Agricultural Economics Research Review
Vol. 25(No.2) July-December 2012 pp 291-298

Impact of Crop Insurance on Rice Farming in Tamil Nadu

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Abstract

Crop insurance serves as an effective institutional mechanism to cope with production risks. The study has assessed the impact of crop insurance on rice farming in Tamil Nadu. The crop insurance has effectively absorbed production risk and has given impetus to crop specialisation. It has also influenced the use of high-value inputs, which in turn has contributed towards enhancing returns from farming. Factors such as access to credit, education, off-farm income, etc. have significantly influenced the adoption of crop insurance.

Key words: Crop insurance, paddy, Tamil Nadu

JEL Classification: G22, Q10, C54

Introduction

The idea of crop insurance in India was conceptualized as far back as 1920, when S. Chakravarti proposed an agricultural insurance scheme based on rainfall approach (Vyas and Singh, 2006). In 1979, with the recommendations of Dhandekar Committee, the General Insurance Corporation implemented the Pilot Crop Insurance Scheme based on homogenous area approach. Following this, another scheme called 'Comprehensive Crop Insurance Scheme (CCIS)' was implemented in 1985. This scheme was further modified and implemented throughout the country as National Agricultural Insurance Scheme (NAIS) in 1999. Agriculture Insurance Company of India Ltd. (AICL) has been managing and implementing this crop insurance scheme in India since April 2003. Unlike earlier insurance schemes which were restricted to the loanee farmers only, NAIS is available to both loanee and non-loanee farmers. Over the years, the performance of NAIS has improved steadily. The annual enrollment of farmers has almost doubled from 1.05 crores to 1.84 crores between 2000 and 2008. The area covered under the scheme has also increased from 16.3 million ha to 27.8 million ha during this period (AICL, 2008). However, the objective of extending benefits of crop insurance to non-loanee farmers has remained under-achieved – the non-loanee farmers make up only 15 per cent of the total farmers covered under the insurance scheme (Raju and Chand, 2008).

Across different states, Maharashtra is the main beneficiary with 1.9 crores of insured farmers, while Madhya Pradesh leads in the area coverage (36.2 million ha up to *kharif* 2007. Tamil Nadu has benefited from the scheme with a cumulative coverage of 10 lakh farmers and 1.7 million ha. However, the low enrollment of farmers (7% of the total farmers in the country in 2007-08) speaks of the poor performance of the crop insurance in the state. Tamil Nadu has a large number of agriculture-dependent farmers (8 million) who produce 75 million tonnes of foodgrains from 3 million ha of cultivable land; it must take steps to improve the performance of the crop insurance scheme *(www.tn.gov.in)*. Since rice is the main crop in the state and it also faces the brunt of unpredictable weather, this study has analyzed the impact of crop insurance on farmers cultivating rice crop.

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Data

The physiography of Tamil Nadu is classified into seven agro-climatic zones, viz. North-Eastern, North-Western, Western, High Altitude, Cauvery Delta, Southern and High Rainfall Zones. The crop insurance scheme in rice is being implemented actively in the Cauvery Delta and Southern Zones. The Nagapattinam district from the Cauvery Delta and Ramanathapuram district from the Southern zone were purposively selected as representatives of these two zones. These two districts differ sharply in their agro-climatic characteristics. The Nagapattinam district gets assured irrigation from canals, wells and lakes besides an abundant rainfall of 1200 mm during the cropping season. On the other hand, in Ramanathapuram 90 per cent of irrigation is dependent on tanks as it receives only 600 mm of rainfall during the cropping season. At the next stage, Kilvelur and Kollidam blocks of Nagapattinam; and Mudhukulathur and R.S. Mangalam blocks of Ramanathapuram were randomly selected. Subsequently, Kilvelur, Mathanam, Kilathuval and Sholandur *firkhas* (an administrative unit of 10 to 20 revenue villages) of respective blocks were selected randomly. In each *firkha*, 45 farmers were randomly surveyed. Thus, a total of 180 farmers spread over 44 villages comprising 39 non-insured and 141 insured farmers comprised the sample for the study. In addition, 20 officials of different grass-root level agencies involved in the implementation of crop insurance were also interviewed.

The primary data were collected during *rabi* 2008-09 using structured schedule on aspects like socio-economic characteristics of farmers, their cropping pattern, loss coping mechanism, cost and returns from rice cultivation, access to loan and other sources of income. The opinion of the farmers on factors influencing and constraints in adoption of NAIS was also sought. Information on the factors affecting the implementation of crop insurance scheme was obtained from the ground level functionaries of various implementing agencies.

Methodology

Crop Diversification — The extent of crop diversification practised by the farmers was calculated using Simpson Index of Diversification (SID), which is given by the formula:

$$SID = 1 - \Sigma(a_j/A)^2 \quad \ldots(1)$$

where, a_j is the area under the j^{th} crop; and A is the gross cropped area.

Cost and Revenue from Rice Cultivation — Various components of cost and revenue of rice cultivation were computed and compared for insured and non-insured farmers to examine the profitability of purchasing crop insurance. Difference in the net revenue of adopters and non-adopters need not be attributed wholly to crop insurance scheme. This could be due to the differences in the unobservable characteristics like their management skills (Brithal and Joshi, 2009; and Birthal *et al.*, 2008). Hence, a simple comparison of the average income could be biased. To correct this bias, a standard treatment effects model was used.

$$R_i = a + bC_i + cX_i + \varepsilon_i \quad \ldots(2)$$

$$C_i = \gamma_1 + \gamma_2 Z_i + \mu_i \quad \ldots(3)$$

where R_i is the net revenue of the i^{th} farmer; C_i is a dummy variable taking the value 1 if one adopts crop insurance and 0 otherwise; X_i is a vector of the variables believed to affect the net income; ε_i is a zero mean random variable; and b measures the impact of insurance on net revenue. An ordinary least squares estimate of Equation (2) is likely to be biased because of the effects of unobservable factors. Thus, ε_i (which contains within it the random unobservable factors) will be correlated with C_i. To correct for selectivity bias, Equation (3) (probit) is estimated with insured/non-insured farmers as a binary dependent variable (C_i) and a set of explanatory variables Z_i. Variables in Z_i will overlap with variables in X_i. Identification requires that there would be at least one variable in Z_i that is not in X_i. If this condition is met, predicted values (also known as the inverse mills ratio) from Equation (3) can be used as an instrument (of C_i) in Equation (2).

Constraints in Adoption — To identify the constraints in adoption of crop insurance, the Garret Ranking Technique was used. As a first step, the respondents were asked to rank the enlisted factors. The orders of merit, assigned by the respondents were converted into percentage position using the formula:

$$\text{Percentage position} = 100 \times (R_{ij} - 0.5)/N_j$$

where, R_{ij} is the rank given for the i^{th} factor by j^{th} individual; N_j is the number of factors ranked by j^{th} individual.

The percentage position of each rank was then converted into scores using the Garret and Woodworth (1969) Table. For each factor, the scores of individual

respondents were added together and divided by the total number of respondents for whom scores were added. The mean scores for all the factors were arranged in the descending order, ranks were assigned revealing the importance of various factors.

Results and Discussion

Socio-Economic Characteristics of Sample Farmers

The outstanding participation of non-loanee farmers revealed the overwhelming reach of crop insurance programme in Tamil Nadu (Table 1). The average age of sample farmers was around 50 years which did not vary much across insured and non-insured farmers. The family size of insured farmers was bigger; they were better educated and had longer farming experience than those of non-insured farmers. A higher proportion of insured farmers compared to non-insured farmers were members of various social groups like Farmers Club and Self-Help Groups. The rice crop in Nagapattinam is fully irrigated by canals, while in Ramanathapuram it is dependent on tank irrigation. The insured farmers revealed a tendency for generating additional income through off-farm occupation.

Extent of Crop Diversification

It is observed that the non-insured farmers practised a more diversified crop combination than that by the insured farmers in both the study districts (Table 2). The farms in the rainfed district of Ramnathapuram recorded greater crop diversification thus demonstrating its important role as one of the risk

Table 1. Socio-economic characteristics of sample farm households

Sl. No.	Particulars	Ramanathapuram farmers		Nagapattinam farmers		All farmers		
		Non-insured	Insured	Non-insured	Insured	Non-insured	Insured	Total
1.	Sample size	17	73	22	68	39	141	180
2.	Non-loanee (No.)	17	59	4	46	21	105	126
3.	Average age of household-head (years)	52	52	51	48	51	50	50
4.	Family size (No.)	4.8	5.3	4.8	5.4	4.8	5.3	5.2
5.	Farming experience of household-head (years)	30	35	30	31	30	33	32
6.	Club membership (Yes=1; otherwise=0)	6	25	1	29	7	54	61
7.	Irrigation source (Yes=1; otherwise=0)	14	58	22	68	36	126	162
8.	Off-farm occupation (Yes=1; otherwise=0)	4	14	8	23	12	37	49
9.	Holding type (No.)							
	Tenant	0	0	5	10	5	10	15
	Marginal	5	16	9	23	14	39	53
	Small	8	37	6	14	14	51	65
	Others	4	20	2	21	6	41	47
10.	Education (No.)							
	Uneducated	8	16	5	6	13	22	35
	Primary	2	16	3	5	5	21	26
	Higher secondary	6	35	14	52	20	87	107
	Graduation	1	6	0	5	1	11	12

Table 2. Extent of diversification among insured and non-insured farmers in Tamil Nadu

Farmers	Net area (ha)	Cropping pattern (ha)					Gross area (ha)	Simpson Index of Diversification
		Paddy	Chilly/Pulse	Cotton	Horse tail	Ragi		
Ramanathapuram farmers								
Non-insured	21	21	10	9	0.8	0.8	42	0.65
Insured	149	149	33	24	2.4	1.6	210	0.46
Nagapattinam farmers								
Non-insured	30	30	26	0	0	0	56	0.50
Insured	222	222	139	4	0	0	365	0.49
All farmers								
Non-insured	51	51	36	9	0.8	0.8	78	0.59
Insured	371	371	178	28	2.7	2.4	575	0.49

coping mechanisms against the vagaries of monsoon. Incidentally, crop insurance effectively absorbed the production risk and played a significant role in encouraging the farmers to concentrate on a few profitable crops instead of spreading their limited resources across a number of crops.

Cost and Returns from Rice Production

It was hypothesized that crop insurance will increase the use of high-value inputs like seed, fertilizer and plant protection chemicals. The estimation of costs and returns from rice cultivation revealed a similar trend (Table 3). Human labour accounted for around

Table 3. Cost and returns from rice cultivation

(₹/ha)

Particulars	Ramanathapuram farmers		Nagapattinam farmers		All farmers	
	Non-insured	Insured	Non-insured	Insured	Non-insured	Insured
Seed	1048	1560	1598	1848	1372	1732
	(4)	(5)	(5)	(5)	(4)	(5)
Hired labour	13835	13010	20855	21130	17964	17869
	(49)	(42)	(61)	(57)	(57)	(52)
Fertilizer	2905	5280	4615	5520	3911	5424
	(10)	(17)	(13)	(15)	(12)	(16)
Pesticide/	963	1030	113	283	463	583
Herbicide	(3)	(3)	(1)	(1)	(1)	(2)
Machinery	7125	7105	6080	6855	6510	6955
	(25)	(23)	(18)	(19)	(21)	(20)
Irrigation	1368	2045	750	798	1005	1299
	(5)	(7)	(2)	(2)	(3)	(4)
Bullock	0	8	18	0	11	3
	(0)	(0)	(0)	(0)	(0)	(0)
Family labour	779	755	325	420	512	555
	(3)	(3)	(0)	(1)	(2)	(2)
Total variable cost	28024	30793	34353	36853	31748	34419
Total fixed cost	12047	11745	12227	12359	12152	12113
Total cost (Cost C_3)	40071	42538	46580	49212	43900	46532
Gross income	41993	47248	48658	53625	45914	51064
Net income	1922	4710	2078	4413	2014	4532

Note: Figures within the parantheses indicate percentages to total variable cost.

50 per cent of the total variable cost, followed by machinery and fertilizer. In absolute terms, the insured farmers spent more on fertilizer and plant protection chemicals to increase production and decrease pest and weed infestation, whereas non-insured farmers relied on human labour to accomplish such tasks. Similarly, insured farmers were found to spend more on seed and irrigation in both the districts. Bullock labour and family labour formed the minor components and did not show much variability across sample farmers.

In general, insured farmers could realize higher returns than that of non-insured farmers. In the Ramanathapuram district, the insured farmers with an incremental expenditure of ₹ 2769 could get an incremental net income of ₹ 2788 over that realized by non-insured farmers. Similarly, in the Nagapattinam district, an incremental expenditure of ₹ 2500 by an insured farmer fetched an incremental net income of ₹ 2335 over that of non-insured farmer.

Application of Treatment Effects Model

A higher net revenue from rice cultivation for insured farmers may not necessarily be due to adoption of insurance. There could be a number of unobservable factors (like management skills) that might cause a difference in the profits of insured and non-insured farmers; thus, a comparision of the average revenue of the insured and non-insured farmers could be biased. This bias has been corrected using the standard treatment effects model.

In the first step of this approach, a probit model was estimated to identify the factors that influence a farmer's decision to participate in an insurance scheme. Farmers' landholding size, access to loan, age, educational attainment, access to non-farm income sources and access to irrigation were considered to be the important factors influencing their decision to participate in the insurance scheme. The dependent variable being binary, takes the value 1 if a farmer avails insurance, and zero otherwise. The estimates from the probit model (presented in column 2 of Table 4) suggest that the probability of participation in crop insurance is significantly higher for those who had access to loan. It is because the farmers with loan by default had to insure the crop. Educational attainment may also positively influence farmers' participation decision. It reflects that the educated farmers are better informed about the insurance agencies, schemes and their characteristics; and also the costs and benefits assoicated with insurance. Access to non-farm income depicted a negative influence on participation. It could be because the non-farm income serves as a cushion against risk and uncertainty. The region in which the farmer was located also affected the decision to participate. The farmers of the region irrigated by canal/ tank were less likely to participate in the programme which was basically due to the fact that the likelihood of occurence of risk was less in such regions compared to that in the rainfed region.

In the second step, a standard treatment effects model was estimated using predicted probabilities from the probit model as an instrumental variable, with net revenue per hectare as the dependent variable. Besides participation in the insurance scheme, it was also expected that access to loan as well as to landholding would be important determinants of revenue.

Column 3 in Table 4 shows the result of the net income equations where the dummy for insurance was instrumented by the predicted probabilities from the probit equation. The coefficient of inverse mills ratio was insignificant, thereby indicating that selection bias is not prevelant in the model.

Constraints in Adoption of Crop Insurance

A number of constraints are faced by farmers while adopting a crop insurance scheme. Farmers of both Ramanathapuram and Nagapattinam districts expressed almost similar types of constraints (Table 5). The striking difference is that, the tenant farmers of Nagapattinam could purchase crop insurance, while their counterparts in Ramanathapuram were denied the benefits even though the crop was insured by their land owners. This was due to lack of awareness about the provisions of the scheme among Ramanathapuram farmers since the scheme is in operation only since 2007 while in Nagapattinam it exists since its inception in the state in 1999.

Farmers identified certain drawbacks in the performance of NAIS such as inadequate estimation of crop yield loss, low indemnity rate and its delayed payment, large insurance unit size; and raised concerns over the limited role of Agriculture Insurance Company at grass-root level which according to them was the root cause for many irregularities and misconceptions about the scheme.

Table 4. Results of the standard treatment effects model

Explanatory variable	Adopters of insurance=1; Otherwise=0	Net income over cost (₹/ha)
Land (ha)	0.0322	79.51*
	(0.064)	(45.75)
Access to loan =1; otherwise=0	1.307***	362.37
	(0.340)	(365.06)
Age of decision maker (years)	-0.0056	-
	(0.0104)	
Schooling (years)	0.061**	-
	(0.029)	
Access to non-farm income=1; otherwise=0	-0.579**	-
	(0.282)	
Access to irrigation=1; otherwise=0	-0.456	-
	(0.423)	
Insured farmer =1; otherwise=0	-	1797.19*
		(1007.17)
Region: Nagapatinam=1; Ramanathapuram=0	-0.494*	-286.99
	(0.270)	(259.57)
Inverse mills ratio	-	381.27
		(598.6)
Constant	1.096	2453.1***
	(0.719)	(754.69)
Chi-squared	28.38***	-
R-squared	-	0.39
Adjusted R-squared	-	0.38
F-test	-	22.96***
No. of observations	180	180

Notes: Figures within parantheses are standard errors.

Figures marked with the symbols ***, **, and * are statistically significant at 1 per cent, 5 per cent and 10 per cent levels of significance, respectively.

Constraints in Implementation of Crop Insurance

Agriculture Insurance Company of India Ltd. is the implementing agency of NAIS in the country. It has established one office in each state and executes the scheme with the help of various agencies involved in agriculture and rural development at various administrative levels. Table 6 summarizes the role and constraints faced by different agencies in implementing NAIS at the grass-root level. Besides facing these constraints, these agencies find it difficult to work in tandem due to lack of coordination between revenue and agriculture departments in conducting crop cutting experiments (CCE), delay in issuing crop cultivation certificate by the revenue department and negligent attitude of commercial banks to insure non-loanee farmers.

The officials of these agencies suggested the following improvements in the scheme, for its effective implementation and utilization:

- Instead of the existing *firkha* level, notification should be done at revenue village level to bring down the demographic variation (basis of risk).
- Yield assessment should be done separately for irrigated and rainfed lands as they widely differ in resource use and performance.
- Number of sample villages selected for yield assessment should be fixed in proportion to the total number of villages under each *firkha*.
- Number of CCE conducted per revenue village should be in proportion to its cultivated area.

Table 5. Constraints in adoption of NAIS

Constraint	Ramanathapuram		Nagapattinam	
	Garret mean score	Rank	Garret mean score	Rank
Tedious and time consuming procedures	23.86	1	15.69	1
Non-availability of crop loan	8.76	2	3.33	5
Lack of motivation from officials	8.73	3	11.07	2
Lack of information from officials	8.21	4	8.04	4
Tenant farmers are denied insurance benefits	7.77	5	-	-
Banks give a short period of time for enrollment	6.80	6	10.30	3

Table 6. Role and constraints of different agencies in implementing NAIS

Sl. No.	Agency	Role	Constraints faced
1.	Agriculture Department	• Issuing application to farmers • Conduct CCE	• Lack of staff
2.	Revenue Department	• Submit crop cultivation report to government • Issue crop cultivation certificate to farmers • Help Agriculture Department in identifying the plots for CCE	• Unable to provide updated computerized land ownership certificates
3.	Statistics Department	• Send code numbers for CCE to Agriculture Department • Inspect CCE	
4.	Commercial and Cooperative Banks	• Enroll farmers and submit the registration details to AICL through nodal office • Disbursement of indemnity amount	• Overlapping service areas • Lack of enthusiasm • Lack of staff • Last minute rush for enrollment in insurance scheme

- AICL should have its own office at district and block levels to improve monitoring and earn confidence of the farmers.
- At the beginning of every crop season, the AICL should organize camps to enroll farmers under the scheme.

Conclusions and Policy Implications

Within a short period of its existence, the AICL has performed credibly in promulgating a massive and complex developmental programme. Crop insurance has been found to absorb the production risk effectively, encouraging the farmers to concentrate on a fewer number of profitable crops instead of spreading their resources and energy across many crops. In this way, it has acted as an incentive for specialization in agriculture. The crop insurance scheme has led to the use of high-value inputs like seed, fertilizer and plant protection chemicals. The insured farmers have realized more returns than their non-insured counterparts. It has been revealed that the factors like access to loan, education, off-farm income, and region (based on nature of irrigation) in which a farmer is located have significantly influenced the adoption of crop insurance. Moreover, landholding-size, whether insured or non-

insured, has depicted a positive influence on the income of farmers.

Farmers face constraints like tedious and time consuming procedure, non-availability of crop loan, lack of motivation and information from officials, etc. Strikingly, tenant farmers of the Ramanathapuram district were denied the benefits of crop insurance by their land owners. On the other hand, the agencies implementing crop insurance expressed that lack of staff, lack of coordination among them and hinderance to their routine functions were the major constraints.

Acknowledgments

The authors are highly thankful to Dr Pratap S. Birthal, Dr V.C. Mathur and the anonymous referee for their constructive suggestions to improve the earlier draft of the manuscript.

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Received: September 2011; Accepted: May 2012