Original Research Article

Determinants of Farmers' Awareness and Perspectives on Pradhan Mantri Fasal Bima Yojana in Southern Tamil Nadu, India

ABSTRACT

Farmers in India face numerous risks that significantly impact their crop production, highlighting the need for effective crop insurance. Recognizing the limitations of the existing crop insurance system, the Government of India initiated the Pradhan Mantri Fasal Bima Yojana (PMFBY) during the Kharif 2016 season. This scheme offers competitive premiums and favourable terms, yet coverage of farmers remains low. This study investigates the factors influencing the farmers' awareness and perceptions of the PMFBY scheme. The survey was conducted to collect primary data from 350 cotton farmers in Virudhunagar district, Tamil Nadu. Findings reveal that while farmers have partial awareness of various aspects of crop insurance, they are generally informed about premiums and procedural requirements. The probit model analysis identifies education, organizational membership, mass media exposure, and extension contacts as positively influencing farmers' awareness levels. However, negative perceptions persist, particularly concerning delayed claims, inadequate compensation, and high premium rates.This study recommends the implementation of government-led awareness programs designed to educate and cultivate greater awareness among farmers regarding crop insurance and its benefits.Such initiatives could enhance demand for crop insurance to mitigate the adverse impactsand ensure greater sustainability of farmers' livelihoods.

Keywords: Awareness, Crop insurance, Perception, Cotton farmers,income source,natural disasters,crop insurance

1 Introduction

Agriculture is a vital income source in many developing countries, including India. In this nation, about 60% of the population depends on farming for their livelihood (MoA&FW, 2024; Rajeev & Nagendran, 2023; Sundar & Ramakrishnan, 2015). However, Indian farmers encounter significant agricultural challenges due to the unpredictability of natural events (Budhathoki et al., 2019; Gulati et al., 2018; Senapati, 2020; Sundar & Ramakrishnan, 2015). Small and marginal farmers, who constitute around 80% of the agricultural community, are particularly susceptible to the high risks associated with crop production (Aditya et al., 2020; Rajeev & Nagendran, 2023).The frequent failure of crops can lead to farmers accruing significant debt, adversely affecting both agriculture and the farm economy (Singh, 2010). Therefore, it is essential to implement effective strategies to stabilize and protect the agricultural sector (Karthick & Mani, 2013). One of the most promising solutions to address these challenges is crop insurance, which has been recognized as a vital tool for managing agricultural risks (Fahad & Jing, 2018; Gulati et al., 2018; Hossain et al., 2022; Venkatesh, 2008). Crop insurance allows farmers to protect their livelihoods against natural disasters such as droughts, floods, cyclones, hailstorms, pest infestations, and diseases (Gulati et al., 2018). Additionally, it promotes a sense of self-reliance and dignity among farmers, as it provides them with the right to claim compensation in the event of crop loss, thus mitigating the financial impact of unforeseen natural events (Kumar et al., 2011).

Despite being introduced in 1972, crop insurance in India has faced numerous challenges (Gulati et al., 2018). Over the years, these schemes have seen various modifications aimed at improving claims processing, premium rates, and other key aspects (Kaur et al., 2021). In response to the limitations of previous insurance systems, the Government of India launched the PMFBY in the Kharif season of 2016 (Gulati et al., 2018). Indian crop insurance programs are known for their broad coverage among farmers. However, India still has the largest population of uninsured farmers globally (Aditya et al., 2018). Although there is significant research and implementation in the field of agricultural insurance, there remains ambiguity regarding the extent to which farmers prefer this method over other risk management strategies (Ghosh et al., 2021).Despite the attractive terms and low prices, only a few farmers purchase insurance under the new PMFBY policy framework(Aditya et al., 2018; Ghosh et al., 2021). Therefore, it is crucial to analyze the factors contributing to this low popularity, given the significant role of the insurance program in supporting India's agrarian economy (Aditya et al., 2018).

Within this context, our study is focused on three main objectives: i) To understand the level of farmers' knowledge of crop insurance, ii) To analyze the factors influencing their awareness of crop insurance, and iii) To examine the perceptions of insured farmers regarding crop insurance. This study contributes to the existing literature by identifying which features of crop insurance are most important to farmers. Additionally, the study identifies factors that hinder farmers' awareness of crop insurance. By improving farmers' understanding of crop insurance and addressing their knowledge gaps, the demand for crop insurance can be increased. Furthermore, the study explores insured farmers' perceptions of crop insurance, providing insights that can help policymakers make necessary adjustments to existing policies, thereby enhancing their overall efficiency and effectiveness.

2 Review of literature

Determining the demand for crop insurance is challenging worldwide, with low adoption in developing countries (Ghosh et al., 2021). The complexity in these countries arises from government interventions to stabilize farm incomes through various means like quotas, price support systems, subsidies, and low-interest loans (Ghosh et al., 2021; Mensah et al., 2023).Singh and Agrawal (2020) found that limited access to agricultural insurance is mainly due to farmers' lack of understanding about insurance and their preference for relief payments. The current crop insurance plans are not working well due to state-level issues. The study by Basir et al. (2024) revealed a significant and positive connection between farmers' risk attitudes and the size of their farms, with farmers' awareness of crop insurance serving as the dependent variable.Ghosh et al. (2021) suggested that understanding which parts of crop insurance matter most to farmers can help improve existing policies.

Islam et al. (2021)have determined that the implementation of government subsidies and increased awareness of crop insurance benefits could improve the agricultural sector and help small farmers sustain their livelihoods. According to Birthal et al. (2022), several factors, including past exposure to climate shocks, resource availability, institutional credit availability, and social safety nets for employment and food security, affect farmers' risk management and adaptation decisions. Sreedaya and Suresh (2022) found that while most farmers are interested in adopting crop insurance, lack of awareness and negative perceptions regarding its guidelines, compensations, and delay in disbursement might be the reason for their medium perception of it. Kramer et al. (2022) emphasized that the complex nature of insurance products and low financial literacy contribute to low demand. Moreover,

subsistence-oriented farmers face additional challenges such as liquidity constraints anda lack of trust and understanding.

3 Materials and methods

3.1 Study area and sampling

The survey was conducted in the Virudhunagar district of Tamil Nadu, a region known for its challenging irrigation conditions due to low rainfall and limited access to reliable water sources(Vikram et al., 2023). Only 57% of the area has access to guaranteed irrigation through wells. The remaining 43% of the areas rely entirely on rain-fed tanks to sustain their irrigation needs. The region primarily cultivates food crops such as paddy, maize, jowar, bajra, and various pulses like horse gram, black gram, and green gram(Vikram et al., 2023). Cotton represents the primary cash crop, predominantly cultivated during the rabi season, encompassing an area of 11,740 hectares(Anonymous). Of the total cotton cultivation, 84% occurs under rainfed conditions.

To accomplish the study objectives, an initial step involved the selection of five blocks, namely Arruppukottai, Virudhunagar, Rajapalayam, Kariapatti, and Sattur, within the Virudhunagar district. Utilizing a simple random sampling technique, seven villages were chosen from each block, followed by the selection of ten farmers from each village. As a result, a total sample size of 350 cotton farmers was obtained, of which 230 are insured and 120 are uninsured. The household survey questionnaire is developed based on input from key informants and subsequently pre-tested with 20 farming households within the study area. Following the pilot testing, feedback was integrated into the final version. A thorough survey was undertaken using a properly structured questionnaire, during the period from mid-September to mid-October 2022. In the survey, the researcher focused on interviewing heads of households with significant farming expertise and the ability to make important financial decisions.The questionnaire was subdivided into 3 sections: the socioeconomic backgroundof the respondents, farmers' awareness of PMFBY, and their perceptions of and experiences with crop insurance. Notably, the perception inquiries were administered exclusively to those respondents who had availed crop insurance in the previous season.

3.2 Empirical Methodology

The probit model is used to determinethe influence of various socioeconomic factors on the farmers' awareness level about crop insurance scheme. The dependent variable is the awareness level of crop insurance,which is a dichotomous variable.The Probit regression model is specified as per Equation (1):

$$Y_i = \alpha_i + \sum_{i=1}^{m} \beta_i X_i + \varepsilon_i \quad (1)$$

WhereY_i is the dependent variable which can be expressed as Y = 1 if a farmer has high awareness and 0 if a farmer has low awareness. $X_i$is a vector of independent variables, including gender, age, education, organisational membership, annual income, farm size, farming experience, livestock, access to credit, exposure to mass media,and contact with extension personnel. $\beta_i$is an unknown parameter that needs to be calculated andε_i is an unobserved error term. STATA software (version 15.0) is used to conduct data analysis and run the probit regression model. Definition and explanation of all variables are given in Table 1.

Table 1. Description of the variables used in the probit model

Variables	Explanation
Dependent variable	
Awareness level of crop insurance	1, if a farmer has a high awareness level and 0 for a low awareness level
Independent variables	
Gender	1 for male farmers and 0 for female farmers
Age	Age of the farmer in years
Education	Level of education (1 = no schooling, 2 = primary school, 3 = middle school, 4 = secondary school, 5 = higher secondary, 6 = graduate, 7 = postgraduate)
Organisational membership	1, if a farmer is a member of any organisation and 0 otherwise
Annual income	Logged value of the average annual income
Farm size	Size of the farm in acres
Farming experience	Number of years engaged in farming activities
Livestock	1 for holding livestock and 0 for otherwise
Access to credit	1 for access to credit; 0 otherwise
Exposure to mass media	0 – Low exposure, 1 – Medium exposure and 2 – High exposure
Contact with extension personnel	0 – Low extension agency contacts, 1 – Medium extension agency contacts, and 2 – High extension agency contacts

To quantify the degree of awareness among farmers, a comprehensive scale designed by Kurmi (2018), with minor modifications, is employed. The farmers' responses to statements concerning their awareness are methodically recorded on a three-point continuum

scale: 'fully aware – 2', 'partially aware - 1', and 'not aware – 0'. Subsequently, the cumulative scores acquired are utilized to categorize the respondents into low and high levels of awareness. Finally, a score of 0 is assigned to respondents exhibiting low awareness, while a score of 1 is attributed to those demonstrating high awareness, for utilization in a probit model.Farmers' perception of crop insurance is evaluated using a 5-point Likert scale: Strongly Disagree - 1, Disagree - 2, Neutral - 3, Agree - 4, and Strongly Agree - 5. Further, ranking for each statement was determined based on the mean scores attained.

4. Results and Discussion

4.1 Demographic and Farming Characteristics

The average age of the sampled farmers is 49 years, with 84% of the total respondents being male, as shown in Table 2. The majority of respondents fall within the age group of 46 to 55 years, boasting an average farming experience of 25 years. Findings show that the average education level of the respondents is at the middle school level. Notably, a small proportion (40%) of the farmers reported having organizational membership. Moreover, the distribution of average annual income among the respondents indicated that approximately 50% of them fall into the medium income category, with earnings ranging between Rs. 2,50,000 and Rs. 5,00,000. The mean farm size is found to be 5.7 acres approximately, with a maximum and minimum farm size of 30 acres and 1 acre, respectively. It is noteworthy that a considerable percentage of households are smallholders, with land sizes ranging from more than 2 to 4 acres.. Additionally, around 47% of the respondents reported holding livestock, and 60% of farmers had access to credit.

Table 2. Descriptive statistics of socioeconomic characteristics of the respondents.

Particulars	Frequency (n=350)	%	Mean	SD	Min	Max
Gender			0.84	0.37	0	1
Male	294	84.00				
Female	56	16.00				
Age			49.08	8.88	25	68
Up to 35	23	6.57				
36-45	106	30.29				
46-55	139	39.71				
56-65	72	20.57				
more than 65	10	2.86				
Education			2.88	1.42	1	7
No schooling	75	21.43				
Primary School	66	18.86				

Middle school	99	28.29				
Secondary	66	18.86				
Higher Secondary	26	7.43				
Graduate	16	4.57				
Post Graduate	2	0.57				
Membership in organisation			0.41	0.49	0	1
No	208	59.43				
Yes	142	40.57				
Annual income			474,423	247,745	120,000	2,600,000
Up to 50,000	0	0.00				
50,000 to 250,000	47	13.43				
250,000 to 500,000	176	50.29				
500,000 to 1,000,000	115	32.86				
More than 1,000,000	12	3.43				
Farm size (acres)			5.68	3.78	1	30
up to 2	25	7.14				
> 2 to 4	123	35.14				
> 4 to 6	111	31.71				
> 6 to 10	66	18.86				
> 10	25	7.14				
Farming Experience			25.51	11.57	1	51
Up to 5	15	4.29				
6 to 15	66	18.86				
16 to 30	170	48.57				
31 to 45	80	22.86				
More than 45	19	5.43				
Livestock			0.47	0.50	0	1
Yes	163	46.57				
No	187	53.43				
Access to credit			0.60	0.49	0	1
Yes	211	60.29				
No	139	39.71				

4.2 Exposure to mass media and contact with extension personnel

The data presented in Table 3 provides insights into the levels of exposure to mass media and contact with extension personnel among the surveyed farmers. To assess the extent of farmers' exposure to mass media, a scoring system is used that takes into account the frequency of use of different media sources. Farmers are asked to indicate how often they use each media source, with the options of Never (0), Occasional (1), or Regular (2). Similarly, farmers are asked to rate the frequency of their contact with extension personnel as Never (0), whenever a problem occurs (1), Weekly (2), or Monthly (3). Based on the total score obtained, each variable is segmented into three categories: Low, Medium, and High.It is

evident that the majority of individuals fall within the low exposure category, with 50.29%of farmers demonstrating low exposure to mass media. Additionally, 38.29%of total respondents exhibit a moderate level of interaction with mass media, indicating sporadic rather than extensive engagement. Conversely, only 7.43% of farmers are classified as having high exposure to mass media, suggesting frequent and varied media consumption.

Regarding contact with extension personnel, the results show that 49.14% of the surveyed individuals had low contact. This indicates that a significant portion of the sample may not consistently engage with extension services, which may impact their access to agricultural knowledge and support. On the other hand, 32.29% of the sampled farmers demonstrated a moderate level of interaction, indicating intermittent rather than consistent contact with extension services. Only 15.54% of the farmerswere actively engaged with extension personnel, likely benefiting from ongoing advice and support for their agricultural activities.Overall, the data indicated a greater number of individuals with low exposure to both mass media and extension personnel, potentially constraining their access to information and resources. Consequently, developing initiatives aimed at enhancing engagement with mass media and extension personnel could be beneficial for the farmers, encouraging them to more fully utilize these resources.

Table3: Distribution of farmers according to their exposure to mass media and contact with extension personnel

Particulars	Low	Medium	High
Exposure to mass media	190 (50.29)	134 (38.29)	26 (7.43)
Contact with extension personnel	172 (49.14)	113 (32.29)	53 (15.14)

Note: Numbers in parenthesis are percentages

4.3 Awareness level of crop insurance

Table 4 depicts the levels of awareness displayed by respondents with regard to various facets of the PMFBY. Each statement in Table 4 is segmented into 3 categories: "Not aware," "Partially aware," and "Fully aware", with corresponding scores of 0, 1, and 2 assigned to each category, respectively. Notably, awareness levels vary across different aspects of PMFBY. Respondents appear to be more familiar with the premium amount and documentation process. However, they show less understanding of the procedures for claim settlement and crop loss assessment. Approximately 54% of the respondents were fully aware of the amount of premium to be paid, and 50% were fully aware of the documentation

procedures required for insuring the crops. A considerable number of respondents have demonstrated partial awareness across aspects such as ‘Extent of coverage of crops under PMFBY’, ‘Risks covered under PMFBY’, ‘Procedure of claim settlement’, and ‘Process of assessment of crop losses. This underscores the importance of targeted interventions to raise awareness among farmers and improve their access to information and resources regarding crop insurance.

Table 4. Awareness of farmers regarding various aspects of PMFBY

Particulars	Not aware	Partially aware	Fully aware
The extent of coverage of crops under PMFBY	63 (18.00)	182 (52.00)	105 (30.00)
Premium amount to be paid	57 (16.29)	105 (30.00)	188 (53.71)
Risks covered under PMFBY	79 (22.57)	204 (58.29)	67 (19.14)
Documentation process for insuring crops	68 (19.43)	107 (30.57)	175 (50.00)
The procedure of claim settlement	121 (34.57)	155 (44.29)	74 (21.14)
Process of assessment of crop loss	132 (37.71)	166 (47.43)	52 (14.86)

Note: Numbers in parenthesis are percentages

The data presented in Figure 1 illustrates the varying levels of awareness among the respondents, which have been categorized as "low" and "high" based on the overall scores derived from the statements in Table 4. The survey findings highlight that there is a significant lack of awareness about the PMFBY scheme among the majority of respondents (61.43%). This suggests the necessity for more extensive information dissemination and educational efforts to enhance awareness within this demographic. In contrast, a smaller percentage of respondents (38.57%) exhibit a high level of awareness.

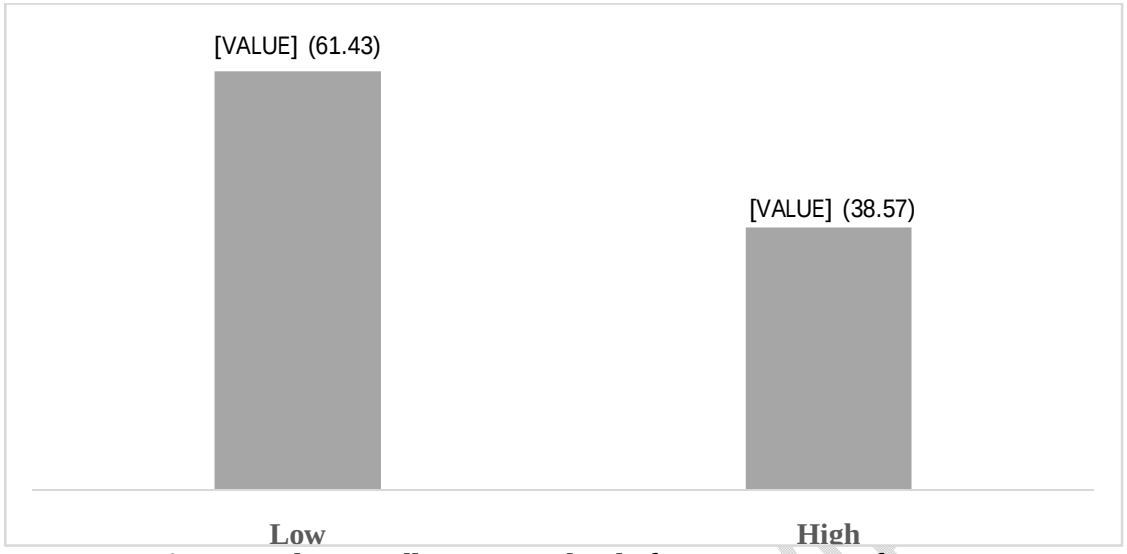

Figure 1. The overall awareness level of PMFBY among farmers

4.4 Results from the probit regression model

The probit regression analysis is utilized to identify the determinants influencing farmers' awareness of PMFBY. Before running the probit model, an examination of multicollinearity among the variables is performed using VIF (Variance Inflation Factor) and Tolerance (TOL). The results in Table 5 demonstrate that VIF values below 5 indicate the absence of serious multicollinearity, suggesting that the data is reliable for further analysis. The probit model displayed substantial explanatory power, with a pseudo-R^2 value of 0.75. Furthermore, Table 6 illustrates the positive and significant impacts of variables such as education, organizational membership, exposure to mass media, and contact with extension personnel on farmers' awareness of PMFBY.

Table 5. Multicollinearity diagnosis indices for explanatory variables

Variable	VIF	1/VIF
Gender	1.08	0.92
Age	2.42	0.41
Education	1.41	0.71
Membership in the organisation	1.36	0.74
Annual income	1.69	0.59
Farm size	1.62	0.62
Farming experience	2.31	0.43
Livestock	1.04	0.96
Access to credit	1.07	0.93
Contact with extension personnel	1.62	0.62
Exposure to mass media	1.54	0.65
Mean VIF	**1.56**	

Education plays a critical role in raising awareness about crop insurance. Findings reveal an 8.2% increase in the likelihood of being aware of crop insurance with the increase in education level. This finding is supported by Kumar et al. (2011), Olila and Pambo (2014), Ghazanfar et al. (2015), and Saravanan and Ganesan (2022). This may be due to the reason that individuals with lower levels of education may face challenges in comprehending the intricacies and operational mechanisms of an insurance policy (Ghazanfar et al., 2015). Results show a significant positive association between organizational membership and awareness, with statistical significance at the 1% level. Moreover, active participation in social and community-based organizations, such as farmers' associations, self-help groups, and cooperative credit societies, increases the likelihood of awareness by 11.0%.This result is consistent with Kumar et al. (2011).Some studiessuggestthat utilizing social networks to disseminate information can have a substantial impact on the spread of crucial information(Banerjee et al., 2019; Cariappa et al., 2021). These findings emphasize the importance of promoting farmers' participation in social activities and highlight education as a fundamental tool for advancement.

Furthermore, it is found that farmers who frequently access information through various media channels exhibit a higher understanding of insurance programs compared to those with limited or no exposure. This result is found to be similar withSaravanan and Ganesan (2022).Correspondingly, farmers who engage in more frequent interactions with extension services demonstrate a more comprehensive understanding of insurance programs in comparison to those with irregular or no contacts.This is in line with findings by Saravanan and Ganesan (2022).This highlights the impactful role of mass media and direct interactions with extension agents in effectively delivering detailed and practical information, empowering farmers to better understand and actively participate in insurance programs.

Table 6. Estimates of the probit model

Variables	Coefficients	Standard error	Marginal effects	Standard error
Gender	0.004	0.326	0.001	0.050
Age	-0.007	0.018	-0.001	0.003
Education	0.538***	0.095	0.082***	0.012
Membership in the organisation	0.716***	0.213	0.110***	0.031
Annual income	0.199	0.300	0.031	0.046
Farm size	0.017	0.033	0.003	0.005
Farming experience	0.003	0.013	0.001	0.002
Livestock	-0.223	0.212	-0.034	0.032

Access to credit	0.210	0.225	0.032	0.034
Exposure to mass media	0.832***	0.193	0.128***	0.027
Contact with extension personnel	1.078***	0.165	0.165***	0.019
Constant	-6.036	3.855		
Summary statistics				
Log-likelihood	= -97.51			
LR Chi^2	= 271.74			
Pro>chi^2	= 0.0000			
Pseudo R^2	= 0.58			
Number of observations	= 350			

Note: ***, **, and * indicate significance levels of 1%, 5% and 10%, respectively.

4.5 Perception of farmers about crop insurance

The data presented in Table 7 illustrates the farmers' perspectives on various aspects of crop insurance. Upon identifying the farmers within the sample population who have availed crop insurance, participants were asked to rate the predetermined items regarding their perception of crop insurance using a five-point Likert scale (Strongly Disagree - 1,Disagree - 2, Neutral - 3, Agree - 4, Strongly Agree - 5). The results highlight three main concerns of PMFBY among farmers: delayed claim settlements, inadequate compensation compared to actual loss, and non-affordable premium rates, with mean scores of 4.29, 3.86, and 3.77, respectively.

While the premium rates are subsidized and have been further reduced in the newly introduced PMFBY, farmers still find the premium rates to be relatively high. This perception may stem from the fact that even with the subsidized premiums, the costs could still pose a significant burden for small and marginal farmers (Rajeev & Nagendran, 2023). Furthermore, farmers have articulated concerns regarding the limitations of the current area-based approach for estimating crop loss assessment. They have underscored that this methodology often disregards individual crop losses, leading to insufficient compensation for the actual extent of their losses. Some studies such as Ghimire et al. (2016), Johnson et al. (2019), and Budhathoki et al. (2019) have indicated that discrepancies between claimed amounts and actual losses may also contribute to the low adoption of crop insurance.

Table 7. Perception of farmers about crop insurance

Particulars	Mean score	Rank
Crop insurance acts as a risk management tool	3.16	V
Amount of premium is not affordable	3.77	III
Availing of crop insurance is a more time-consuming process	2.87	VIII
Helps in providing financial support during crop losses	3.10	VI
Helps to adopt innovative and modern farm practices	2.40	IX

Need to ensure quick settlement of claims	4.29	I
Timely conducting of crop-cutting experiments	2.95	VII
The amount of compensation is less compared to the actual loss that occurred	3.86	II
Loss assessment should be based on an individual farm approach, not on an area-based approach	3.34	1V

5. Conclusion and recommendations

Crop insurance remains an integral component within the agricultural frameworks of developing nations, serving as a primary instrument in the stabilization of farm income and the mitigation of risks inherent to agricultural activities.However, the adoption of agricultural insurance products among farmers in India has been limited, as evidenced by their reluctance to invest in insurance coverage(Rajeev & Nagendran, 2023). This study seeks to ascertain the extent of farmers' understanding of insurance, analyse the factors influencing their awareness, and explore their perceptions of crop insurance.The outcomes of the study indicate that the majority of the farmers have limited exposure to mass media and minimal contact with extension personnel.Specifically, only 7.43% of farmers have high mass media exposure with15.14% of farmers demonstrating high extension contacts. In addition, results show that61.43%of the respondents have low awareness of various aspects of PMFBYwhile 38.57% have relatively high awareness.

Probit model results show that education, membership in the organisation, mass media exposure, and contact with extension personnel have a significant positive influence on the awareness level of crop insurance. However, it is noteworthy that the level of education, mass media exposure, and extension contacts is notably low among sampled farmers and only40% of the respondentsaremembers of the organisation. Therefore, it is recommended to prioritize the cultivation and strengthening of relationships between farmers and extension agents to effectively propagate heightened awareness regarding crop insurance amongst farmers. One approach is to develop extension networks funded by training individuals from local communities in insurance. The private insurance sector can also be encouraged to utilize the public extension system to reduce costs and improve trust in insurance products.Additionally, involving grassroots organizations, such as self-help groups and rural cooperatives, which possess extensive experience in collaborating with farmers, can substantially facilitate the dissemination of comprehensive information about crop insurance. Furthermore, it is important to conduct awareness campaigns to educate farmers about the benefits and functioning of crop insurance.

The findings on the perception of crop insurance among insured farmers reveal that many of them harbournegative views about the insurance program. The primary concerns of the respondents include late settlement of claims, inadequate compensation, and unaffordable premium rates. It is crucial to take action to ensure that indemnity payments are made promptly when farmers suffer losses. Additionally, it is recommended to employ advanced technologies, such as satellite imagery or drones, to swiftly assess crop damage and provide compensation amounts that accurately reflect the actual loss. By addressing these issues and tailoring crop insurance to meet the needs of farmers in developing countries, there could be a significant increase in demand for crop insurance.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during the writing or editing of manuscripts.

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