the most critical needs that could be met by these new products is offering products that make more timely payments. In effect, the existing area-yield insurance would provide localized reinsurance for the new products being developed since the area yield would pay for the large correlated risk that is present in crop-yield insurance. To make such a system work most effectively, market innovators would have to have confidence in the integrity of the development of area yield estimates. Another design might involve making the higher of a timely

insurance payment or the area-yield payment. In this case, the later area-yield payment to farmers would only be made for the amount that exceeds payments made on the first insurance contract; be that a weather contract or some other form of insurance.

Developing Weather Index Insurance Products

This study investigates the potential role that could be played by the use of parametric weather insurance. Information on weather events is more quickly available and can be used to make timely payments. Such timely payments are critical to improving cash flow for farmers and banks and freeing farmers from interest payments that currently accrue long after crop failures. Thanks to assistance by the World Bank's agriculture and rural development department in 2003, ICICI Lombard began offering rainfall insurance to farmers in limited areas in Andhra Pradesh, Madhya Pradesh, and Uttar Pradesh. The microfinance institution, BASIX sponsored these pilots. In 2004 these pilots will be scaled up and replicated in new areas, for example a leading bank now protects its crop loan portfolio in one state with weather derivatives. This development provides evidence that market innovation could be significant if the *GoI* allows providers of new risk products the opportunity to use the area-yield insurance product as a form of localized reinsurance. This is especially true in light of the regulatory requirement that all insurers must have at least five percent of their premium coming from rural areas in the next few years. Still, it is important to recognize where weather insurance products might add value and where they would not be the appropriate instrument due to large basis risk. Finally, developing weather insurance markets will come at some costs. These costs would be higher if the developers need to install and maintain their own weather instruments.

Improving Ratemaking and Product Design for the Current Product

There are numerous recommendations about improving the current products that tie directly to the fiscal exposure principle. Among the most critical involve adoption of more appropriate procedures for setting threshold yields using as many years of area yields as possible rather than the current three- or five-year moving average. This is a critical first step to determining an actuarially sound premium rate. Procedures that are used by the U.S. Group Risk Plan (GRP), which is a similar product, could be adopted to give farmers more choices (different threshold yields) and to set premium rates (see Skees, Black, and Barnett, 1997). If area-yield insurance contracts and the premium rates are set using acceptable procedures, this will greatly improve the fiscal exposure of the current program. More fundamentally, if such procedures were followed, it may also improve the likelihood that international reinsurers would be willing to share the risk and mitigate the extreme exposure of bad years for the *GoI*.

Establishing a Standing Disaster Program

The poorest of India currently have little access to the current crop insurance program. Some of the current infrastructure of an area-yield program could be used to target the poor in India. This would involve a "free insurance" at low levels of coverage (e.g., Rs10,000). However, as is developed in the conceptual section, a disaster should not be defined as the percent below average. Rather, frequency of a specific event is a more appropriate way to define a disaster. It is possible to establish threshold yields so that everyone gets the same expected benefit. Such a system would give a more appropriate focus on defining a disaster. For purposes of budget control, the *GoI* might consider setting the threshold yields for the "free insurance" so that it gives an expected benefit of 2 percent pure premium for everyone. If all 100 million farmers in India used such insurance the total budget exposure would be roughly 2000 Crore. Importantly,

with such a policy, *all* farm households could have a base level of protection. This policy could help to rationalize and better target *ex ante* emergency payments in India. The current *ex post* system of disaster assistance is draining public resources in India in an ineffective and inefficient fashion.

Further Refinements

Once the *GoI* improves the core product (the area-yield insurance product), there are many other refinements and uses of the program that are possible. This is particularly true if contracts are properly designed and priced in an actuarially sound fashion. The area-yield insurance product could facilitate the expansion of rural financial markets through several mechanisms, including:

- Insuring crop-loan portfolios directly by banks and other financial entities via purchasing a customized area-yield insurance contract.
- Providing reinsurance to mutual insurance groups or other local groups who seek to organize their own solutions to the idiosyncratic risks of individuals within the group: such solutions may involve formal or informal arrangements to use payouts from area yields to compensate individuals within the group for their own losses.
- Using the area-yield insurance contracts to support savings accounts that are designed to help individuals manage risk by providing for matching payments to savings withdrawals when area-yield payouts are large (see Hess, 2003).

Section 1: Introduction

This report reviews both the broader policy issues regarding government response to crop failures and specific issues related to the crop insurance program in India. It is part of a larger World Bank review of rural finance in India. Given that nearly three-fourth's of India's one billion people live in rural areas with a heavy dependence on agriculture, it is appropriate that the Indian government be concerned about crop failures.

Nearly all of India had significant shortfalls in rain for the 2002 Kharif season.[3] Anyone familiar with India did not require this event as a reminder of the harsh climate that influences the livelihoods of the rural poor. Nonetheless, 2002 provided a cruel reminder of how delays or failures of the monsoon rains can inflict hardships upon crops, livestock, and the day-to-day lives of literally millions of poor in India. Additionally, since agriculture comprises roughly 26 percent of the gross domestic product (GDP), crop failures are also disruptive to India's general economic health.

In recent years, the Indian government's response to crop failure has focused on expansion of the crop insurance program. The issue of crop insurance continues to generate a lively public policy debate inside India. Even as this report is written, there are pronouncements from the government of India (*GoI*) regarding major changes in the crop insurance program. This report raises serious questions about two key aspects of crop insurance in India: 1) the shortcomings of the program in helping farmers gain access to credit; and 2) the rapidly increasing cost and open-ended fiscal exposure of the current program. While the report is critical of certain aspects of the crop insurance program, it also offers significant suggestions for working within the current structure to improve the performance of the program. Among the largest shortcomings of the current program is timeliness of payment. Again, the 2002 crop failure serves as a case in point. Many farmers began the Kharif season in 2003 without a payment from the crop losses suffered in the 2002 Kharif season. The payments were delayed well beyond nine months. It also seems that delays are even longer when the crop year is bad, as many states have trouble organizing the needed finances to pay large losses.

It is not all together clear who is damaged greater due to the long delays in crop insurance payments — farmers or banks. In some cases, farm loans continue to accrue interest payments on the portion of the expected indemnity payment until the payment is made. This can easily reduce the "real value" of the indemnity payment by 15 to 20 percent given nine-month delays with interest rates that are over 20 percent. Farmers also suffer when the crop insurance payments are delayed, as this can lead to denied access to loans for the new crop year. Banks suffer in disasters when the *GoI* forces them to reschedule loans without interest payments. Banks also suffer when borrowers default on loans.

Given the high opportunity cost of limited fiscal resources, the current and future costs of India's crop insurance program present a challenge. Recently, the Indian government announced a plan to make all premiums actuarially sound while raising the premium subsidy for small and

[3] There are two growing seasons in India, *Kharif* (generally April–September for spring crops) and *Rabi* (generally October–March for fall crops). While data on insurance are not separated by season, it is important to note that only about 10 percent of the premium comes from the *Rabi* season. Additionally, loss experience is over 500 percent for the *Kharif* season and about 200 percent for the *Rabi* season.

marginal farmers from 50 to 75 percent. More will be said about estimating the cost of these subsidies below. It is possible to estimate the government cost of the current crop insurance program. Within two years, the expected costs will exceed one-half billion U.S. dollars or 2400 Crore. Currently, Indian farmers are paying only about 20 percent of the estimated full cost of the crop insurance program (which does not comprise some of the administrative costs). Indemnity payments in 2002 totaled about 2200 Crore or US$470 million, while premium payments totaled 362 Crore.

Yet more critical is the growth path for crop insurance in India. Since the major changes made in 1999, the program's fiscal exposure has increased at a pace in excess of 20 percent per year. This suggests that without strong adjustments to make actuarially sound premiums, in five years the program cost could be twice its current level. Despite the heavy expenditures, only around 10 percent of the crop area is covered by crop insurance. Extrapolating current trends, in five years that number would reach 20 percent. Even if the Indian government effectively establishes actuarially sound premium rates, the cost of the subsidy for small and marginal farms could be significant since the vast majority of Indian farms are small. The 1990-91 Census shows some 83 million small and marginal farms accounted for some 54 million hectares. There are ways to control these costs and maintain a core support for these farmers without undue fiscal exposure. This report examines this important issue. Beyond the potential fiscal exposure of the Indian crop insurance program, a careful analysis should also examine the benefits of these public expenditures. This study frames the issues and begins that process. Nonetheless, we cannot provide a full analysis of the benefits.

Economic theory can be used to highlight the problems associated with substantial crop insurance subsidies. As with any subsidy, farmers have the incentive to put more resources into growing crops that are eligible for subsidies. Many of these crops are already in surplus due to the government minimum support prices (MSP). And while convincing arguments can be made that crop insurance can spur rural finance, it is also important to sort out how the *GoI* facilitates rural finance with the current crop insurance program. The current program encourages borrowing and then leaves the farmer in debt long after the crop fails due to the long delays in payment. Given these delays, and in the absence of debt moratoriums, it is likely that bankers benefit more than farmers. In addition, other distributional issues can be raised regarding the current program since the unintended subsidies that are embedded in the current low-rate structure are directly tied to the amount of insurance purchased. Since there is no longer a limit on how much insurance protection can be purchased, large-scale farmers benefit significantly more than small-scale farmers. Finally, the past performance of crop insurance in India clearly demonstrates that the benefits of excess government expenditures are heavily skewed. In fact one state within India receives over half of the indemnity payments.

Recent announcements about changes in the crop insurance program suggest that Indian policy makers are trying to address these problems by developing a program that covers the dual function of social aid for the poor and a sustainable crop insurance program supported by farmer premiums. These changes will not be easy and they will require some specific expertise, in particular, in using historic data to develop appropriate premium rates. Even with lower subsidies, *ex ante* risk management tools such as crop insurance should improve access to credit among the rural poor. With proper designs, crop insurance can ease the shock related to crop failure, helping to smooth the income losses and financial inputs for the next planting season.

Thus, crop insurance could be an important element in deepening access to rural credit needed to spur agricultural productivity in India.

Ex ante social aid and risk management is preferred over many policy choices. However, the implementation details of how to achieve these dual objectives are essential, and designing such policies within India will not be easy. Many of the core elements for a successful reform can be built upon the current crop insurance program and the emerging markets in India. Creating transparent programs where fiscal exposure is limited and emerging markets are fully utilized will be important for effective reform.

Section 2: Multiple Objectives: Framing the Problem[4]

At the outset it is critical to recognize that multiple objectives are always present in government response to crop failure. These may include both social intentions and political agendas that have little to do with helping the poor. While a number of weather events can be responsible for crop failure in India, drought is the most common. There is a heavy political dimension to any government response to drought and other natural disasters.[5] Such attention leads to multiple responses from government.

Droughts are among the most difficult natural hazards for which to develop effective public policy responses. Unlike an earthquake or a hurricane, a drought emerges slowly. When is a response appropriate? One region's drought may be another region's normal year. People living in semi-arid regions have developed coping strategies for drought over hundreds of years. Government response can interfere with these coping strategies. *Inappropriate government response can make the situation worse*. If decision makers come to expect significant government aid when a drought occurs, they will modify their behavior to take on more risk by either planting more or adding more inputs to current plantings. This behavior increases future government expenditures as there will be more economic exposure by the time of the next drought.

An important aspect for framing the question of public response to crop failure is to perform a more complete risk assessment by region. Even here, there are many intertwined operational issues. For example, if one is focused on drought, what threshold of rainfall constitutes a drought? In many cases, policy makers turn to some rather simplistic notions to define a drought. For example, agronomists can provide information regarding the amount of rainfall needed during a growing season for a specific crop. However, if that threshold of rain is only met one out of two years, should that be considered a drought? If the event occurs very frequently, it is a common part of the environment and should not be considered a disaster; other adjustments are needed (e.g., different crops, developed infrastructures, etc). A more appropriate anchor for considering a disaster situation is *frequency of the measure*. Asking the political process to frame the problem in this fashion is important. This forces a more careful discussion of the issue. How often can the government afford to respond? If the government must provide some form of aid one out of three years, it is unlikely that such a program can be sustained. If the event occurs one out of ten years, is that a more reasonable frequency to merit government response?

To the extent that social objectives motivate government responses, in a short time such responses can grow to be quite costly. Careful consideration is needed in designing government responses that will overcome market failures and create more efficient and productive use of resources. Even then, it is important to consider the social cost of the alternatives versus the social benefits. Such evaluations are extremely difficult in a complex environment like India. Nonetheless, some basic principles can be applied to gain insights into the trade-offs associated with various policy choices.

[4] The Kalavakonda and Mahul study on crop insurance in Karantaka frames the issues in a similar fashion.
[5] In his book, *Everyone Loves a Good Drought*, P. Sainath highlights the popularity of making even small droughts in India a media event. Such media attention is not unique to India.

Government responses should address market failure problems. Two classes of government action may be more appropriate than direct government aid:

1. Redefining property rights
2. Strengthening rural finance

In many ways these issues are very much interrelated. The poor have limited property rights which limit their access to rural finance. Rural finance involves savings, borrowing, and insurance. Facilitating proper insurance markets to mitigate the impact of a natural disaster can improve access to rural finance. However, the way that insurance markets are facilitated with government action does indeed matter. Who has access to rural finance and crop insurance subsidies is important when considering the impacts of these programs on both the rural poor and the developmental process.

2.A. Basic Policy Goals

After discussions with policy makers in India, three overall policy goals seem to be most important when considering government response to crop failures in India.

1. Risk Management. Improving rural financial services available to farmers, including their ability to manage commercial risk, is important for improving access to rural finance.

2. Social Response. Providing for social responses that assist the poor who stand to lose the most during severe crop failures is an appropriate goal for government.

Controlling the fiscal exposure of the government is also important for *GoI* given limited fiscal resources. It is believed that systems which improve risk management and help stabilize farm incomes will improve access to rural financial services — more broadly defined as savings, borrowing, and insurance. Nonetheless, it is not a forgone conclusion that providing government-sponsored crop insurance will improve the rural finance sector. This report raises serious questions about the extent to which India's current crop insurance program fails to improve the rural financial sector. If more complete financial services are made available to farmers, they would be in a better position to use more advanced and efficient production technologies that could spur economic development

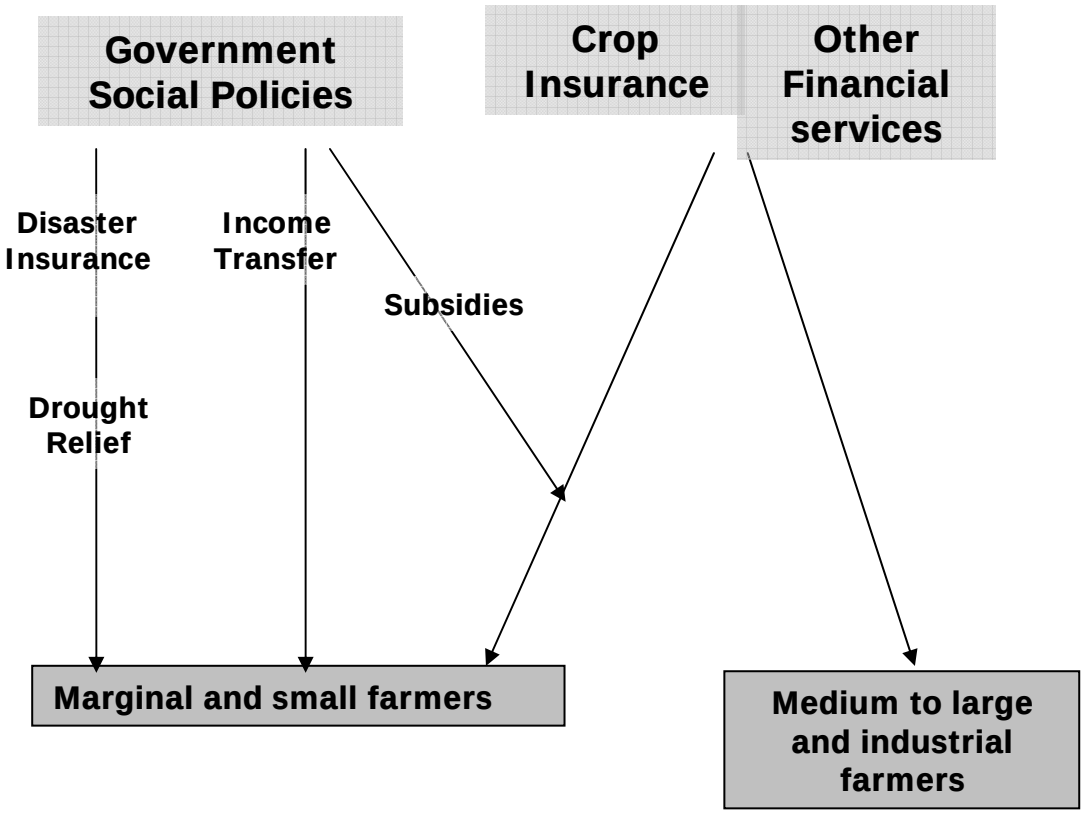
Insurance is not always the best instrument to achieve these goals. Worse, using crop insurance to meet social objectives can defeat the utility of the insurance instruments for risk management objectives. Heavily subsidized non-actuarial "insurance" used as a relief instrument for social goals crowds out actuarial insurance that really addresses the needs of a farming sector transitioning from subsistence and food crop farming to higher value farming. In many cases, the intended and unintended subsidies of a crop insurance program will also crowd out private sector instruments that could offer tailor-made solutions to farmers' risk management needs.

Crop insurance can be used to achieve the risk management goal. Using crop insurance to reach social goals is not as straightforward. To begin, the poorest citizens in rural areas may have control over very small or no plantings. Since the benefits of traditional crop insurance schemes are directly tied to the size of the plantings, this limits the access of the poorest rural members. Yet, when crop conditions in the area are very bad, these citizens may actually suffer the most when their sources of revenue are tied to the agricultural output. Thus, the social response goal may require other actions, such as drought relief, disaster insurance, and cash transfers.

When insurance-like solutions are used to achieve social goals, there should be great care. Simply subsidizing premiums at a flat percentage value is not an effective way to introduce such subsidies. Rather, the subsidies should be targeted so that they compensate for the cognitive failure of individual decision makers. This can be effectively accomplished by introducing programs that compensate for the catastrophic risks. Catastrophic risks are those risks that are infrequent but very large. Programs that target catastrophic risks can be complementary to insurance. In other words, crop insurance starts where catastrophic relief stops. Frequent drought relief and income transfers crowd out real actuarial crop insurance, as can be seen in India and certain countries in the European Union.

This crop insurance assessment is based on the framework of how government and private sector should address crop failures shown in Figure 2.1.

Figure 2.1. Schematic of Goals for Disaster Assistance



The government response should use limited government funds to achieve the most impact. Given this constraint, it is likely that the government of India would also do well to consider how this can be done by facilitating emerging markets. As will be developed below, indemnities from the existing area-yield insurance product could be made assignable to banks and insurance providers in India as they introduce new products. Farmers would first purchase the government area-yield insurance product and then transfer some or all of the indemnity payments to the provider of a tailored product in higher demand than the area-yield insurance product. Such a mechanism would serve as a form of localized reinsurance to cover the correlated risk. Such an innovation could open the way for the emerging banking and insurance sector to become more involved, improving financial services in the rural sector. The key will be to do so without allowing undue rent seeking. Developing transparent and well-specified rules about how banks and insurers use base insurance products will be critical.

Section 3: International Experience in Dealing with Crop Failure

Policy responses to drought can be divided into two major categories: 1) those involving some form of compensation; and 2) those designed to mitigate the effects of drought. Deshpande lists the following under compensation programs:

A. Crop insurance
B. Crop loan insurance
C. Disaster assistance payments
D. Debt forgiveness programs
E. Subsidizing inputs after the drought

Deshpande includes the following programs designed to mitigate the effects of drought:

A. Irrigation and watershed management systems
B. Plant breeding for drought tolerance
C. Promotion of diversification and varieties that provide lower correlation to dominant crops
D. Community action for crop plant protection, watershed management, etc.
E. Support for infrastructure to promote dryland technologies
F. Institutional reforms in agricultural credit, land tenancy, land reforms, etc.

This report focuses on compensation programs. Two major types of compensation programs dominate the international arena: 1) traditional crop insurance that gives individuals the opportunity to protect against natural disaster risk *ex ante*; and 2) disaster aid that gives assistance *post hoc*. There are important differences between these strategies that involve access, incentives, and costs to society. Free disaster aid can work at cross-purposes with crop insurance by reducing the incentives for individuals to purchase insurance.

3.A. Problems with Traditional Crop Insurance

Government-supported crop insurance has been touted for years as being an important innovation for helping rural households manage risk since, conceptually, it provides well-targeted compensation for yield-related risks. In addition, crop insurance can be used as collateral for small and medium farmers who would not be able to obtain credit otherwise. These arguments are attractive since credit plays a major role in development.

Still, there are very few examples of successful crop insurance programs without heavy reliance on government subsidies (Hazell, 1992; Skees, Hazell, and Miranda, 1999; Skees, 1999b; and Skees, 2001). The use of public funds to support crop insurance is questionable since these funds likely have a high opportunity cost in many developing countries. Moreover, crop insurance programs are directly linked to the crop size being grown by individuals. This has important implications for the distributions of benefits from the

programs. Not only do such programs generally favor those farmers growing the most, they do not compensate non-farmers when the rural economy is affected by crop losses.

More fundamentally, the success of crop insurance programs has been curtailed due to adverse selection and moral hazard problems. Adverse selection means that those who know *ex ante* that their risks are high are the most likely to buy the insurance. Moral hazard occurs *ex post* as farmers change their behavior in ways that make them more risky to the insurance provider. The dual problems of adverse selection and moral hazard increase the cost of crop insurance. Typically, these problems are far greater in multiple-peril crop insurance programs that are paid based on estimates of individual farm yields. Moral hazard and adverse selection are not as problematic under area-yield index insurance programs where individual payments are based on what happens to area yields. India has such a program. Nonetheless, as will be demonstrated below, India has tremendous problems with its area-yield insurance program.

Beyond the problems of adverse selection and moral hazard is the difficulty of pooling the correlated risks present when insuring crops against natural disasters. This is a particular problem in developing countries. In the absence of government programs to finance the large losses that accompany a widespread crop failure, primary insurers must rely heavily on traditional reinsurance markets. Reinsurance markets are inefficient, costly, and suffer from pricing cycles that respond to major losses (Froot, 1999; Kunreuther et al., 1995; Noonan, 1994; Jaffee and Russell, 1997; Stipp, 1997). Access to reinsurance in developing countries is also extremely limited. Reinsurance can be expensive or impossible in many cases, as most reinsurers shy away from providing their services for agricultural risk in developing countries. The few international reinsurers that understand agricultural risk rightly conclude that there are problems with underwriting crop insurance in developing countries.

Finally, the demand for crop insurance is curtailed by the cognitive failure problem among individuals in assessing catastrophic risk (Kunreuther and Slovic, 1978; Kunreuther, 1996). Thus, even when a decision maker may be able to afford insurance, they may underestimate the real risk and decide that the price of insurance is too high. This disconnect is even more pronounced given that crop insurance providers must add extra premium for the correlated risk that can cause catastrophic losses.

3.B. Problems with Free Disaster Assistance

If traditional crop insurance is neither the most appropriate nor affordable means for poor farmers, what else can governments do to compensate for income losses from natural disasters? Free disaster assistance is a common response, even among poor countries. In many cases free aid is the result of the contributions that come from the international donor community after a natural disaster. However, international aid is more likely to come in the face of major hurricanes and earthquakes and is not as forthcoming when the natural disaster is a slowly developing drought. Delays in the disbursement of aid are common as well. Furthermore, disaster aid is almost always *post hoc* with few rules and no real knowledge about how much will come and who will get the aid. This raises serious equity questions and opens the door for corruption and abuse.

In many developing countries, *post hoc* disaster aid comes in the form of debt forgiveness. Debt forgiveness does not help the poorest rural residents since most of them do not have credit. For that matter, few countries actually have disaster aid programs that are targeted at the poor.

Economists are rightly concerned with the incentives embedded in free disaster aid (Anderson, 1976; Dacy and Kunreuther, 1969; Freeman and Kunreuther, 1997; Kaplow, 1991; Kunreuther, 1973, 1993, 1996, Rettger and Boisvert, 1979; U.S. Government Accounting Office 1980, 1989). When households come to expect government compensation for natural disaster losses, they will take on additional risks. If they do not bear the consequences of risky decisions, they will engage in activities that expose them to still more risk. For example, in the United States well-intentioned federal relief has likely encouraged further development along geologic fault lines and hurricane prone coastal areas (Noll, 1996; Epstein, 1996; Rossi, Wright, and Weber-Burdin, 1982). Research by Keeton, Skees, and Long (1999) suggests that the U.S. federal agricultural disaster assistance and heavily subsidized crop insurance encourage crop production in marginal areas. Disaster relief becomes self-perpetuating when individuals do not get proper price signals about their exposure to losses from natural disasters.

To avoid some of the problems with free disaster aid, risk must be internalized or at least made explicit. Insurance and other risk-sharing markets make risk explicit by pricing risk so that decision makers can fully see the real cost of the risks they face in these markets. Subsidies distort the pricing of risk. Free disaster aid may be justified based upon social criteria. Nonetheless, great care must be taken and it is critical that well-defined rules for the provision of such aid are established *ex ante* to avoid serious rent-seeking and equity problems.

3.C. International Experience with Crop Insurance

Over 100 countries in the world have some form of crop insurance. The United States, Canada, Mexico, and Spain dominate the world crop insurance market in terms of premium. North America and Europe have a combined total of 90 percent of the world premium for crop insurance. And while there are important differences among these countries, they each offer individual multiple-peril crop insurance (MPCI) that requires heavy support from the government[6].

Named-peril policies such as hail insurance have successfully been offered by the private sector. However, the success of the private sector offering multiple-peril policies is extremely limited. Multiple-peril policies are often favored by government and producers, yet this type of insurance is extremely expensive to administer. Once this type of program is introduced and subsidies are provided, it becomes very difficult to alter the program design to curtail costs and inefficiencies.

Performance of publicly supported multiple-peril crop insurance has been poor when all costs are considered. If companies were private, the premiums collected would have to exceed the administrative cost and the indemnities paid out. Hazell quantifies the condition for sustainable insurance as follows:

[6] Appendix A contains details of the U.S. crop insurance program.

$$(A + I) / P < 1$$

where A = average administrative costs
I = average indemnities paid
P = average premiums paid

Given this ratio, Hazell finds that in every case the value exceeds 2 (Table 3.1). This means that the support from government is at least 50 percent. However, there are cases where farmers are clearly paying only pennies on a dollar of the real cost of the crop insurance program. A ratio of 4 means the farmer pays only 25 cents per 1 dollar of total costs. Skees (2001) reports a ratio of 4 for the current U.S. crop insurance program and Mishra reports that India's I/P ratio increased to 6.1 for the period 1985–94.

Loss ratios indicate the actuarial soundness of an insurance program by comparing the total payouts (indemnities) to total revenue (premiums). Table 3.1 has only one case where the loss ratio of indemnities over premiums approaches 1 — Japan. In this case, the administrative costs needed to achieve this loss ratio are quite unbelievable — over four and one-half times higher than the farmer premium. It seems a very high price to pay to obtain "actuarially sound" crop insurance. The other strategy in reaching this goal is to make the premium subsidy high enough so that there is no adverse selection — even the low-risk farmers soon learn that crop insurance is a good buy. Once these lower risk farmers are in the risk pool, the actuarial performance can improve, especially when the system measures the unsubsidized premium against the loss experience. Obviously this is an accounting exercise and reflects little about the true performance of the program. This is what the United States has done in recent years (Skees, 2001).

Table 3.1. Financial Performance of Crop Insurance in Seven Countries

Country	Period	I/P	A/P	(A+I)/P
Brazil	75-81	4.29	0.28	4.57
Costa Rica	70-89	2.26	0.54	2.80
India	85-89	5.11	n/a	n/a
Japan	47-77	1.48	1.17	2.60
	85-89	0.99	3.57	4.56
Mexico	80-89	3.18	0.47	3.65
Philippines	81-89	3.94	1.80	5.74
USA	80-89	1.87	0.55	2.42

With such poor performance one must ask if it is even possible to run an individual multiple-peril crop insurance program that is self-sustaining. Furthermore, one should ask why we have such poor performance. Important differences in farm structure also play a role in considering alternative approaches to crop insurance. However, it must be acknowledged that such a program is more likely to be funded in a wealthy country like the United States, and that the farms are very different in the United States as well. An average farm size in the United States is much larger than in India. As farm size increases, monitoring costs should

decline. Nonetheless, even in the United States, the information required to deliver and monitor individual multiple-peril insurance programs is daunting. This kind of monitoring in India would be simply out of the question. With individual multiple–peril crop insurance, the insurer must know the following for every individual insured unit:

Insurance yield. Estimating the expected yield for an insurance unit is a daunting task. For the U.S. federal crop insurance program, insurance yields are based on a simple average of the most recent 4-10 years of realized yields on the insurance unit. Farmers can establish an initial insurance yield with as little as four years of yield records (there are significant penalties if farmers cannot provide at least four years of yield records). As the farmer builds toward 10 years of yield records, the realized yield in a given year is incorporated into the calculation of insurance yield in subsequent years. When the farmer has built 10 years of yield records, the insurance yield is calculated as a rolling average of the most recent 10 years of realized yields. This is a rather crude method for estimating the central tendency in yields. Due to sampling error, insurance yields can either underestimate or overestimate the true central tendency depending on the random weather events over the most recent 4-10 years. The effect of sampling error is further compounded by the fact that for most multiple-peril crop insurance programs, insurance yields are also the primary (if not the only) mechanism for relative yield risk classification. Thus, the mechanism for establishing insurance yields can lead to adverse selection where only those farmers who believe they are getting a fair or better offer will choose to participate. Farmers who think the insurance yield is too low will not participate. Also, since farmers provide the yield records on which insurance yields are based, there are opportunities for fraud.

Loss adjustment. It is complicated and expensive to measure realized yields for determining payable losses. Most farmers do not like the idea of having someone come to their farm to estimate the realized yield. Nor is loss estimation a precise science. As is implied by the word "estimate," measurement errors are common. Additional investment in personnel and training is required to minimize measurement errors. When losses are widespread, a very large workforce of trained individuals is needed. In the United States, farmers are often allowed to self-report realized yields. Spot checks are conducted with penalties for filing false reports, yet there are opportunities for farmers to receive payments that are not warranted.

Gross premium rate. For most insurance products, premium rate calculation is based on historical loss experience. However, calculating crop-yield insurance premium rates is more complex. One would ideally like to know the yield distribution for each individual farm. That is, one would like to know all of the possible yield outcomes and the probability of occurrence for each of those outcomes. But as indicated above, most crop-yield insurance programs have difficulty estimating even the central tendency in yields. Estimating factors that influence the higher moments of the yield distribution is much more problematic. Furthermore, simply knowing the yield distribution for a well-classified group of farmers may not be enough. Extra losses (beyond those represented by the yield distributions) can occur due to moral hazard.

The considerations discussed above offer insight to the difficulties of designing an efficient and equitable insurance program that pays for individual losses. Up to this point, the *GoI* has avoided the use of such programs avoiding many of the problems outlined here and in

Appendix A on the U.S. crop insurance program. A key to the future will be how the *GoI* responds in fixing the current area-yield insurance program and allows for market innovations that build on that basic instrument.

3.C.1. Mexico as a Case Study

Mexico offers an interesting case study that has implications for Indian policy makers who are struggling to achieve multiple objectives using the crop insurance program. In Mexico both a disaster relief program and crop insurance program are offered to help farmers manage natural disasters. Skees et al. (2002) review the Mexican experience in depth, providing recommendations that are similar those in this study and in the Kalavakonda and Mahul study about how to use collective groups of farmers who can serve as 'mutual insurers' once the correlated risk is removed with index insurance contracts. The Mexican crop insurance program has moved from government playing a primary role in selling and servicing individual crop insurance policies to government acting strictly as the reinsurer for a system where both the private sector and groups of farmers (FONDOS) sell and service crop insurance policies. FONDOS are structured groups of farmers in the same region. In effect, they are similar to mutual insurance providers. The Mexican government subsidizes crop insurance premiums at rates varying by state between 20 and 45 percent, applying higher subsidization rates in the more underdeveloped states.

Among the more important lessons from the Mexican crop insurance experience in recent years is the use of weather markets to serve as reinsurance. This is important for India as it becomes more important for the *GoI* to use international capital markets to smooth the expenses of the disaster and crop insurance program. The traditional reinsurance industry is unlikely to provide an efficient means to offset the risk from the current crop insurance program in a direct fashion. The primary reason is the reinsurance industry will be highly guarded given the program history and the current rate of expansion. It will not be easy to convince those in the global reinsurance market that the Indian crop insurance program represents a reasonable risk. This market increases rates charged significantly when they are not comfortable with the risk. More fundamentally, even if the premium rates were set in a fashion that is actuarially sound, losses are still a function of how the *government* estimates area yields that trigger indemnity payments. Reinsurers would be concerned about moral hazard on the part of the government.

An alternative to traditional approaches directly on the losses of the *GoI* crop insurance program is to determine a proxy for losses based on objective weather measurements. It is highly likely that the portfolio of insurance is strongly correlated to weather events across India. Weather data can be more easily verified using secondary sources of information. For example, grids of basic weather data (temperature, rainfall, and wind speed) are developed via the World Metrological Organization (WMO). These data are available from the U.S. NASA (National Aeronautical and Space Agency). Reinsurers are increasing the use of such data to remove the extreme losses from weather events.

To the point, world markets (both traditional reinsurers and weather markets) may be interested in a policy that would pay the *GoI* based on catastrophic weather events. This is precisely what happened in Mexico. Innovations such as those used in Mexico may be important in India as the central government increases it share for covering excess losses

from the National Agriculture Insurance Scheme (NAIS). For that matter, the states could also protect against their extreme losses using the same approach. Having a "weather hedge" at the state level might be a superior approach for the entire portfolio.

The 2002 crop experience demonstrated the extent of the exposure for the Indian government. A very large percentage of these losses can be directly linked to the lack of rainfall across regions where crop insurance participation and exposure was large. As the exposure grows, the prospects for the Indian government's ability to finance catastrophic losses such as those suffered in 2002 will be greatly challenged. While the 2002 losses exceeded 2000 Crore, participation in the crop insurance program was only about 10 percent of the potential plantings. Excess loses will increase proportionally as participation increase

In addition to learning from the Mexican government crop insurance program, the *GoI* might also glean some lessons from FONDEN, the Mexican disaster relief program.[7] FONDEN payments are triggered only when droughts, frost, or other perils affect most producers in a region — that is, FONDEN only pays out against correlated risks. FONDEN provides disaster relief for a variety of public sector assets in various sectors in Mexico, including agriculture. The agricultural component of the program has characteristics similar to crop insurance. For example, FONDEN makes payments to local governments in response to many of the same perils covered by private insurers — for example, wind, drought, and frost. India is well positioned to implement such a system with the current area-yield insurance program.

FONDEN is the Mexican government's disaster relief program, established to provide compensation for correlated losses arising from natural disasters. Agriculture is just one of the sectors eligible to receive relief funds from FONDEN. FONDEN payments are made only after the declaration of a disaster by the government. Various levels of government are involved in both the declaration of a disaster and in sharing the payments. This is a time-consuming and potentially conflictive process, despite the strong guidance provided by FONDEN rules. Indeed, there are reports that it may take 5-6 months for FONDEN payments to actually be made to state trust funds, thereby engendering liquidity problems and complaints at the state level.

Within the agricultural sector, only smallholders are eligible to receive FONDEN payments via local governments; however, the definition of smallholder varies according to regional and agronomic differences. Eligibility requirements range from five or fewer hectares to twenty and fewer hectares depending on the state. FONDEN also restricts the number of hectares eligible for payments to limit payments to any one farmer. In addition, irrigated land and insured lands are not eligible for FONDEN payments. Payments vary with type of crop. Payments for agricultural losses from FONDEN from 1997-99 totaled nearly 1 billion pesos (approximately US$110million) for the three-year period. Generally, FONDEN payments were spread out among many states.

FONDEN payments are triggered through a discretionary process, and for this reason it is difficult to determine the likelihood of a FONDEN payout. However, setting aside political uncertainties, FONDEN guidelines provide strict definitions of certain types of perils. For

[7] More details about FONDEN are provided in Appendix B

perils such as drought and frost, the guidelines are similar to the types of triggers found in parametric insurance. Unlike regular crop insurance, parametric insurance does not directly compensate for assessed losses, but rather pays out when an agreed-upon indicator meets an agreed-upon condition — for example, when the temperature recorded at a defined weather station falls below a certain level. Consequently, transaction costs associated with the insurance are lower, since field assessments of damage are not required. Parametric insurance is also easier to price, since the expected payouts from the insurance can be estimated by calculating from historic data the probability of the trigger condition being met.

Although the rules for drought and frost are reasonable and technically well defined, the rules result in differing levels of coverage for different regions. Drought protection is greater in areas where the variance of rainfall is greater and frost coverage is greater for colder climates and for crops whose growing seasons makes them most susceptible to frost. Consequently, FONDEN rules unintentionally reward risky behavior. Such perverse incentives can be easily changed by rewriting FONDEN rules so that payouts are given equal probability across regions: for example, using historic weather data, define drought as occurring when the rainfall for two consecutive months falls below a trigger defined as having a 10 percent probability of occurring.

Section 4: The Indian Crop Insurance Experience

Indian scholars have written about the problems of attempting to insure individual farm yields since the early 1900s. India is the home for conceptual thinking about using index-based insurance such as rainfall indexes or area yields. Area-based crop insurance products have been at the core of Indian crop insurance since the initiation of the Comprehensive Crop Insurance Scheme (CCIS) in 1985. The CCIS was replaced with the National Agricultural Insurance Scheme (NAIS) for the 1999 Rabi season. The NAIS made many changes and is still undergoing important changes. Among the most important changes were 1) more crops are covered; 2) nonloanee farmers can now buy crop insurance; 3) the cap on liability was raised to the value of 150 percent of average yield per hectare (it was Rs 10,000 per farmer per season); and 4) an attempt has been made to set actuarially sound rates for commercial crops. More states and more farmers are now participating in the crop insurance program as well. For Kharif season 2002, more than 9.7 million farmers had insured a total of 48.6 million hectares.

This report assesses the experience of both the CCIS and NAIS as there is limited data on the NAIS scheme. Special adjustments are made in the historical data to reflect recent changes. Both the CCIS and NAIS use area-yield insurance programs as the core offering. While there are certain disadvantages to using an area-based scheme, the problems with using individual crop insurance would be tremendous given the small farm size and the millions of farmers in India. The only way to combat the dual problems of adverse selection and moral hazard that plague individual crop insurance is with more information. Obtaining farm-level data and monitoring individual farmers is an impossible task in most of India. The added cost of doing so would very likely offset the gains that may be involved in reducing the basis risk that is present with an area-yield insurance program. In fact, as will be explained below, there may be better ways of reducing the basis risk.

The problem with using the same yield in a geographic area as the base for making payments to all who grow the crop in that area is that there will be events when farmers experience a loss and do not obtain a payment. By the same token farmers who have no loss may receive a payment. This is referred to as basis risk. When the area is more homogenous and subjected to the same weather events basis risk will be less of a problem. Analytically, one must consider the trade-off between basis risk and the higher transaction cost that would be needed to deliver individual crop insurance. If data existed in India to perform such an exercise, it would be critical to also model the basis risk and misclassification problems that would accompany an individual crop insurance program. The academic literature is woefully lacking in providing such models. There are no articles that compare area-yield insurance products with the true nature of individual insurance. Rather than attempting to model the misclassification problems of individual insurance programs, the literature assumes perfect classification and perfect loss adjustment.

In the Indian setting, it should be clear that the added costs needed to develop an adequate individual crop insurance program would most certainly offset the advantage of potentially reducing basis risk for most farms in India. Where opportunities do exist to develop individual crop insurance products, area-based crop insurance can clear the way for private sector development as will be explained more fully below. *To the point, the concept of area-yield*

insurance in India is sound. Nonetheless, moving from concept to practice has not been easy. Many details must be worked out before one can implement an effective area-yield insurance program. There are several important dimensions of the program. These are developed below with a brief comment on each. More complete analysis of some of the key issues is developed in the next major section. The following list of important issues is considered:

A. What is being insured?
B. How are threshold yields determined?
C. How are indemnity payments calculated?
D. How are area boundaries to be determined?
E. What sales closing dates are used for the policy?
F. How is actual area yield determined?
G. Who is eligible to purchase area-yield insurance?
H. How much insurance (sum insured) are the insured allowed to purchase?
I. What premiums are charged?
J. How much subsidy is allowed?
K. How are premiums to be collected?
L. How are losses to be paid?
M. How is catastrophic risk financed?
N. Should crop insurance be compulsory for borrowers?
O. Are crop insurance portfolios reinsured?

4.A. What Is Being Insured?

The NAIS currently covers all major crops against natural, non-preventable risks.

- Food crops (cereals, millets, and pulses)
- Oilseeds
- Annual commercial and horticultural crops (cotton, jute, sugarcane, potato, onion, tapioca, chili, turmeric, ginger, annual banana, and annual pineapple).

The risks covered include, but are not limited to: natural fire and lightning, cyclones, typhoons, hail, flood, landslides, drought, pests, and disease. Insurance payments are based on the threshold yield that is established each year.

COMMENT: The NAIS is moving into new crops very rapidly. While it was not determined how much data are available for these new crops, it is likely that the data are limited. This compounds the opportunity for mistakes in rating and potential actuarial problems. As the GoI attempts to access international capital markets for reinsurance, they should consider separating their program into at least two groupings: 1) program crops with longer histories (10 years or more); and 2) new program crops (less than 10 years). This would likely enhance the negotiations with reinsurers.

4.B. How Are Threshold Yields Determined?

Threshold yields are based on a three-year moving average for rice and wheat, and a five-year moving average for all other crops. Yield averages are determined by the results of crop-cutting experiments. Threshold yields are set based on 60, 80 or 90 percent of the moving average yield for the area. This has been the only means for discriminating against differences in relative risks as premium rates are flat for the different crops. The coefficient of variation (CV) of the area yield is used to determine which coverage level will be used for the area:

Low Risk	90%	if CV is less than 15%
Medium Risk	80%	if CV is 15 to 30%
High Risk	60%	if CV is greater than 30%

COMMENT: The procedures used to calculate threshold yields are problematic. The NAIS is not effectively using the longer series of data that are available. The best procedures possible need to be used to estimate the central tendency of the yield probability distribution function (PDF). As will be demonstrated below, this issue is a critical first step toward developing actuarially sound premium rates. Using a three- or five- year moving average will result in significant estimation errors of the central tendency of the PDF. This opens the door for adverse selection among nonloanee farmers. Also, using limited data makes the program unfair, giving some farmers in different areas too little payment for losses and others too much payment. In short, both procedures for developing estimates of the "expected area yields" need to be adjusted, and the use of setting one threshold yield abandoned in favor of a more appropriate procedure to match premium rates to the risk and contract design thresholds. (More on these issues is developed below.)

4.C. How Are Indemnity Payments Calculated?

Indemnities are calculated as the difference between the area yield (as determined by crop-cutting experiments) and the threshold yield multiplied by the liability:

$$\text{Indemnity Payment} = \frac{\text{(Threshold Yield} - \text{Estimate of Actual Yield)}}{\text{Threshold Yield}} \times \text{Sum Insured}$$

COMMENT: This is an acceptable procedure for developing payments. Calculating the percentage shortfall from the threshold has several desirable properties: 1) for premium rating, the simple average of the percentages can be used as a pure premium; and 2) there is a built-in disappearing deductible: as one approaches a zero actual yield, the payment approaches 100 percent. The United States uses the same methods in the Group Risk Plan (GRP).

4.D. How Are the Area Boundaries to Be Determined?

Currently, the yield estimations are determined primarily at the Mandal or Block level. However, all state/United Territories (UT) governments are to have yield estimations at the Village/Gram Panchayat level within three years. The intent is to increase farmer participation in the insurance scheme. There are also some ongoing limited experiments to allow individual insurance for hailstorms, landslides, cyclones, and floods.

COMMENT: The desire to move to a smaller geographic boundary is reasonable to mitigate basis risk. Nonetheless, information from the field visits suggests that sampling would need to increase about fivefold to facilitate moving to the Village/Gram Panchayat level. This report raises the issues of using other markets to mitigate the basis risk. The issue of which approach is more cost effective needs to be seriously considered. Any reinsurers will be concerned about the degree to which the area-yield program is mixed with individual insurance adjustments, and smaller areas increase the perception of potential adjustments as well as sampling and technical errors due to the high numbers of crop-cutting experiments that need to be conducted.

4.E. What Sales Closing Dates Are Used for the Policy?

Sales closing dates are based on the two growing seasons, Kharif (April-September) and Rabi (October-March). For nonloanee farmers, the closing dates for submitting insurance declarations and premium payments is July 31 for the Kharif season, and December 31 for the Rabi season.

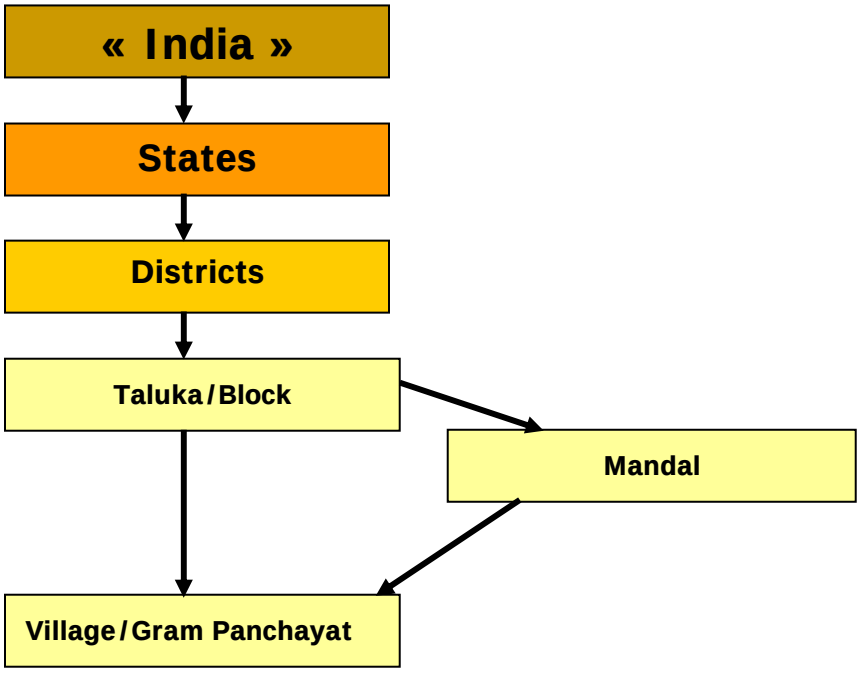
For loanees, declarations must be received before the end of the month following the month in which the loan is received. For example, a farmer taking out a loan in September must submit insurance declarations by October 30.

COMMENT: There may be some serious problems with sales closing dates on crops. As new crop insurance is optional for nonloanee farmers, they can adversely select based on how the crop year is advancing. It is critical that the sales closing be set at between four to six weeks prior to planting. Even these suggestions need to be reviewed based on the power of weather forecasts for India. In addition sales closing dates need to fit planting patterns that vary widely across the country and states. In Karnataka, for example, the monsoon and planting seasons start much earlier than in the northern states and should therefore have a different sales closing date.

4.F. How Is the Actual Area Yield Determined?

Figure 4.1 presents the hierarchy of government administration involved in administering the Indian crop insurance program. State implemented crop-cutting experiments are performed to obtain an official yield estimate used for determining yield shortfalls. The area can be Gram Panchayat, Mandal, Hobli, Circle, Phirka, Block, Taluka, etc., to be decided by the state government. The minimum number of crop-cuttings required varies by the unit area being used. At the Taluka/Tehsil/Block level, at least 16 crop-cutting experiments must be carried out. As the unit area decreases, so does the requirement for number of cuttings. Eight crop-cutting experiments are required at the Gram Panchayat level.

Figure 4.1. Administrative System for Indian Crop Insurance Program



COMMENT: Crop-cutting experiments are performed using scientific procedures relatively well-established in the world. What is not clear is how the political process enters into the development and modification of these numbers. Many levels of government are involved in reviewing and releasing the official estimates. This both slows the release of the numbers and introduces the possibility for changing the numbers. A reinsurer will be concerned about this process. The cost of reinsurance would be lower if a process could be developed that would be less subject to potential political manipulation. Furthermore, crop-cutting experiments are costly. There may be less costly and equally accurate procedures that could be used.

The United States uses a blended system of interviews on subjective yields and crop-cutting. This system may offer some possibilities in India. The U.S. agency that performs these services is the National Agricultural Statistical Service of the United States Department of Agriculture (NASS/USDA). The U.S. GRP program uses estimates from NASS to make payments. This system first estimates State yields and then Crop Reporting District yields. The county yields must be checked against these aggregate estimates. This provides important tensions in the system and prevents those who make local estimates to do so in isolation. The U.S. GRP program began by making early partial payments based upon the estimates of the Crop Reporting Districts. This practice was discontinued after a few years. However, if the yield estimates were done in a similar fashion in India, an early partial payment could be made for data that would be available on the aggregate units.

4.G. Who Is Eligible to Purchase the Area-Yield Insurance?

Crop insurance is available for all farmers in all participating states. It is compulsory for loanee farmers and voluntary for others, in contrast to the previous CCIS which was

available for loanee farmers only. Coverage insures against all natural, non-preventable risks. As of 2002, twenty-three states and UTs were implementing the NAIS.

COMMENT: There are still some important states, such as Punjab, that have not joined the NAIS. They have likely made a proper judgment that their yield risks are considerably lower than many other states and that the current procedures do not properly adjust the coverage and premium rates for the relative risk. Moving toward a system with voluntary participation is important. However, it also greatly increases the need to make certain that the insurance offer is correct and farmers are informed about the program.[8] Given that the program is still mostly based on area yields, moral hazard is not a major issue. Still, adverse selection is a problem, as demonstrated by significantly higher participation rates in high-risk areas. If farmers judge that the area yield is too low, they will not buy. If they judge that the area yield is too high or the premium rates are too low, they will purchase.

4.H. How Much Insurance (Sum Insured) Are Insureds Allowed to Purchase?

The sum insured (SI), or liability, for loanee farmers must be at least equal to the amount of the loan, but they may select additional coverage up to 150 percent of the average area yield. The monetary value is calculated by multiplying the insured yield by either the minimum support price (MSP) or the market price for crops having a MSP. Nonloanee farmers can insure values at 150 percent of the value of the threshold yield times the plantings.

COMMENT: As long as the program uses area-based yields and adverse selection issues can be controlled, issues of how to set the limits on sum insured are not critical. The procedures being used now are reasonable. Many farmers will have expected yields that are greater than the area yield. Thus, allowing them to scale up to 150 percent is a good practice. This is also a practice that is followed with the GRP in the United States.

4.I. What Premiums Are Currently Charged?

Premium rates increased slightly with the launch of the NAIS in 1999. Yet for many areas and crops, the rates still remain quite low. For food and oilseed crops, the rates below represent a rate ceiling, as the rate charged will be the lesser of the rate listed or the actuarial rate.

Premium rates for Kharif season food and oilseed crops are as follows:

- 3.5 percent for bajra & oilseeds
- 2.5 percent for other food crops

Premium rates for Rabi season crops are as follows:

- 1.5 percent for wheat and 2.0 percent for other food crops and oilseeds OR actuarial rate, whichever is less.

[8] In a recent survey of 435 poor people in three regions of Andhra Pradesh, the marjority of 51 farmers in the sample indicated that they did not know about the existence of crop insurance. Only one farmer had purchased crop insurance. Still about 25 percent of the farmers indicated that crop insurance should be a first priority.

- The premium rates for annual commercial/horticultural crops are to be based on actuarial rates

COMMENT: Developing an appropriate protocol for developing actuarially sound premium rates will be critical to gaining control over the fiscal exposure of the NAIS. Premium rates are woefully inadequate in many areas. Premium rates should be set based on the local relative risk for each crop. Procedures for doing this have been well-established. If the state chooses to subsidize smaller and marginal farmers, it shall do so in an explicit manner that does not alter the risk costing and therefore risk taking behavior by parties.

4.J. How Much Subsidy Is Allowed?

To the extent that rates are below actuarial levels, there is an implicit subsidy. As will be more fully developed below, that subsidy is quite large. Given that the historic loss ratio is greater than 500 percent, the implicit premium subsidy is 80 percent. This number varies greatly by state and crop. In addition, as the NAIS moves to make premium rates actuarially sound, small (less than 2 hectares) and marginal (less than 1 hectare) farmers have been eligible for a 50 percent premium subsidy. While the original plan was to phase these subsidies out, it is now proposed that this level of subsidy be maintained at 50 percent or raised to 75 percent. The cost of the subsidy is to be equally shared by the State/UT Government and the *GoI*. The subsidy for 2002-03 was 30 percent.

COMMENT: While it is common to set premium rates as a percent of pure risk premium, if the premium rates are actuarially sound such a procedure will favor higher risk regions. A cap on the rupee amount of subsidy per hectare, for example, would prevent a few farmers in high risk areas who take out the maximum liability to benefit more than proportionately from the subsidies. The GoI should also be concerned about the fiscal exposure of an open ended set of subsidy rules for small and marginal farmers. (More will be developed below on this issue.)

4.K. How Are Premiums Collected?

Village-level banks will receive the paperwork and premiums from farmers. The declaration forms and premiums are consolidated at a nodal bank and then turned over to the implementing agency (IA), which is now the newly created Agricultural Insurance Company of India (AICI).

COMMENT: Given the vast number of farmers and the potential expense of delivering crop insurance, this appears to be a logical solution. There are reports in the press of corruption within this system. The potential for bankers to demand some payment to provide these services is present as long as there is limited competition in the community. Opening the market to more suppliers could provide the needed tension to mitigate the potential for such corruption. As long as banks are used to deliver the crop insurance, the challenge of reaching the smallest farmers remains. It is unlikely that many of the smallest farmers have access to crop loans or even bank accounts. This could prove to be a major obstacle to achieving the goal of reaching the smallest farmers in India.

4.L. How Are Losses Paid?

State/UT Governments shall submit area-yield data to the AICI for settlement. Indemnity payments will be disbursed to the nodal banks and then passed down to the village level. Indemnity payments are ultimately credited to the farmer's loan or bank account.

COMMENT: This is a logical and potentially the lowest cost system. However, such a system still limits access and use by many of the smallest farmers. Long payment delays defeat the income stabilization goal of the government, especially if the farmer continues to pay interest on his crop loan.

4.M. How Is Catastrophic Risk Financed?

While there are some transition plans for food crops and oilseeds, the general plan calls for the AICI via the central government to cover all claims beyond 150 percent in the first three years. After the first three years, the central government will cover all claims beyond 200 percent. Claims beyond the first layer covered by the central government will be paid by a corpus fund that has contributions from the *GoI* and State/UT on a 50:50 basis.

COMMENT: This is likely to become a major issue. In 2002, claims payments required exceeded 2200 Crore. Some states were unable to fund the excess losses, delaying payments even further. The insurance program is subject to highly correlated losses that create a need for careful consideration of how to finance potentially large losses. To finance large loss ex ante, the GoI must make careful consideration of how to use government funds, reserve loading in premiums, and the international reinsurance markets. Catastrophic losses are also partially covered by drought relief measures, since around 70 percent of all crop insurance losses are caused by drought. [9]

4.N. Should Crop Insurance Be Compulsory for Borrowers?

Crop insurance is obligatory for loanee farmers, that is, crop loan borrowers.

Comment: The practice has the apparent advantage of increasing the penetration of the instrument and reducing adverse selection issues. On the other hand adverse selection issues creep back in to the extent that loanees are free to choose the sum insured up to 150 percent of the value of the average yield. Some farmers will go for the maximum, and others will choose the minimum, and probably loss ratios are higher for the first group. In addition, the crop insurance premium is often perceived as an additional cost of credit by farmers, particularly for those who have not yet received indemnity payments (that is, debt relief) or who perceive the indemnity payment delays as a cost that outweighs the instrument's benefits. If the proportion of these farmers is very high, the benefits of crop insurance might even be neutralized in terms of access to finance. The crop insurance premium shifts the demand curve for crop loans slightly to the left; the question is whether it significantly moves the supply curve to the right in order to achieve a higher equilibrium.

Once it is recognized that crop insurance has serious actuarial problems if large investments are not monitored, many policy makers conclude that they can make a crop insurance program actuarially sound by forcing all farmers to purchase the insurance. Given 100 percent participation, there can be no adverse selection. However, forcing farmers to purchase crop insurance invites even more moral hazard than does a voluntary program. Forcing farmers to purchase insurance will ultimately lead to a failed system. The economics literature demonstrates that moral hazard problems will be compounded, as even the better farm managers are more prone to change their behavior in ways that increase risk when they are forced to purchase insurance. In the farmer's mind, "If they are going to force me to purchase this, I will have a loss!"

In short, as soon as premiums become actuarially sound and thereby increase dramatically in most areas, the GoI and Reserve Bank of India (RBI) should consider making individual loanee's participation in the

[9] See M.K. Rao's analysis of GIC loss ratios in relation to weather and other factors.

NAIS voluntary. In practice, it should be the lending banks decision whether to impose this crop insurance requirement on borrowers.

4.O. Are Crop Insurance Portfolios Reinsured?

Currently, there is no reinsurance cover for the NAIS scheme. The AICI will seek reinsurance coverage while the company reforms the rate setting of the NAIS.

Comment: With the current rate distortions due to implicit and explicit subsidies as well as the choice of five- and three-year moving averages for the reference yields, it is difficult, if not impossible or at least prohibitively expensive, to obtain both proportional and stop loss reinsurance. However, it may be possible to obtain weather index-based reinsurance; as more than 70 percent of the former losses can be explained by weather events.[10] *Such coverage would be similar to the Mexican example of Agroasemex. Agroasemex is the national agricultural insurance reinsurer with a diversified portfolio across the country. Nevertheless, a series of adverse weather events could predictably increase losses beyond an acceptable level for Agroasemex. An international weather risk market maker constructed a weather index based on eight weather stations in Mexico that captured the risk exposure of Agroasemex. This policy was also thought to be considerably less costly for Agroasemex than the alternative of using traditional reinsurance. In effect, Agroasemex entered into a reinsurance treaty with a third-party reinsurer to facilitate the use of weather index reinsurance.*

[10] Personal conversations with M.K. Rao while in India, July, 2003. The Kalavakonda and Mahul study on crop insurance in Karantaka also investigates relationships with weather and crop yields in some detail.

Section 5: Performance of the Indian Crop Insurance Program

Having commented on the technical efficiency of the program, at this stage the economic and allocative efficiency of the program should be evaluated. Not all questions can be properly evaluated in this report. A partial list of questions follows:

Economic Efficiency

- To what extent does the program support rural lending?
- Does the support for lending lead to economic development?

Allocative Efficiency

- What is the opportunity cost of the government funds being used to support crop insurance?
- What is the expected growth and potential government cost of the program?
- What is the past actuarial performance of the program?
- How does the performance of the program vary by state?
- What is the catastrophic exposure that is represented in the program?
- What might the catastrophic exposure be if the program were actuarially sound?

5.A. Does the Current Crop Insurance Enhance Access to Rural Finance?

This discussion requires a brief review of the credit system in India. The formal credit structure for agriculture in India comprises rural/agricultural operations of commercial banks (around 52,000 branches); 196 regional rural banks (RRBs) with more than 14,000 branches, created specifically to address the credit needs of the rural poor and farmers; and cooperative banks including state-level and district cooperative banks (for short-term purposes) — together with around 13,500 branches and close to 100,000 ground-level primary agriculture credit cooperative societies that mostly serve as final delivery conduits for credit and can often be channels for the public distribution system of fertilizers and agri-inputs); as well as agricultural and rural development banks providing the long-term structure, though they do not classify as scheduled commercial banks.

Around 43 percent of agricultural credit comes from commercial banks, 8 percent from RRBs and the remaining from the cooperatives. Agricultural credit in India falls under priority sector lending where all commercial banks are required to lend 18 percent of the net bank credit to agriculture — this share has been difficult to achieve for banks, in particular, the private banks. Moreover, with moral suasion pinning interest rates on small loans to 9 percent and an RBI directive capping all loans below Rs 200,000 to the prime lending rate, credit rationing may indeed be restricting the flow of formal credit to the farm sector. However, among the bright spots is the recently introduced Kisan credit card (a credit card for farmers) has been making

rapid progress, saving on transaction costs both for the lender and borrower, while providing relatively more flexible finance.

Despite strong growth in India's formal lending sector, roughly 40 percent of lending comes from other sources. About 22 percent was classified as nonformal in 1991. These loans have potentially very high interest rates and are also likely concentrated among the poor. The long delays in payments from crop insurance may create even more problems for this group of farmers. They generally borrow in the informal sector when there is a serious short fall in cash. Thus, they are borrowing for consumption at very high interest rates. An affordable insurance that made timely payments could ease the burden on for these farmers.

Among the most important questions for the Indian crop insurance program is whether it enhances access to rural finance, and, in turn, how it would support economic development. The delays in payments have been reviewed. Many farmers suffering crop failure in the 2002 Kharif season were not paid before planting time for the 2003 Kharif season. Many farmers who did not receive debt and interest moratoriums continued to accumulate interest payments on loans obtained for the 2002 season. Additionally, some of these farmers were likely denied credit in 2003. The cycle of borrowing is exacerbated in this sequence. Furthermore, to the extent that such borrowing compounds itself, farmers will have great difficulty making technological advances. Loans will likely be limited to operating loans and refinancing loans. Appendix C develops models to illustrate the potential impact of the crop insurance payment delays on financing. These models suggest that the de-facto interest rate after taking payment delays into account is from 2 to 6 percentage points higher.

Mishra (1996) argues that farmers with access to crop insurance borrow more and may also use more advanced technology, contributing to economic growth. Mishra goes on to demonstrate that the increase in farm income has been greater than the cost of the crop insurance program. This conclusion is used to argue that investment in crop insurance is justified. Given that the current crop insurance program pays nearly 5 rupees for every 1 rupee invested by the farmer it should be expected that bankers will loan more. Thus, while the Mishra result is interesting; it does not provide an adequate justification for subsidizing crop insurance at these levels. The work begs the question regarding the opportunity cost for these government subsidies. Welfare economics would also carefully consider the dead weight losses that are generated from crop insurance subsidies to the farm sector. Such an analysis is beyond the scope of this study. Nonetheless, it is likely that there is a better use for limited government funds spurring more appropriate resource allocation decisions among farm households and enhancing access to rural credit.

The broader economic questions are particularly important given three limitations of the current crop insurance program: 1) long delays in payments; 2) the potential of a subsidized crop insurance program to restrict important resource allocation decisions; and 3) the unanswered questions regarding what households in Indian benefit the most. Long delays in payments add to interest payments for farmers with loans. For the poorest farm households such delays increase the likelihood that they will need to borrow in the expensive informal credit markets when there is a crop failure. A fundamental issue that should also be addressed is to what extent more subsidies on crop insurance will prevent farmers from making needed adjustments in what they grow or how they use their other resources. At some point, crop insurance subsidies will slow adjustments and cause farmers to continue to produce high risk crops that are almost

certain to have problems given bad weather. Finally, since crop insurance subsidies are explicitly tied the size of the farm, careful consideration is needed to prevent these programs from benefiting only the larger farms. Many of the rural poor in India have little or no plantings of crops and, thus, will not benefit from subsidized crop insurance.

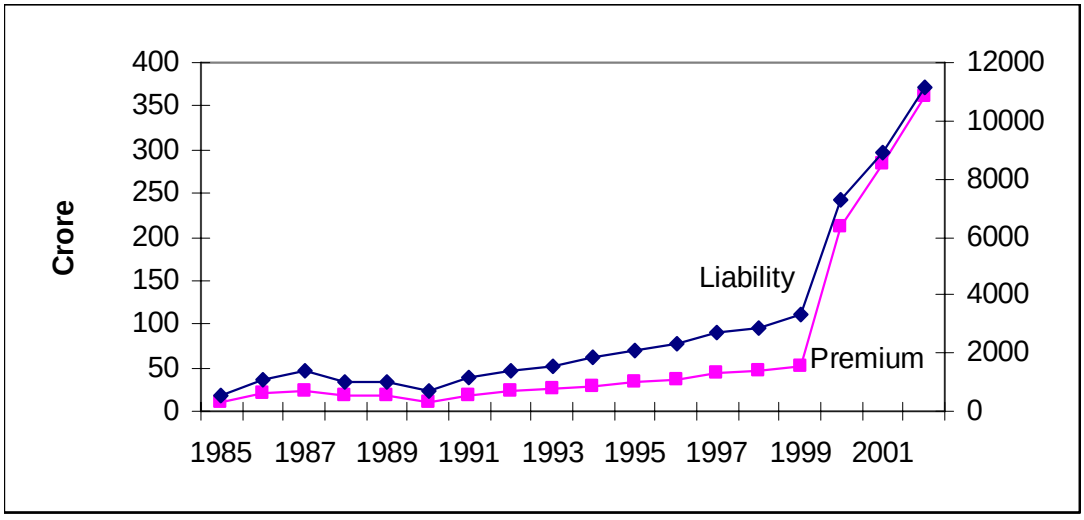
5.B. Data Used to Analyze Past Performance

Data supplied by the AICI were used to evaluate past performance of the Indian crop insurance programs. It is important to recognize that these data span the two crop insurance programs (CCIS and NAIS). Key differences do exist in these programs and have been reviewed above. The differences manifest themselves in the data as major changes in the beginning of 1999. Among the most significant changes is the level of uptake on the new crop insurance program. The program was greatly expanded with the 1999 Rabi season and the numbers on value insured (liability) demonstrate the impacts of that expansion. Several factors explain the large increase after the 1999 changes: 1) coverage of new group of crops — annual commercial / horticultural crops; 2) coverage of nonloanee farmers, though on an optional basis; 3) removal of the cap on the sum insured (earlier it was Rs 10,000 per farmer per season); and 4) acceptance of the scheme by more states.

5.C. Rapid Growth in Exposure and Cost

Figure 5.1 plots the premium paid by farmers versus the liability from 1985-2002. The growth in exposure (liability) has been just over three times since 1999. The growth in premium has been nearly seven times. This differential growth is a positive sign that premium rates are increasing. Prior to 1999, the average premium rate in the portfolio was 1.7 percent. In 2002, that number was 3.3 percent. This is due to a higher percentage of commercial crops being insured under the new program. The premium rates are meant to be more actuarially sound for commercial crops.

Figure 5.1. Premium and Liability Growth (Values in Crore)



Exposure is still growing at a rate of roughly 25 percent per year since the major program changes. It is critical to note that there is no indication or reason for this growth rate to slow in

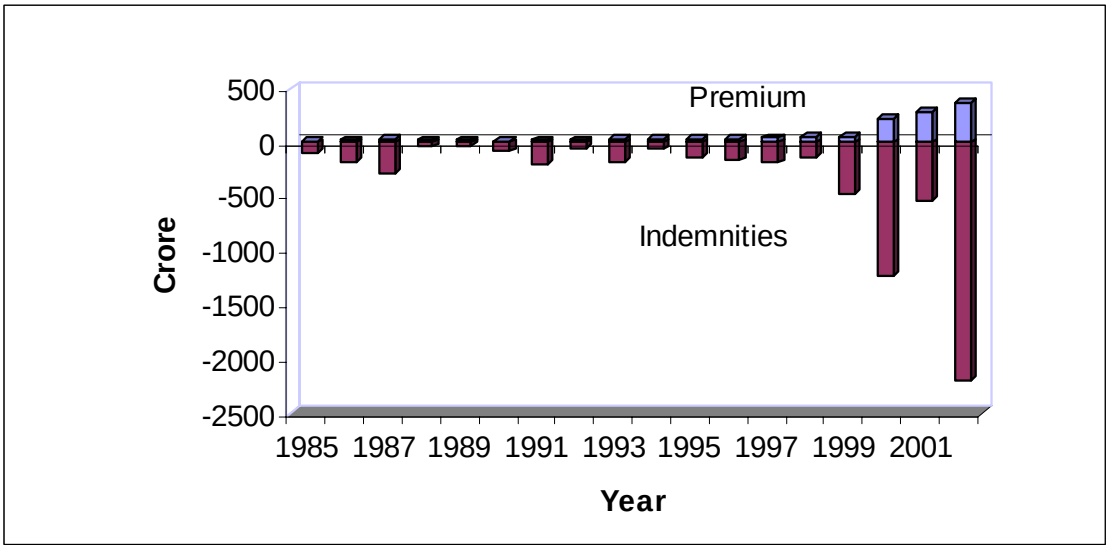
the near term. Many new crops and areas are being added to the program and the area insured is still modest even in the markets where crop insurance has a strong showing.

5.D. Actuarial Performance

Actuarial performance of the program has been dismal. Of course this was by design as the Indian government freely admits that flat premium rates were used for many basic food crops. And while it is only a few years since the NAIS was introduced, there has been no improvement in actuarial performance since that time. A relatively straightforward way to examine actuarial performance is to develop a loss ratio. The loss ratio is the claims paid (indemnities) / premium. The sum of indemnities from 1985 to 2002 is approximately 6,278 Crore. The sum of premiums is 1,262 Crore. Thus, the loss ratio is nearly 5 to 1. When comparing the 1999-2002 period, the loss ratio is very similar.

The growth of the program is also painfully clear when one examines the indemnities paid in 2002. When examining the data in Figure 5.2, 2002 year may appear to be an extreme outlier due to the unusually bad weather. However, it is rather straightforward to estimate the expected value of future indemnity payments. Premium growth is roughly 25 percent per year. Extrapolating the base premium of 2002 gives an expected 2003 premium level of 453 Crore. Given an expected loss ratio of 5, the expected losses in 2003 exceed 2200 Crore. The last four years of liability can be used to provide a long-run forecast of the crop insurance business in India. There is a distinct linear trend that gives a liability of 24,000 Crore in 2007. The premium generated with 24,000 Crore in liability and 3.3 percent premium rate (the 2002 value) is 791 Crore. If the expected loss ratio remains at 5, the net cost of the indemnities from a base premium of 791 Crore could easily be 3,165 Crore (or US$670 Million).

Figure 5.2. Indemnities Compared to Premiums (Values in Crore)



5.E. Claims are Heavily Skewed in a Few States

The serious nature of the loss experience is compounded when one carefully examines which states have received most of the indemnity payments. They are highly skewed. One state, Gujarat, accounted for over one half of the indemnities paid over the 1985-2002 period. Gujarat accounted for about 5 percent of the total agricultural value in India. Ground nuts have continued to cause severe losses in Gujarat. The Gujarat loss ratio over the period exceeded 1000 percent. Table 5.1 shows the major states receiving claims from 1985-2002. Only five states received nearly 90 percent of the indemnities. These states also had 78 percent of the liability.

Table 5.1. Share of Indemnity by State (1985–2002)

State	Indemnity Share	Loss Ratio	Share of Agriculture	Share of Liability
			%	
Gujarat	52	1112	5	21
Andhra Pradesh	14	314	9	24
Orissa	9	658	3	7
Maharashtra	8	211	10	16
Madhya Pradesh	6	348	9	9
Karnataka	4	281	7	7
Chhattisgarh	3	908	0	2
Bihar	1	281	6	2
Tamil Nadu	1	239	6	3
West Bengal	1	86	12	4

The level of participation by state can be estimated using the state value of GDP for agriculture and the total value of sum insured (liability). Table 5.1 provides these estimates and clearly demonstrates the states with no crop insurance in 2002. While the information provides a useful cross comparison, it must be acknowledged that GDP from agriculture includes both crops and livestock. Thus, in states where livestock comprises a larger share of GDP, this percent of value insured will be misleading. Nonetheless, the table does highlight the fact that there is a significant area of India where agriculture is important and no crop insurance is being sold. Those areas with zero crop insurance comprise nearly 30 percent of the total agricultural value in India. Gujarat comprises only 4.1 percent of the total agriculture in India and has about 13 percent of its agricultural value insured. It should not be surprising that this state has the highest level of participation given the large indemnities that have been paid.

Table 5.2. Value of Agricultural Product and Sum Insured by State

State	State GDP from Agriculture 1999-2000	Share of India %	Sum Insured in 2002	% of Value Insured
Arunachal Pradesh	47126	0.1	0	0
Andhra Pradesh	3141627	8.1	232665	7
Assam	969830	2.5	442	0
Bihar	1993500	5.2	9636	0
Gujarat	1568377	4.1	205740	13
Haryana	1666691	4.3	0	0
Himachal Pradesh	246443	0.6	2686	1
Jammu Kashmir	360958	0.9	0	0
Karnataka	2359734	6.1	122337	5
Kerala	1250214	3.2	2681	0
Madhya Pradesh	2920650	7.6	108087	4
Maharashtra	3485175	9.0	123439	4
Manipur	71897	0.2	0	0
Meghalaya	68505	0.2	158	0
Orissa	1154639	3.0	123114	11
Punjab	2561544	6.6	0	0
Rajasthan	2183565	5.7	0	0
Sikkim	17961	0.0	41	0
Tamil Nadu	1917481	5.0	19571	1
Tripura	109066	0.3	80	0
Uttar Pradesh	6273215	16.3	79784	1
West Bengal	4180483	10.8	39467	1
Chandigarh	6107	0.0	0	0
Pondicherry	13386	0.0	0	0

Rs in Lakh 1 Lakh= Rs 100,000

Performance by state is shown in Table 5.2. The early years (1985-1987) are dropped from this analysis as they should be considered learning years and therefore not representative. Table 5.3 (below) examines the loss cost relative to the premium rates that were actually paid over the period. Once again, Gujarat stands out as the premium rates paid are less than 3 percent, yet the loss cost is 28 percent. While data by crop were not provided, one could expect major differences between crops. Raising rates to levels that match the loss cost should be done on a crop by crop basis on a local level. And while raising rates generally also should be of concern as to how that might influence the pool of risk, this is not the critical issue it would be if these insurance policies were indemnifying for individual losses.

Table 5.3. Performance by State and Season (Ranked by Loss Cost)

State	Season	Loss Cost %	Premium Rates %	Sum over 1988-2002 (in Lakh)		
				Liability	Indemnity	Premium
Gujarat	Kharif	28.0	2.7	1033373	289331	28017
Himachal Pradesh	Kharif	19.7	2.4	2751	542	67
Orissa	Kharif	18.7	2.5	298932	55897	7500
Himachal Pradesh	Rabi	11.5	1.9	454	52	9
Karnataka	Rabi	9.5	2.0	21050	1999	424
Madhya Pradesh	Kharif	9.2	2.6	362158	33334	9574
Pondicherry	Rabi	8.8	1.9	1169	103	22
Bihar	Kharif	8.2	2.2	59302	4843	1308
Kerala	Kharif	7.9	2.2	12258	971	264
Andhra Pradesh	Kharif	7.5	2.3	1061272	79720	24219
Karnataka	Kharif	6.7	2.5	309218	20627	7868
Tamil Nadu	Rabi	5.5	1.8	95783	5302	1752
Maharashtra	Kharif	5.3	3.0	708974	37597	21416
Madhya Pradesh	Rabi	5.2	1.7	82001	4236	1370
Maharashtra	Rabi	4.1	1.5	87694	3571	1285
Meghalaya	Kharif	3.8	2.2	419	16	9
Tamil Nadu	Kharif	3.3	2.0	44238	1458	876
Bihar	Rabi	3.2	1.9	37895	1202	733
Gujarat	Rabi	3.2	1.6	24315	766	386
Kerala	Rabi	3.0	2.0	12880	389	258
Assam	Rabi	3.0	2.0	1241	37	25
Pondicherry	Kharif	2.8	1.9	715	20	14
Orissa	Rabi	2.2	1.8	62270	1395	1151
Assam	Kharif	2.2	2.1	1360	30	28
West Bengal	Kharif	1.9	2.1	117281	2213	2488
Andhra Pradesh	Rabi	1.7	1.7	130957	2262	2253
West Bengal	Rabi	1.6	2.2	81193	1317	1765

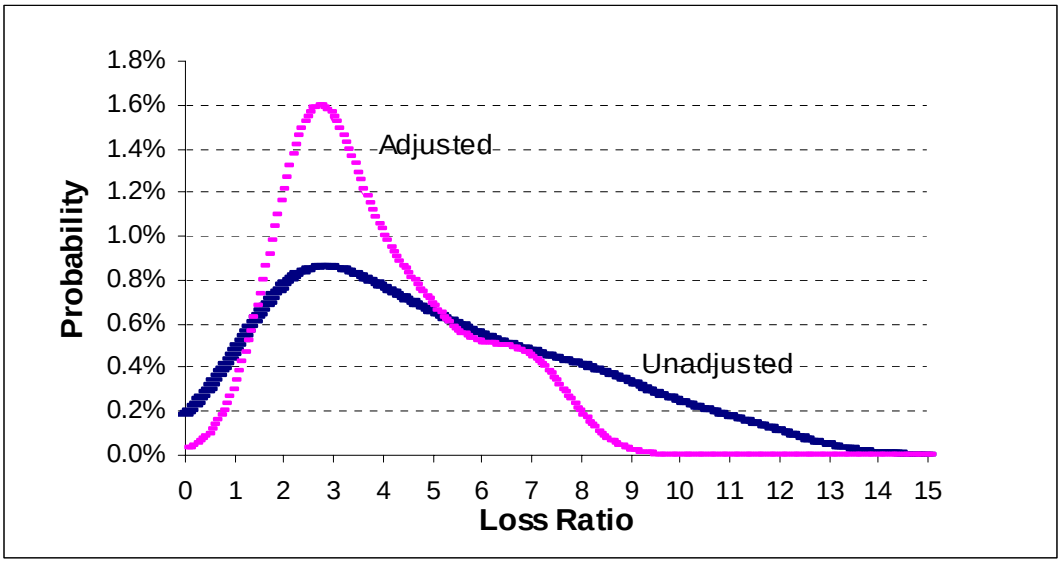
Rs in Lakh 1 Lakh= Rs 100,000

5.F. The Nature of Catastrophic Risk for Indian Crop Insurance

Beyond poor actuarial performance by state is the issue of the balance of business by state. Crop yields for multiple risk are also classically uninsurable risk since the risks are highly correlated — in a drought year many farmers suffer losses at the same time. India is a large country with diverse regions and diverse crops. This diversity affords an opportunity to spread risk, even correlated risks from major droughts. However, the participation in the current program is skewed and some important agricultural states (e.g. Punjab) do not participate.

A relatively simple analysis was performed to demonstrate the shape of the loss function for the current crop insurance program. First, historic data were used from 1988-2002 to develop a *smoothed kernel distribution* of historic loss ratios by year. Next, the 2002 premiums by state were used to backcast the loss ratios as if the distribution of premiums that were in place in 2002 were in place in all previous years. This was done by taking each state's historic loss ratio and assuming that the 2002 premiums would generate loss ratio. Thus, the past indemnities were reset to equal the 2002 premium multiplied by the historic loss ratios. The sum of the indemnities and premiums for the states were used to develop a new aggregate estimate of loss ratios by year. Since the premiums were spread over more states in 2002, the country loss ratio is not nearly as skewed as the simply unadjusted data (see Figure 5.3). The distribution that has the long tail to the right with very large loss ratios (exceeding 13) is the unadjusted distribution. The distribution of losses that stop at about 9 is the adjusted distribution.

Figure 5.3. Loss Function with Unadjusted versus Adjusted Data



While both distributions presented in Figure 5.3 should raise serious concerns, the 2002 premium-based distribution does not have the long tail as does the unadjusted distribution. Nonetheless, there is a significant probability that the loss ratio will be greater than 600 percent (roughly 15 percent versus 35 percent in the unweighted case) and it is possible that the losses could exceed 800 percent. A loss ratio of 800 percent and a base premium approaching 500 Crore mean that losses could be as high as 4000 Crore in India. Clearly, such numbers should alarm any policy maker in India. The need for careful consideration of how to finance these

extreme losses must be a critical component of a successful crop insurance program. This analysis also suggests that the expected loss ratio may be better than the historic average of the data (3.75 versus 4.9). However, the hope of this analysis is quickly dashed when recognizing that the past five years have had a better spread of risk and the loss ratio has still been about 5.0.

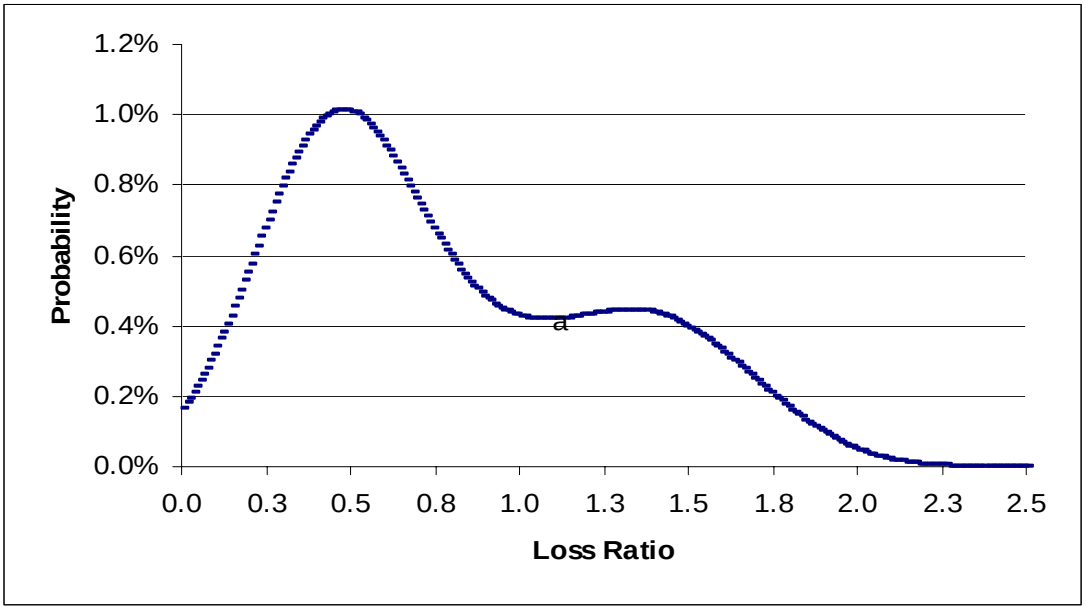
The extreme values on loss ratios are a function of both poor rating and a poor spread of risk. In some cases, there may be underwriting problems that also contribute to poor performance. However, these are likely to be minor compared to the rating and spread of risk problems. To illustrate the potential loss function with the current spread of risk, rates were set using historic loss cost by state:

Loss Cost = Indemnity / Liability

These rates were then used to generate a new premium value that represents the actuarially fair premium based on the historic losses and value insured:

New Premium = Loss cost * Liability

Figure 5.4. Loss Function after Setting State Rates to Pure Premium



The newly generated aggregate loss ratio by year appears in Figure 5.4. The average weighted loss ratio for this series is equal to 1; that is, over the time series, premium received would equal indemnities paid. What is of interest is that extreme losses are now much more modest. Extreme losses above two times the premium are rare in this distribution. Nonetheless, reinsurance cost would be extremely high if this were the expected distribution of losses. By far, the largest reinsurance for agricultural risk is for the U.S. program. This program involves very special arrangements where the government shares risk with the private sector. The maximum loss ratio for private reinsurers is roughly 1.25 for the U.S. program. Thus, having a maximum loss ratio that exceeds 2, as in Figure 5.4, would most certainly frighten the international reinsurance community a great deal. If the NAIS rated in a more actuarial fashion and participation was

more uniform across India, the distribution of losses would be even less skewed than what appears in Figure 5.4, as the risk pool would be more balanced. Under these conditions, international reinsurers would be more interested in sharing the crop insurance portfolio of risk in India.

One way to consider the potential cost of reinsurance in India is to assume that international reinsurers believe that the loss function looks like the one depicted in Figure 5.4. If the NAIS wanted to shift all losses beyond 1.5 for the country, they could conceivably purchase a stop loss policy from international reinsurers whereby all losses beyond 1.5 or 150 percent would be paid by the international community. The cost of this reinsurance would be a function of the area under the curve beyond 1.5. Given the distribution in Figure 5.4, the pure premium for such reinsurance would be roughly 18 percent[11]. If reinsurers load their premium by only 50 percent and the NAIS had total farmer premiums of 500 Crore, roughly 150 Crore would likely be used to pay reinsurers. More important, if the government could 1) make the rates actuarially sound; 2) improve the spread of risk across India; and 3) obtain stop loss reinsurance at the 150 percent level, they would limit the loss on a premium of 500 Crore to no more than 750 Crore. This is in stark contrast to the potential loss of the current program which exceeds 4000 Crore.

5.G. Recommendations from the Government

In the recent press, the Indian government has publicly stated a desire to move toward a more cost effective program. Premium rates are to be made actuarially sound. Making premium rates actuarially sound with the current program will not be easy. It will require significant rate increases if the current level of coverage remains in force. The current average premium being paid is roughly 3.3 percent. Using the average loss cost of the past experience, the average premium should be closer to 12 percent for those buying crop insurance at the current coverage levels. This is nearly a fourfold increase in premiums. Another way to mitigate the shock of raising rates would be to adjust the methods for establishing the threshold yields and to lower the coverage levels in those areas with the greatest risk. These premium rates are a direct function of threshold yields. It may be easier to lower threshold yields than to raise premium rates by a factor of four.

Furthermore, the government plans to target the poor with a subsidy of 50–75 percent. This would be for small and marginal farmers. The 1990–91 Census shows some 83 million small and marginal farmers operating some 54 million hectares. This is roughly 32 percent of the land mass that is operated. Given the past experience of crop insurance, the average loss cost is roughly 12 percent. Furthermore, the growth path on liability gives an expected liability in 2007 of 24,000 Crore. At a 12 percent premium times 24,000 Crore, the total premium should be roughly 2880 Crore by 2007. If small and marginal farmers comprise 30 percent of that share, this would be 864 Crore. Thus, one can estimate the cost of the premium subsidy at between 430 and 640 Crore. This would be under conditions where the participation in crop insurance would still remain relatively low. The trend on participation puts the number of farmers insured by 2007 at roughly 21 million. The Census of 1990-91 reports some 106 million farm households. Thus, less than 20 percent of the farms would be insured and it is highly likely that even a smaller percentage of small and marginal farms would be included.

[11] Numerical intergration procedures were used to develop the area under the curve in Figure 5.4 above the stop loss of 150 percent. This is a generally accepted proceudre that is used by reinsurers if they feel they know the loss function

Section 6: Moving Toward Solutions

There are numerous challenges facing the *GoI* as they strive to improve the current crop insurance program. Four of these challenges deserve special attention:

1. Improving the product, in particular, improving the timeliness of crop insurance payments.
2. Improving area-yield assessments
3. Establishing actuarially sound premium rates and containing the fiscal exposure of the current program.
4. Targeting the poor in a cost effective fashion.

6.A. Improving the Products Offered

The Indian government has a significant crop insurance program. The basic concept of using area yields to indemnify farmers in India is sound given the small size of farms. Nonetheless, the current program has a significant flaw since there are long delays in payments. Furthermore, the government acknowledges that the geographic areas used as the base for payment, create problems as some farmers will not receive payments when they have losses. The plans to move to smaller geographic units are underway. Building on the existing area-yield system will first require modifications to the existing program to improve accuracy and performance.

Indian officials will need to continue to monitor and provide appropriate incentives to minimize abuse of the current crop insurance program. New systems for monitoring the crop-cutting experiment results may be needed to assure that these systems are performed in a uniform manner and that the estimates are passed along in a timelier manner with little or no opportunities for manipulation. The *GoI* may also want to consider imposing penalties on the states for delays in reporting results from crop cutting experiments (CCEs).

The Indian insurance regulators are requiring that insurance providers target small rural areas. In the next three years, these insurance companies must have 5 percent of their premium coming from insurance products in small rural areas. The insurance and banking sectors of India are growing rapidly. These markets offer some important opportunities for enhancing crop insurance and risk management products that are offered to small farmers in India.

A number of options are presented below. Some of the solutions involve modifications and restructuring of the current crop insurance scheme. These include:

- Using area yields for reinsurance purposes.
- Using weather indexes for direct crop insurance
- Improving the ratemaking for base products
- Establishing a complementary disaster program

Development of index based insurance could also facilitate the expansion of rural financial markets through several mechanisms:

- Insuring crop loan portfolios
- Providing reinsurance to mutual insurance groups
- Improving access to credit
- Supporting savings accounts for risk management

6.A.1. Allow Risk Management Providers to Use Area Yields as Reinsurance for New Crop Insurance Products

It is possible to make excellent progress in fixing the problem of timely payments. Both insurance and banking entities in India are well positioned to design new products that make timely payments. Area-yield insurance products could offer a localized form of reinsurance for insurance companies and bankers. The *GoI* could improve the product offerings to farmers of India considerably by allowing insurers and bankers to sell tailored products to individual farmers who would assign their indemnity payments of the area-yield insurance over to the provider of the tailored products. This would open the door to innovation in risk management products that more closely meet the localized needs of individual farmers in India. The area yield would protect these providers of new products from the major correlated losses that are present in crop yields. The providers of new insurance products could greatly improve the timeliness of payment if they have confidence that they would receive the area-yield payments later.

Should the *GoI* provide the opportunity for market innovators to use the area-yield insurance as a form of localized reinsurance, this would increase the need for transparent and reliable systems for developing estimates of area yields. However, the past history is also an indicator of how these data could be used to evaluate localized reinsurance. Markets discount of uncertainty. Thus, even with little or no modifications in the yield estimation process, it is likely that the area yields could serve as a basis for new product developed as proposed in this section. Nonetheless, the value of this approach would be improved as confidence in the area yield estimation procedures improves.

Weather-based insurance products could be one way to fix the timely payment issue. Weather data can be used early on during a significant weather event to trigger payments. For example, by the end of August, weather data are available regarding how much it has rained during the critical crop stages for the Kharif season. Both government and private providers of financial services could design rainfall insurance contracts (e.g., Parchure, 2002) that would pay for extreme rainfall events even during the season, as the first of two triggers with the second trigger being area-yield-index-based. If individuals purchasing such contracts were allowed to assign the area-yield insurance payment to the provider of these contracts, such an arrangement would allow the provider to significantly lower the price. The government area-yield insurance would provide considerable protection against the correlated risks that stand in the way of private sector involvement in providing crop insurance services. With this arrangement, some firms may even determine that it is feasible to provide forms of individual insurance to a certain segment of agriculture in India.

6.A.2. Using Weather Index-Based Insurance as Direct Crop Insurance

There is emerging literature about how weather indexes could be used to improve upon traditional crop insurance (Gautum, Hazell, and Alderman, 1994; Sakurai and Reardon, 1997;

Skees, Hazell and Miranda, 1999; Skees, 2000a; Hess, Richter, and Stoppa, 2002; Hess, 2003). A key advantage of this kind of insurance is that the weather or "trigger" event (e.g. a rainfall shortage) can be independently verified and, in theory, would not be subject to the same possibilities of manipulation present when insurance payments are linked to actual farm losses. Also, since the contracts and indemnity payments are the same for all buyers per unit of insurance, the usual problems of moral hazard and adverse selection associated with public crop insurance are lessened. Nonetheless, opportunities for manipulation and corruption can still persist under an index-based approach. The institutional structure of the crop insurance program and the degree of private sector involvement should influence the presence of these problems.

Additionally, the insurance would be easy to administer, since there are no individual contracts to write, no on-farm inspections, and no individual loss assessments. This can help make the insurance affordable to a broad range of people, including agricultural traders, shopkeepers, and landless workers whose incomes are also affected by the insured events.

Weather index insurance would also be easy to market. For example, it could be sold through banks, farm cooperatives, input suppliers, and microfinance organizations, as well as directly to farmers. Weather insurance is not only for producers and rural people. Banks and rural finance institutions could purchase such insurance to protect their portfolios against defaults caused by severe weather events. Similarly, input suppliers could be the purchasers of such insurance. Once financial institutions can offset the risk with index insurance contracts, they would be in a better position to expand credit to farmers, perhaps with improved terms.

While index-based weather insurance is attractive, there are few applications of weather-based index insurance in agriculture. In Canada, both Ontario and Alberta are insuring against low rainfall for forage and pasture. Alberta has also introduced a policy for silage corn that involves using heating degree days since there is a high degree of correlation between heating degree days and corn silage yields. A private insurance company in Argentina is offering a rainfall insurance contract to a milk-producing cooperative (there is strong positive correlation between rainfall and milk yields). In France a series of agricultural cooperatives bought weather derivatives for crops that are not included in the common agricultural policy. A South African cooperative bought a freeze cover in the form of a weather derivative. Recently in India, weather index insurance against drought and flood risk has been sold to farmers in Madhya Pradesh and Andhra Pradesh by ICICI Lombard and through BASIX, a microfinance bank,. The details on this policy are presented in Appendix D. While the overall number of applications is still relatively small, the interest is growing.

6.A.3. Designing Weather Index Insurance Products

In many cases, when a weather event is strongly correlated with yields, a weather-based index contract may provide equal or more risk protection than traditional insurance. As the payment would be solely based upon a weather event, these contracts could be made widely available to anyone judged to have an insurable risk when poor weather creates extreme agricultural losses within an area. Poor households could be provided disaster aid based on the portfolio of income. Anyone could purchase additional index contracts to reflect the full array of income that may be disrupted when a major weather event occurs (e.g., drought). For example, if a household earning $2000 per year from a mix of sources estimates that half of this income is vulnerable during a major drought, they may purchase $1000 of value in the drought index

insurance. This would be true even if only a very small percentage of the $1000 comes from crops they grow themselves. Traditional crop insurance would never provide such an opportunity.

A number of different contract designs are possible (Skees, 2000a). In practice, weather derivatives and weather index insurance have become more sophisticated. To mirror the yield-risk exposure of food crops for example, the weather contracts have to take the distribution of rainfall into account. Farmers care as much about the timing of the rain as the amount. Critical periods in the growing season are weighted more heavily in the index. Moreover there is a limit to the useful amount of rain per period, so weather contracts cap the amount of rainfall counted per period. A well-designed weather index incorporates an excess rainfall trigger that indemnifies flood related losses. Finally it is critical to choose the right contract period that corresponds to planting practices in the area covered. (Hess, Richter, and Stoppa, 2002).

One simple structure for a rainfall index insurance contract is presented below. In a straightforward proportional contract, the payments would be structured as a percentage of the rain below a specified threshold or strike level. For example, let us assume that the average rainfall is 300 mm for the most critical three months of the crop season. Any rainfall below 200 mm creates problems. With a straightforward proportional contract, if rainfall were 100 mm, a 50 percent payment would be made:

Percentage Payment = (Strike – Actual Rain) / Strike

Percentage Payment = (200 –100) / 200, or 50%

The protection purchased is an individual decision that should be based on value-at-risk and the amount of funds that are available to pay premiums. Premiums are a direct function of the protection purchased:

Premium Payments = Protection Purchased x Premium Rate

Indemnity payments are a direct function of the percentage payment and the protection purchased:

Payment = Percentage Payment x Protection Purchased

For example, with a 50 percent payment rate, an individual who purchased $1,000 of protection would receive $500 (.50 x $1,000).

Details on the design of weather index contracts and an application in Morocco are in Hess, Richter and Stoppa (2002). The same design principles have been applied in the BASIX weather index insurance pilots launched by ICICI Lombard in India.

While weather insurance offers some degree of hope, there are many operational issues that must be addressed if it is to become widely available in India. First, weather losses are also correlated and require reinsurance. Second, weather data from the Indian Metrological Department would need to be made readily available. Third, the company providing the weather insurance would need both a sales force and a system to make timely payment.

Losses from weather insurance would also be highly correlated and require some form of ex ante financing to assure that payments would be made when a large number of farmers have losses at

the same time. To the extent that data on weather are reliable and tamperproof it would be relatively easier to receive reinsurance for these losses than the current area yield insurance program. However, to do so, the reinsurance community would also need to be convinced that the weather insurance being sold was appropriately priced.

The Indian Metrological Department (IMD) works under WMO rules and has a relatively extensive network of weather monitoring stations. Nonetheless, the IMD may not be willing to participate in new weather insurance and there may not be enough weather stations to effectively lower the basis risk of weather insurance. It is possible to invest in secure and reliable private weather stations. However, such stations would require both an initial investment and an ongoing effort to monitor and maintain the stations. In the U.S. a private provider (AWS[12]) can supply this service for less than US$5,000 per year per station.

Finally, sales agents and claims systems to write timely checks will also be needed to sell weather insurance. Sales should be less complex than traditional crop insurance. Further, there may be other systems (such as directly tying the insurance to loans) for sales that would make it more affordable. In the U.S., companies are reimbursed at a rate of 24.5 percent for complete deliver and service of traditional crop insurance. One would think that weather insurance could be delivered for considerably less than this. It is possible that such insurance could add between 10 and 15 percent to the cost of weather insurance for a fully developed system.

6.A.4. Improving the Ratemaking for the Base Products

Open-ended fiscal exposure for the Indian crop insurance program is a critical issue. Current systems of setting a flat premium rate and adjusting for relative risk by changing the trigger yields (90, 80, or 60 percent) is suboptimal. Furthermore, the use of three- and five-year moving averages to establish trigger yields provides real opportunities for farmers to adversely select upon the crop insurance offerings.

Longer data series are available and should be used to establish the best estimate of the central tendency of yields within an area. Consider the problem with using a three year moving average to establish trigger yields when the three years that have occurred are well above average. Under these conditions, it is possible to offer an insurance contract that is above the expected yield for the area. Since premium rates will be established based upon longer data sets and the assumption that the trigger is set at 90, 80, or 60 percent of average yield, this opens the door for products that are under priced. While one can argue that the inverse is true — if the three previous years have been particularly bad, the important point is that farmers will know when the trigger yield is either a fair value or too low or too high. More farmers will chose to participate when they think that the trigger yield has been set at a value that is higher than the average yield. Such behavior will doom the actuarial performance of the crop insurance program over time.

6.A.5. Establishing a Standing Disaster Program

As was presented above, the plans to establish a program for small and marginal farmers offer potential for open-ended fiscal exposure. In addition, one can envision that such a program will

[12] AWS Convergence Technologies, Inc. owns and operates the largest network of weather stations in the world. This real-time network gathers comprehensive, up-to-the-second weather information from more than 5,000 communities and powers the company's various products and services. (Information taken from the AWS website: www.aws.com)

be difficult to administer. Another way to accomplish the same objective is to simply make a base product available free to all farmers in India. Such a base product should adhere to the principles that were developed earlier in this document — setting disaster aid as a function of frequency rather than the percentage below normal as the crop insurance program does currently.

Consider a base disaster program that would enable any farmer to obtain up to Rs 10,000 in liability. The threshold for the area and crop would be set by solving for the premium rate rather than using a flat percent of average. The government could give a base policy to all farmers that would have a threshold that gives a two percent pure premium rate. The value of the policy per farmer would be equal to Rs 200 (.02 x Rs 10,000). If all 106 million farm households in India obtained this policy, the total exposure would be contained at 2120 Crore. Compare this value to the current call for subsidy of small and marginal farmers at a cost of up to 640 Crore. This estimate would only include less than 20 percent of the farm households. If 100 percent of the household participated, the fiscal exposure of the current program would exceed 3200 Crore. It is unlikely that the uptake for even a "free insurance" of this nature would ever approach 100 percent of farmers. One can envision that somewhere between 50 and 75 percent of farmers might sign up for this type of program after several years. Thus, the cost would likely be between 1000 and 1500 Crore.

All farmers, including marginal and landless farmers could obtain the "free" disaster insurance policy that is anchored on thresholds that result in a 2 percent premium rate for up to Rs 10,000. If they chose either a policy with more coverage (e.g., greater than Rs 10,000) or one with a lower threshold, they would pay the full cost of the additional insurance. The advantage to this approach would be that it would entice more farmers to purchase added coverage and would be easy to administer. No one would need to be concerned with size of farm. All farmers would be eligible for the base disaster payment.

6.B. Blending Index Insurance and Rural Finance[13]

Given that the base insurance products offered under the NAIS are index-based products, a number of possibilities exist for sharing and layering these risks. The motivation for using index insurance contracts rather than individual indemnity has been developed. Index insurance can shift correlated risk into the global market. India has already followed the Mexican lead and obtained reinsurance based on weather data for a series of pilot weather index insurance cases.

Index insurance contracts involve significantly lower transaction costs and can be offered directly to end users from companies that operate in a global market, particularly if the end user is positioned to aggregate large amounts of risk (e.g., rural finance institutions, RFIs). To the extent that the writer of the index insurance is a reputable global partner, the RFI could pay premiums in dollars and be paid indemnities in dollars as well. This would mitigate inflation risk and exchange rate risk to some extent. The legal framework needed to allow RFIs to purchase these contracts from a global writer should be much more straightforward than the legal framework needed to offer traditional insurance. An important challenge is assurance that the global partner has the reputation and the resources to pay indemnities. Should the International Finance Corporation or the World Bank Group become more involved in partnering on writing

[13] This section borrows heavily from Skees (2003).

index insurance contracts for price, yield, weather, and livestock, many of these concerns could be eased.

The potential mismatch between an individual farmer's loss experience and the area results is known as basis risk. Basis risk exists whenever indemnities are determined against an estimated loss rather than a field assessment of an individual farm. Therefore, basis risk exists with parametric (index) insurance; however, an advantage of using index-based over area-yield insurance is that indemnities can be determined more quickly to expedite payments.

The issue of basis risk has been of some concern for the index insurance contracts discussed in this paper. However, if these contracts are sold to RFIs, the RFI should be in a position to mitigate basis risk in a number of creative ways. It is useful to illustrate some potential arrangements that could emerge between global sellers of index insurance contracts and rural finance entities. Consider a microfinance group or a small RFI with members having household activities in the same neighborhood. While this group of individuals may use many informal mechanisms to pool risk and assist individuals when bad fortune visits one of their members, they are unable to cope with a major event such as drought that adversely impacts all members at the same time.

If the group could purchase an index insurance contract that would simply make payments based upon the level of rainfall (an excellent proxy for drought), the group would be in a much better position to cope when everyone suffers a loss at the same time. The RFI would need to develop *ex ante* rules regarding how indemnity payments from the index insurance would be used. Three examples of how those *ex ante* rules may be developed are presented for illustration.

6.B.1. Indemnity Payments Could Be Used to Insure Crop Loan Portfolios

The ability to repay loans will likely be in jeopardy when there is an event that adversely impacts everyone. Having loan defaults from a large number of borrowers at the same time is likely to put the RFI at some risk. Thus, indemnity payments from index insurance can be used to offset defaults that occur due to natural disaster. Effectively, indemnity payments become a form of credit default insurance. The RFI would still need to implement rules regarding debt forgiveness for individuals.

6.B.2. Indemnity Payments Could Facilitate a Form of Mutual Insurance

Once again, the index insurance, be it the government area-yield insurance or a weather index insurance contract, could be used as a form of financing (or reinsurance) for a group. The group could be a microfinance entity or it could be structured like the Mexican Fondos (Skees, et al., 2002). *Ex ante* rules could be established by the group and these rules could be used to distribute payments from the index insurance contract. Given that only actual indemnity payments received would be distributed, a common problem among mutual insurance providers in developing countries would be avoided — inadequate cash to pay for indemnities that are specified in insurance contracts (McCord, 2003). To the extent that the RFI is relatively small and members know one another, the asymmetric information problems discussed earlier would be avoided. The monitoring cost of delivering some form of insurance payments to individuals would thus be considerably lower than in situations where a traditional insurance company attempts to deliver crop insurance.

6.B.3. Crop loans could be indexed to monsoon levels

In this Indian case the insurance event is defined as cumulative weighted rainfall dropping below a certain threshold of 75 percent up to 85 percent of the normal rainfall measured at the nearest weather station. Contract periods and payout dates depend on the particular crop cycle. Payouts are proportional to the measured rainfall deficit below the threshold and occur in the form of crop loan interest and principal relief.[5] In other words, the crop loan debt service is indexed to weather events. In exchange for a slightly higher interest rate, the borrower does not pay any interest and no principal in an extreme drought year. In a mild drought year, he does not pay any interest, but pays principal. In a normal year the borrower pays interest (including the weather insurance premium) and principal (Parchure, 2002; Hess, 2003).

6.B.4. Index Insurance Could Be combined with a Farm Risk Management Account[14]

By tying index insurance indemnity payments to a farm-risk management account, rural financial institutions and the *GoI* could encourage borrowing and savings even during drought years. The savings portion of the scheme would enable farmers to build collateral, improving their access to credit and lower interest rates. Eventually the scheme seeks to improve farmers' creditworthiness to a level where creditors would provide access to consumer credit. The incremental transaction costs would be minimized by using smart or simple debit cards and by packaging crop loans and risk management with agricultural extension services and crop marketing. Weather index insurance would not a self-standing insurance product, but would be embedded in the loan agreement and then combined with a farm risk management account.

The purpose of the risk management account component would be income stabilization and reducing farmer risk to the bank. The farmer would pay half of the overall insurance premium into a risk management account, effectively serving as self-insurance. This account can be used by the insured party when weather index insurance does not adequately compensate losses, thereby further mitigating the basis risk of weather index insurance. A minimum balance would be required. The farmer would be allowed to deposit part of his excess harvest earnings into the account through a deduction at the source, as his harvest sale receipts are channeled through the bank or agricultural service provider. In addition, the farmer could be allowed to deposit cash into the account at specialized low-cost rural branches of the lending bank. The lending bank would provide incentives for accumulating savings with loan interest rebates and, eventually, access to a credit line. This account represents additional liquid collateral to the bank and thereby encourages more farmer credit and better credit terms. For the same reasons the farmer is more reluctant to default on his credit obligations as he has more to lose.

6.C. Who Will Pay for Disaster Risk?

While there are many challenges to implementing some of the ideas presented in this report, possibly the most significant among them involves paying for insurance. This is especially true if one expects the rural poor to pay. Premiums for some natural disaster risks could be quite expensive. Of course, if one considers the extremely high interest rates that are being paid by the rural poor in the informal credit markets of India, the alternative of purchasing even fully-priced insurance may be more attractive. Nonetheless, the issues of trust involved are significant

[14] This section borrows from Hess (2003)

between obtaining cash immediately from a moneylender and signing a contingent claims contract that allows payment only under certain circumstances.

Goes and Skees (2003) argue that those who give to victims of natural disasters *ex post* might find *ex ante* giving to be more effective and more efficient. In fact, there are potentially some financial advantages to individuals to provide *ex ante* donations. When the international community responds to a natural disaster by dumping supplies or even large sums of money after the event, it is highly inefficient and many questions can be raised about who obtains the benefits.

Many times, the scale of loss from natural disasters in low-income countries requires emergency responses from outside the country. Such disaster assistance may not meet the immediate needs of the disaster-effected communities, in particular if the disaster is localized and not understood by the international community or does not attract their attention. Furthermore, *ex post* assistance can be distributed in ways that are both inefficient and inequitable. While the focus of this report is on index insurance contracts that are written either by the government or the market, the same concepts can be used by relief organizations to write contracts that would fund *ex ante* disaster relief. Such solutions could provide aid even before the disaster is out-of-hand, and do so in a more efficient and equitable fashion. Relief organizations and NGOs could work closely with local groups in developing risk management plans as a condition to obtaining the indemnity payments from these relief insurance contracts.

To the extent that a credible risk consortium could be developed to write index-based insurance contracts for a wide array of disaster risk, NGOs and charities could also purchase these contracts. They could be allowed to purchase index insurance from the NAIS of India. This would give them the needed resources for quick response. Furthermore, they would have more influence in working with local groups regarding *ex ante* rules about how to spend the money (i.e., working with local groups to develop risk management plans). Given that a number of groups are involved in financially supporting rural finance, these same groups could also co-pay premiums when they are convinced that a local rural finance entity has a true need for the type of index insurance contracts that have been presented in this paper. Such undertakings could motivate many *ex ante* approaches. The RFI would know what they are going to do with indemnity payments to facilitate improved management of correlated risk; such actions by NGOs would make the challenge of coping with correlated risk at the local level much less formidable.

Section 7: Conclusion

A number of alternatives are available to governments as they attempt to address the problems that are created by crop failure. While the *GoI* has experience with several of these alternatives, they have invested significant resources in expanding the national crop insurance program as the mechanism to address the problems. The basic design of the Indian crop insurance program is sound. Some time ago, scholars and government officials in India made a proper assessment of the problems associated with introducing individual crop insurance in India. The decision was to develop a program using estimates of area-based yields to make insurance payments. Given the small farm size in India and the extremely large transaction cost that would accompany an individual crop insurance program, designing an area-yield program was logical.

1. Risk Management. Improving rural financial services available to farmers, including their ability to manage commercial risk, is important for improving access to rural finance.

2. Social Response. Providing for social responses that assist the poor who stand to lose the most during severe crop failures is an appropriate goal for government.

These goals should be pursued with consideration of the fiscal exposure. Controlling the fiscal exposure of the government, both in terms of the average exposure as well as the peak exposure during disaster years is important for *GoI* given limited fiscal resources. It is not a foregone conclusion that providing government-sponsored crop insurance will improve the rural finance sector.

This report raises serious questions about the extent to which India's current subsidized crop insurance program improves the rural financial sector. The broader economic questions are particularly important given three limitations of the current crop insurance program: 1) long delays in payments; 2) the potential of a subsidized crop insurance program to restrict important resource allocation decisions; and 3) the unanswered questions regarding which households in Indian benefit the most. Long delays in payments add to interest payments for farmers with loans. For the poorest farm households such delays increase the likelihood that they will need to borrow in the expensive informal credit markets when there is a crop failure. A fundamental issue that should also be addressed is to what extent more subsidies on crop insurance will prevent farmers from making needed adjustments in what they grow or how they use their other resources. At some point, crop insurance subsidies will slow adjustments and cause farmers to continue to produce high risk crops that are almost certain to have problems given bad weather. Finally, since crop insurance subsidies are explicitly tied the size of the farm, careful consideration is needed to prevent these programs from benefiting only the larger farms. Many of the rural poor in India have little or no plantings of crops and, thus, will not benefit from subsidized crop insurance.

While this report goes through many details regarding how to improve the Indian crop insurance program, four specific areas of focus relate directly to the three goals outlined above:

1. Using area yields as a form of reinsurance to spur market innovation.
2. Developing weather index insurance products.
3. Improving ratemaking and product design for the current product.
4. Establishing a standing disaster program.

Area of focus one and two relate directly to the risk management goal; the third relates to the constraints imposed by fiscal exposure; and the fourth to the social response goal.

Delays in crop insurance payments can be addressed in a number of ways: 1) more resources could be put into more timely estimates of area yields; 2) a partial payment could be made using estimates of a larger area of yields which would presumably be made on a more timely basis; or 3) a dual trigger insurance program could be developed using weather information that is available on a more timely basis. More fundamentally, if the *GoI* allowed those in the market the opportunity to let farmers assign indemnity payments in exchange for new risk services, this could spur innovation to tailor insurance products more specifically to the farmers needs. It would also increase the need for maintaining integrity in the process of developing area yield estimates. As the market gains confidence in the area yield insurance estimates, these payments could serve as a localized reinsurance contract. In addition, the issue of timely payments would likely be addressed by market innovators.

Weather insurance products could improve the timeliness of payments. Such insurance could also be used to address the problem of access for smaller households and others at risk when there are severe weather events. There is no need to have crop acres match the amount of insurance purchased. Finally, by introducing the opportunity to insure against adverse weather events, the way is also open for making adjustments in crops. There is no need to grow only those crops where crop insurance is available.

India has a significant historic data base on area yields. These data can be used to improve the contract design and rating of the base product for the Indian crop insurance program. India must use more data to develop the central tendency and the threshold yields for making payments by area. The procedures used in the U.S. GRP program could be used to make significant improvements (Skees, Black, and Barnett). Even setting premium rates to the pure premium values would represent a significant improvement over the current system. However, there are more basic issues. It could be more acceptable to change the threshold yields than to increase premium rates too quickly.

Finally, a very explicit program design is recommended for the social goals of the Indian crop insurance program. By allowing *all* rural households access to a base disaster program that would trigger with area yields, the Indian government could provide clear rules about getting compensation to the poor. This could also be done with the existing infrastructure. The suggestion is to set the thresholds so that the value of the disaster program would be known; for example at a 2 percent premium rate. This would allow the *GoI* to control the fiscal exposure and also encourage farmers to purchase more crop insurance. This 'free disaster' aid could be the only direct subsidy for crop insurance. Farmers could be required to pay the pure premium for levels of liability above the base level. This would also assure that the subsidies are not unduly benefiting the largest farmers.

Once the *GoI* improves the core product (the area-yield insurance product), there are many other refinements and uses of the program that are possible. This is particularly true if contracts are properly designed and priced in an actuarially sound fashion. The area-yield insurance product could facilitate the expansion of rural financial markets through several mechanisms, including:

- Insuring crop-loan portfolios directly by banks and other financial entities via purchasing a customized area-yield insurance contract.

- Providing reinsurance to mutual insurance groups or other local groups who seek to organize their own solutions to the idiosyncratic risks of individuals within the group: such solutions may involve formal or informal arrangements to use payouts from area yields to compensate individuals within the group for their own losses.
- Using the area-yield insurance contracts to support savings accounts that are designed to help individuals manage risk by providing for matching payments to savings withdrawals when area-yield payouts are large (see Hess, 2003).

The *GoI* is well positioned to make changes in the crop insurance program. These changes could facilitate both risk management and social goals. This could also be done in a fashion that controls the fiscal exposure. Decisions in the next few years will be critical to the future. Putting more unintended subsidies into the current program will not spur rural finance in a constructive fashion. Further, such subsidies will benefit larger farmers and banks more than the rural poor. Hopefully recommendations made in this report will spur a debate in India regarding the future path of crop insurance.

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Appendix A: The U.S. Crop Insurance Program

When considering premium and risk exposure, by far the largest crop insurance program in the world is in the United States. The details present here on the U.S. crop insurance program are provided for context since this is the dominant crop insurance program in the world. Nonetheless, policy makers in India who wish to emulate the U.S. programs should proceed with great care. There are vast differences in agriculture in the United States and in India. Furthermore, it should be clear to anyone who researches the U.S. program that this program has been expensive and challenged by abuse. Major changes in the U.S. program in the early 1980s set the stage for adding more and more subsidies to change the pool of insured from one that was dominated by moral hazard and adverse selection to a large percentage of the farm population. Thus, subsidies have been used to mask some of the real problems in the crop insurance programs. The benefits of the program remain skewed to farmers who continue to abuse the program at some level.

Two crop insurance programs in the United States merit some attention from the Indian scholars and policy makers: 1) the Group Risk Program; and 2) the Gross Revenue Insurance Product. The GRP is surprisingly structured in a similar fashion to the Indian area-yield insurance program. The GRIP insures area yield times price changes as described below. Such a program may be possible in India for select commodities that are traded in global markets (e.g., cotton).

The U.S. government has supported crop insurance in some fashion since 1938. Farms in the United States are very different than those in India, both in terms of size and the technologies used for production. Less then two percent of the U.S. population now live on farms. Average farm size in the United States is over 100 times greater than those farms in India. The United States is also a rich country that has a history of subsidizing farmers. The U.S. farmer pays less than 25 percent of the cost of the crop insurance programs.

In the United States, multiple-peril crop insurance (MPCI) is designed to protect against losses from a wide array of natural occurrences, including hail, drought, excess moisture, plant disease, insects, and wind. The intent is to insure only acts of nature and not bad management. Policyholders must follow "generally accepted farming practices." While this provision is in place to reduce the impact of moral hazard, it is difficult to enforce.

Indemnifiable losses include quality adjusted yield shortfalls, prevented planting, and in some cases, replanting costs. Contracts for annual crops must be purchased no later than approximately six weeks prior to planting. Contracts for perennial crops must be purchased in the fall of the year before the crop is harvested. These dates are set to reduce the possibility that farmers will purchase insurance only when the likelihood and/or magnitude of a potential loss is greater than normal — a phenomenon known as intertemporal adverse selection.

A payable loss occurs if the *realized yield* is less than the *trigger yield* (the trigger yield is sometimes called the yield guarantee). Payable losses (in bushels, hundred weight, tons, etc.) for an insurance unit are calculated as:

$$Payable\ Losses = \max\left(0,\ Trigger\ Yield - Realized\ Yield\right) \times Insured\ \ Acreage$$

Trigger yield is based upon the coverage chosen and the insurance yield. Specifically,

$$Trigger\ Yield = Insurance\ Yield \times Coverage$$

The *insurance yield* is an estimate of the long-run average yield for the insurance unit. However, as few as four years of crop yield data can be used to set the average yield (known as the Actual Production History — APH). A farm may have several insurance units. Such a program is more possible in a country like the United States, where the average farm size is many times greater than in India. *Coverage*, as the term is used in the U.S. federal crop insurance program, is 100 percent minus the percent deductible. Available coverage levels typically range from 50 percent to 85 percent in 5 percent increments. Deductibles are one way to reduce the problems that emerge from adverse selection and moral hazard.

The policyholder selects an *indemnity price* that is less than or equal to a federal estimate (made prior to planting and sales closing) of the market price at harvest. The payable loss is converted into dollars as follows:

$$Indemnity = Payable\ Loss \times Indemnity\ Price$$

Liability is the amount that the insurance contract would pay if the realized yield were equal to zero (i.e., a 100 percent loss):

$$Liability = Trigger\ Yield \times Indemnity\ Price \times Insured\ Acreage$$

The *gross premium* is calculated as:

$$Gross\ Premium = Gross\ Premium\ Rate \times Liability$$

Gross premium increases as coverage levels increase. The farmer's premium is calculated as:

$$Farmer\ Premium = Gross\ Premium - Government\ Subsidy$$

Beyond the base MPCI product, the United States now offers a wide array of products. Revenue insurance products for the individual farm yields have been the fastest growing in the set of new products. Interestingly, the United States also has an area-based product that pays based on losses at the county-yield level (Skees, Black, and Barnett, 1997). The Group Risk Plan (GRP) is remarkably similar to the Indian crop insurance product, with important differences in the manner in which the expected county yield is determined and premium rates are established. County premium rates are designed to be actuarially sound and the procedures have been approved by both the U.S. government and the international reinsurance community. More will be developed on these procedures below as they offer an important base for setting actuarially sound premium rates for the Indian crop insurance program.

The United States also offers a number of revenue insurance products, including a product that is based on county yields and the national average movement in prices. The Gross Revenue Insurance Product (GRIP) is offered only for commodities where a futures exchange market can be used as the base for establishing the expected price. This is important as revenue insurance

requires a reliable source for determining the expected price for the current season. Expected county revenue shortfalls with triggers as high as 90 percent of the expected level and liability up to 150 percent of the expected county revenue are available under GRIP.

An example may be useful to illustrate how GRIP works. Consider a county in Illinois where the GRP expected yield (using long-term trends and at least 30 years of data) is 120 bushels per acre. If the future market price in February for the harvest contract (December) is $2.50, the expected county revenue is set at:

Expected county revenue = 120 x $250 or $300.

Farmers can select a liability that is 150 percent of this value or $450. This is done to allow farmers with yields that are greater than the county average the opportunity to get adequate protection. The farmer can also select a trigger revenue at 90 percent of the expected revenue or $450 x .9 = $405.

Given this policy, either low prices or low yields can trigger a payment. The calculation of the indemnity is based on the estimates of actual county yields and the actual November futures market price. Consider two scenarios where payments would be made: 1) county yields are 80 bushels and the December price is $2.50; and 2) county yields are 120 bushels and December price is $1.80.

Revenue with yields at 80 = 80 x $2.5 x 1.5 = $300

Revenue with prices at $1.80 = 120 x $1.8 x 1.5 = $324

The revenue estimates are compared to the expected revenue in percentage terms to make the payments.

Payment with yields at 80 = (405-300) / 405 = 25.9% x 405 =$105 payment

Payment with price at $1.80 = (405-324) / 405 = 20% x 405 = $81 payment

Appendix B: Mexico's FONDEN Program

FONDEN is the Mexican government's disaster relief program, established to provide compensation for correlated losses arising from natural disasters. Agriculture is just one of the sectors eligible to receive relief funds from FONDEN. FONDEN payments are made only after the declaration of a disaster by the government. Various levels of government are involved in both the declaration of a disaster and in sharing the payments. This is a time-consuming and potentially conflictive process, despite the strong guidance provided by FONDEN rules. Indeed, there are reports that it may take 5-6 months for FONDEN payments to actually be made to state trust funds, thereby engendering liquidity problems and complaints at the state level.

Within the agricultural sector, only smallholders are eligible to receive FONDEN payments via local governments; however, the definition of smallholder varies according to regional and agronomic differences. Eligibility requirements range from five or fewer hectares to twenty and fewer hectares depending on the state. FONDEN also restricts the number of hectares eligible for payments to limit payments to any one farmer. In addition, irrigated land and insured lands are not eligible for FONDEN payments. Payments vary with type of crop. Payments for agricultural losses from FONDEN from 1997-99 totaled nearly 1 billion pesos (approximately US$110million) for the three-year period. Generally, FONDEN payments were spread out among many states.

FONDEN payments are triggered through a discretionary process, and for this reason it is difficult to determine the likelihood of a FONDEN payout. However, setting aside political uncertainties, FONDEN guidelines provide strict definitions of certain types of perils. For perils such as drought and frost, the guidelines are similar to the types of triggers found in parametric insurance. Unlike regular crop insurance, parametric insurance does not directly compensate for assessed losses, but rather pays out when an agreed-upon indicator meets an agreed-upon condition — for example, when the temperature recorded at a defined weather station falls below a certain level. Consequently, transaction costs associated with the insurance are lower, since field assessments of damage are not required. Parametric insurance is also easier to price, since the expected payouts from the insurance can be estimated by calculating from historic data the probability of the trigger condition being met.

Although the rules for drought and frost are reasonable and technically well defined, the rules result in differing levels of coverage for different regions. Drought protection is greater in areas where the variance of rainfall is greater and frost coverage is greater for colder climates and for crops whose growing seasons makes them most susceptible to frost. Consequently, FONDEN rules unintentionally reward risky behavior. Such perverse incentives can be easily changed by rewriting FONDEN rules so that payouts are given equal probability across regions: for example, using historic weather data, define drought as occurring when the rainfall for two consecutive months falls below a trigger defined as having a 10 percent probability of occurring.

Appendix C: Simulating the Crop Loan Cycle Given Long Delays in Crop Insurance Payments

While there may be a number of procedures that can be used to gain insight into the problems that are created by delayed insurance payments, one approach is to perform some sensitivity analysis under various scenarios to demonstrate how these delays get compounded in the interest rates.

A simple case of the financing cycle in a severe loss year illustrates the extra costs generated by the payment delays. Three cases are presented: the NAIS case with a premium of 2 percent; an actuarial NAIS case with a premium of 6 percent; and a third case with a double trigger insurance policy that adds an early weather index based payout to the area yield trigger, with a premium of 6 percent. A primary motivation for this analysis is to demonstrate what happens when insurance indemnity payments are delayed until the next Kharif season, a partial default after harvest, a doubled default interest rate and no moratorium. The result is an extra cost of interest of the actuarial NAIS case compared to the double trigger insurance case of 3.7 percent of the loan amount. In other words due to the late payment the farmer *de facto* pays an annualized interest rate of 14.4 percent instead of 11 percent. The farmer also pays the actuarial insurance premium of 6 percent according to the new NAIS regime. Thus, total real cost of credit is 20.4 percent, excluding the costs of uncertainty and the halt in the credit cycle.

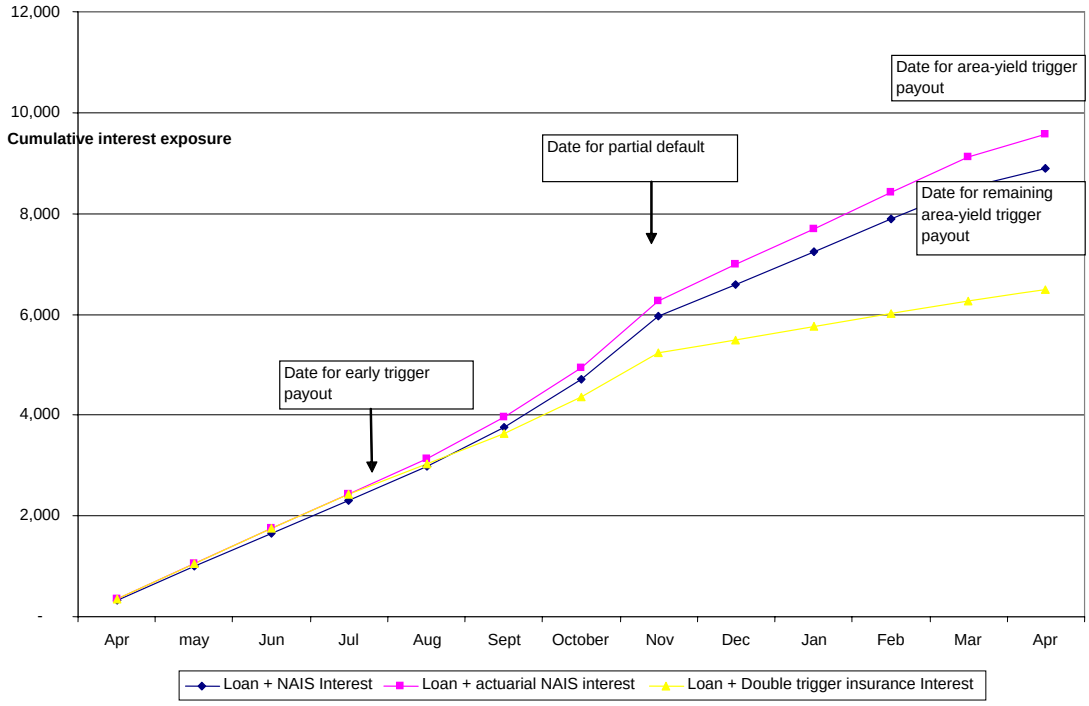
Since the analysis presented above represents only a single scenario of assumptions with a crop failure, Table C.1 presents a sensitivity analysis on some key assumptions.

Table C.1. The Impact of Sensitivity Analysis on Extra Cost of Interest

	%
Base Case	3.7
Reducing default interest rates by 50%	1.9
Increasing interest rates by 30%	4.1
Decreasing interest rates by 30%	2.2
Increasing the loan amount by 50%	3.2
Increasing the NAIS premium rates by 20%	4.6

These costs are shared somewhat among farmers, banks, and even the state, respectively, through extra interest costs, zero interest moratoriums, and state-financed debt relief. This arrangement is suboptimal. A double-trigger insurance that makes timely payments would provide debt relief to the farmer at an early stage. The early payment within season can be based on a weather trigger or an area-yield crop forecast. Clearly, basis risk needs to be controlled and transaction costs contained. In addition to reducing the interest expenses, the early payout feature of a double-trigger product would mitigate much of the systemic risk for both the loanee and the bank. This should enhance the access to finance.

Figure C.1. Comparing Interest Payment Scenarios for Three Different Interest Payment Scenarios (Loan Amount Rs 200,000)



Currently, the delayed area-yield indemnity payments increase uncertainty in the crop lending cycle because both bank and loanee are uncertain whether a state imposed debt moratorium, rescheduling, or similar debt relief measures will bridge the period to crop insurance payouts. Moreover, these payouts are highly uncertain as area-yield estimates are not made public at repayment dates, increasing overall uncertainty. Such uncertainty likely results in restrictions on crop loans to farmers. This is likely true for commercial banks that worry about the weather risk impacts on defaults or government imposed moratoriums on interest payments. Systems that shift more of the weather risk out of the banking system by making more timely payments could make the business more predictable.

Assumptions:						
CREDIT						
loan amount without premiums	**100,000**	Rs	*$ 2,128*			
NAIS incl. Premium	**102,000**					
NAIS actuarial incl. Actuarial Premium	**106,000**					
Double trigger insurance incl. Premium	**106,000**					
Interest rate (annualixed)	11%					
default interest rate	22%					
money lender rate	25%					
Maturity	7	months				
First disbursement	70%	of loan amount				
Second disbursement	30%	of loan amount				
INSURANCE			all in % of average yield		yield equivalent of	
		Liability	threshold yield		rainfall deficit	Yield at harvest
NAIS Premium	2%	100,000	90%	0%		60%
NAIS actuarial Premium	6%	100,000	90%	0%		60%
Double trigger insurance premium	6%	100,000	90%	0%	65%	60%
ABILITY TO REPAY AT HARVEST						
Cost per hectare	4,700					
hectares	21					
Revenues per hectare (average yield year)	7,050					
price rise in drought year	30%					
sales revenues at harvest	117,000					
gross income	17,000					
Livelihood expenses	50,000					
Cash deficit	(33,000)					
Ability to repay	67,000					

Appendix D: Rainfall Insurance in India

Of significant interest is the emergence of new insurance offerings even without the opportunity to wrap individual insurance over the government area-yield insurance. In 2003, ICICI Lombard General Insurance Company began a pilot insurance program that will pay farmers when there are shortfalls in rainfall in one area and pay others in case of excess rain. ICICI Lombard offers the drought cover policies via a small microfinance bank in southern India (BASIX) and the excess rain covers through the ICICI Bank. Such contracts offer the distinct advantage of solving the delayed payment problem.

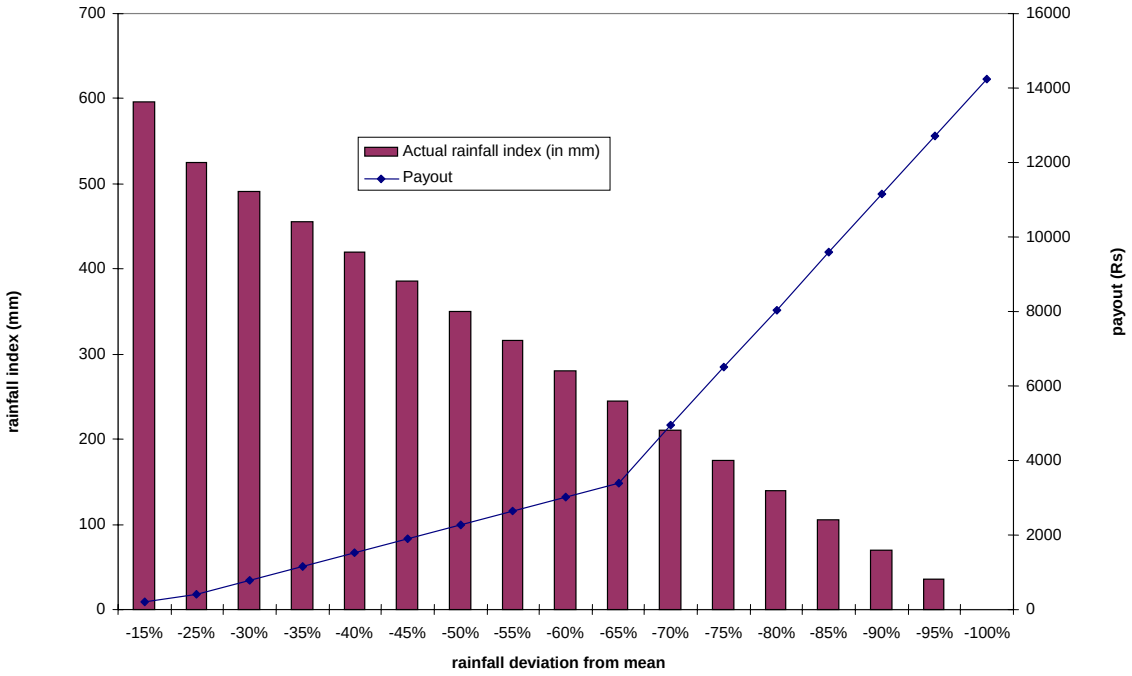
BASIX used ICICI Lombard to launch the new rainfall insurance products. BASIX is a microfinance institution offering a wide array of financial services to rural customers. In February 2001, BASIX also obtained a license from the Reserve Bank of India to open a local area bank. The Krishna Bhima Samruddhi (KBS) local area bank promoted by BASIX commenced operations in March 2001, in the districts of Mahbubnagar in Andhra Pradesh and Raichur and Gulbarga in Karnataka.

BASIX launched its first weather insurance program in July 2003 through its local area bank KBS in Mahbubnagar. Local area banks are limited to operations in three adjacent districts and therefore face limited natural portfolio diversification, which helped to convince KBS that weather insurance contracts for its borrowers could mitigate the natural default risk inherent in lending in drought prone areas such as Mahbubnagar, at the extreme eastern end of Andhra Pradesh, bordering Karnataka. The district has experienced three consecutive droughts during the last years.

KBS bought a bulk insurance policy from ICICI Lombard and seeks to sell individual farmer policies for three categories of groundnut and castor farmers, small, medium and large. Small farmers are defined as households farming less than 2 acres of land, medium farm between 2 and 5 acres and large farmers have more than 5 acres. Premium rates are Rs 456 for the small farmers with a liability of Rs 14,250; medium farmers pay Rs 600 with a maximum liability of Rs 20,000; and large farmers pay Rs 900 for a liability of Rs 30,000. At this pilot stage KBS decided to limit liability per farmer rather than imposing per acre limits, in order to manage overall liability. KBS sold the policies to 250 farmers for each of the two targeted crops. Farmer uptake has been immediate, with around 150 farmers signing up at the first day. The payout structure of the rainfall insurance is presented in Figure D.1.

KBS and ICICI Lombard opted for a weighted and capped rainfall index, which means that the maximum rainfall counted per sub-period is limited to 200mm and more critical periods for the plant growth are more heavily weighted than others.

Figure D.1: Mahbubnagar Weather Insurance — Small Farmer Payout Structure



Informal interviews with around 15 of the farmers who bought the policies revealed that farmers are very well aware of the rainfall-based index nature of the contracts and the associated basis risk. They also understand the two-step payout structure of the policy and the fact that the liability limit is a theoretical number and historical maximum payouts are around Rs 3025 and would have occurred in 2002 and 1997. Thus, the premium rate at that level is around 15 percent. Nevertheless the farmers seem to value the quick payout of the weather policy, which distinguishes it from the NAIS crop insurance policy in India. Interviewed farmers also understand and appreciate the weighted and capped structure of the contract as it directly reflects their experience that the distribution of rain throughout the season matters a lot for the yield and floods do not help the yield.

KBS decided that only borrowing farmers can buy weather insurance policies. Eventually KBS contemplates to lower the interest rate for these farmers due to the reduced default risk.

ICICI Lombard also offered excess rain policies to around 5,000 wheat farmers in Uttar Pradesh (in conjunction with ICICI Bank) and 150 soya farmers in Madhya Pradesh in 2003/2004 (in conjunction with BASIX).