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Index based Crop Insurance

By

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Abstract

Agriculture sector is subject to a great many uncertainties. Yet, more people in developing countries like India earn their livelihood from this sector than from all other economic sectors combined. Agriculture, particularly prone to systemic and co-variant risk, doesn't easily lend itself to insurance. Lack of historical yield data, small sized farm holdings, low value crops and the relatively high cost of insurance, have further made it more difficult to design, a workable crop insurance scheme (Rao K N). Despite these constraints, India debated the feasibility of crop insurance schemes, since late nineteen forties, and could settle for 'yield index' based crop insurance on a country-wide basis since 1985.

The yield index based crop insurance in India, presently under the name 'National Agricultural Insurance Scheme (NAIS) is the flagship crop insurance programme, annually insuring about 25 million farmers with an area of over 35 million hectares (AIC's provisional figures as of 31st March 2010), and available for almost all seasonal and annual crops for which there exists historical yield data of 10 years at sub-district level. NAIS despite well suited for Indian conditions, suffers from some key problems. These include basis risk (insurance unit being too large), delay in receiving yield estimates leading to delay in settlement of indemnities, non-coverage of pre-sowing & post-harvest losses, huge infrastructure and manpower required to estimate yields (irrespective of yield loss), etc.

Keeping in mind the challenges with yield index insurance, India started piloting 'rainfall (weather) index' based insurance since 2003. The government from 2007 started providing subsidies in premium, and is being tested as a substitute for NAIS. At present Agriculture Insurance Company of India (AIC), an entity created at the behest of the Government in 2003 and the largest market player in India, has insured 1.98 million farmers during 2009-10 (April to March) covering more than 2.68 million hectares of cropped area for a sum insured of approx. US $ 870 million for a premium income of US $ 80 million (AIC's Provisional figures as of 31st March 2010).

India started experimenting the Biomass Index for crops like wheat, mustard, chickpea since 2005. The index has so far met limited success, but could play important role in near future, as remote sensing technology experiencing quantum jump in terms of all-weather satellites, high resolution data and higher frequency of fly-overs.

Index based insurance is here to stay, and is the way forward in many developing nations. Best results could be obtained by careful deign of index and use of a combination of indices (multiple triggers) to capture the key production risks in agriculture.

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1. Introduction

Agriculture in India despite its relatively diminishing contribution to Gross Domestic Product (GDP), accounts for over 50 percent of employment, and sustains close to 70 percent of the population (RBI Annual Report 2007-08). In addition to satisfying all the food and nutritional requirements of the nation, agriculture also provides important raw materials to some major industries and accounts for significant share of total exports. Another feature of the Indian agriculture sector is the large number of small sized landholdings. Of the estimated total 120 million farm-holdings, 63 per cent of farm-holdings were less than one hectare in size, with average holding size of merely 0.4 hectares. As a consequence, the performance of agriculture in the near future will be crucial not only for the Indian farmers and the Indian agribusiness entities, but also for the Indian economy as a whole.

2. Climate of India and Climate Variability

The India Meteorological Department (IMD) was established as a National agency in 1875 merging various provincial meteorological services which existed in the 19th century. However, instrumental data and records for a few stations in India existed since 18th century. Some of the oldest observatories include Madras (September 1793), Bombay (1823) and Calcutta (December 1829). Basically, the climate of India is dominated by the summer monsoon (June to September). The entire year is, however, divided into four season: (i) Winter (January and February) (ii) Pre-monsoon or Hot Weather season (March-May) (iii) Southwest or Summer Monsoon season (June-September) (iv) Post monsoon season (October-December), of these Summer Monsoon season (June-September) accounts for nearly 3/4th of the annual rainfall received in the country (IMD).

2.1. Floods and Droughts

Floods and droughts over India are the two aspects of the weather associated with the abundance or deficit of monsoon rains. A large number of studies are available on various aspects of floods and droughts, and one of the studies ranks the year 1918 as the worst drought year of the 20th century, a year when about 68.7 percent of the total area of the country was affected by drought. A list of major drought and flood years of last one hundred years is compiled by De et al (table-1).

Table-1 : Year of Major Droughts and Floods in India and their Categorization

DROUGHTS				FLOODS			
Year	Area affected (10^6 sq.km)	% age of the country affected	Category	Year	Area affected (10^6 sq.km)	% age of the country affected	Category
1918	2.16	68.7	Extreme	1961	1.80	57.17	Exceptional
1877	2.03	64.7	Extreme	1917	1.43	45.45	Exceptional
1899	1.99	63.4	Extreme	1878	1.51	48.19	Exceptional
1987	1.55	49.2	Severe	1975	1.27	40.38	Exceptional
1972	1.39	44.4	Severe	1884	1.18	37.42	Exceptional
1965	1.35	42.9	Severe	1892	1.16	37.01	Exceptional
1979	1.24	39.4	Moderate	1933	1.15	36.47	Exceptional
1920	1.22	38.8	Moderate	1959	1.14	36.15	Exceptional
1891	1.15	36.7	Moderate	1983	1.03	32.80	Exceptional
1905	1.09	34.7	Moderate	1916	1.03	32.60	Exceptional
2002	0.91	29.0	Moderate				

Source: De, U.S.De, Dube, R.K and Prakasa Rao, G S

Note: 2002 area affected value is derived based on percentage of the country affected

Agriculture sector is, thus subject to a great many uncertainties. Uncertainty of crop yield is thus one of the fundamental risks, which every farmer has to face, more or less, in all countries, whether developed, or developing. These risks are particularly high, in developing countries particularly in the 'tropics' as in most of these countries, the overwhelming majority of farmers are poor, with extremely limited means and resources. They cannot bear the risks of crop failure of a disastrous nature.

3. Crop Insurance

Agriculture, particularly prone to systemic and co-variant risk doesn't easily lend itself to insurance. Lack of historical yield data, small sized farm holdings, low value crops and the relatively high cost of insurance, have further made it more difficult to design, a workable crop insurance scheme (Rao K N). Despite these constraints, India debated the feasibility of crop insurance schemes, since early part of 20th century, and could settle for 'yield index' based crop insurance on a country-wide basis since 1985.

3.1. Yield Index based Insurance

The countrywide yield index insurance introduced in 1985 was preceded by detailed feasibility study under the stewardship of Professor V M Dandekar. For his efforts in introducing index based crop insurance programme, Dandekar is rightly remembered as the 'father of Indian crop insurance programme'.

The basic character of the yield index approach (area approach) as explained by Dandekar, is that it sets up, for each area, an independent chance-system entirely dependent on the annual average yields of the crop in that area and avoids altogether any reference to individuals or groups of individuals in the area not only while fixing the premium rate but also for assessment of indemnity. This makes a crop insurance scheme based on this approach a fair betting system in principle. But if the area is sufficiently 'homogeneous' to make the annual crop experience of a majority of the farmers similar, it serves for them as crop insurance as well. Within these limits, the scheme appears to be an operationally simple and practically useful. The yield index approach obviates the main difficulties of the 'individual farm based approach'. It does not require ascertaining the crop-outputs of individual farmers. All that it needs is estimates of average annual yields of the crop over an area. These can be ascertained objectively from the crop cutting experiments conducted by the state goverrments for purpose of crop estimation. Being objectively determined, they are much less open to dispute and much less liable to moral hazard.

3.2. Homogeneity

From the standpoint of a farmer, the years when the average productivity of the 'area' is below the normal should also be the years when his own productivity is below his own normal and vice versa. If the area is small enough and is agro-climatically homogeneous, the productivity of a majority of farmers therein would be highly correlated, that is to say, they would move together above or below their respective normals. In such a case, they would also move together with the average productivity of the area and hence the scheme would be meaningful as a crop insurance scheme. For this reason, Dandekar suggested that, in a crop insurance scheme based on the 'area approach', the area in which all farmers would pay the premium at the same rate and would receive indemnity at the same rate should be a **'homogeneous area'**.

3.3. Crop Production Index Insurance

In area yield index insurance, a programme covering a specific single crop may be relevant in the case of a few high-valued crops susceptible to special damage. Prof Dandekar, therefore, felt that there is no particular advantage in having a separate index for each specific crop in case of field crops. On the other hand, there is distinct advantage in having a crop insurance scheme for all major crops of the area taken together. A crop-wise programme for a number of specific crops will require calculation and collection of so many separate premium and assessing so many separate indemnities. Instead, if the crop insurance covers all crops taken together, it will involve the calculation and collection of a single premium and assessing a single indemnity. It will thus greatly simplify the administration of a crop insurance scheme. Most importantly, because yield variability in the overall productivity of all crops taken together is much smaller than that of individual crops, it will be possible, in general, either to lower the rate of premium or offer more liberal indemnity. A crop insurance scheme covering all crops taken together would be based on a 'production index' of all crops which would be an appropriately weighted average of the production indices of the several crops. For constructing a combined production index, the weights could be the acreages under the several crops in the area. However, the policy makers of the country opted for 'crop specific yield index' based crop insurance as against 'combined crop production index based insurance, suggested by Dandekar.

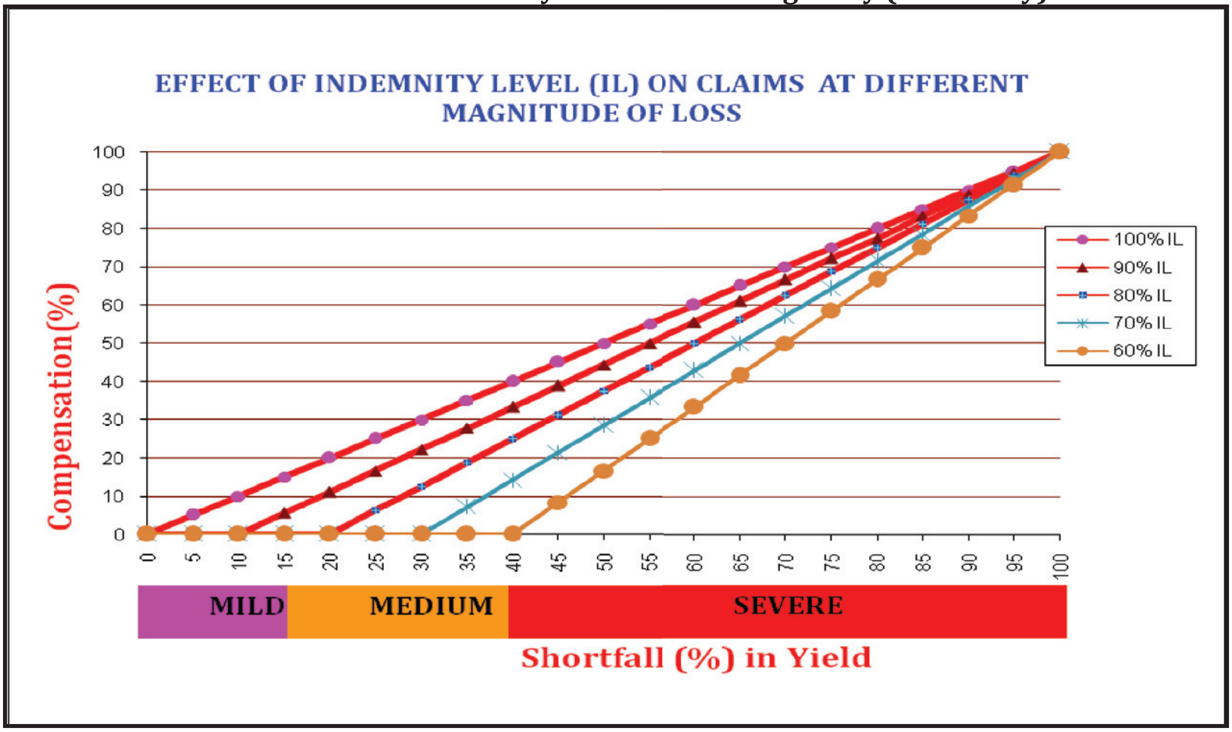
3.4. National Agricultural Insurance Scheme (NAIS)

India moved quite a long way since the area yield index insurance pilot in 1979 and the countrywide programme since 1985. The present programme known as 'National Agriculture Insurance Scheme (NAIS)' is the world's largest area yield index insurance programme, which during 2009-10 insured about 24.5 million farmers cultivating crop on over 35 million hectares for a sum insured of approx. US $ 9.5 billion (AIC's provisional figures as of 31st March 2010). The programme pays indemnity on the basis of the formula produced below:

$$\text{Indemnity} = \text{Max}\left(0, \frac{\text{Threshold Yield} - \text{Actual Yield}}{\text{Threshold Yield}}\right) \times \text{Sum Insured}$$

Threshold yield or trigger yield is moving average yield of past five years, multiplied by the indemnity (coverage) level. The indemnity levels range from 60 percent to 90 percent depending on risky nature of the crop in a given area. The concept of 'indemnity level' is very unique in the sense that the lower indemnity levels make a huge difference on indemnity eligibility for small and medium losses, and gradually move towards unification as the losses (shortfall in actual yield) becomes larger. The concept is explained in Box-1below:

Box 1: Effect of Indemnity Level on Loss Eligibility (Indemnity)



Source: Author

3.5. Key Challenges of Area Yield Index Insurance

Area yield index insurance though best suited for Indian conditions, but not without shortcomings. The most important one is 'basis risk' as the area (insurance unit) is rarely homogenous. Presently efforts are made to lower the size of the area in order to minimize the basis risk. As the index is based on yield, the insurance cover primarily operates from 'sowing till harvesting', and for this reason pre-sowing and post-harvest losses are not reflected in the yield index. Yet another challenge is the infrastructure and manpower required to conduct over a million crop cutting experiments across the country to estimate the yields of each specific crop in an area. The process also contributes to delay in settlement of indemnities as the yield estimates' compilation takes almost two to three months after the harvest season. Moreover, yield index based insurance can be designed for only crops there exists at least 10 years' historical data at insurance unit level.

Despite these shortcomings, area yield index is still considered very important insurance programme in Indian conditions. The government is set to introduce amendments in the programme to overcome some the challenges mentioned above.

4. Weather Index Insurance

Weather index based insurance caught the imagination of the policy makers at the beginning of 21st century, and international financial institutions like the World Bank encouraging the pilots in low income countries where crop insurance could not take off for various regions, including lack of historical yield or loss data. The basic purpose of 'weather index' insurance is to estimate the percentage deviation in crop output due to adverse deviations in weather conditions. There are crop modeling and statistical techniques to precisely workout the relationships between crop output and weather parameters. This gives the linkage between the financial losses suffered by farmers due to weather variations and also estimates the payouts that will be payable to them.

Its worth mentioning that the pioneering work on weather index insurance commenced as far back as 1912 by J S Chakravarthi, as a mechanism to compensate crop losses. It was between 1912 and 1920, Chakravarthi of Mysore State (India) published technical papers on the subject of 'Rainfall Insurance' and a book entitled **'Agricultural Insurance: A Practical Scheme Suited to Indian Conditions'**, in 1920, describing how rainfall index could be used to guarantee payouts to farmers due to adverse deviations. He used rainfall data from 1870 to 1914 from India Meteorological Department (IMD) to demonstrate the utility of the index. Surprisingly, this piece of pioneering work, which is probably one of the earliest monographs on the subject, does not appear to have been taken into account in the analytical literature on agricultural insurance (Mishra P K). It was some 85 years later that the policy makers of the modern world started advocating the very same index for low income countries.

4.1. Weather Index – Key Advantages

One key advantage of the weather index based crop insurance is that the payouts could be made faster, besides the fact that the insurance contract is more transparent and the transaction costs are lower. Because index insurance uses objective, publicly available data, it's less susceptible to moral hazard (IRI, 2009). Most importantly there are many low income countries where no historical data whatsoever is available, except weather data, affording an opportunity to try out some sort of index insurance. A large amount of literature is now available on weather index insurance, mostly commissioned by the World Bank.

Thanks to the advocacy role played by the World Bank, many countries are piloting the weather index based crop insurance. Countries like Mexico, India, Ukraine, Malawi, Ethiopia and China have been piloting weather index based crop insurance for some years, while others like Tanzania, Nicaragua, Thailand, Kazkhastan, Senegal, Morocco, Bangladesh, Vietnam, Caribbean Islands the weather index products are in development stage (Mahul & Barnett).

4.2. Weather Index – Indian Experience

Thanks to availability of historical weather data for a large number of locations, dependence of agriculture on rains, and huge pool of scientific resources, India is in the fore-front of piloting different models of weather index insurance. An illustrative deficit rainfall insurance product of AIC (called **Varsha Bima**) piloted during 2004 is produced in box-2. The government realizing the need for encouraging the pilot, supporting the programme since 2007 by providing financial support in terms of up-front subsidy in premium. Consequently private sector insurers, besides AIC have been running pilots in various parts of the country. The weather parameters so far indexed include rainfall (deficit, excess, dry-spell, wet-spell), temperature (minimum, maximum, mean), humidity, wind speed etc.

AIC during 2009-10 piloted weather index based crop insurance for over 35 different crops, insuring 1.98 million farmers covering more than 2.68 million hectares of cropped area for a sum insured of approx. US $ 870 million for a premium income of US $ 80 million (AIC's Provisional figures as of 31st March 2010).

Box-2: Agriculture Insurance Company of India Ltd. – Aggregate Rainfall model

Illustration of Varsha Bima – 'Seasonal Rainfall' Option for Lucknow (Rice)

1. **Season span / Period of insurance**: 1st June to 30th September 2004
2. **Risk Acceptance Period**: Upto 30th June 2004
3. **Reference IMD Rain-gauge Station**: Lucknow (UP)
4. **Rain-gauge Station's jurisdiction for Insurance**: Badagaon and Babina Blocks
5. **Normal Rainfall**: 853 mm; 6. **Crop**: Rice
7. **Maximum Pay-out**: INR 18,000/- 8. **Premium** (per hectare): INR 1296/
9. **Pay-out structure** (Per hectare compensation structure at various levels of deviations):

Rainfall Range MM	Payment rate INR / MM	Rainfall Range MM	Payment rate INR / MM
1. 640-682	10.77	2. 597-640	11.99
3. 554-597	13.32	4. 512-554	14.80
5. 469-512	16.47	6. 426-469	18.30
7. 384-426	20.35	8. 341-384	20.40
9. 298-341	20.45	10. 256-298	20.56
11. 213-256	20.65	12. 170-213	20.78
13. 128-170	20.87	14. 85-128	20.93
15. 42-85	21.00	16. 0-42	21.10

How to read the table:

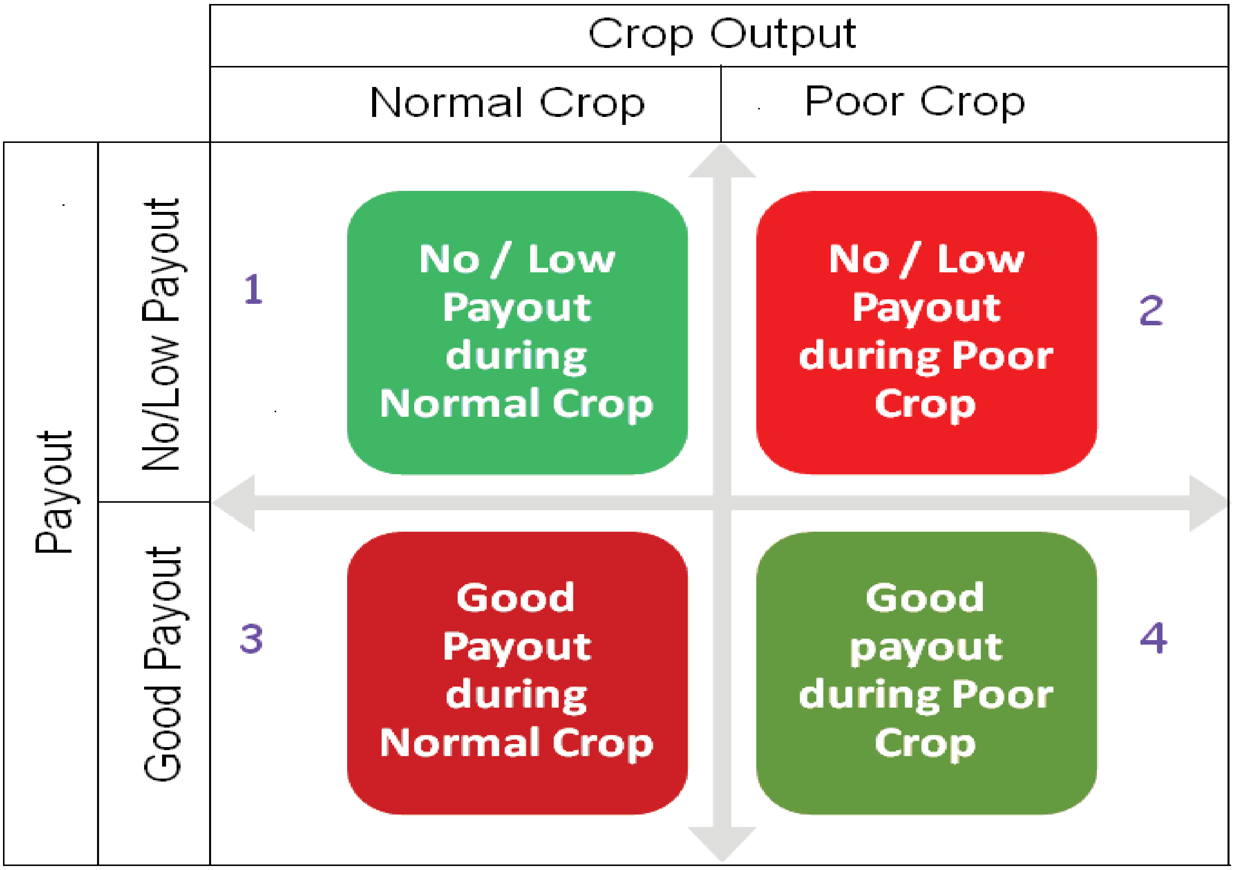
Payout starts once the negative deviation in rainfall touches 20 percent. In case of Lucknow location, the strike point is 682 MM. If, say actual rainfall is 650 MM, the payout per hectare of rice is – 'deviation in rainfall' (as against normal), multiplied by 'payment per MM deviation' at a given range. In this case, it is 203 MM * INR 10.77 = INR 2186. At this deviation, the insured farmer would receive approx. 20 percent of sum insured as payout, and is roughly equivalent to 1½ times the amount of premium paid. The farmer would receive 50 percent of the sum insured if the deviation of rainfall were 50 percent.

Source: Rao, K N, 'Risk Management of Small Farms in India – Food and Agriculture Organization (FAO)', April 2008 (unpublisl

4.3. Weather Index – Key Challenges

Weather index based insurance has many advantages and offers great potential for farmers in low income countries to manage the production risk. At the same time, weather index based crop insurance faces several challenges, and these include non-availability of reliable and quality weather data, basis risk, complex index contract design, etc. The most important challenge of course, is 'basis risk'. Basis risk in a way is inseparable part of any index based insurance – it can only be minimized, but not totally removed. Basis risk may arise for many reasons. In case of weather index it could mainly arise because of lack of good density of weather stations, and poor index design, though there could be other reasons. How these dimensions could lead to basis risk is presented in box-3:

Box 3: Effect of Basis Risk & Poor Design of Weather Index



Source: Author

Basis risk may get accentuated as a result of poor density of weather stations, as well as poor design of weather index, which may result in failure to capture the yield loss and thus, cause a payout when there is no loss and vice-versa. Both, Basis risk and Poor Design of Weather Index may result in 'no payout' despite the poor crop at individual farmer's farm and vice-versa. A good index insurance product should be able to ensure 'good payout' if the crop is 'poor' (quadrant-4), or 'no payout' if the crop is 'normal' (quadrant-1), only then the insurance can be called effective. Or else, it would lead to 'no payout' despite the crop being 'poor' (quadrant-2) or 'good payout' despite a 'normal crop' (quadrant-3), defeating the very purpose of insurance. In other words, what's important for the farmer is not merely a payout through weather index insurance, but a payout when it matters, i.e. when the crop is poor. In other words, minimizing the basis risk in terms of good density of weather stations and correct design of the weather index are vital to the success of weather index based crop insurance, lest it may run the risk of being called 'gamble'.

Nevertheless, weather index offers great potential, and is seen as important adaptation mechanism in mitigating Climate Change impact on Agriculture.

4.4. Basis Risk: Yield Index and Weather Index

In case of yield index, basis risk may arise mainly because of lack of homogeneity in the insurance unit in terms of production systems. An analysis of sources of basis risk in case of yield index and weather index is presented in box-4:

Box-4: Basis Risk in Index Insurance

S.No	Nature of Basis Risk	Yield Index	Weather Index
1	Geographic Basis Risk	Arises when the Insurance Unit size is too large and is not homogenous in terms of agricultural production level	Arises when a weather station is referenced for a larger geographical area, covering areas far off from weather station
2	Product Basis Risk	Yield index insurance covers risk from sowing till harvesting. As Yields are estimated at harvest stage, losses if any suffered after harvest are not reflected in the yield index.	Weather index covers risk arising out of deviations in parametric weather exigencies only. Risks outside these parametric weather (like pests, diseases, hailstorm, flooding etc.) are not covered
3	Product Design Basis Risk	Trigger yield used in yield index insurance is a function of moving average of past 5 years' yield and coverage level, which may range from 60 to 90 percent. In other words, the shortfall between 'normal yield' and 'trigger yield' is not protected	Arises because of imperfect correlation between weather index and the production process (yield)

Source: Author

5. Biomass (Crop Health) Index

'Biomass index' based on satellite image derived Normalized Difference Vegetative Index (NDVI) has been used in countries like United States of America, Canada and Spain for pasture and forage crops for some years. In India AIC started pilots in 2003 primarily to model the yield estimates as a substitute for manual system of yield estimation (to feed the yield index insurance). While the results were encouraging, AIC saw an opportunity to develop a trigger using the crop health (biomass) index, and accordingly piloted biomass trigger alongside weather trigger for wheat crop during 2005. The pilot was extended to chick pea as well during the subsequent seasons. Wheat is a winter crop in India sown during 2nd half of November and harvested towards end of (next) March, and research studies found that the average values of NDVI derived from satellite imagery taken during 3rd week of January and 2nd week of February found to have the highest correlation with the final yield. AIC procured past 10 years satellite imagery for those periods and locations and constructed the index based on scaled NDVI. Based on the NDVI and yield correlation, the triggers have been defined at a level between 95 to 85 percent of past 10 years' average. It has been found that the start-up costs are very huge on account of procurement of historical images and their processing. Calculation of current season's NDVI too required ground-truthing so as to improve the accuracy of the calculated NDVI.

5.1. Biomass Index: Challenges

Biomass index appears to hold great promise in future, and is most likely to be used to model the yield estimates, and a definite prospect for replacing manual yield estimation. However, at present there are many challenges, which need to be tackled before successfully using the biomass index either as an index or proxy for yield estimates. Some of the challenges include:

(i) High start-up costs
(ii) Requirement of all-weather satellites (particularly during cloudy season)
(iii) Costs associated with procurement of high resolution imagery data
(iv) Requirement frequent fly-overs (number of days passed before a satellite or a group of satellites to fly over the same territory) in order to capture key crop growth stages without fail.

(v) Challenge of accurately estimating NDVI in case of mixed / inter crops
(vi) Not suitable for tree (perennial) crops; and also crops where the economic product is formed below the surface (potato, peanut etc.)

The author having experience of working on all the three index based insurance products, viz. Yield index (full-fledged programme); weather index and biomass (crop health) index (pilot programmes), compared the characteristics, strengths and weaknesses in box-5, below:

Box-5: Comparison of Index Based Insurance Products

Yield Index Insurance	**Weather Index Insurance**	**Crop Health Index Insurance**
Characteristics 1. Practically 'all-risk' insurance 2. Can work well for field crops having historical yield data of at least 10 – 15 years 3. Works efficiently when the insurance unit is largely homogenous **Strengths** 4. Very important program in developing countries like India where large number of small sized farm holdings exist 5. It's a good solution where historical farm-level yield data do not exist 6. Can minimize problems associated with 'asymmetric information', like adverse selection & moral hazard 7. Credit-linkage can help in reducing administrative cost **Weaknesses** 8. Delay in indemnity payment of almost 6 - 9 months as indemnity processing is linked to availability of final yield estimates 9. Basis risk is another serious problem as the insurance unit is rarely homogenous 10. Huge administrative cost in conduct of yield estimation surveys, and also the possibility of interference at grass root level in yield estimation	**Characteristics** 1. Payouts are linked to performance of the weather index 2. Can be designed for field crops and horticultural crops having weather data of 25 – 30 years **Strengths** 3. Has almost all the advantages of 'Area Yield' Insurance, plus many other positive features 4. It can work even for areas / crops, which do not have historical yield data 5. Provides timely indemnity payment 6. All communities whose incomes are dependent on weather could buy the insurance 7. Indemnity payments are made on the basis of weather data, which is both tamper-proof & accurate and transparent **Weaknesses** 8. Basis risk due to poor density of weather stations 9. Scope limited to parametric weather exigencies 10. Challenges in contract design 11. Challenges in actuarial modeling 12. Changing weather patterns	**Characteristics** 1. Practically 'all-risk' insurance 2. Can work well for field crops and forage crops 3. Best captures crop stress (drought and pest / disease affected) 4. About 10 years' of historical satellite imageries is must **Strengths** 5. Provides for reasonably accurate loss assessment 6. Faster and rapid loss assessment 7. Provides for reasonably timely indemnity payments 8. Can assess losses of areas unapproachable by normal means **Weaknesses** 9. Unsuited for tree crops; and seasonal crops where the economic product grows below the surface 10. Quality scientific information is required in designing the insurance product 11. Requires all-weather satellite and good resolution images at key crop stages, which is a challenge 12. Could be expensive in the initial stage

Source: Author

The author tried to compare the three 'index based insurance' products on a common parameter on the basis of Indian experience, in box-6 below:

Box-6: Comparison of Working of Index based Crop Insurance Products in India

S.No	Parameter	Yield Index	Weather Index	Crop Health Index
1	Nature of Index	Random samples taken from across the unit	Point data (about 20 KM radius for rainfall and 50 KM for others)	Weighted data of the unit (based on individual pixels)
2	Time of Parameter Measurement	Measured at harvest time	Through out risk period	At two / three key crop stages
3	Mode of measurement	Manual	Mechanical / Automatic	Automatic followed by ground-truthing
4	Pay for	Shortfall in guaranteed (trigger) yield	Adverse weather deviations	Crop stress / Poor Crop health
5	Payout Criteria	Guaranteed Yield (60 to 90 percent of past 5 years' moving average yield)	Normal / Critical Weather requirements	90 percent of Index based on 10 years
6	Payout Equation	Proportional / linear	Mostly non-linear	Linear / non-linear
7	Basis Risk	Relatively high	Relatively high	Low to moderate
8	Best suited for	Mainly field crops (seasonal / annual crops)	Seasonal / annual / perennial crops	Seasonal crops, mainly pasture / forage crops
9	Initiated in	1979	2003	2005
10	Present Status	Full fledged / countrywide	Large Pilot	Pilot
11	Farmer's understanding	Reasonably good	Reasonably good	Not sure
12	Government Support	Financial support (claims subsidy) on an average 75 percent	Financial support (premium subsidy) ranging from 40 to 80 percent	No Support

Source: Author

6. Multiple (Index) Trigger Insurance Products

Experience of index based insurance products in India suggest that the various index products are not substitutes for each other, but largely complementary in nature. For example, between yield and weather index products, each have their strengths and weaknesses. Yield index insurance provides nearly all-risk cover, where as weather index insurance quick and timely payouts. A combination of these indices can bridge the 'gap' in indemnity and lower the basis risk.

An illustration is provided, assuming that it's proposed to use both 'Weather index' and 'Yield index' as independent triggers so as to capture the best of both into the insurance product. Under this model the overall payout (compensation) comes from two different indices, viz. 'weather index' and 'yield index', and both operate independently. Assuming that ½ payout is determined by weather index and balance ½ payout by yield index, the sum insured (coverage) by the farmer is placed in two different 'baskets'. If the sum insured for a crop is Indian Rupees (INR) 30,000, of which INR 15,000 is placed under weather index basket and the balance INR 15,000 under yield index basket. In other words, payout under weather index is based on a sum insured of INR 15,000, and that of yield index is based on a sum insured of INR 15,000. Assuming that the payout rate under weather index is 15 percent, and the shortfall in yield is 20 percent, the total indemnity payable is INR Rs. 5,250 (15 percent of INR 15,000 + 20 percent of INR of 15,000).

Multiple trigger products thus tend to bridge the 'gap' to some extent in indemnity and provides safe hedge against basis risk.

7. Conclusions

Index based insurance is here to stay, and is the way forward in many developing nations. Weather index appears to hold more promise for low income countries because many of these countries do not have historical yield data of adequate length at district or sub-district level. Conversely many of these countries have historical rainfall data, which could be used to create rainfall index. Experts are also exploring the possibility of creating satellite based rainfall data series in these countries so that such data could be created at micro location level. Satellite imagery based yield estimates are also likely to be used in a big way in future. Best results, however, could be obtained by careful deign of index and use of a combination of indices (multiple triggers) to capture the key production risks in agriculture.

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