“Determinants of future crop insurance purchase decisions among pepper growers in the South Hill Zone of Karnataka, India”

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ARTICLE INFO	Manukumari M. S., Veena Kumari B. K. and Abhilash Abhilash (2026). Determinants of future crop insurance purchase decisions among pepper growers in the South Hill Zone of Karnataka, India. *Insurance Markets and Companies*, *17*(2), 76–92. doi:10.21511/ins.17(2).2026.06
DOI	http://dx.doi.org/10.21511/ins.17(2).2026.06
RELEASED ON	Monday, 21 September 2026
RECEIVED ON	Wednesday, 20 May 2026
ACCEPTED ON	Thursday, 27 August 2026

JOURNAL	"Insurance Markets and Companies"
ISSN PRINT	2616-3551
ISSN ONLINE	2522-9591
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
31	2	6

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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DETERMINANTS OF FUTURE CROP INSURANCE PURCHASE DECISIONS AMONG PEPPER GROWERS IN THE SOUTH HILL ZONE OF KARNATAKA, INDIA

Abstract

The Indian agricultural system is diverse, monsoon-dependent, and smallholder-driven. In this context, crop insurance is a suitable protective measure for farmers, though it has not been widely adopted. This study aims to examine the influence of demographic factors, economic factors, farm-related factors, risk perception factors, insurance-related factors, and institutional factors on future crop insurance purchase decisions among pepper-growing farmers in the south Hill Zone of Karnataka, India. To conduct an empirical investigation, a total of 407 samples were collected using a multistage sampling technique. Logistic regression models were employed to analyze the influence of the considered factors on farmers' future crop insurance purchase decisions. The results show that all considered variables do not influence farmers' future crop insurance purchase decisions except the Size of landholding ($\beta = 0.3334$, $p = 0.034$). Among the variables included in the model, size of landholding was the only variable that showed a statistically significant positive association with farmers' future crop insurance purchase decisions. The findings imply that farmers' future crop insurance purchase decisions are likely to be affected by structural and resource factors. To improve the effectiveness and inclusiveness of crop insurance, the government should strengthen the scheme with greater emphasis on supporting small and medium-sized landholders.

Keywords crop insurance, pepper growers, logistic regression, landholding, purchase decision

JEL Classification G22, Q12, Q18, C25

Type of the article: Research Article

Received on: 20th of May, 2026
Accepted on: 27th of August, 2026
Published on: 21st of September, 2026

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Conflict of interest statement:
Author(s) reported no conflict of interest

INTRODUCTION

Agriculture faces many uncertainties, which include unfavorable weather, pests, market price fluctuations, and natural calamities. These uncertainties have profound impacts on farmers' income, productivity, and livelihood security. With this view, crop insurance is an alternative technique available for farmers to mitigate these risks or uncertainties. It also reduces agricultural risk and stabilizes farmers' income, contributing to economic security and confidence in the future (Agbenyo et al., 2022).

The concept of crop insurance in India dates back to 1920, when J.S. Chakravarthi proposed agricultural insurance in Mysore State to protect farmers from severe drought. However, financial and administrative constraints hindered their success. Similarly, the government realized the importance of a specialized crop insurance program to provide coverage for farmers. As traditional insurers were unwilling to take agricultural risks, the process of making a crop insurance purchase decision involves carrying out tasks and making choices over an extended period of time, during which the farmer assesses the innova-

http://dx.doi.org/10.21511/ins.17(2).2026.06

tion and decides whether or not to adopt it. Additionally, the purchase process is quite difficult due to the diverse number of factors that come into play when adopting an innovation (John et al., 2023).

It is noted that pepper is one of the most important commercial spice crops cultivated in the South Hill Zone of Karnataka, particularly in the districts of Kodagu, Chikkamagaluru, Hassan, and Shivamogga. Also, the livelihood of a large number of farmers in this region depends on pepper cultivation, which is highly vulnerable to unpredictable rainfall, changing climatic conditions, pest and disease infestations, and market price fluctuations. These production and income risks expose pepper growers to considerable financial uncertainty, making crop insurance an important risk management strategy. Despite the availability of government-supported crop insurance schemes, the adoption of crop insurance among pepper growers remains uneven due to various demographic, socio-economic, institutional, and behavioral factors. Therefore, the understanding of factors influencing farmers' crop insurance purchase decisions in the future among pepper growers in the South Hill Zone is essential for improving farmers' participation and developing policies that enhance farmers' resilience against agricultural risks.

1. LITERATURE REVIEW

Over the past two decades, research on crop insurance has focused on factors affecting farmers' decisions to adopt insurance. The literature revealed mixed results indicating the influence of multiple factors. Although the determinants vary across countries and farming systems, the research consistently suggests that crop insurance adoption is the result of the interaction between farmers' personal characteristics, government support, perceived risks, and the design of insurance products.

A substantial body of literature identifies socio-economic characteristics as the primary determinants of crop insurance participation. Farmers with higher educational attainment generally possess better financial literacy and a greater understanding of insurance mechanisms, enabling them to evaluate the benefits and limitations of insurance more effectively (Dragos et al., 2023; Wang et al., 2016). Education enhances farmers' capability to benefit from extension advice, comprehend the policy rules, and interpret insurance documents, which increases their probability of participating. Likewise, the size of farms is another factor that has been found to be important in predicting the adoption of crop insurance. Large crop areas generally mean high levels of investment and increased risks, thus motivating farmers to take insurance to cover such risks. Past literature on crop insurance also reveals that household income, farming experience, institutional credit, and productive assets have a positive impact on insurance adoption (Silong & Gadanakis, 2020).

Behavioral and psychological issues have been given growing importance in recent crop insurance studies. The attitude of the farmer towards risk, their trust in the insurer, and experience in terms of compensation greatly determine their attitude towards buying an insurance policy. Risk-averse farmers see insurance as a good way of mitigating income risk, while risk-seeking farmers manage production losses without insurance (Glaser, 1996). Also, Previous indemnity benefits were found to be motivating factors of farmers' confidence in insurance programs by demonstrating that compensation is delivered following crop losses. In contrast, factors like delays in claim settlement, inadequate compensation, and lack of transparency are considered to be the hindering factors.

There are many other studies that focused on factors like institutional and policy-related factors. It is observed that the role played by the government through premium subsidies, an easy enrollment process, and awareness campaigns greatly enhances crop insurance adoption. Many studies have demonstrated that subsidized premiums significantly decrease the cost of insurance for farmers, thus improving their enrolment (Khan et al., 2026). Agricultural extension services further enhance participation by disseminating information regarding eligibility, premium payment procedures, claim settlement, and policy benefits (Nivetha et al., 2025). These institutional mechanisms bridge the information gap between insurance providers and farming communities. The effectiveness of policy support has also been

demonstrated internationally. Babcock and Hart (2005) analyzed the impact of the Agricultural Risk Protection Act (ARPA) on farmers in the U.S. and concluded that higher premium subsidy payments substantially increased the farmers' insurance purchases, indicating that proper government encouragement greatly improves insurance adoption.

Many researchers have emphasized the role of awareness and information dissemination in shaping farmers' attitudes towards insurance policies. Even though there have been considerable efforts from countries to expand their crop insurance programs, the lack of awareness about the terms of the policy, claiming procedures, and premiums remains an important reason behind the low uptake of insurance policies. Awareness, training, financial literacy, and frequent contact with extension workers help farmers gain better insight into insurance policies. Researchers found that awareness coupled with institutional trust is more influential in adopting insurance policies compared to awareness alone (Dragos et al., 2023).

Climate change is one of the most significant concepts of crop insurance demand. Increasing frequency of droughts, floods, irregular rainfall, and extreme weather events has heightened production risks, making insurance an essential component of agricultural risk management. Hasanah et al. (2025), have observed that farmers facing more climate risks tend to have a higher propensity to buy insurance against their crops and also pay insurance premiums. The previous history of weather-related damage to the crops further reinforces the same because of higher risk awareness among the farmers. There is also evidence that localized weather prediction systems and climate advisory services increase risk perception and uptake of crop insurance (Anjitha et al., 2024). These findings demonstrate that climate information services and insurance complement each other to improve agricultural resilience.

The design and operational efficiency of crop insurance products also influence farmers' participation. An insurance system with adequate indemnity, affordable premiums, transparent claim assessment, and timely compensation is more likely to attract farmers. Acchukatla et al. (2025) observed that previous indemnity payments, premium affordability, and favorable market conditions positively influence insurance purchase decisions. Similarly, Teegerstrom et al. (2013) have shown that yield variance, premium charges, subsidies, and revenue risk can influence farmers' preferences for insurance products. High-risk farmers would go for revenue insurance rather than yield insurance. This indicates the need to incorporate the local production environment into insurance designs.

International experience further suggests that the success of crop insurance is conditional upon country-specific institutions and technologies. The study conducted in Thailand revealed that lack of weather data, lack of farmers' awareness, moral hazard, and lack of compensation were the key barriers to weather index insurance (Sinha & Tripathi, 2016). The study recommended strengthening weather monitoring infrastructure, using satellite technology for drought assessment, improving policy support, and expanding farmer education programs. Similarly, Bokusheva (2011) explained that there is a temporal variation between weather factors and agricultural yields. This makes the current risk assessment models used by the insurance firms ineffective.

The recent literature also stresses that agricultural insurance needs to be considered a component of the wider agricultural risk management system. Insurance becomes more efficient in the presence of institutional credit, advanced weather forecasts, extension, technology and marketing. Although a lot of work has been done by scholars on this topic previously, most of the work conducted so far related to either the overall agricultural families or particular insurance programs that have been adopted in various countries. Moreover, empirical evidence from the South Hill Zone of Karnataka remains limited despite the region's importance as one of India's major pepper-producing areas.

Thus, the present study aims to investigate factors influencing future crop insurance purchase decisions among pepper growers in the South Hill Zone of Karnataka. The study based on the theoretical and empirical literature framed the following hypotheses:

http://dx.doi.org/10.21511/ins.17(2).2026.06

H1: Farmers' demographic factors (age, education) significantly influence future crop insurance purchase decisions.

H2: Farmers' economic factors (family annual income, annual saving, borrowings, financial security) significantly influence future crop insurance purchase decisions.

H3: Farm-related factors (size of land holding, land ownership, crop yield, input cost) significantly influence crop insurance purchase decisions.

H4: Risk perception factors (expected risk, weather conditions) significantly influence crop insurance purchase decisions.

H5: Insurance-related factors (trust in insurance, premium payment, previous year indemnity, premium collection period, claims assessment) significantly influence crop insurance purchase decisions.

H6: Institutional factors (bank compulsion, awareness) significantly influence crop insurance purchase decisions.

2. METHOD

The primary data for the study were collected from insured pepper-growing farmers who had experienced crop insurance in the previous years. The Study was conducted in the Hill Zone of Karnataka, which is one of the eight agro-climatic zones of the state. This region receives high rainfall, favorable climatic conditions, and rich biodiversity. Agriculture is the primary occupation of this zone. Major crops cultivated in the region include coffee, pepper, paddy, arecanut, and vegetables. Among these crops, pepper is more popular and brings a high income to the farmers. Interestingly, growers are showing more interest in purchasing crop insurance for pepper due to its high commercial value, climatic risks and diseases.

A multistage sampling technique was used for the selection of respondents. In the first stage, taluks with participation in insurance were selected for the study. Eight taluks were selected from the identified study area. The total number of insured farmers in each selected taluk was identified with the help of official records and local authorities of the Hill Zone of Karnataka (Directorate of Economics & Statistics, 2025). For this study, only farmers who had participated in a crop insurance scheme during the previous year were selected as respondents. The questionnaire was reviewed by subject experts in agricultural economics and finance to ensure content validity. The content validation assessment indicated satisfactory agreement among the experts, with a Kappa coefficient of 0.77, demonstrating acceptable content validity of the questionnaire. Based on their suggestions, appropriate modifications were incorporated before conducting the pilot survey. A structured questionnaire was administered to these farmers to collect information on their socio-economic characteristics, crop insurance experience, and factors influencing their future crop insurance purchase decisions. In the final step, 2.18% of the insured pepper-growing farmers from each taluk were randomly selected. A well-structured and pre-tested questionnaire was used to collect the required data through personal interviews with pepper growers. The questionnaire utilized a five-point Likert scale, which had responses from 1 = strongly agree to 5 = strongly disagree. Reverse coding was performed on the responses before calculating the average and ranking the factors so that higher numerical scores would be associated with a greater level of agreement. The responses obtained from the pilot study were analyzed to identify ambiguous questions and improve the overall structure of the questionnaire. The internal consistency of the perception measures was assessed using Cronbach's Alpha, which yielded value 0.950, indicating excellent reliability of the measurement instrument. The higher average scores would show higher levels of importance attributed to the factors that influence the decision-making process for purchasing crop insurance. The data were collected during November and December 2025. A total of 431 farmers were selected for the study, but due to 24 incomplete responses, a total of 407 valid and complete questionnaires were retained for the final statistical analysis. The adopted methodology ensured adequate representation of pepper growers across the selected taluks.

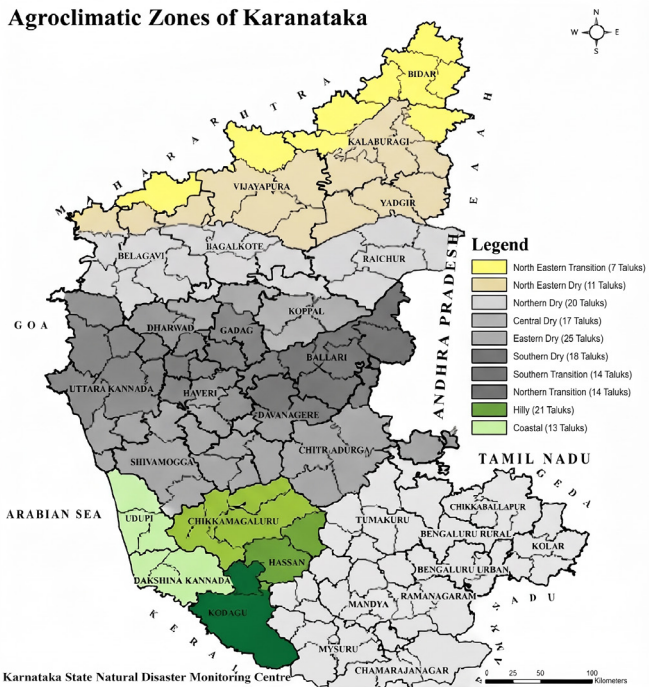

Figure 1. The study area (South Hill Zone of Karnataka)

Descriptive and inferential statistics were used to analyze the data. The dependent variable in this study is the farmers' future crop insurance purchase decision, measured as whether they would purchase crop insurance (Yes) in the future or not (No), and the response variable is binary. If the respondent had the decision to buy crop insurance in the future, it would be coded Yes (1); otherwise, No (0). Among the respondents, 264 farmers (64.86%) indicated a Yes response (Y = 1), while the remaining 143 farmers (35.14%) reported a No response (Y = 0). The demographic variables included age and education, while farmers' economic factors included family annual income and annual savings. These variables consisted of naturally ordered categories. Therefore, they were coded using sequential numerical values and entered directly into the logistic regression model as ordinal predictors rather than as dummy variables. This approach was adopted to preserve the inherent ordering of the categories, reduce the model parameters, and maintain model parsimony (Hosmer & Lemeshow, 2000). The other variables, such as farm-related factors, risk perception factors, insurance-related factors, and institutional factors, were measured using a five-point Likert scale. The equation is mentioned as:

$$P(Y=1)=\frac{1}{1+e^{-((\beta 0+\beta 1X1+\beta 2X2+\cdots+\beta nXn)1}}, \quad (1)$$

where $P(Y = 1)$: probability that the farmer purchases insurance; e: exponential constant; β0: constant/intercept; β1, β2….βn: coefficients of variables $X1$, $X2…Xn$: independent variables.

A total of nineteen factors, namely demographic characteristics, farmers' economic factors, farm-related factors, risk perception factors, insurance-related factors, and institutional factors, were considered in this study to identify the determinants of farmers' future crop insurance purchase decisions.

Table A3 presents the respondents results related to farmers future crop insurance purchase decision. However, for the logistic regression analysis, only twenty explanatory variables were considered, while gender and marital status were used solely to describe the demographic characteristics of the respondents and were not incorporated into the regression model. The demographic profile indicates that the majority of the respondents were male 289 (70.8%), whereas 118 respondents (29.2%) were female, suggesting that men predominantly undertake pepper cultivation and crop insurance-related decisions in the study area. Regarding marital status, 354 respondents (87.2%) were married, and 53 respondents (12.8%) were unmarried. The predominance of married respondents reflects the

http://dx.doi.org/10.21511/ins.17(2).2026.06

family-based farming structure prevalent in the South Hill Zone, where household responsibilities and long-term financial commitments continue to influence agricultural decision-making, including participation in crop insurance.

The majority of the farmers belong to the 40-60 years category (54.8%), followed by 25-40 years age category (34.8%) and below 25 years (2.4%), indicating the deeper involvement of middle-aged farmers in agricultural activities. 38.5% of respondents were graduates, and 28.1% studied PUC. 43.2% of farmers hold 5-10 acres of pepper crops. 92% of farmers cultivated crops on their own land. This shows that a considerable proportion of farmers had moderate levels of education. In terms of annual family income, 189 respondents (46.6%) earned ₹5,00,000-₹10,00,000, followed by 106 (26%) earning less than ₹5,00,000, 68 farmers (16.5%) earned ₹10,00,000-₹15,00,000, and 44 (10.9%) earned more than ₹15,00,000. Regarding annual savings, 162 respondents (39.9%) reported that their savings could not be determined, while 94 (23%) saved 15-30%, 80 (19.7%) saved less than 15%, and 71 (17.4%) saved more than 30%. Overall, the respondents were predominantly medium-scale landowners cultivating their own land, with moderate family incomes and varied annual savings.

3. RESULTS

This section presents the results of the binary logistic regression analysis conducted to identify the factors influencing farmers' future purchase decisions of crop insurance. The multicollinearity check was done using the Variance Inflation Factor (VIF) test. During the preliminary diagnostic assessment, the government/agent support variable was identified as a duplicated predictor that represented information already captured by another explanatory variable. The duplicated Government/Agent Support variable was removed before model estimation as it was perfectly dependent on the Premium Collection Period variable. The revised model, therefore, reported the absence of multicollinearity issues as all values obtained were less than 10.

Table 1 shows the results of the logistic regression analysis. In this analysis, the purchase of crop insurance is a dependent variable. A total of nine-

Table 1. The results of the logit model

Variable	Coefficient	Standard error	z-statistics	p-value	Odds ratio	95% CI lower	95% CI upper	VIF
Constant	0.8285	1.38	0.6004	0.5483	2.29	0.1532	34.239	NA
Age	0.2123	0.1871	1.135	0.256	1.2365	0.8570	1.7842	1.291
Education	0.1752	0.1508	1.162	0.245	1.1915	0.8866	1.6013	1.215
Family Annual Income	−0.0829	0.1455	−0.570	0.569	0.9205	0.6922	1.2241	1.580
Annual Saving	−0.0453	0.1012	−0.448	0.654	0.9557	0.7837	1.1654	1.239
Borrowings	0.1023	0.1010	1.012	0.311	1.1077	0.9087	1.3502	1.165
Financial Security	−0.0146	0.0994	−0.147	0.883	0.9855	0.8110	1.1975	1.211
Size of Land Holding	0.3447	0.1558	2.213	0.027	1.4115	1.0402	1.9157	1.555
Land Ownership	0.0900	0.0772	1.165	0.244	1.0942	0.9405	1.2730	1.112
Yield Performance	0.1906	0.1121	1.701	0.089	1.2100	0.9714	1.5072	1.262
Input Cost	0.1765	0.1007	1.753	0.080	1.1930	0.9794	1.4533	1.114
Expected Risk	−0.0481	0.1451	−0.331	0.741	0.9531	0.7171	1.2667	1.144
Weather Conditions	−0.0416	0.1205	−0.345	0.730	0.9593	0.7574	1.2149	1.123
Trust in Insurance	−0.1206	0.0926	−1.302	0.193	0.8864	0.7393	1.0629	1.147
Premium Payment	0.0097	0.0982	0.099	0.921	1.0097	0.8329	1.2241	1.198
Previous Year Indemnity	0.0202	0.1080	0.187	0.851	1.0204	0.8258	1.2610	1.150
Premium Collection Period	0.0274	0.0988	0.277	0.782	1.0278	0.8468	1.2475	1.168
Claims Assessment	−0.0552	0.1037	−0.532	0.595	0.9463	0.7722	1.1596	1.210
Bank compulsions	−0.0022	0.0972	−0.023	0.982	0.9978	0.8248	1.2071	1.058
Awareness	0.0795	0.0850	0.936	0.349	1.0828	0.9166	1.2790	1.086

Note: β = regression coefficient; SE = standard error; OR = odds ratio; CI = confidence interval; VIF = Variance Inflation Factor. The VIF for the constant (intercept) is not reported because multicollinearity diagnostics apply only to the explanatory variables.

teen variables were considered as explanatory variables. The coefficient of age is positive (0.2123), although the association is not statistically significant, meaning that age itself does not determine whether a farmer will use crop insurance. Education was found to be an insignificant determinant of future crop insurance purchase decisions. The estimated coefficient for education was 0.1752 with a p-value of 0.7352, indicating that the relationship is not statistically significant at the 5% significance level and it does not provide sufficient evidence to conclude that education has a meaningful influence on farmers' future crop insurance purchase decisions. This suggests that the level of education does not play a significant role in determining whether farmers are likely to purchase crop insurance in the future.

The economic factors show negative coefficients. Family annual income ($\beta = -0.0829$; $p = 0.569$) and annual savings ($\beta = -0.0453$; $p = 0.654$) were found to have negative but statistically insignificant effects on future crop insurance purchase decisions. This indicates that neither household income nor annual savings has a significant influence on farmers' decisions to purchase crop insurance. Borrowings ($\beta = 0.1023$; $p = 0.311$) shows a positive but statistically insignificant, financial security ($\beta = -0.0146$; $p = 0.883$) exhibited negative but statistically insignificant relationships with future crop insurance purchase decisions. The results reveal that neither the level of borrowings nor the perceived financial security of farmers has a significant influence on their decision to purchase crop insurance.

Among nineteen independent variables, only one variable is significant in this study. The size of landholding has a positive and statistically significant coefficient of 0.3447 and a p-value of 0.027. It indicates that farmers who own agricultural landholdings are more likely to purchase crop insurance. Large farmers generally invest more capital in cultivation activities like the purchase of seeds, fertilizers, machinery expenses, irrigation, and labor charges. Consequently, they face risk in the event of crop failure caused by droughts, floods, pest attacks or climate variability.

In the same vein, the coefficient for Land Ownership is positive, which means that individuals who have security in land ownership would be motivated to protect their crops using crop insurance. However, this is not statistically significant. Crop yield has a positive coefficient of 0.1906, with a p-value of 0.089 indicating an insignificant association with farmers' future crop insurance purchase decisions. Similarly, input cost showed a coefficient value of 0.1765, with a p-value of 0.080 indicating that the relationship is not statistically significant. The expected risk, weather conditions and trust in Insurance show negative coefficients of –0.0481, –0.0416 and 0.1206 respectively with p-value of 0.741, 0.730 and 0.193. All these results indicate insignificant effects on farmers' future crop insurance purchase decisions. The results of Premium Payment, Previous Year Indemnity, and Premium Collection Period show positive coefficient values of 0.0097, 0.0202, and 0.0274 with p-values of 0.921,0.851 and 0.782 respectively, indicating their insignificant effects on farmers' future crop insurance purchase decision. Also, the result of Claims assessment shows insignificant effects with a coefficient value of –0.0552 and a p-value of 0.595, indicating its negligible effect on crop insurance purchase decision.

Moreover, the result of bank compulsion shows a negative effect with a coefficient of –0.0786 and p-value of $p = 0.982$, indicating an insignificant effect. It suggests that compulsory insurance through banks did not significantly influence farmers' future crop insurance purchase decisions. Similarly, the result of awareness shows an insignificant effect with a positive coefficient of 0.0795, with p-value of 0.349, indicating that awareness alone is not a significant determinant of future crop insurance purchase decisions. Thus, all framed hypotheses are rejected except hypotheses three which is land holding that demonstrated its significance effect on future purchase decision.

Table 2. Model diagnostic results

Diagnostic measure	Value
Number of observations	407
Likelihood ratio (LR) χ^2	19.28
LR test p-value	0.5038
McFadden pseudo R^2	0.0365
Overall classification accuracy	65.60%
Sensitivity	92.05%
Specificity	16.78%
Area Under ROC Curve (AUC)	0.620

http://dx.doi.org/10.21511/ins.17(2).2026.06

Table 2 presents the diagnostic statistics for the binary logistic regression model. The likelihood ratio (LR) test yielded a $\chi 2$ value of 19.28 with a corresponding p-value of 0.5038, indicating that the full model did not significantly improve upon the intercept-only model. The McFadden pseudo R2 value of 0.0365 suggests that the explanatory variables accounted for a relatively small proportion of the variation in farmers' crop insurance premium payment decisions. The model achieved an overall classification accuracy of 65.60% with a sensitivity of 92.05% and a specificity of 16.78%. Furthermore, the Area under the Receiver Operating Characteristic (ROC) Curve was 0.620, indicating a modest ability of the model to distinguish between farmers who will be paid and those who will not pay the crop insurance premium.

Table 3. Matrix of the binary logistic regression model

Observed	Predicted: No	Predicted: Yes	Total
No	24	119	143
Yes	21	243	264
Total	45	362	407

Table 3 shows the classification matrix of the binary logistic regression model. A total of 407 observations were included in the analysis; the model correctly classified 21 farmers who will pay the crop insurance premium (true positives) and 24 farmers who will not pay the crop insurance premium (true negatives). However, 119 farmers who will not pay the crop insurance premium were incorrectly classified as premium payers (false positives), while 21 farmers who will pay the crop insurance premium were incorrectly classified as non-premium payers (false negatives). The model accuracy was 65.60%, indicating that approximately two-thirds of the observations were correctly classified. Further, 92.5% sensitivity demonstrated a high ability to correctly identify farmers who will pay the crop insurance premium in the future. In contrast, the specificity was 16.78%, indicating a relatively limited ability to correctly identify farmers who will not pay crop insurance premiums in the future. These results suggest that the model performs considerably better in predicting farmers who will pay crop insurance premiums than those who will not.

4. DISCUSSION

The study aims to examine factors affecting future Crop Insurance purchase decisions among pepper-growing farmers' adoption in the Hill Zone of Karnataka, India. The influence of age on decision-making has been reported differently in the previous studies. Variations in findings could be attributed to differences in study objectives, sample characteristics, and contextual factors. These differences suggest that the role of age in influencing crop insurance pur-

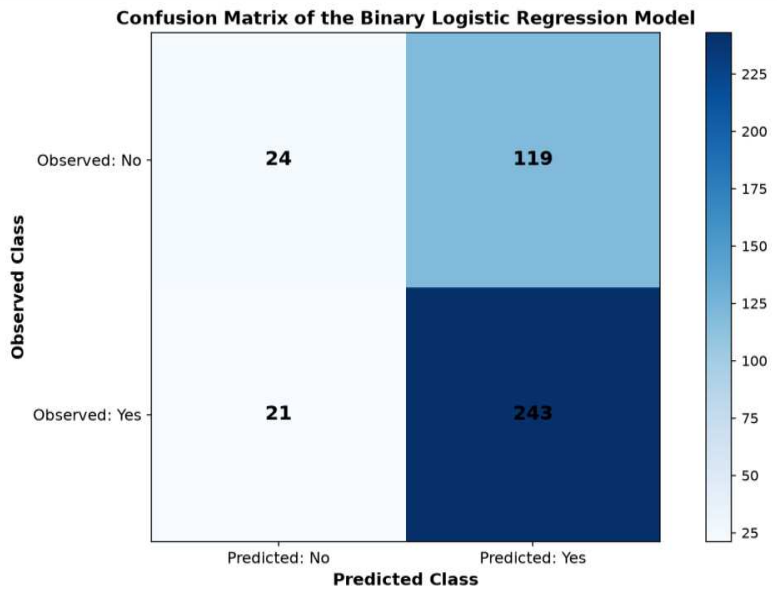

Figure 2. Classification matrix of the binary logistic regression model

chase decisions tends to vary across regions and farming communities (Sanz de Acedo Lizárraga et al., 2007).

Education was not found to have a significant influence on farmers' future crop insurance purchase decisions. This suggests that differences in educational attainment did not substantially affect farmers' willingness to purchase crop insurance. Although educated farmers have better access to information and a greater understanding of insurance products, this advantage did not translate into a significant difference in purchase decisions. This finding contrasts with Madaki et al. (2023), who reported that education positively influences crop insurance adoption by improving farmers' awareness and understanding of insurance schemes. The difference in findings could be attributed to variations in the study area, farmers' socio-economic characteristics, and the level of awareness created through local institutions and extension services.

Farmers' income is generally recognized as a determinant of crop insurance participation, as higher-income farmers are expected to possess greater financial capacity to purchase insurance. However, the current study revealed that income has no substantial impact on the future crop insurance purchase decision. This is contrary to Cha et al. (2024) who reported a positive effect of income on crop insurance purchase decision. Household savings are generally expected to influence farmers' risk management decisions as accumulated savings provide financial security during periods of uncertainty. Farmers with higher savings often rely on self-insurance by using their own financial reserves to recover from production losses, thereby reducing their dependence on formal insurance mechanisms. However, the current study revealed that savings has no substantial impact on the future crop insurance purchase decision, contradicting Dercon (2002).

Agricultural borrowing is closely associated with production investment and financial risk. Nevertheless, the influence of borrowing was found to be insignificant in the study. This could be due to the fact that agricultural borrowing varies according to farmers' access to credit and repayment capacity.

Financial security denotes the capacity of the farmers to deal with production risks due to diversification of income, regular cash flows, asset accumulation, or availability of financial capital. Though farmers who are financially secure are more resilient to agricultural risks, the current research found that financial security does not have an impact on decision-making regarding crop insurance purchases.

The size of the land holding has a significant positive influence on farmers' decisions for crop insurance in future. A farmer with large land holdings tends to spend more money on farming. Hence, in case of failure, the financial risk will be higher. Farmers believe that crop insurance secures investment and stabilizes income. In addition, those large farms have better access to credit institutions, extension, and other sources of agriculture-related information (Sherrick et al., 2004). In the South Hill Zone in Karnataka, farming is based on horticulture, with plantation crops like pepper, coffee, and arecanut accounting for a significant portion of cultivated land. Plantation crops entail huge expenditure on labor, plantation material, fertilizers, and crop cultivation. As a result, it is more likely that farmers tend to buy crop insurance in future. This finding is supported by Oduol and Tsuji (2005), who reported that larger landholdings increase the likelihood of insurance participation due to higher production investment and greater exposure to agricultural risk. Land ownership has a positive but statistically insignificant effect on farmers' crop insurance purchase decisions. The finding suggests that both landowners and non-landowners perceive similar production risks and have comparable access to crop insurance schemes. This result is consistent with the findings of Cole et al. (2013), who reported that awareness, accessibility, and institutional support play a more important role in insurance adoption than land ownership.

The crop yield is positively related but does not affect the insurance purchasing decisions. This suggests that variations in crop yield did not significantly influence farmers' decisions to purchase crop insurance. High-yielding commercial crops will always need large investments; hence, there is a need for farmers to secure their investments. There have been claims that farmers growing

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high-yielding commercial crops are more likely to buy crop insurance (Goodwin & Smith, 2013). However, the present study indicates that crop yield alone does not significantly determine insurance adoption among pepper farmers. Farmers' insurance decisions depend not only on expected production but also on their perceptions of claim settlement, awareness, institutional support, affordability of premiums, and previous insurance experiences. Since most respondents cultivate commercial plantation crops under relatively similar production conditions, variations in crop yield are insufficient to produce statistically significant differences in insurance purchase behaviour.

The cost of inputs has risen significantly owing to the rise in the cost of seeds, fertilizers, pesticides, labor, and irrigation. Increased production costs will lead to higher financial risks for farmers; hence, there is a higher need for risk management. However, normally, farmers view paying a premium on crop insurance as an additional burden for them. Expected production risk exhibited a positive but statistically insignificant association with future crop insurance purchase decisions. Theoretically, farmers facing higher production risk are expected to demand greater insurance protection due to increased uncertainty associated with agricultural production. However, the findings suggest that pepper farmers in the study area perceive production risk as an inherent component of farming rather than as an independent factor influencing insurance decisions.

Weather conditions also does not significantly influence future crop insurance purchase decisions in the present study. Previous studies have consistently reported that increasing climatic uncertainty and extreme weather events generally encourage farmers to adopt crop insurance as a means of managing production risk (Enjolras & Sentis, 2011). However, the findings of the present study differ from this expectation. Pepper cultivation in the South Hill Zone is largely concentrated in a high-rainfall agro-climatic region where weather-related risks are experienced uniformly across farming communities. Consequently, farmers perceive adverse weather conditions as an unavoidable and common aspect of agricultural production rather than as a factor that independently motivates farmers' participation. Similar observations have been reported by Smith (2016), who argued that when farmers perceive insurance coverage as inadequate under highly variable climatic conditions, weather risk alone does not necessarily encourage insurance adoption. Therefore, in the present study, weather conditions does not emerge as a significant predictor of crop insurance participation.

Trust issues have frequently been identified as one of the major barriers to crop insurance adoption as delayed claim settlements, lack of transparency, inadequate communication, and difficulties in crop loss assessment reduce farmers' confidence in insurance programs (Greatrex et al., 2015). Although the coefficient for trust issues is negative, the variable is not statistically significant in the present study. As opined by Dragos et al. (2023), awareness is not enough by itself unless there is trust in the performance and credibility of insurance organizations, especially in countries where farmers doubt about insurance programs sponsored by governments.

Premium collection time frame and premium payment options do not play any vital role in the purchase decision-making process of crop insurance among pepper farmers. The reason behind this could be that in the case of crop insurance in India, lending banks usually collect the premium amounts of the farmers directly from their bank accounts, which makes the process easy for the farmer borrowers. Hence, farmers hardly view premium collection as an issue while taking up crop insurance (Workineh et al., 2022).

In the present study, the previous year's indemnity was not found to have a statistically significant influence on farmers' future crop insurance purchase decisions. This indicates that receiving compensation in the previous year did not significantly affect farmers' willingness to purchase crop insurance in the future. Although past claim experiences influence farmers' perceptions toward insurance, it is not considered to be a decisive factor in the present study. This finding contrasts with Wang et al. (2016), who reported that positive indemnity experiences strengthen farmers' trust in the insurance system and encourage continued participation. The difference in findings could be attributed to variations in

the study area, farmers' experiences with claim settlements, and the socio-economic characteristics of the respondents.

Assessment of claims has a negative coefficient in the current study despite the fact that it does not influence crop insurance purchase decisions statistically. This negative relationship implies that farmers' dissatisfaction with the process of claim assessment would act as an obstacle to their participation in agricultural insurance schemes. Delayed payments for claims, fraud, inefficiency in crop losses assessment, poor use of technology and absence of transparency during the process of claim assessment have often been cited as key obstacles for agricultural insurance (Vijayakumar et al., 2022). Farmers generally expect claim settlements to be timely, transparent, and proportional to their actual crop losses. When these expectations are not fulfilled, confidence in the insurance system declines, reducing farmers' willingness to purchase insurance.

Earlier crop insurance programs in India were frequently linked with institutional credit, making insurance compulsory for loanee farmers. Following the implementation of Pradhan Mantri Fasal Bima Yojana and subsequent policy reforms, participation has gradually become more voluntary in several states, reducing the influence of compulsory enrolment on farmers' insurance decisions. Recent studies suggest that awareness, perceived benefits, and previous claim experiences have become more important determinants of insurance adoption than mandatory enrolment through banks (Biswal & Bahinipati, 2025). In the present study, awareness was found to have a positive but statistically insignificant influence on future crop insurance purchase decisions. Although awareness about crop insurance schemes, premium subsidies, enrolment procedures, and claim settlement improve farmers' understanding of insurance, it did not significantly influence their purchase decisions. This suggests that awareness alone not be sufficient to encourage participation in crop insurance. Previous studies consistently report that effective institutional support increases farmers' confidence and participation in insurance programs (Kalavakonda & Mahul, 2005). However, the effectiveness of government support depends not only on policy design but also on efficient implementation, transparency, and farmers' awareness of available benefits. Among the nineteen explanatory variables included in the model, size of landholding was the only variable that exhibited a statistically significant positive association with farmers' future crop insurance decisions. The hypotheses proposed in this study were examined simultaneously using a single multivariable logistic model. Therefore, the statistical significance of each explanatory variable was interpreted within the overall model rather than through separate joint hypothesis tests. Only the size of landholding was found to be statistically significant. Therefore, the results indicate an association rather than definitive evidence of causal relationships.

CONCLUSION

This research aimed to find out how demographic factors, economic factors, farm-related factors, risk perception factors, insurance-related factors, and institutional factors affect future Crop insurance purchase decisions among pepper growers in the South Hill Zone of Karnataka. Among the variables included in the logistic regression model, size of landholding was the only variable that showed a statistically significant positive association with farmers' future crop insurance purchase decisions. It indicates that farmers with larger landholdings are more likely to purchase crop insurance in the future, possibly as they have greater investments at risk and are more willing to protect their farm income.

Although several other variables, including age, education, borrowings, land ownership, crop yield, input cost, premium amount, indemnity, collection period, and awareness, show positive coefficients, their effects were not statistically significant. Likewise, family annual income, annual savings, financial security, expected risk, weather conditions, trust in insurance, claim assessment and bank compulsion showed statistically insignificant relationships with future crop insurance purchase decisions. These findings suggest that, within the study area, these variables did not independently explain farmers' pur-

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chase decisions after controlling for the effects of other factors. The findings imply that crop insurance penetration has yet to reach its peak in the South Hill Zone of Karnataka. Furthermore, farmers' future crop insurance purchase decisions tend to be influenced by structural and resource factors.

A DATA AVAILABILITY STATEMENT

The data are available upon reasonable request.

ETHICS APPROVAL

This study received approval from the Institutional Ethics Committee of the authors' affiliated institution.

AUTHOR CONTRIBUTIONS

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http://dx.doi.org/10.21511/ins.17(2).2026.06

APPENDIX A

Table A1. Factors influencing crop insurance: impact of agricultural income and indemnity settlements on agricultural sustainability

No.	Characteristics	Category	Mark
1	Name		
2	Place	Mudigere	
		Chikmagalur	
		Sringeri	
		Sakleshpur	
		Virajpet	
		Somwarpet	
		Madikeri	
3	Gender	Male	
		Female	
4	Marital status	Married	
		Unmarried	
5	Did you pay any insurance premiums in the previous years	Yes	
		No	
6	If yes, how did you get information about crop insurance?	Advertisement	
		Farmers' group	
		Agent bank	
		Friends and family	
		Other (please mention)	
7	Are you interested in continuing to purchase crop insurance in the future?	Yes	
		No	
8	Age	Less than 25	
		26-40 years	
		41-60 years	
		Above 60 years	
9	Education	Below SSLC	
		PUC	
		Graduation	
		Above graduation	
10	Size of landholding	Less than 2 acres	
		2-5 acres	
		5-10 acres	
		Above 10 acres	
11	Annual income	Less than 500,000	
		500,001 to 1,000,000	
		1,000,001 to 1,500,000	
		Above 1,500,000	
12	Annual saving	Less than 15%	
		15% to 30%	
		Above 30%	
		Cannot be determined	

Table A2. Influencing factors on crop insurance purchase decision in the future (using a five-point rating scale ranging from very strongly agree to strongly disagree)

No.	Factors	1. Strongly agree	2. Agree	3. Neutral	4. Disagree	5. Strongly disagree
1	Borrowings					
2	Financial security					
3	Size of land holding					
4	Land ownership					
5	Crop yield performance					
6	Input cost					
7	Expected risk					
8	Weather conditions					
9	Trust in insurance					
10	Premium amount					
11	Previous year's indemnity					
12	Premium collection period					
13	Claim assessment process					
14	Bank compulsion					
15	Awareness					
16	Government/agent support					

Table A3. Respondents' results

Variables			Frequency	Percentage
Demographic factors	Gender	Female	118	29.2
		Male	289	70.8
		Total	407	100
	Marital status	Married	354	87.2
		Unmarried	53	12.8
		Total	407	**100**
	Age	Less than 25	10	2.4
		25-40 years	142	34.8
		40-60 years	223	54.8
		Above 60 years	32	8.0
		Total	407	**100**
	Education	Below SSLC	114	28.1
		PUC	124	30.4
		Graduation	157	38.5
		Post graduation	12	3.0
		Total	407	**100**
Farmers' economic factors	Family annual income	< 500,000	106	26.0
		500,000-1,000,000	189	46.6
		1,000,000 to 1,500,000	68	16.5
		> 1,500,000	44	10.9
		Total	407	**100**
	Annual savings	15% to 30%	94	23.0
		Above 30%	71	17.4
		Cannot be determined	162	39.9
		Less than 15%	80	19.7
		Total	407	**100**
	Borrowings	Strongly agree	39	9.7
		Agree	146	35.9
		Neutral	82	20.2
		Disagree	106	26.0
		Strongly disagree	34	8.2
		Total	407	**100**
	Financial security	Strongly agree	64	15.8
		Agree	173	42.5
		Neutral	63	15.5
		Disagree	75	18.6
		Strongly disagree	32	7.6
		Total	407	**100**

http://dx.doi.org/10.21511/ins.17(2).2026.06

Table A3 (cont.). Respondents' results

Variables			Frequency	Percentage
Farm-related factors	Size of landholding	Less than 2 acres	23	5.8
		2-5 acres	122	29.7
		5-10 acres	176	43.2
		Above 10 acres	86	21.3
		Total	407	100
	Land ownership	Owned	377	92
		Leased	22	5
		Both	8	3
		Total	407	**100**
	Crop yield performance	Strongly agree	89	21.8
		Agree	172	42.2
		Neutral	74	18.3
		Disagree	58	14.2
		Strongly disagree	14	3.5
		Total	407	**100**
	Input cost	Strongly agree	52	12.8
		Agree	163	40.2
		Neutral	76	18.6
		Disagree	92	22.5
		Strongly disagree	24	6.0
		Total	407	**100**
Risk perception factors	Expected risk	Agree	178	43.8
		Disagree	10	2.3
		Neutral	17	4.2
		Strongly agree	197	48.5
		Strongly disagree	5	1.2
		Total	407	**100**
	Weather conditions	Strongly agree	163	40.1
		Agree	149	36.6
		Neutral	67	16.5
		Disagree	22	5.1
		Strongly disagree	6	1.6
		Total	407	**100**
Insurance-related factors	Trust in insurance	Strongly agree	90	22.3
		Agree	169	41.5
		Neutral	55	13.5
		Disagree	58	14.2
		Strongly disagree	35	8.6
		Total	407	**100**
	Premium amount	Strongly agree	39	9.5
		Agree	117	28.8
		Neutral	94	23.2
		Disagree	103	25.3
		Strongly disagree	54	13.2
		Total	407	**100**
	Previous year indemnity	Strongly agree	207	50.8
		Agree	130	32.0
		Disagree	32	7.9
		Neutral	26	6.5
		Strongly disagree	12	2.8
		Total	407	**100**
	Premium collection period	Strongly agree	106	26.2
		Agree	167	41.1
		Neutral	41	9.9
		Disagree	69	16.9
		Strongly disagree	24	5.8
		Total	407	**100**
	Claim assessment process	Strongly agree	42	10.4
		Agree	114	27.8
		Neutral	126	31.1
		Disagree	91	22.3
		Strongly disagree	34	8.4
		Total	407	**100**

Table A3 (cont.). Respondents' results

Variables			Frequency	Percentage
Institutional factors	Bank compulsion	Strongly agree	67	16.2
		Agree	157	38.5
		Neutral	75	18.6
		Disagree	84	20.9
		Strongly disagree	24	5.8
		Total	407	100
	Awareness	Strongly agree	65	16.01
		Agree	129	31.69
		Neutral	20	4.9
		Disagree	112	27.5
		Strongly disagree	81	19.90
		Total	407	**100**
	Government subsidies and agent support	Strongly agree	52	12.8
		Agree	131	32.2
		Neutral	82	20.0
		Disagree	85	20.9
		Strongly disagree	57	14.1
		Total	407	**100**

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