



CROP INSURANCE

AN ACTUARIAL PERSPECTIVE

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TYPES OF CROP INSURANCE IN INDIA

- Modified national agricultural scheme : MNAIS
- Weather based crop insurance scheme : WBCIS
- Tailor made insurance schemes for specific crops like sugarcane, plantations, horticulture



SCOPE

- To discuss the key actuarial considerations while pricing for
 - MNAIS
 - WBCIS



APPROACHES TO CROP INSURANCE

- There are two approaches to crop insurance
 - Yield based – MNAIS
 - Weather Index based - WBCIS



PRICING : KEY CONSIDERATIONS

- Coverage : crops , perils , indemnity limits
- Indemnity triggers – measures and data
- Expenses , commissions
- Reinsurance
- Profit margins



MNAIS

Scope of cover:

Insure loss of standing crops, prevention of sowing due to weather conditions, post harvest losses

Perils Covered:

AOG perils, deficit rainfall or adverse seasonal conditions, specified perils for post harvest losses, pest / diseases specified perils

Benefit amount:

Indemnifications are based on loss of yields due to the perils covered. The SI is based on either the loan amount or the notional thresh hold yield * minimum support prices



WBCIS

Scope of cover:

Insure loss on crops due to deviations in the weather parameters - Rainfall, Temperature, Humidity, Wind velocity, Sunshine hours etc.

Perils Covered:

Deficit/Excess rainfall, High/Low temperature, High relative humidity, high wind velocity, adverse foggy conditions, excess snowfall or combination of above are the perils covered.

This product design is based on local weather indices, ideally correlated to local yields.

Benefit amount:

Indemnifications are triggered when there is a deviation on the set weather indices and not by actual yields. It pays a fixed amount for each level of variance in the weather indices. The sum Insured and claim payable at various trigger level of weather parameter are pre-defined



INDEMNITY TRIGGERS

- In MNAIS the indemnity triggers when yield falls below the thresh hold limit
- In WBCIS the indemnity trigger is the weather related index
- Hence estimation of the thresh hold limit is the key
- Thresh hold limit is to be estimated based on yield data available / weather related data
- Data availability is the key
- Data should be for a reasonable time frame
- At the required geographical level
- However, the big question .. In today's world of dramatic climate changes how reliable is the past data for projecting the future



NEED FOR SPECIALISTS

- Actuarial work is dependent on reliability of past data to help in projection of future experience
- Weather related prediction is a specialised field
- Hence, for this type of product, it is prudent to seek specialists opinion
- Could be available with reinsurers or service provider



PRICING OVERVIEW

Pricing:

Pricing of product is depending on historical losses, volatility and management expenses.

Crop period is one of the key considerations in pricing

The product could be reinsurance driven in terms of rates of the portfolio.

Pricing Methodology:

Regardless of the pricing methodology adopted, both expected loss and the risk of the most extreme (catastrophe) payout are factored into pricing and in order to calculate the Technical Premium.

The Technical Premium (TP) is defined as:

$$\mathbf{TP = AEL + \alpha * [PML - AEL]}$$

AEL: Adjusted Expected Loss

PML: maximum likely payout in 25 to 100 contract life times.

α : (Expenses+ Margin + commission) Percentage Return on Risk (ROR)



CASE STUDY : WBCIS

Crop selected : Paddy

Location : Tirunelveli District

Perils: Deficit / Excess rainfall and Consecutive dry days

Key crop cycle stages and period:

Germination stage(1th October to 29th November)

Development and reproductive stage(30th November to 18th January)

Maturity stage(19th January to 27th February)

- Index:**
1. Total Amount of Rainfall less than Strike
 2. Maximum of Cumulative Rainfall of 2 consecutive days above Strike
 3. Consecutive Days with < 2.5 mm of rainfall

Weather stations : AWS installed by TNAU in each block



PRODUCT DESIGNING – TERM SHEET

Termsheet

Crop	Paddy - II	District	Tirunelveli
Reference Weather Stations	AWS installed by TNAU in each block		
Backup Stations	Ranguages maintained by TNPWD		
Data Provider	Tamilnadu Agriculture University / TNPWD		
1. Deficit Rainfall Index			
Index	Total Amount of Rainfall less than Strike		
Cover Period	01 Oct - 29 Nov	30 Nov - 18 Jan	19 Jan - 27 Feb
Strike 1	200	50	
Strike 2	100	10	
Notional 1 (Rs./mm)	10	10	
Notional 2 (Rs./mm)	20	60	
Maximum Payout (Rs.)	4000		
2. Excess Rainfall Index (ERI)			
Index	Maximum of Cumulative Rainfall of 2 consecutive days above Strike		
Cover Period	01 Oct - 29 Nov	30 Nov - 18 Jan	19 Jan - 27 Feb
Strike (mm)	125	125	60
Notional (Rs./mm)	10	10	10
Maximum Payout (Rs.)	3000		
3. Dry Days index (DDI) (Multiple Events)			
Index	Consecutive Days with < 2.5 mm of rainfall		
Number of days	01 Oct - 29 Nov	30 Nov - 18 Jan	19 Jan - 27 Feb
Incidence Count	NA	Payoff (Rs.)	NA
0-24		0	
25-44		500	
45-59		1500	
> = 60		3000	
Maximum Payout (Rs.)	3000		

Weather Index Covered	DRI +ERI + DDI
Total Sum Insured (Rs/Acre)	10000
Premium Rs./Acre	1000

Historical Index of the above Termsheet

Year	ERI	DDI	DRI	Pay Off
1974	0	500	1716	2216
1975	0	500	1180	1680
1976	28	0	0	28
1977	0	0	0	0
1978	0	0	0	0
1979	17	0	0	17
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	40	0	0	40
1984	0	0	0	0
1985	0	0	56	56
1986	0	0	0	0
1987	0	0	0	0
1988	0	0	149	149
1989	0	0	44	44
1990	0	0	0	0
1991	0	0	324	324
1992	0	0	0	0
1993	478	500	0	978
1994	0	0	580	580
1995	0	0	296	296
1996	0	500	320	820
1997	0	0	0	0
1998	1650	0	0	1650
1999	0	0	144	144
2000	170	500	720	1390
2001	12	0	0	12
2002	1150	0	390	1540
2003	0	0	0	0
2004	0	0	385	385
2005	78	0	0	78
2006	78	0	1231	1309
2007	0	0	0	0
2008	156	0	231	387
Average Payoff				403



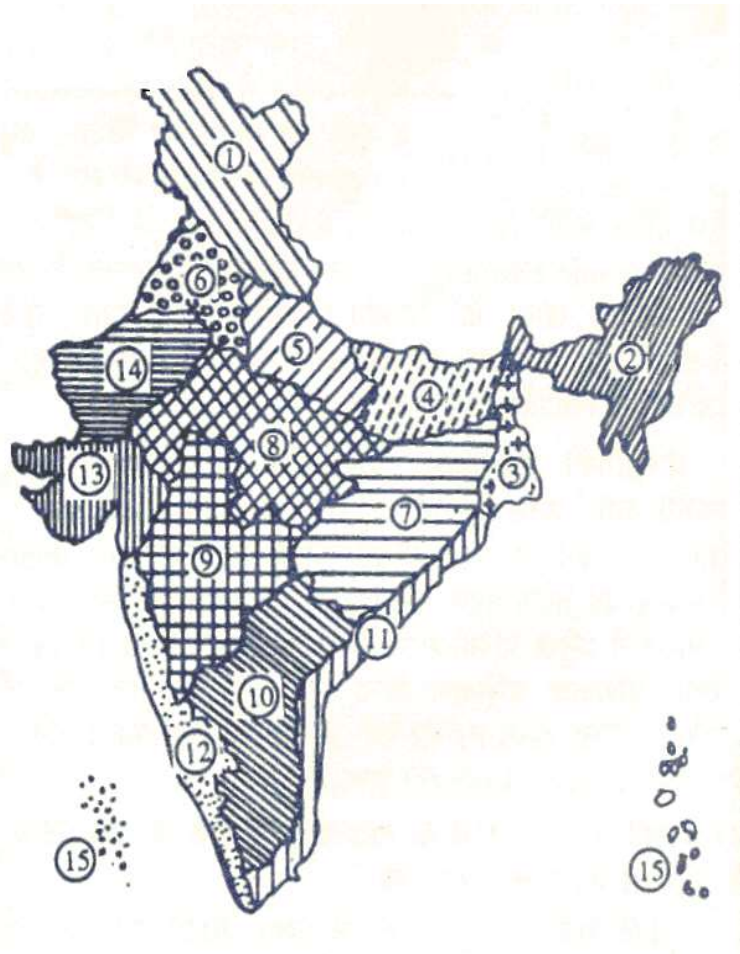
WEATHER INSURANCE – PAST EXPERIENCE PROVED PROFITABLE

Index Based Weather Insurance– Indian Market Scenario					
Season	Farmers Covered (Lakhs)	Farmers' Premium (Rs Cr.)	Gross Premium Inclusive of subsidy (Rs Cr.)	Claims (Rs. cr.)	Claim Ratio
Kharif 2007	0.4	1.42	7.03	5.24	75%
Rabi 2007-08	6.4	43.77	141.32	98.82	70%
Kharif 2008	1.8	9.61	36.16	16.05	44%
Rabi 2008-09	2.1	11.23	45.53	33.42	73%
Kharif 2009	11.6	60.58	212.11	158.05	75%
Rabi 2009-10	11.2	56.37	232.62	187.01	80%
Kharif 2010	48.9	170.58	471.34	144.1	31%
Rabi 2010-11	43.9	171.48	694.59	52.08	7%

Past experience promises enough scope for commercially viable proposition.



WHY INDIA IS BIG OPPORTUNITY?



- Varying climate risks with the country
- Large Agriculture base that is dependent on Weather
- India is divided in 15 agro-climatic zone
- Climate extremes exists in each climatic zone
- Different vulnerability to weather
 - Himalayan and sub-Himalayan region has low temp risks
 - Northern plains suffer from temperature variations and drought
 - Eastern and Southern region face floods and high humidity related risks

India provides natural hedges to climate risk underwriters



CONCLUSION

- Crop insurance products are a big opportunity in India
- Product is expected to be financially viable if priced right with adequate expertise from specialists
- Close coordination between underwriters and actuaries would help the insurance company assess and select and price the risk at a viable level
- Reinsurance support is critical for these type of covers
- The profitability of these products to be ideally calculated on a longer term horizon
- The Board of the insurance company should be aligned to the risk appetite



THANK YOU

