AGRICULTURAL RISK MANAGEMENT THROUGH WEATHER BASED INSURANCE

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Introduction

Agriculture production and farm incomes in India are frequently affected by natural disasters such as droughts, floods, cyclones, storms, landslides and earthquakes. Susceptibility of agriculture to these disasters is compounded by the outbreak of epidemics and man-made disasters such as fire, sale of spurious seeds, fertilizers and pesticides, price crashes etc. All these events severely affect farmers through loss in production and farm income, and they are beyond the control of the farmers. With the growing commercialization of agriculture, the magnitude of loss due to unfavorable eventualities is increasing. The question is how to protect farmers by minimizing such losses. For a section of farming community, the minimum support prices for certain crops provide a measure of income stability. But most of the crops and in most of the states MSP is not implemented. In recent times, mechanisms like contract farming and future's trading have been established which are expected to provide some insurance against price fluctuations directly or indirectly. But, agricultural insurance is considered an important mechanism to effectively address the risk to output and income resulting from various natural and manmade events. Agricultural Insurance is a means of protecting the agriculturist against financial losses due to uncertainties that may arise agricultural losses arising from named or all unforeseen perils beyond their control (AIC, 2008).

Unfortunately, agricultural insurance in the country has not made much headway even though the need to protect Indian farmers from agriculture variability has been a continuing concern of agriculture policy. According to the National Agriculture Policy 2000, "Despite technological and economic advancements, the condition of farmers continues to be unstable due to natural calamities and price fluctuations". In some extreme cases, these unfavorable events become one of the factors leading to farmers suicides which are now assuming serious proportions (Raju and Chand, 2007). Agricultural insurance is one method by which farmers can stabilize farm income and investment and guard against disastrous effect of losses due to natural hazards or low market prices. Crop insurance not only stabilizes the farm income but also helps the farmers to initiate production activity after a bad agricultural year. It cushions the shock of crop losses by providing farmers with a minimum amount of protection. It spreads the crop losses over space and time and helps farmers make more investments in agriculture. It forms an important component of safety-net programmes as is being experienced in many developed countries like USA and Canada as well as in the European Union. However, one need to keep in mind that crop insurance should be part of overall risk management strategy. Insurance comes towards the end of risk management process. Insurance is redistribution of cost of losses of few among many, and cannot prevent economic loss.

There are two major categories of agricultural insurance: single and multi-peril coverage. Single peril coverage offers protection from single hazard while multiple-peril provides protection from several hazards. In India, multi-peril crop insurance programme is being implemented, considering the overwhelming impact of nature on

agricultural output and its disastrous consequences on the society, in general, and farmers in particular. This present study looks at the genesis of agricultural insurance in India, examines various agricultural insurance schemes launched in the country from time to time and the coverage provided by them.

Climate change is one of the most important global environmental challenges facing by human beings, which affects food production, property, natural ecosystems, freshwater supply and health sector. The Intergovernmental Panel on Climate Change (IPCC) projects that the global mean temperature may increase between 1.4 and 5.8 °C by 2100 (IPCC, 2007). The impact due to this unprecedented increase in extreme weather events would be particularly severe in the tropical areas, which mainly consist of developing countries, including India. An analysis of 100 years of rainfall data in India reveals that the frequency of 'below-normal rainfall' in arid, semi-arid and sub-humid regions is 54-57%, while severe and rare droughts occurred once every eight to nine years in arid and semi-arid zones. For instance, In July 2002, rainfall deficiency dropped to 51%, surpassing all previous droughts. The impact of the drought spread over 56% of the land mass and threatened the livelihoods of 300 million people across 18 states.

The impact of climate variability and change on farmer's livelihood in different agro-climatic systems and the changes in risk management approaches have shaped the mitigation and the response strategies of farmers and societies over the years. Farming communities that do not have inbuilt buffering mechanisms, as in resource poor rain-fed regions, are disproportionately vulnerable to the severity of extreme climate events. Climate change caused by global warming is likely to increase the frequency of climatic extremes in the future and result in changes in cropping practices and patterns over time and space. Climate change further compounds the problem, as it threatens to alter the frequency, severity and complexity of climate events, as also the vulnerability of high-risk regions in different parts of the country. In recent years, there has been a dramatic technological progress in the understanding of climate systems, as well as in monitoring and forecasting weather events on the scale of seasons and beyond. The advent of more reliable forecasts goes hand-in-hand with emerging trends in risk management, where reactive strategies are gradually being replaced with more anticipatory, proactive and forward looking approaches. The introduction of new crop varieties and production techniques offers the potential for improved efficiency; however, agriculture is affected by many uncontrollable events that are often related to weather including excessive or insufficient rainfall, hail, extreme temperatures and frost that can severely impact yields and production levels. In the light of above weather insurance acts as a one of the adaptation strategy to mitigate /manage weather related risks in rainfed areas.

Risk and Risk Management

Risk considers not only the potential level of harm arising from an event or condition, but also the likelihood that such harm will occur. Risk conditions are climate-related and include hazards such as droughts and heat waves. Risk levels can change, including as a result of potentially detrimental changes in the climate (e.g. warming, decreasing rainfall). Thus, in risk terms, an unlikely hazard or condition causing

severe impact (e.g. a category 5 hurricane, such the cyclone in the state of Orissa that devastated parts of India in 1999) may be compared to a hazard or condition which causes less harm but has a higher probability of occurring (e.g. a seasonal drought).

Risk management in rainfed agriculture

Rainfed agriculture is often characterized by high variability of production outcomes, that is, by production risk. Unlike most other entrepreneurs, agricultural producers cannot predict with certainty the amount of output their production process will yield, due to external factors such as weather, pests, and diseases. Agricultural producers can also be hindered by adverse events during harvesting or collecting that may result in production losses. In discussing how to design appropriate risk management policies, it is useful to understand strategies and mechanisms employed by producers to deal with risk, including the distinction between informal and formal risk management mechanisms and between ex-ante and ex-post strategies. The-ex ante or ex-post classification identifies the time in which the response to risk takes place: ex-ante responses take place before the potential harming event; ex post responses take thereafter. . Ex-ante informal strategies are characterized by diversification of income sources and choice of agricultural production strategy. One strategy producers employ is risk avoidance. Extreme poverty, in many cases, makes producers very risk-averse, pushing them to avoid high-risk activities, even though the income gains to be generated might be far greater than those gotten through less risky choices. This inability to accept and manage risk respectively reflected in the inability to accumulate and retain wealth is sometimes referred to as the "the poverty trap" (World Bank 2001).

Based on Clarkson et al. (2001), there are six requirements that must be met if rainfed farmers are to manage risks related to climate extremes, variability and change.

These include:

1. Awareness that weather and climate extremes, variability and change will impact on farm operations
2. Understanding of weather and climate processes, including the causes of climate variability and change
3. Historical knowledge of weather extremes and climate variability for the location of the farm operations
4. Analytical tools to describe the weather extremes and climate variability
5. Forecasting tools or access to early warning and forecast conditions, to give advance notice of likely extreme events and seasonal anomalies
6. Ability to apply the warnings and forecasts in decision-making.

In the absence of formal risk sharing / diffusion mechanisms, farmers rely on traditional modes and methods to deal with production risk in agriculture. Many cropping strategies and farming practices have been adopted in the absence of crop insurance for stabilizing crop revenue. Availability and effectiveness of these risk management strategies or insurance surrogates depend on public policies and demand for crop insurance (Walker and Jodha 1986). The risk bearing capacity of an average farmer in the semi-arid tropics is very limited. A large farm household or a wealthy farmer is able to spread risk over time and space in several ways; he can use stored grains or savings during bad years, he can diversify his crop production across

different plots. At a higher level of income and staying power, the farmer would opt for higher average yields or profits over a period of time even if it is achieved at the cost of high annual variability on output (Rao et al., 1988). Binswanger (1980), after studying the risk in agricultural investments, risk averting tendencies of the farmers and available strategies for shifting risk, concludes that farmers' own mechanisms for loss management or risk diffusion are very expensive in arid and semi-arid regions. The major role played by insurance programmes is the indemnification of risk-averse individuals who might be adversely affected by natural probabilistic phenomenon. The philosophy of insurance market is based on large numbers where the incidence of risk is distributed over individual. Insurance, by offering the possibility of shifting risks, enables individuals to engage in risky activities which they would not undertake otherwise (Ahsan et al., 1982). Individuals cannot influence the nature and occurrence of the risky event. The insurance agency has fairly good but generalized information about the insurer. However, this does not hold true in the case of agriculture or crop insurance. Unlike most other insurance situations, the incidence of crop risk is not independently or randomly distributed among the insured. Good or bad weather may affect the entire population in the area.

Lack of data on yield levels as well as risk position of the individual farmer puts the insurance company in tight spot. As in the case of general insurance, agricultural insurance market also faces the problem of adverse selection and moral hazard. The higher premium rates discourage majority participation and only high risk clients participate leading to adverse selection. Moreover, in crop insurance the individuals do not have control over the event, but depending on terms of contract, the individuals can affect the amount of indemnity. Tendency of moral hazard tempts an insured individual to take less care in preventing the loss than an uninsured counterpart when expected indemnity payments exceed the value of efforts. The imperfect information (gathering information is costly) discourages participation of private agencies in crop insurance market. Similarly, incidence of random events may not be independent. Natural disasters may severely damage crops over a very large area and the domain of insurance on which it is based crumbles down i.e., working of the law of large number on which premium and indemnity calculations are based breaks down. The private insurance companies of regional nature will go bankrupt while paying indemnity claims unless it spread risk over space. Farming or crop production being a biological process, converting input into output carries the greatest risk in farming. This, coupled with market risk, impinges on the profits expected from farming. Efficient risk reducing and loss management strategies such as crop insurance would enable the farmers to take substantial risks without being exposed to hardship. Access to formal risk diffusing mechanisms will induce farmers to maximize returns through adoption of riskier options. Investment in development of groundwater, purchase of exotic breeds for dairy will be encouraged due to insurability of the investment. This will help the individual to augment and increase the farm income (micro perspective) and also help to augment aggregate production in the country (macro perspective). The benefits of crop insurance vary depending on the nature and extent of protection provided by the scheme. It is argued that farmers' own measures to reduce the risk in farming in semi-arid tropical India were costly and relatively ineffective in reducing risk in farming and to adjust to drought and scarcity conditions. Jodha finds that the riskiness of farming impinges upon the investment in agriculture leading to suboptimal allocation of resources. He also finds that official credit institutions are ill equipped to reduce the exposure of Indian farmers to risks because they cannot or do

not provide consumption loans to drought-affected farmers (Jodha 1981).

Agriculture Insurance Company of India Ltd. (AIC)

Prior to 2002-03 General Insurance Corporation of India (GIC) was implementing NAIS. Recognizing the necessity for a focused development of crop insurance program in the country and an exclusive organization to carry it forward, Government created an exclusive organization - Agriculture Insurance Company of India Limited (AIC) on 20th December 2002 (www.aicofindia.org). AIC commenced business from 1st April 2003. AIC introduced rainfall insurance known as 'Varsha Bima' during the 2004 South-West Monsoon period. Varsha Bima provided for five different options suiting varied requirements of farming community. These are – (i) seasonal rainfall insurance based on aggregate rainfall from June to September, (ii) sowing failure insurance based on rainfall between 15th June and 15th August, (iii) rainfall distribution insurance with weights assigned to different weeks between June and September, (iv) agronomic index constructed on the basis of water requirement of crops at different pheno-phases and (v) catastrophe option, covering extremely adverse deviations of 50 percent & above in rainfall during the season. Varsha Bima has been piloted in 20 rain gauge areas spread over Andhra Pradesh, Karnataka, Rajasthan and Uttar Pradesh. During 2005, Varsha Bima was fine-tuned and extended to 120 locations in 10 States during kharif 2005, and further to 150 locations in 15 States during kharif 2006 AIC also introduced weather insurance pilots on wheat insurance, mango insurance, and coffee insurance during 2005-06, and is looking ahead for expansion.

Crop Insurance

The idea of crop insurance emerged in India during the early part of the twentieth century. Yet it was not operated in a big way till recent years. J.S. Chakravarti proposed a rain insurance scheme for the Mysore State and for India as a whole with view to insuring farmers against drought during 1920s. Crop insurance received more attention after India's independence in 1947. The subject as discussed in 1947 by the Central Legislature and the then Minister of Food and Agriculture, Dr. Rajendra Prasad gave an assurance that the government would examine the possibility of crop and cattle insurance. In October 1965 the Government of India decided to introduce a Crop Insurance Bill and a Model Scheme of Crop Insurance in order to enable the States to introduce, if they so desire, crop insurance. In 1970 the draft Bill and the Model Scheme were referred to an Expert Committee headed by Dr. Dharm Narain. Different experiments on crop insurance on a limited, ad-hoc and scattered scale started from 1972-73. The first crop insurance program was on H-4 cotton in Gujarat. All such programs, however, resulted in considerable financial losses. The program(s) covered 3110 farmers for a premium of Rs. 4, 54,000 and paid claims of Rs. 3.79 millions. It was realized that programs based on the individual farm approach would not be viable in the country. Obviously, "individual farm approach" would reflect crop losses on realistic basis and hence, most desirable, but, in Indian conditions, implementing a crop insurance scheme at "individual farm unit level" is beset with problems, such as:

(i) Non availability of past record of land surveys, ownership, tenancy and yields at individual farm level (ii) Large number of farm holdings (nearly 116

millions) with small farm holding size (country average of 1.41 hectares) (iii) Remoteness of villages and inaccessibility of farm-holdings (iv) Large variety of crops, varied agro-climatic conditions and package of practices (v) Simultaneous harvesting of crops all over the country (vi) Effort required in collection of small amount of premium from large no. of farmers (vii) Prohibitive cost of manpower and infrastructure

Weather Insurance

As the name suggest, weather insurance is an insurance coverage against the vagaries of weather. Many agrarian economies owe their strength to favourable weather parameters, such as rainfall, temperature, relative humidity etc. Around sixty five percent of Indian agriculture is heavily dependent on rainfall, and, therefore, is extremely weather sensitive. Many agricultural inputs such as soil, seeds, fertilizer, management practices etc. contribute to productivity. However, weather, particularly rainfall has overriding importance over all other inputs. The reason is simple - without proper rainfall, the contributory value of all the other inputs diminishes substantially. An analysis of Indian Crop Insurance Program between 1985 and 2003 reveals that rainfall accounted for nearly 95 percent claims – 85 percent because of deficit rainfall and 10 percent because of excess rainfall (AIC, 2006). Reducing vulnerability to weather in developing countries may very well be the most critical challenge facing development in the new millennium. One of the most obvious applications of weather risk management products, weather insurance or weather derivatives. Weather impacts on many aspects of the agricultural supply and demand chain. From the supply side, weather risk management can help to control both production risk and quality risk. Weather events like warmer than normal winter or a cooler than normal summer can impact all sorts of companies like utilities, food and agricultural groups and even retailers.

The basic idea of weather insurance is to estimate the percentage deviation in crop output due to adverse deviations in weather conditions. There are statistical techniques to workout the relationships between crop output and weather parameters. Techniques like multivariate regression could explain the impact of weather deviations / variations on productivity. This gives the linkage between the financial losses suffered by farmers due to weather variations and also estimates the indemnities that will be payable to them. The analysis could also include contingencies associated with the timing and the distribution of weather parameters, particularly over the season.

Advantages of weather insurance over traditional crop insurance

There are many shortcomings in the traditional crop insurance. The important ones are: (a) adverse selection (b) multiple agencies and their huge administrative cost (c) lack of reliable methodology for estimating and reporting crop yields (d) delays in settlement of claims (f) program limited to growers (farmers). Majority of these shortcomings could be overcome in the weather insurance, as follows:

- Trigger events (like rainfall) can be independently verified & measured.
- Compared to yield based insurance, weather insurance is inexpensive to

operate. Since very few agencies would be involved in implementation, the aggregate administrative cost would be far lower.

- Unlike traditional crop insurance where claim settlement can take up to a year, quick payouts in private weather insurance contracts can improve recovery times and thus enhance coping capacity.
- Scientific way of designing product and transparency.
- Individual farmers are generally unable to influence the weather index value.

Weather-Index

Index-based weather risk insurance contracts in agriculture have emerged as an alternative to traditional crop insurance. These are linked to the underlying weather risk defined as an index based on historical data (for example, for rainfall, temperature, snow, etc.) rather than the extent of loss (for example, crop yield loss). Weather insurance is a creative product that can be used for situations ranging from sales promotions to income stabilization, unlike regular insurance, which would only cover physical damage, weather insurance protects against additional expenses or loss of profit from a specific weather event. Insurance generally pays based on actual damages, while weather insurance pay based on the difference between a negotiated "strike price" and the actual weather (or the total of weather related index). As the weather index is objectively measured and is the same for all farmers, the problem of adverse selection is minimized. Weather-indexed insurance can help farmers protect their overall income rather than the yield of a specific crop, improve their risk profile enhancing access to bank credit, and hence reduce overall vulnerability. Some of pilot schemes and delivery models operated in India are:

1. ICICI Lombard pilot scheme for groundnut in Andhra Pradesh
2. KBS pilot scheme for soya farmers in Ujjain
3. Rajasthan government insurance for orange crop
4. IFFCO-TOKIO monsoon insurance
5. AIC Varsha Bima Yojana (rainfall insurance scheme)
6. AIC Sookha Suraksha Kavach (drought protection shield)
7. AIC coffee rainfall index and area yield insurance
8. ICICI Lombard loan portfolio insurance

Weather Insurance Pilots in India

ICICI-Lombard was the first general insurance company in India to introduce rainfall insurance pilot based on a ‘composite rainfall index’ in 2003. It implemented a pilot project in Mahabubnagar district of Andhra Pradesh for groundnut and castor. Though participation was limited, it held out valuable lessons for future programs. The rainfall index insurance and other weather-based insurances have since been extended to other areas and crops beginning with kharif 2004 season.

IFFCO-Tokio General Insurance Company (ITGI) piloted rainfall insurance by the name – ‘Baarish Bima’ during 2004 in nine districts of Andhra Pradesh, Karnataka, Gujarat & Maharashtra. The product is based on rainfall index compensating farmers for deficit rainfall. The policy pays for deviations in actual rainfall exceeding 30 percent. The claims are paid on graded scale, with 100 percent claims payable when adverse deviation in rainfall reaches 90 percent. This pilot again is expanded to more crops and areas after kharif 2004 season. After analysing the impact that temperature has on wheat cultivation,

ICICI Lombard had designed a weather insurance product for wheat cultivators which addresses the dual risks of extreme temperature fluctuations and unseasonable rainfall

Table.1. Example for the Weather insurance product for wheat

Time period	Jan-Mar	Mar-Apr
Stage	Grain filling stage	Harvesting phase
Risk	Extreme temperature fluctuations	Unseasonal rainfall
Weather index	Deviation in fortnightly average Tmin and Tmax on higher side from benchmark	Max. rainfall on any single day

Conclusion

Despite progress of irrigation and improvement in infrastructure and communication the risk in agriculture production has increased in the country.

Despite various schemes launched from time to time in the country agriculture insurance has served very limited purpose. The coverage in terms of area, number of farmers and value of agricultural output is very small, payment of indemnity based on area approach miss affected farmers outside the compensated area, and most of the schemes are not viable. Expanding the coverage of crop insurance would therefore increase government costs considerably. Unless the Programme is restructured carefully to make it viable, the prospects of its future expansion to include and impact more farmers are remote.

insurance could be brought down to a village panchayat level. Insurance products for the rural areas should be simple in design and presentation so that they are easily understood. There is lot of interest in private sector to invest in general insurance business. This opportunity can be used to allot some target to various general insurance companies to cover agriculture. To begin with, this target could be equal to the share of agriculture in national income. Good governance is as important for various developmental programmes as for successful operation of an agriculture insurance scheme. Poor governance adversely affects development activities. With the improvement in governance, it is feasible to effectively operate and improve upon the performance of various programmes including agriculture insurance.

Crop insurance program works as collateral security, therefore also benefit banks. Weather insurance will continue to be the dominant insurance concept as the coming years will experience more frequent extreme weather events like heavy rains, droughts heat and cold waves etc. Food security and weather risk management are inextricably linked: weather risk management or the lack of it determines the level of systematic risk in the food security system. At the farm level, weather based index insurance allows for more stable income streams and could thus be a way to protect peoples livelihood and improve their access to finance. Weather based insurance is an upcoming strategy that has proven its worth in places such as India and its important that it given the attention it deserves as improve the food securities of communities especially the resource

poor. Climate change needs to be treated as a major economic and social risk to national economies, not just as a long-term environmental problem.

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