CROP INSURANCE SCHEME FOR PADDY IN PALAKKAD DISTRICT - AN ECONOMIC ANALYSIS

By

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(2017-11-064)

THESIS

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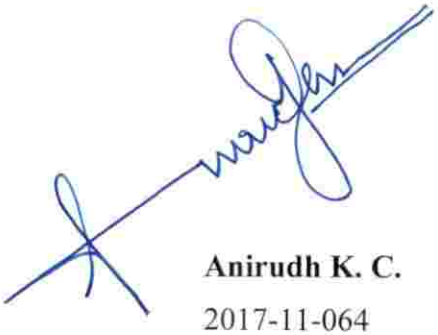
DECLARATION

I, hereby declare that the thesis entitled **"Crop insurance scheme for paddy in Palakkad district - An economic analysis"** is a bonafide record of research done by me during the course of research and that it has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.



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Introduction

1. INTRODUCTION

Agriculture sector employs more than 50 per cent of the population in India and contributes 17.1 per cent of the nation's Gross Domestic Product (GoI, 2018). Agriculture in India is highly dependent on weather elements, especially on the monsoon rains. An astonishing 68 per cent of Indian agriculture falls under dry land agriculture, which contributes 44 per cent of the total food production (Roshni, 2016). Unfortunately, agriculture is a risky venture and is vulnerable to large number of risks (Swain, 2015). The inherent risks associated with agriculture are broadly classified as, (i) production risk (ii) market risk (iii) finance/credit risk and (iv) institutional risk (GoI, 2006).

Production risks arise from various factors such as change in weather parameters, pest attacks, incidence of diseases and natural calamities, which cause the yield to fall below the expected levels. Of all the sources of production risks, weather variables are the most crucial (Miranda and Vedenov, 2001). The low latitude countries of South Asia face severe consequences of climate change and their economies are struck hard by the irregular weather patterns which cause frequent and wide spread crop losses (Thomas and Twyman, 2005). India, owing to its location in the above specified region, is one of the worst victims of the vagaries of climate change, leading to crop loss and fluctuations in farmers' income. A single drought year in India can bring about 24 to 58 per cent reduction in farmers' income and 12 to 33 per cent increase in the farm household poverty in the country (Pandey *et al.*, 2007).

In a developing country like India, with 70 per cent of the rural population dependent on agriculture and 82 per cent of them being small and marginal farmers (FAO, 2019), the impact of such crop losses and the consequent fluctuations in income are not just confined to the farmers but affects the economy as a whole. Redressal of grievances of farmers, arising out of recurring episodes of crop losses is a cumbersome process and different techniques have been employed for the same.

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Risks can be handled in two ways, the first one being the ex-ante measures, also called the protective measures, which help in ensuring smooth flow of income to the households. The second is the ex-post measures, which ensures smooth consumption and minimises the economic impact of crop loss on the households (Morduch, 1995). Adopting and implementing ex-ante measures to avoid risks is considered better than relying on ex-post measures which are employed after the occurrence of the crop loss. The ex-ante measures range from the selection of the crop till harvest, storage and sales. Risk mitigation measures such as enhancing irrigation infrastructure and adopting Good Agricultural Practices are categorised under ex-ante measures.

When the causes of crop loss are so severe, highly unpredictable and beyond control, ex-ante measures fail and risk coping ex-post strategies turns out to be the only option. The ex-post measures, often resorted to by the farmers of middle income countries are sales of fixed assets, drawing from their own savings, borrowing, migration, depending on government relief schemes and crop insurance schemes (Swain, 2015). Among the alternatives for coping with crop loss and income fluctuations, crop insurance is regarded as one of the best solution (Singh, 2010). It acts both as a coping mechanism and an ex-ante measure, wherein, the risk of an anticipated crop loss is transferred to an institution through the substitution of a known cost termed "premium", for a larger possible but uncertain cost which will be compensated through indemnification (Dandekar, 1976).

1.1 HISTORY OF CROP INSURANCE SCHEMES IN INDIA

The history of crop insurance in India dates back to1920s (Nair, 2010). Crop insurance in India has undergone a large number of policy level experiments and amendments after the independence (Prabhu and Ramachandran, 1986; Sinha, 2004; Vyas and Singh, 2006; Raju and Chand, 2007; Nair 2010; Banerjee and Bhattacharya 2011). During October 1965, the first ever crop insurance bill and a model crop insurance scheme was presented by the central government that gave the state governments the rights to implement crop insurance programmes in order

to manage agricultural risks and to stabilize the fluctuations in income of the farmers. The draft bill analysed by a committee chaired by Dharam Narain in 1970, concluded that India was not yet ready to accept crop insurance schemes even on a pilot basis. Dandekar in 1976 studied in detail the arguments and advocated for the introduction of an area based design for the crop insurance programme in the country (Nair, 2010).

The H4 cotton insurance scheme was the first crop insurance scheme implemented in India. It was introduced in Gujarat in 1972 and followed the individual approach. The programme was wound up by 1978 due to the difficulties in fixing the threshold yield for every individual farmer and collecting a fair premium from them (AICI, 2019).

The Pilot Crop Insurance Scheme (PCIS) was introduced in 1979 based on the report by V.M. Dandekar and followed the 'homogeneous area' approach. The scheme insured food crops (cereals, millets and pulses), cotton, oilseeds and potato but was confined to the borrower farmers and subscription was voluntary. The premium rates were subsidised to 50 percentage for the marginal and small farmers. The scheme was executed in 13 states and covered about 6.27 lakh farmers (AICI, 2019).

Comprehensive Crop Insurance Scheme (CCIS) which was in execution from 1985 to 1999, followed the PCIS. The new scheme was an expansion of the PCIS and demanded the active participation of the state governments. Unlike the previous scheme, CCIS was compulsory for all the loanee farmers growing the notified crops. The sum insured was 150 percent of the loan amount initially, but was later reduced to a maximum of ₹10,000 per farmer. The premium and claims were shared between the state and central governments in the ratio of 2:1 and the programme was carried out in 19 States and three Union Territories in the country, covering a total of 763 lakh farmers (GoI, 2019).

The major drawbacks of the scheme were that the decision for the execution of the scheme was to be made by each state. Consequently, some of the

state governments decided not to implement the scheme and in states where the scheme was implemented, some of the major cash crops were excluded and the coverage was limited to selected crops. One of the major constraints in the execution of the programme was the weak data base on crop loss estimations and historical data and the lack of systematic Crop Cutting Experiments (GoI, 2019).

The National Agricultural Insurance Scheme (NAIS) came into operation from 1999-2000 season. The scheme was implemented by the Agricultural Insurance Company of India Limited (AICI) and covered crop loss due to natural calamities, pest and disease attacks. The coverage increased as it was made compulsory for all the loanee farmers. Subscription was voluntary for non-loanee farmers. The scheme insured horticultural and commercial crops. The subsidy in the premium was shared equally between the state and the central governments (AICI,2019). The penetration of the scheme was very low even when the crop loan subscriptions increased. The reluctance of the banks in enrolling the borrowers in crop insurance schemes was utilized, which led to the fall in subscription of crop insurance (Mukherjee and Pal, 2017).

With the objective of improving crop insurance programmes in the country, the Modified National Agricultural Insurance Scheme (MNAIS) was implemented in 50 districts of the country on a pilot basis during the 2010-11 Rabi season. The major changes incorporated in MNAIS were that the basic unit area of insurance was reduced to village Panchayat for all the major crops, insurance cover was made available for prevented sowing/planting risk, along with post-harvest losses due to cyclone and the direct payment of 25 per cent of the claims to the insured farmers' account as an immediate relief was also ensured. MNAIS was the first ever crop insurance scheme that allowed private sector insurance companies to take the role of implementing agencies. In MNAIS, the premium was subsidised by the government but the insurance company had the total responsibility of the claim settlement (GoI, 2019).

With the objectives of bringing more farmers under the protection of crop insurance and improving the transparency and efficiency of claim settlement, the

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Weather Based Crop Insurance Scheme (WBCIS) was implemented on a pilot basis in 2003. The scheme was intended to provide the farmers a stable income and protection from yield losses due to weather adversities such as excess or deficit rainfall, low or high temperature, humidity and other factors to which the plants are highly sensitive to (GoI, 2019).

After the evident success of the Pilot Weather Based Crop Insurance Scheme, Weather Based Crop Insurance Scheme with its unique and efficient design began to be implemented on a larger scale throughout the country from *Rabi* 2007 (AICI, 2019). Claims were calculated based on the weather data from the Reference Weather Stations (RWS) installed in the Reference Unit Areas (RUAs). The Reference Unit Area is assumed to have a homogenous weather pattern and farmers were eligible for the claims, if the weather parameters showed fluctuations from the normal pattern and crossed the trigger limits. The compensation was to be calculated based on the extent of variation of the weather parameters from the normal range (Swain, 2015) and was to be transferred to the farmers' account in 45 days after the recorded variation. Even with all these merits, the WBCIS did not exhibit the expected rate of growth in the number of farmers enrolled in crop insurance schemes (GoI, 2019).

The Pradhan Mantri Fasal Bhima Yojana (PMFBY) was introduced in 2016 with the objective of bringing 50 per cent of the farmers in the country under the coverage of crop insurance. The scheme provided protection against crop loss due to natural calamities, pests and diseases and was intended to ensure flow of credit to agricultural sector. The scheme also had provisions to accommodate localized calamities and individual losses. Use of hand held devices, geo-fencing, geo-mapping and other technologically advanced tools were encouraged through the scheme for the speedy redressal of grievances. The premiums were subsidized and the subsidy was shared equally between the state and central governments (GoI, 2019).

Even with the introduction of such comprehensive schemes, the number of farmers insured by the crop insurance schemes in India is still very low. Delayed

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claim settlement, lengthy administrative procedures, lack of awareness of the farmers about the schemes and the reluctance of farmers in paying the premium for such schemes have slowed down the rate of penetration of crop insurance schemes. It was found that the increase in the number of claims released by one percent would increase the enrolment by 0.63 per cent and the increase in premium by one per cent would lead to a fall in enrolment by 0.43 per cent (Dey and Maitra, 2017). The proportion of non-loanee farmers taking insurance was only 15 per cent of the total insured (Mukherjee and Pal, 2017). The National Sample Survey Organization (NSSO) data revealed the fact that about 60 per cent of the farmers in the country were not aware about the crop insurance itself or the facility to buy crop insurance (Cole *et al.*, 2013). The less than expected penetration of the crop insurance schemes was attributed to the delay in payment of coverage due to lengthy procedure of loss assessment (Nair, 2010).

Mukherjee and Pal (2017) used the data from the NSSO situation assessment survey to analyse the progress and performance of crop insurance schemes in the country from 2001 to 2013 and found that the average growth rate in terms of the number of farmers enrolled was 6.5 per cent. Based on their analysis the states were classified into those having high growth rates and those with low growth rates in subscriptions of crop insurance. Kerala belongs to the category of states with low rate of growth. The reasons for the low growth rate of crop insurance schemes in the state were to be analysed and brought to the notice of the policy makers. The constraints in the adoption of the schemes and the methods adopted to manage income variability have to be evaluated to analyse the present status of crop insurance in the state.

Paddy covers more than half of the total insured area under cultivation in the state of Kerala and Palakkad district has the maximum area under paddy cultivation in Kerala. Untimely rains, extended spells of drought and sudden outbreak of pests and diseases put the farmers of the district under great distress. Central crop insurance schemes like PMFBY and WBCIS along with State Crop Insurance Scheme (SCIS) are the crop insurance schemes available for farmers in

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the district. Recurring crop losses along with other reasons have made Palakkad district to account for the maximum number of claims for paddy in Kerala. Even with heavy crop losses being reported often, the rate of voluntary subscription of crop insurance schemes was very low in the district. The reasons for the low rate of voluntary subscription needed to be sorted out and rectified in order to bring more farmers under these schemes and help them get the benefits of crop insurance. The study was intended to sort out the specific needs and problems of farmers and to recommend for changes in crop insurance scheme to include state specific requirements in the PMFBY and other national level crop insurance schemes. Analysing the claims and premiums, would help in calculating actuarial premium rates which are affordable to the farmers and at the same time viable for the implementing agencies.

In this context, the present study analysed the performance and progress of crop insurance schemes in Kerala, viability of crop insurance schemes, constraints in the adoption of crop insurance schemes for paddy, factors affecting the adoption of crop insurance, and the Willingness To Pay (WTP) for the crop insurance schemes, with reference to Palakkad district.

The main objectives of the study are:

1. To analyse the performance and progress of crop insurance schemes in Kerala
2. To assess the viability of crop insurance schemes.
3. To identify the constraints in the adoption of crop insurance.
4. To determine the factors influencing the adoption of crop insurance for paddy.
5. To estimate the Willingness To Pay (WTP) for crop insurance schemes.

1.2 LIMITATIONS OF THE STUDY

The main limitation of the study is that the primary data collection was confined to two blocks in the district of Palakkad and hence the generalization need not be completely accurate. Errors like bias in reporting the data and

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inadequacy of information that are inherent in social surveys and limitations of statistical analysis might have also affected the study to a slight extent. In spite of all the above, maximum effort has been taken to ensure that the limitations do not affect the authenticity of findings or results of the study.

1.3 PLAN OF THESIS

The thesis is divided and presented in five chapters. The first chapter gives a general idea about the theoretical background of the study along with the relevance of the study and the objectives. The second chapter provides the empirical and theoretical background of the study, reviewing previous studies related to the present which will help in acquainting the reader with methodologies followed by previous researchers. The third chapter contains the explanation of the methodology followed in the study. The results and discussions are presented in chapter four, followed by summary and conclusion in the fifth chapter.

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Review of literature

2. REVIEW OF LITERATURE

Review of literature is done to provide an insight into the historical perspectives and theoretical background of the present study. It will help in identifying the methodologies used and for comparing the present results with the results of the past studies. The present study has been reviewed under the following headings.

2.1 Agricultural risk and risk management
2.2 Performance and progress of crop insurance schemes
2.3 Impact of crop insurance on agriculture
2.4 Factors influencing adoption of crop insurance
2.5 Constraints in adoption of insurance schemes
2.6 Willingness to pay (WTP) and factors influencing WTP

2.1 AGRICULTURAL RISK AND RISK MANAGEMENT

Jodha (1981) argued that farmers' own methods of facing risks, especially production risks were very expensive compared to the institutionalized alternatives for managing them in the semi-arid and arid regions and showed a positive correlation between the quantum of risk and the investment made in agriculture. According to him, the institutional credit system was ill developed considering the amount of service they were able to render. The lack of consumption loans during the period of crop loss was forcing the farmers to approach non-institutional establishments.

Valdes *et al.* (1986) quoted that risk and uncertainty held a great threat to agriculture and highlighted crop insurance as a way out of these problems. High administration cost of these schemes made government subsidies inevitable, but the design of the products should be planned with utmost care so that they support the farming community without being a burden for the state.

Rao *et al* .(1988) tried to analyse the ability of an average farmer to bear production risks in semi-arid tropics. They used information on off farm income,

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size of holding, ability to vary input use as demanded by different situations and ability to diversify crops and area under production. They found that over the period of time, large scale farmers were able to have a less fluctuating income even though it needs different levels of input use at different times. The ability of an average farmer to bear risk was found to be very limited.

Blank *et al.* (1997) attempted to rank the producers' risk using data collected from the farmers of California who produced different crops. Price risk and production risk associated with drought were ranked first and second respectively.

Hedley *et al.* (1991) ranked economic, social, biological and environmental risks in agriculture and concluded that biological and environmental risks were more threatening than socio-economic risks.

Smith and Baquet (1996) pointed out that debt and yield variations were the major risks in agriculture. Education level of farmers was found to be positively correlated with effectiveness of risk management strategies. adopted by the farmers.

Skee (1997) provided an overview of the risk management in agriculture and emphasized the need for providing crop and revenue insurance policies to the farmers. He highlighted that risk management without government subsidies would not sustain over long periods.

Hardaker *et al.* (1997) while delineating the risk and uncertainty, associated uncertainty with imperfect knowledge while risk was defined as an uncertain consequence due to unfavourable conditions. They explained yield loss due to climatic variables as risk and that due to pest and diseases as uncertainty. They also recorded governments as a source of institutional risk.

Moreddu (2000) analysed the risk management strategies to be employed in developing and under developed countries by studying the effectiveness of debt management, production techniques and marketing techniques which included

futures market and crop insurance. Among the alternatives, crop insurance was found to be the most effective and popular measure to manage risks.

Kosco (2000) made a study on the Slovakian agriculture by recording the sources of risk as production, price, market, environment and risks due to personal reasons. In his suggestions to manage these risks, credit linked with insurance was selected as the best alternative.

Chang (2005) analysed the impact of climate change on the yield and output of the farms in Taiwan. He used a regression model to study the impact of global warming on farmers' income. He concluded that the chance of the society incurring the cost of the climate change as a whole is limited and farming community suffers the maximum adversities due to climate change.

Luan and Cheng (2007) concluded after a study in China that in places frequently affected by natural disasters, government relief funds can be the only effective method to support the farmers. Large scale crop loss due to catastrophes would lead to the collapse of insurance and credit systems and to handle situations of that sort, the government interference becomes very important.

Raju and Chand (2007) opined that even with technological and economic advancements, agriculture in India is highly vulnerable to different kinds of risks.

Sinha (2007) showed that even though crop insurance programmes are efficient in handling risks in agriculture, only 10 per cent of the total area under cultivation was insured and schemes have defects in design and implementation. He suggested that the government should give importance to risk mitigation tools like improved irrigation and develop infrastructure to handle risks associated with agriculture.

Singh *et al.* (2009) studied the pitfalls in the institutional credit systems in 11 districts of Punjab by studying a sample of 600 farmers which included

marginal, small and medium farmers. It was found that even though the easiness in availing non-institutional credit led the farmers to depend more on these sources, they were subjected to a much higher risk while borrowing from the local money lenders than from institutional establishments.

Singh (2010) recorded that crop insurance was one of the best alternatives to tide over yield and income fluctuations and manage risk in agriculture.

Nair (2010) concluded in a study that enrolling farmers in crop insurance programmes would help them to stabilize their income during periods of crop loss. In crop insurance programmes, the risk is transferred from the insured farmer to the insurer and for the same reason, formulating and implementing a foolproof insurance product is a challenging task.

Ferroni (2016) commented that the small holders need specifically designed and tailor-made risk management policies like the total crop insurance and prepaid insurance cards to aid them cope with the yield and revenue variability. He also advocated ICT based application to remove the issue of moral hazard.

2.2 PERFORMANCE AND PROGRESS OF CROP INSURANCE SCHEMES

Dandekar (1976) emphasized the degree of dependence of Indian agriculture on monsoon rains and advocated crop insurance as the best mechanism for managing income variations and distress due to crop losses. Even though he held the opinion that crop insurance based on individual approach was effective, due to issues such as moral hazard, adverse selection and high administrative cost, he concluded that area-based approach will be effective and sustainable in the long run. He also opined that the areas with higher risk should be charged more premium than the areas with lower perceived risk.

Hazell (1992) analysed the role of crop insurance in developing countries. Farmers employed risk reducing and risk coping mechanisms, and these measures

were expensive, so that the farmers had to sell their assets or approach for a fresh debt to cope up with the risk. The banks were also having different mechanisms to reduce the risks. Crop insurance in developing countries were giving more confidence to farmers and banks for investing in high value crops, even if they were risky as the farmers were assured of the compensation in case of an adversity. The main limitation was that the majority of the production and market risks were under the non-insurable class of risks and hence could not be insured.

Dandekar (1985)suggested that insuring all the farmers of the country would be a herculean task, and highlighted the need for linking agricultural insurance with crop loans, with premiums being deducted compulsorily from the crop loans, and the indemnities being adjusted against the recovery.

Walker *et al.* (1986) identified the participation of Indian farmers in crop insurance programmes and formulated crop insurance designs. The study found that the agricultural insurance was not strong enough to control the income fluctuations of the households, so that other institutional mechanisms were required for managing the variability in income.

Smith and Goodwin (1996) analysed the moral hazard issues related to crop insurance and found that the relative use of chemicals and other inputs by the insured was lesser than the non-insured farmers because of the moral hazard incentives. They made a striking observation that at reasonable levels of risk aversion, nitrogen fertilizers and crop insurance even acted as substitutes for one another.

Sud (2001) studied the merits and demerits of the crop insurance schemes in India and found that the National Agricultural Insurance Scheme (NAIS) had more practicality compared to other programmes because along with crop insurance the NAIS also covered livestock farming and apiculture. The reason that the crop insurance schemes do not achieve the projected results was that these schemes were not comprehensive, i.e., they did not cover all the crops. The crops which required heavy investments compared to other crops were left out and the schemes ultimately focused on rainfed agriculture.

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Veeramani *et al.* (2003) analysed the impact of rainfall index-based crop insurance schemes in different states of the country. They used monthly rainfall data for 130 years around the coastal belt of Andhra Pradesh. They studied elasticity of farm revenue with respect to rainfall and found that the actuarial premium rates were higher than the collected premium rates. They also noted that any increase in the existing premium rates would lead to lesser subscription of crop insurance policies and indicated about the use of optimization techniques and risk swapping between localities to bring down the premium rates.

Sinha (2007) studied the crop insurance schemes in India and compared the crop insurance with minimum support price and crop loss relief funds given by the governments as a safeguard to protect farmers. He concluded that the crop insurance schemes were having less coverage, nearly ten per cent of the total cropped area. He suggested for encouraging the private sector to crop insurance business and also suggested the government to focus on other mitigation programmes like irrigation and water management systems, instead of taking the huge burden of subsidies on crop insurance.

Raju and Chand (2008) analysed the progress and issues in various crop insurance programmes in India, and reported that the agriculture production in India is affected by natural disasters and changes in the weather pattern. This caused great loss in agriculture and has led to huge fluctuations in farmers' income. The authors suggested that along with crop insurance other relief measures should be employed. They also suggested that more importance should be given to contract farming and futures trading.

Sinha (2004) compared the effect of crop insurance programmes in different states of India using the participation rate and claims ratio. The NAIS had only covered ten per cent of the gross cropped area. He identified the issues of adverse selection caused by uniform premium rates and suggested that an efficient design of private-public risk sharing in crop insurance is required to eliminate the issues of moral hazard and adverse selection.

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Goudappa *et al.* (2012) studied the awareness and perception of farmers regarding the crop insurance schemes in the state of Karnataka. The study revealed that even though the NAIS had been operational in the area for nearly ten years, the respondents had no understanding about who was implementing the scheme or the source of compensation. 75 per cent of the respondents subscribed insurance on compulsion from the banks, but they were not satisfied with the schemes. Positive attitude of the fellow farmers had huge impact in the adoption of schemes by other farmers in the region.

Sporri *et al.* (2012) analysed the crop insurance schemes in Hungary to study the impact of the schemes on the performance of the farms. They linked economic performance model with demand model of insurance solving a simultaneous equation. The results of the study was striking and showed a negative impact of crop insurance on performance indicators like profit from the farm, productivity of land and labour. When the demand for crop insurance was analysed, it showed that many farms had financial limitations to invest in crop insurance schemes.

Kumar *et al.* (2011) studied the perception of farmers in Tamil Nadu on crop insurance and their awareness on crop insurance as a tool to mitigate risk. They used probit model, logit model and crop diversification index in a sample of 600 farmers and concluded that the lesser rates of subscription was mainly due to lack of awareness about the schemes. The factors influencing the decision making of farmers for subscribing insurance were cropped area, off farm income, number of family labour and affordability of premium rates.

Mani *et al.* (2012) identified high premium rates and lack of awareness as the major reasons for low popularity of crop insurance schemes in Tamil Nadu.

Swain (2014) recorded the two major threats faced by Indian farmers and they were the production risk arising from the climate change and the price risk arising from globalization. She compared the area-based and the weather index-based crop insurance schemes with special reference to Odisha. The two schemes

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were compared based on their coverage, financial performance and operational efficiency, and effectiveness in managing climate related risks. She concluded that the crop loss assessment must include the opinion of progressive farmers and also strengthen the public-private partnership.

Byjesh *et al.* (2014) analysed the performance of the rainfall insurance scheme and recorded that the lack of awareness, lack of reliable data and equal treatment given to high and low risk crops were the major setbacks in the design of the scheme.

Mohapatra *et al.* (2016) reviewed various crop insurance schemes in Punjab using a descriptive study design and emphasized the need of crop insurance scheme for motivating the farmers to diversify crops.

Dey and Maitra (2017) showed the need for implementing revised and specific insurance products to make the products more popular and efficient. They analysed the existing WBCIS and PMFBY and found them inadequate to meet the diversified coverage needs of the farmers and suggested that products like input insurance, seed insurance, complete crop cycle insurance, unseasonal rainfall during harvesting insurance etc., as some of the innovative insurance products that could increase subscription of crop insurance.

2.3 IMPACT OF CROP INSURANCE ON AGRICULTURE

Smith and Godwin (1996) studied the relationship between the use of chemical inputs and purchase of crop insurance by dry land wheat producers. They found that input use and insurance decisions were made jointly and thus used a simultaneous-equation method. From the result they concluded that insured farmers used fewer chemicals when compared to the non-insured farmers and the farmers who use more chemicals and follow better management practices were less likely to insure the crops.

Goodwin *et al.* (2005) studied the effect of insurance on the acreage allotted to competing crops. They tried to test the hypothesis that the crop

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insurance had no effect on land use. They concluded that the demand for crop insurance is more or less inelastic, and the acreage coverage is moderately affected by decrease in premium.

Batova and Rassadin (2014) stated that it is very laborious to estimate the role of insurance in ensuring food security of a nation. Insuring of risks in crop production is one of the most complex problems in the agrarian business though it is one of the most effective ways of managing the risks.

Mukherjee and Pal (2017) analysed the NSSO data and concluded that the insured farmers reported more crop loss compared to that of non-insured farmers. This was more intense when the subscription was voluntary and could be attributed to the issues of moral hazard, adverse selection and information asymmetry.

Dey and Maitra (2017) recorded that adverse selection, resulting from asymmetry of information was a major issue associated with crop insurance. Farmers subscribing to insurance have better knowledge about the crop loss than the insuring agencies. Thus, farmers with higher perceived risk were more open to crop insurance than those with lesser risk perception.

2.4. FACTORS INFLUENCING ADOPTION OF CROP INSURANCE

Chaudary (1977) based on his study on H4 cotton insurance scheme concluded that even though individual crop insurance products were more desired by the farmers, sustaining them over a large period of time was economically impossible.

Pandey *et al.* (1981) studied the feasibility of agricultural insurance for the state of Haryana. The large premiums were found to be a constraint in the adoption of crop insurance schemes by the farmers. He concluded that it would be easier for the farmers to decide on the premium rates if the premiums were expressed in terms of percentage of average yield.

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Reddy (1984) recorded the lack of farmers' willingness to pay high premium rates as the major constraint in adoption of crop insurance products. He highlighted the lack of awareness about schemes among the farmers, failure from the part of agents, loss of faith in existing schemes due to delayed claim settlements as the major reasons for low participation in crop insurance schemes.

Dandekar (1985) noted the limitations of area-based approach in calculating compensation for crop insurance and found that the variations within a homogenous area were neglected and individual losses were not considered in assessing the claims.

Rustagi (1988) concluded that the major factor that affected the demand for insurance was the risk awareness of the farmers. This awareness as quoted by him depended on the size of operation, type of farming and environmental conditions.

Goodwin (1993) formulated an empirical model to mark the demand for crop insurance and found that subscription rates were highly affected by the yield, price and coverage. As the yield loss risk increased, the demand for insurance became more inelastic. He also recorded that the major factors influencing the adoption of crop insurance were tenancy, size of operation and premium rates. Regions with more rental land under cultivation had more subscriptions, and larger farmers adopted crop insurance more than the small farmers.

Williams *et al.* (1993) compared crop insurance, disaster assistance programme and government commodity programme to find out which combinations of these measures, the farmers preferred the most. They used stochastic dominance analysis of the net returns distribution to find out the preferred design(s) over an array of risk preference intervals. They concluded that the majority of farmers adopted insurance package or disaster assistance along with the government commodity programme.

Sakurai and Reardon (1997) stated that self-insurance affects formal insurance. Farmers with self-insurance and own land tend lesser to participate in insurance programmes than those without own land and self-insurance.

Makki and Somwaru (2001) analysed the factors influencing farmers' decision to participate in crop insurance programmes. They also discussed about various methods to increase the coverage and to bring diverse sections of farmers under insurance coverage. They employed Artificial Neural Networks and analysed data from 1995 to 1999 collected from the Risk Management Agency in the USDA and concluded that the factors influencing subscription were availability of diverse products, subsidies, premium rates and risk levels associated with cropping. Setting premium rates based on risk and avoiding blanket rates attracted more subscriptions to the schemes.

Ghorbani (2001) tried to analyse the attitude of the farmers towards risk using the data from 105 farmers and concluded that the factors like age and education of the farmer, involvement in extension programmes, yield, premium rate and the subsidies availed were positively correlated with growth of subscription. However, he noted that the farm size and income from other sources had negative correlation with subscription.

Mahul (1999) analysed the attitude of farmers towards different crop insurance designs using beta coefficient which relates farm yield to the area yield. He also compared critical yield and coverage, and concluded that critical yield influenced farmer's decision for subscribing crop insurance than the coverage.

Makki and Somwaru (2001) recorded that the attitude of the farmers towards risk and the quantum of risk faced by them in different regions were the major factors that influenced the adoption of the crop insurance schemes. Farmers facing high risks and farmers with high income preferred policies with wider coverage and revenue assurance and were willing to pay more for such designs. The farmers with high expected yield were also likely to go for schemes with wider coverage even if the premium rates were comparatively higher.

Gorbhani (2001) studied the factors affecting the demand for agricultural insurance products and concluded that the decisions of the policy makers have huge impact on persuading the farmers to buy or not to buy an insurance product. If the policy makers could design and market the products in a better manner, with proper steps taken to convince the farmers about the benefits, higher rates of subscription could be ensured.

Torkamani (2002) analysed the factors influencing adoption of crop insurance and found that crop rotation and diversity showed negative correlation in the subscription, whereas factors like farmer's age and education, previous risks faced, yield, area under lease and risk-taking capacity were positively correlated with adoption.

Sherrick *et al.* (2004) compared three different insurance schemes and also analysed the factors influencing the adoption of crop insurance schemes. They pointed out that level of risk, risk management practices, size of farm, debt to assets ratio and higher yield expectations were positively correlated with rate of subscription. Revenue insurance schemes were found to have wider popularity than the yield and catastrophe insurance programmes.

O'Donoghue (2014) conducted a study for the USDA regarding the performance and progress of the crop insurance programmes based on the rate of enrolment. He concluded that the subsidies positively influenced subscription. Farmers opted for larger coverage when subsidies were hiked and one per cent increase in subsidies increased the premium collected from farmers by 0.86 per cent.

Smith (2016) identified that the aversion of the small holder farmers towards crop insurance coverage was due to delay in paying compensation, extended crop loss estimation period, lesser popularity of crop loss assessment through crop cutting surveys, coupling of crop insurance products with crop loans and lack of institutional support.

Dey and Maitra (2017) analysed the existing situation in Indian crop insurance industry and found that the compensation amount given to the farmers was not only very low and but was also given based on the amount of crop loan taken by the farmers, which discouraged the voluntary participation in subscribing crop insurance. They also inferred that the increase in premium by one per cent will reduce enrolment by 0.49 per cent and an increase in claims by one per cent will reduce the enrolment by 0.63 per cent.

Mukarjee and Pal (2017) estimated the coverage, growth rate and reasons for the low supply and demand of the agricultural insurance products in India. They found that the insurance was made mandatory for availing crop loans and the insurance subscription was very low compared to that of the crop loans which was caused by the negligence from the side of the banks issuing the crop loans.

Rajeev and Nagendran (2018) analysed the factors affecting the adoption of crop insurance scheme using a probit model. They concluded that the poor and marginal sections in the country needed more attention, and enhancing financial literacy and access to agricultural extension services would enhance the subscription rate of these schemes.

2.5 CONSTRAINTS IN ADOPTION OF INSURANCE SCHEMES

Reddy (1984) reported that high rates of premium, lack of access to insurance agencies, financial troubles and fall in confidence on crop insurance products forced the people to abstain from subscribing the crop insurance schemes.

Skees and Reed (1986) compared the actual expected yield and the theoretical yield that led to the trigger of compensation payments. Even among farmers with same expected yield, there was difference in the standard deviation which showed that the insurance rates were inappropriate. They represented relative risk using yield, Coefficient of Variation and standard deviation. Since the indemnity was not paid based on relative risk, the farmers with higher yields who paid the same blanket premium rates for an area were on the side with the least

advantage, even though they were using better inputs and expensive land to cultivate. They highlighted the adverse selection issues to be the main constraint and offering protection based on actual farm level expected yield as way out of the problem.

Quiggin *et al.* (1993) analysed the issues of moral hazard and adverse selection associated with crop insurance. They pointed out that the insured farmers used lesser inputs than the non-insured farmers. Both observable and unobservable inputs were found to be used in lesser quantities by the insured.

Maki and Somvaru (2001) studied the type of insurance product preferred by different categories of farmers and concluded that the farmers with higher risk were going for revenue assurance schemes than yield based products. They also noted that high risk farmers preferred individual schemes than the area-based schemes. Premium rates and farmers income were the factors that influence the decision-making process and it was concluded that the higher premium rates and adverse selection issues made the schemes less popular.

Mishra and Goodwin (2003) scrutinized the factors prompting the adoption of crop insurance. They used a logit model to compare the insurance schemes available to farmers of United States of America and the results pointed out that the probabilities of adoption changed with the changes in the design of the schemes.

Goodwin *et al.* (2004) argued that the low risk farmers were over charged and the high-risk framers were under charged as blanket rates were fixed on an area approach, which in turn created a sense of dissatisfaction among the buyers of insurance.

Mani *et al.* (2012) quoted that the major reasons leading to unpopularity of the crop insurance schemes in the state of Tamil Nadu were delayed settlement of claims, lack of awareness, complexity in subscription procedures, high rates of premium and the wide gap in actual yield loss and the yield loss estimated through crop cutting experiments.

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Sivakumar *et al.* (2013) stated that the main reason for limited subscription is the lack of knowledge about insurance schemes and the benefits of such schemes among the farmers. They surveyed 600 farmers in Tamil Nadu and found that only half of the sample population were aware of the crop insurance schemes.

Sundar and Ramakrishna (2015) conducted a study on the farmers' awareness, willingness to pay and perception about crop insurance schemes and found that most of the farmers were unaware of the crop insurance schemes and low levels of willingness to pay was attributed to low financial literacy, low compensation, lack of ability to pay the premium and issues with distribution channel.

Swain (2015) suggested that hybrid crop insurance schemes would enhance the adoption of the schemes.

Karthikeyan *et al.* (2015) stated that crop loss events occur at low frequencies, but the high intensity makes the premium amounts larger and less likely to be paid by the farmers.

Ferroni (2016) and Smith (2016) in studies carried out by them individually concluded that delay in compensation, extended loss assessment period, unjustified crop cutting experiments, bundling insurance product with crop loan amount, and lack of choice for institution-driven risk mitigation tools have constrained smallholders from having an optimal insurance policy coverage.

Ranganathan *et al.* (2016) quoted that the low awareness and high premium rates made the insurance schemes less popular.

Mukharjee and Pal (2017) analysed the constraints and obstacles in bringing the Indian farmers under insurance coverage using data from National Sample Survey Organisation and Agriculture Insurance Company of India. Most of the farmers chose insurance based on previous experience. Delayed claim settlement, underpayment and adverse selection were the major issues that made

the schemes less popular. Another issue pointed out by them was regarding the cut-off date of subscription and lack of awareness about the schemes.

Dey and Maitra (2017) stated that the delay in payment of the state shares to the insurance agencies caused the delay in claim settlement by the insurance agencies which was contrary to the operational guidelines of the PMFBY.

Rajeev and Nagendhran (2018) on investigating the reasons for dissatisfaction among farmers about crop insurance schemes found the issues with the designs of the schemes to be major reason. They emphasized it with an example that the trigger limit for prevented sowing was when 75 per cent of the total area remained unsown due to changes in Monsoon. The farmers were not eligible to get the claims even if 74 per cent of the area was affected. The same applied to all other parameters, which in turn has led to dissatisfaction among the farmers.

2.6 WILLINGNESS TO PAY(WTP) AND FACTORS INFLUENCING WTP

Leatham *et al.* (1987) evaluated the conditions under which the farmers and lenders preferred crop insurance policies. Insurance products were purchased by the moderately risk averse farmers. The major factor that determined the WTP was noted to be the average yield and not the variance in yield. The lenders always preferred insurance products. They also showed a positive correlation between yield variability and WTP.

Fraser (1992) studied the aspect of WTP for crop insurance and stated that although the WTP was positively related to both the levels of coverage and yield variability, the ratio of WTP to estimated actuarial costs was increasing with yield variability but decreasing with coverage. Consequently, if administrative costs increased proportionately with the estimated actuarial costs, the buyers would find the premiums attractive only in the case of increased yield variability and decreased coverage.

Wang *et al.* (1998) examined the relative performance of different types of crop insurance designs. They compared different schemes that existed along with

the WTP of the farmers for each scheme using two types of designs *viz,* insurance alone and insurance along with futures and options and concluded that the WTP is affected by the futures and options, but the major reason affecting WTP is the trigger yield levels.

Manojkumar *et al.* (2003) tried to find out the factors affecting the adoption of insurance for banana farmers in the district of Wayanad. More than 50 per cent of the farmers were willing subscribe insurance and the reasons for backing out of the schemes were delayed payments, lack of credibility of the schemes and high premium rates. More than 75 per cent of the people had financial issues in participating in these schemes. They considered it an addition to the cost of cultivation and were not able to bear such costs during the gestation period of the crop.

Babcock and Hart (2005) tried to study the relation between subsidies and farmers' decision to adopt crop insurance. The results showed that actuarial premium rates with government subsidies would increase the farmers' participation by 400 per cent.

Makaudze (2005) showed that the government support like food aid, indirect subsidies and relief measures would decrease the willingness to participate by 20 percent. They analysed the situations with and without aids and external assistances.

Shaik *et al.* (2005) studied the factors influencing farmers' WTP for a crop insurance programme and found that the major factor was farmer's perceived risk levels. Farmers in high risk areas preferred insurance products more than those in the low risk areas. WTP was also influenced by the design of the product available and it was more for the revenue assurance schemes than the yield-based schemes.

Anderson *et al.* (2005) analysed the risk perceptions of the farmers with respect to the WTP for maize seed. They noted that the source of risk was given prime importance by the farmers. They were more conscious about the catastrophes and occurrence of pest and diseases than about the lack of

technological advancements. Past losses experienced by the farmers were also found to affect the WTP.

Whitehead (2006) used contingent valuation method to study the WTP for low hazard and low probability insurance. He made an empirical study using a product that did not exist in the market during the time of the study. The respondents did not take much interest since the probability and the degree of loss was quite low in the design explained to them.

Simmons *et al.* (2007) concluded that the WTP depends on the degree of risk aversion by the farmers and the elasticity of supply.

Charness *et al.* (2007) conducted choice experiments to study the preferences for agricultural insurance. They showed that the price of product and damage assessment criterion were the major factors that determined WTP for a particular design.

Gine *et al.* (2007) conducted household survey in 37 villages asking the reasons to participate or not in any insurance scheme. The reason for participation was the security that the products provided and those who did not participate had various reasons like financial problems, lack of trust and the delay in receiving payments. They also showed that 10 per cent reduction in the price would increase the participation by 6 to 8.7 per cent.

Aidoo *et al.* (2014) analysed the WTP by using exponential power utility function subjected to various conditions and concluded that the WTP decreased or increased proportionately with the farmers' perception of risk. The location and size of the farm also played a role in deciding the WTP for the products.

Cole *et al.* (2013) studied the influence of price and non-price factors in the adoption of insurance products. They found that the innovative weather-based product was highly price sensitive with an elasticity ranging from -0.66 to -0.88. Non-price factors like trust and liquidity also affected WTP.

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Smith and Watts (2009) opined that farmers' WTP was an important factor that decided the success of an index-based crop insurance programme.

Turvey and Kong (2010) reported that the price of the insurance product was one of the major factors determining the willingness to purchase the particular product.

Ahsan (2010) identified positive correlation between experience, age, amount of dry land, participation in extension activities and previous experience in insurance and WTP.

Liesivaara and Myyra (2014) analysed the demand for and WTP for crop insurance products in countries where the schemes were not available. The employed choice experiment s with mixed logit models to derive the WTP for crop insurance products. They found that the countries had a demand for crop insurance products and the demand was higher among the young farmers. The WTP was found to be sensitive to the premium intervals.

Gaurav *et al.* (2011) stated that the farmers perception of risk leads to varying levels of WTP, crop choice and income from agriculture.

Ranganathan *et al.* (2018) quoted that the farmer's WTP was identified as the major factor that decided the voluntary subscription of crop insurance schemes in India.

Aditya and Kishore (2018) employed contingent valuation method to elicit the WTP for crop insurance among the wheat farmers of Punjab. They concluded that the farmers were not willing to pay the existing rates. The WTP was estimated to be ₹297 per acre.

Subash *et al.* (2018) tried to analyse the sustainability of community driven programmes with special focus on the community driven seed production programme facilitated by Rajiv Ghandi Mahila Vikas Pariyojana. They employed double bounded contingent valuation method and found that the farmers were

willing to pay 11 times the amount of foundation seed that they received against the existing norm of three times.

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Methodology

3. METHODOLOGY

In this chapter, a concise report on the research design employed in the present study is presented. A comprehensive description of the study area, sampling procedure and method of data collection are provided so as to convey a better understanding of how the research was performed. The analytical tools used are also explained in brief in the section so that the reader can have a better evaluation of the research work and replicate the study in other areas and for other crops.

3.1 TYPES OF DATA

The present study is based on both primary and secondary data. The secondary data on production, productivity and area of rice was collected from the Directorate of Economics and Statistics, Government of Kerala, to analyse the growth and find out the magnitude and direction of the determinants of growth. Time series data on state and national crop insurance schemes was collected from the Directorate of Agriculture, Thiruvananthapuram, to analyse the progress and performance of crop insurance schemes in the state. To assess the micro level implications of the schemes, primary data was collected from selected households of Palakkad district on asset position, farm and non-farm income, loan details, particulars of participation in insurance schemes, attitude towards crop insurance, status of crop insurance schemes in each area, factors affecting adoption of the crop insurance schemes, affordability of the schemes, reasons for less adoption in each area, constraints faced by the farmers in crop production and the Willingness To Pay (WTP) for crop insurance programmes.

3.2 SOURCES OF DATA AND PERIOD OF STUDY

The main items of observation were the area, production and productivity of paddy for the state of Kerala and for Palakkad district from 1981 to 2018, which were collected from the Directorate of Economics and Statistics, Government of Kerala. The details of the State Crop Insurance Scheme from

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2015 to 2019, which included number of farmers covered, number of farmers benefitted, gross premium collected and claims paid, were obtained from the Directorate of Agriculture, Thiruvananthapuram. Time series data on area covered, number of farmers covered and benefitted, gross premium collected and claims paid through the national level crop insurance schemes operating in Kerala was also collected from the Directorate of Agriculture, Thiruvananthapuram. The growth and viability of the schemes, based on the claims to premium ratio were assessed from the secondary data.

3.3 AREA OF THE STUDY

The study was carried out in the district of Palakkad in Kerala State. Palakkad is known as the rice bowl of Kerala. The district, due to its geographical position has severe summer and relatively longer hot spells, compared to many of the other districts in the state. Crop loss, especially in rice has become very common in the district due to water shortage and untimely rainfall. In the present study, the progress of crop insurance schemes with special reference to paddy has been analysed to have a deeper insight into the performance, constraints and prospects of the existing crop insurance schemes.

3.3.1 Palakkad district

Palakkad is the largest district in Kerala and is head quartered at Palakkad town. According to the census of 2011, 24.09 per cent of the population lives in the urban areas. The district is also nick named as the "granary of Kerala or the "rice bowl of Kerala". The district has 94.20 per cent literacy and a population density of 627 inhabitants per square kilo meter, with 8.41 per cent of the total population of the Kerala state. The most commonly used language is the official language, Malayalam. A section of people also uses Tamil for communication.

3.3.1.1 Location

Palakkad is located towards the central region of the state of Kerala, with a total land area of 4,482 sq. km and the coordinates are $10^{o}46'27"$N and $76^{o}39'22"$E. The district is bordered by Malapuram district in the northwest, Thrissur district in the southwest, Nilgiri district of Tamil Nadu in the northeast and Coimbatore district in the east. The break in the long strip of the Nilgiris, the 'Palakkad Gap' is located along the eastern border of the district, which influences the climate of the district to a large extent.

3.3.1.2 Land utilization pattern

The land utilization pattern of Palakkad district for the year 2017-18 is presented in Table 3.1. The net sown area in Palakkad was 43.73 per cent of the total geographical area of the district in 2017-18 and the area sown more than once was 23.82 per cent of the total geographical area. While forests accounted for 34 per cent of the total area of the district, the share of land put to non-agricultural uses was 30.44 per cent.

Table 3.1 Land utilization pattern of Palakkad in 2016-17

Particulars	Area (ha)	Percentage to total geographical area
Total geographical area	447584	100
Forest	136257	30.44
Land put to non -agricultural uses	41410	9.25
Barren and uncultivable land	2756	0.61
Land under tree crops	1023	0.22
Cultivable waste	24033	5.36
Fallow other than current fallow	12837	2.86
Current fallow	17048	3.80
Still waters	15020	3.35
Social forestry	382	0.08
Net sown area	196818	43.97
Area sown more than once	106643	23.82
Total cropped area	**303461**	**67.79**

Source: Agricultural Statistics, 2017-18, Directorate of Economics and Statistics, Government of Kerala.

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3.3.1.3 Topography and Climate

Palakkad district is the biggest district in the state of Kerala with a geographical area of 4482 sq. km. Palakkad is a land locked district without costal line. The wide gap of length of 40 to 50 km in the Western Ghats, termed as the Palakkad gap opens the state to the rest of the country. This break in the Western Ghats chain has large influence in the climate of the district which is different from most other parts of the state. Out of the total land area, about 1,360 sq km is under forest cover. Vast area of the district falls in the midland region with an elevation ranging from 75 to 250 metres from the sea level, with the exception of Nelliampathy-Parambikulam region in the Chittoor taluk and Attappadi-Malampuzha region, which are categorized under the highland region with an elevation above 250 metres from the sea level.

The district experiences tropical humid climate with a hot season and assured seasonal precipitation. The summer starts in the month of March and ends by the month of May, which is then followed by the South-West monsoon season extending from June to September. The district also receives rain from the North-East monsoon. The monsoon recedes towards the end of December and the following period is usually dry. The maximum average temperature in summer season is 37.3° Celsius while the minimum average temperature is 28.3° Celsius. The lowest average temperature is recorded in the month of January and was 21.8 ° Celsius. Humidity is very high throughout the year and average recorded humidity is 70 per cent. The mean annual rainfall of the district is 3198 mm. July with the highest rainfall of 522.6 mm is the rainiest month and January with the lowest recorded rainfall of 3.5 mm is the driest month.

3.3.1.4 Demographic features

As per the census of 2011, the total population in the district of Palakkad was 28,09,934.The number of males and females was recorded as 13,59,478 and 14,50,456 respectively. In the census of 2001, Palakkad had a

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total population of 26,17,482 out of which the number of males and females were 12,66,985 and 13,50,497 respectively. Palakkad recorded a population growth of 7.35 per cent during the period from 2001 to 2011. The population density of the district was 627 persons per sq. km. The district has an average literacy rate of 89.31 per cent. The male and female literacy rates were 93.10 and 86.79 respectively.

As per the 2011 census, 24.09 percent of the population of Palakkad lived in urban regions of the district. Out of the 6,76,810 people who live in the urban areas, 3,28,012 were males and 3,48,798 were females. Sex Ratio in urban region of the district was 1063 as per 2011 census. Average literacy rate of the urban population of the district as per census 2011 was 92.45 per cent.

About 76 per cent of the population of the district were rural dwellers. Out of this, 3,28,012 were males and 3,48,798 were females. The sex ratio in the rural region of the district was 1063. The average literacy rate of the rural population of Palakkad was 92.45 per cent. More than 44 per cent of the population was engaged in the agricultural sector.

There were 59,194 main cultivators in the district among whom, 47,183 were males and 11,381 were females. Out of the 59,194 cultivators, 55,794 dwelled in the rural areas of the district. The total number of marginal cultivators was 8,611, out of which 4,996 were males and 3,615 were females. The number of main agricultural workers was 1,95,394 and in this, 1,04,552 were males and 90,872 were females. Out of the total main agricultural labourers, 1,80,457 live in the rural areas. The total number of marginal agricultural labourers was recorded as 54,555 and 24,829 were males and 29,726 were females. Out of the total marginal agricultural labourers 49,244 were rural dwellers.

3.3.2 Description of the selected Panchayats

Two blocks having the maximum sum insured for paddy cultivation under WBCIS in Palakkad district *viz.*,Kollengode and Nenmara were selected

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for the study. From each of the selected blocks, two Panchayats having maximum sum insured for paddy cultivation under WBCIS *viz.*, Elavanchery and Palassana Panchayats from Nenmara block and Pattenchery and Kollengode Panchayats from Kollengode block were selected for the study.

3.3.2.1 Panchayat-wise distribution of area

Wet land was found to occupy more than 55 per cent of the total area in all the four Panchayats selected for the study. The distribution of area according to the type of land in the study area is presented in Table 3.2.

Table 3.2 Panchayat-wise area according to type of land in the study area

	Area in cents			
Panchayat	**Wetland**	**Dry land**	**Others**	**Total**
Kollengode	443005 (56.59)	339197 (43.41)	-	782802 (100)
Pattenchery	429826 (57.26)	263000 (35.04)	57827 (7.70)	750653 (100)
Elavanchery	382281 (64.43)	211056 (35.57)	-	593287 (100)
Pallashana	405267 (55.83)	320562 (44.16)	106242 (14.6)	832071 (100)

Source: Panchayat Level Statistics, 2011, Government of Kerala.
Note: Figures in parentheses indicate per cent to row total

3.3.2.2 Cropping pattern

The major crops cultivated in the study area are paddy, coconut, arecanut, plantain, banana, pepper, tapioca, mango etc. The cropping pattern in the selected blocks are presented in Table 3.3. It could be noted from the table that among the crops grown, paddy occupied the maximum area in both the blocks. It occupied 52.67 per cent in Kollengode block and 42.42 per cent of gross cropped area in Nenmara block. Next to paddy, both the block Panchayats have maximum share of area under coconut cultivation. Area under mango cultivation occupies about 11 per cent of area in Kollengode block but in Nenmara block it is only 3.08 per cent of the total cropped area. Kollengode has comparatively more share of its total cropped area under paddy compared to that of Nenmara.

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Table 3.3 Cropping pattern the selected blocks (2016-17)

Crops	Kollengode (ha)	Share in total cropped area (per cent)	Nenmara (ha)	Share in total cropped area (per cent)
Rice	7577.61	52.67	8586.08	42.42
Arecanut	412.84	2.87	543.55	2.69
Pepper	8.78	0.06	10.01	0.05
Coconut	3797.41	26.40	8494.49	41.96
Cashew	14.64	0.10	10.12	0.05
Papaya	72.38	0.50	91.87	0.45
Tamarind	210.65	1.46	236.88	1.17
Nutmeg	11.34	0.08	36.43	0.18
Banana	258.2	1.79	398.31	1.97
Plantain	189.5	1.32	880.34	4.35
Tapioca	7.65	0.05	11.53	0.06
Cocoa	8.94	0.06	82.32	0.41
Jack	210.65	1.46	236.88	1.17
Mango	1605.53	11.16	623.49	3.08
Gross cropped area	**14386.12**	**100**	**20242.3**	**100**

Source: Agricultural Statistics 2016-17, Directorate of Economics and Statistics, Kerala.

3.4 SAMPLING DESIGN

The current study is based on both primary and secondary data. Primary data was collected from the district of Palakkad, which accounts for the maximum area under paddy cultivation and maximum sum insured for paddy cultivation under the Weather Based Crop Insurance Scheme (WBCIS). Two blocks with maximum claims for paddy under WBCIS were selected purposively for the study. Four Panchayats, two from each block having the maximum number of claims released for 2016-17 season, were again selected purposively. The list of farmers was obtained from the Krishi Bhavans of the respective Panchayats and also from the regional office of the Agricultural Insurance Company of India Limited. From each of the selected Panchayats, 20 farmers who had subscribed to the WBCIS and 25 farmers who had subscribed to the State Crop Insurance Scheme were selected, constituting a sample size of 180. Time series data on the area, production and productivity of paddy was collected from the various editions of the Economic Review, Government of Kerala. District-wise time series data on area and sum insured

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and claims paid over the years were collected from the Directorate of Agriculture, Thiruvananthapuram.

3.4.1 Collection of data

Primary data was collected using a pre-tested and structured interview schedule, from farm households on variety cultivated, methods of production, crop management practices, inputs used, prices of inputs, constraints in production, associated production risks and risk management strategies followed. Details were also collected on the socio-economic profile of the farmers, loans obtained from various banks, drawbacks of the existing crop insurance policies and suggestions for better and efficient design of the crop insurance schemes. Secondary data was collected from various published and unpublished sources.

3.5 ANALYSES OF DATA

3.5.1 Estimation of Growth rates

Trend in the area, production and productivity of rice in the state of Kerala was analysed using the time series data. An exponential function of the form,

$$Y_t = ab^t,$$

was fitted to analyse the compound growth rates of area, production and productivity of rice for the state of Kerala.

Where,

Y_t : Area/production/productivity of rice in Kerala
a : Intercept
b : Regression coefficient
t : Number of years

Taking logarithms on both sides,

$$\ln Y_t = \ln a + t \ln b$$
$$Y_t' = A + B$$

Where,

$Y_t' = \ln Y_t$, $A = \ln a$ and $B = \ln b$

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Compound growth rate of a variable shows the rate of change per unit time, usually in a year. The co-efficient (b) was estimated using the method of Ordinary Least Squares. The Compound Growth Rate in percentage was calculated using the relationship,

Compound Growth Rate, CGR = (Antilog B – 1) X 100

3.5.2 Decomposition of sources of growth in rice production

There are three sources of change in the difference in production of paddy between two periods. They are change in area, change in productivity and interaction between change in area and productivity. Change in area and change in productivity are the pure effects and they arise even if there is no other change. The interaction effect will be zero if either area or productivity remains unchanged.

Table 3.4 Decomposition of sources of growth in rice production in Kerala

Sources of change in rice production		Components of Change
Description	**Symbols**	
Change in productivity	ΔY	$A_0 \times \Delta Y$
Change in area	ΔA	$Y_0 \times \Delta A$
Area-productivity interaction	$\Delta A\, \Delta Y$	$\Delta A \times \Delta Y$
Change in Area- productivity Covariance	$\Delta\, COV(A,Y)$	$\Delta\, COV(A,Y)$

3.5.3 Estimation of viability of the schemes- Claims to premium ratio

This is the ratio of the claims paid to the farmers by the agency to the premium collected by the insurance agency. The total premium amount, which includes premium paid by Government (subsidies) and the share of premium borne by the farmers, was considered for the analysis. For a viable insurance programme the ratio should be less than unity

3.5.4 Socio economic profile of the respondents- Percentage Analysis

The percentages and averages were calculated to evaluate the socio-economic and demographic variables including the age, experience in farming, education, farm size, land holding pattern, income and occupation of the respondents.

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3.5.5 Logit Regression Model for estimating the factors influencing voluntary adoption of crop insurance

Logit model is employed to explain the dichotomous dependent variable (i.e., Y = 1, if yes or 0 otherwise). The standardized normal cumulative distribution function is employed in such estimates to check the probability of incidence of the event P(Y=1/X). In the present study, logistic regression analysis was used to estimate the probability of voluntary adoption of crop insurance. A set of variables, such as gross cropped area, income, farming experience, education and cost of cultivation were used to find the effect of these factors on voluntary adoption of crop insurance.

The Logistic Regression (LR) model was constructed as:

$$\text{Logit } (p_i) = \text{In}\left(\frac{p_i}{1-p_i}\right) = \beta_o + \beta_1 x_{1,i} + \ldots\ldots\ldots\ldots\ldots \beta_k x_{k,i}$$

Where,

p_i = The probability of becoming an adopter or non-adopter of crop insurance.

1 = If the sample farmer was a voluntary adopter of crop insurance.

0 = If the sample farmer adopted insurance as it was compulsory.

x_1-Gross Cropped A-rea (ha)

x_2-Income (₹)

x_3-Farm experience (years)

x_4-Education

x_5-Cost of cultivation (₹)

$\beta i, \beta_2, \beta_3$ ----- β_i are regression coefficients

3.5.6 Ranking the alternatives for risk management and constraints in adoption of crop insurance- Garrett's ranking technique

The constraints in the adoption of crop insurance, the measures employed for managing income variation, reasons for crop loss and suggestions for improvement of the existing schemes in the surveyed area were ranked and analysed using the Garrett's ranking method. The first step in constraint analysis was to identify the major problems faced in voluntary adoption of the crop insurance schemes. The surveyed farmers were requested to rank the

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major constraints. Their rankings were then analysed using the Garrett's ranking technique. The assigned ranks were then converted into percentages using the formula,

$$Per\ cent\ position = \frac{R_{ij} - 0.5}{N_{ij}}$$

Where,

R_{ij} = Rank given for the i^{th} factor by j^{th} individual

N_{ij}= Number of factors ranked by j^{th} individual

Here, 0.5 is subtracted from each rank because the rank is an interval on a scale and its midpoint best represents the interval. Then, the percentage scores were converted into scores on a scale of 100 points referring to the table given by Garrett and Woodworth (1969). The mean score level was obtained from the scores thus calculated and constraints were ranked based on the mean score level.

3.5.7 Contingent valuation method

Contingent Valuation (CV) methods use the responses of the subject to calculate the Willingness To Pay (WTP) (O'Doherty, 1998). The method allows the creation of a hypothetical market which is explained to the subject through the questionnaire and thus, has a possibility to elicit the WTP of products not existing at the time of interview. Several authors have employed CV methods to find the WTP for water quality improvements (Carson*et al.*, 2001; Alberini and Cooper, 2000; Malzubris *et al.,* 1997; Hanemann, 1994; Carson and Mitchell, 1993; Green and Tunstall, 1991; Whittington *et al.*, 1990; Shultz and Lindsay, 1990; Mitchell and Carson, 1989; Edwards, 1988; Korman, 2002). Dichotomous choice method of elicitation was employed in the current study. In this method, the respondents are asked if they are willing to pay a particular amount. They may accept or reject the given amount, the responses being yes or no. This is similar to making market decisions every day based on the price (Freeman, 1992).

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In order to get more realistic WTP estimates in CV studies, the reference (*status quo*) and target levels of every character of interest must be clearly explained to the respondents (Horton *et al.*, 2003). The existing scheme was first explained to the farmers. The WBCIS was then administered for crop loss due to changes in weather variables, which in turn was calculated using weather-based indices. A trigger limit was fixed, beyond which the variations in weather parameters qualified the farmer to avail the claims. The farmer paid 1.5 per cent of the actuarial premium rates and the rest was to be shared equally between the state and the central governments. The claims were calculated based on the cost of cultivation of the crop and the data for the calculation was collected from the reference weather station in every Reference Unit Area. The claim amount is usually transferred directly to the farmer's bank account. After explaining the existing scheme, the details of the proposed insurance scheme were also explained to the farmers. The exact wording of scheme posed to farmers was- a new crop insurance scheme is being introduced, in which the compensation would be calculated based on the procurement price of the produce unlike the existing scheme in which the compensation covered only the cost of cultivation. The assessment of crop loss will be done using drones and satellite imageries and claims will definitely be transferred to the farmers' bank account within 45 days of reporting of the crop loss. Area based approach will be followed but there will be provisions for accommodating individual losses in the design. After explaining the scheme, the farmers were asked to pick a lot. The lots contained the amounts ₹300, ₹400, ₹500, ₹600, ₹700 and ₹800. The amounts in the lots were thus selected because the premium paid by the farmers for an acre was then ₹400 and the intention was to assess the range of premium that the farmers would be willing to pay for the new scheme. If the farmer was ready to pay the amount quoted in the lot, he was asked if he was willing to pay an additional amount of ₹100 and the response was recorded. If the respondent was not willing to pay the amount in the lot, he was asked if it was okay for him to pay a premium of ₹100 less than the value in the lot he took. If he was not willing for that also, he was asked to quote the amount he was willing to pay. Sufficient care was taken to limit all kinds of probable biases like starting point

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and information bias, interviewer and respondents' bias and also anchoring effect. Anchoring effect occurs when the farmers is already aware of the existing scheme and has a tendency to answer based on previous experiences. He would compare the premium and terms and conditions of the proposed scheme with the existing scheme and thus, the answers will be highly influenced by existing situation. To avoid this, the farmers were told that the explained scheme was entirely new and independent from the operation of the existing scheme.

The WTP for the proposed crop insurance scheme was estimated using Single Bounded Contingent Valuation Method. In this approach, the respondents pick a lot which has the premium amount quoted on it and their willingness to pay that particular amount was captured as Yes or No. The approach uses probit model employing the Maximum Likelihood Estimation procedure to estimate WTP. For each observation t, assume that the net gains from subscribing to crop insurance is U_t, which is related to a set of exogenous variables x_i. Next, the coefficients β are used to describe the relation in the probit model and the latent model, assuming the error term, μt which follows standard normal distribution. i.e., μt~N(0,1) μt~N(0,1) :

$$U_t^* = x_t'\beta + u_i$$

This is equal to the probit model,

$$Y_t^* = x_t'\beta + u_i$$

when the relationship between latent utility variableU_t^* and the observable response (0/1) variable of whether a farmer would subscribe to crop insurance, Y^t, satisfies:

$$y_t = (1, \text{if } U^*_t >, 0 \text{ otherwise})$$

To further develop this regression model, in addition to normally distributed error terms, it was assumed that the conditional probability takes the normal form:

$$\Pr(y_t=1|xt)=\Phi(x't\beta)$$

where $\Phi(\cdot)$ is the standard normal CDF

The probit model is of the form

$$Y = \alpha + \beta_1 X + \beta_2 B + \varepsilon$$

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Where Y is the yes/no response, X is a vector of variables reflecting household, area or other characteristics, B is the bid price and ε is an error term The mean willingness to pay is estimated as,

$$WTP = (\alpha + \sum(\beta_{1*} X^{a}) / \beta_{2})*-1$$

Where, X^{a} is the mean value of X variables.

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Results and Discussion

4. RESULTS AND DISCUSSIONS

The analysis was carried out within the framework of the specified methodologies and with specific reference to each of the objective covered in the present study. The main purpose of the study was to analyse the performance and progress of crop insurance schemes in Kerala, to assess the viability of crop insurance schemes, to identify the constraints in the adoption of crop insurance, to determine the factors influencing the adoption of crop insurance for paddy and to estimate the Willingness To Pay (WTP) for crop insurance schemes. Several possible models mentioned in the methodology were used to obtain consistent results and to draw meaningful inferences. The results of the analysis carried out using primary and secondary data are discussed and presented under the following headings.

4.1 Performance and progress of crop insurance schemes in Kerala

4.2 Viability of crop insurance schemes

4.3 Constraints in the adoption of crop insurance

4.4 Factors influencing the adoption of crop insurance for paddy

4.5 Estimation of the Willingness To Pay for crop insurance schemes

4.6 Suggestions for improvement of crop insurance schemes

4.1 Performance and progress of crop insurance schemes in Kerala

The performance and progress of crop insurance schemes in Kerala was analysed using secondary data collected from the Directorate of Agriculture, Government of Kerala. Since the study was based on crop insurance schemes with special reference to paddy, analyse of the trend in area, production and productivity of paddy for Kerala state and Palakkad district were carried out.

4.1.1 Status of area, production and productivity of paddy

The growth rates of area, production and productivity of paddy in Kerala and Palakkad district for the period from 1980-81 to 2017-18 are presented in Table 4.1. Area and production exhibited a negative growth both in the Palakkad

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district and the state during the period. The decline in growth rates of area and production of paddy in the state was found to be almost double when compared to that of Palakkad district. Higher rates of conversion of paddy fields for other purposes might have resulted in the negative growth rates. Even though productivity exhibited a positive growth, it was not high enough to compensate for the negative growth in area, which resulted in negative growth of production. Hari and Kumar (2017) also concluded the same after analysing the trend in paddy cultivation.

Table 4.1 Growth rates of area, production and productivity of paddy from 1980-81 to 2017-18

Particulars	Kerala	Palakkad
Area	-4.32*	-2.33*
Production	-2.87*	-1.58*
Productivity	1.51*	0.77*

Note: *Denotes significance at 1 per cent level

4.1.2 Decomposition of sources of growth in the production of rice

There were three sources of variation in the difference in production of paddy between the periods under consideration. They were change in area, change in productivity and the interaction between the both. Change in area and change in productivity were pure effects and they arise even if there is no other change. The interaction effect would remain zero if any of the other parameters remain unchanged. In all the periods under consideration, with the exception of the period from 2010-11 to 2017-18, area effect was negative. Similarly, the area-productivity interaction effect was also negative. Productivity effect was found to be positive in all the periods, except during the period from 2010-11 to 2017-18. The decline in the production of rice was influenced by the change in area rather than that of productivity (Table 4.2).

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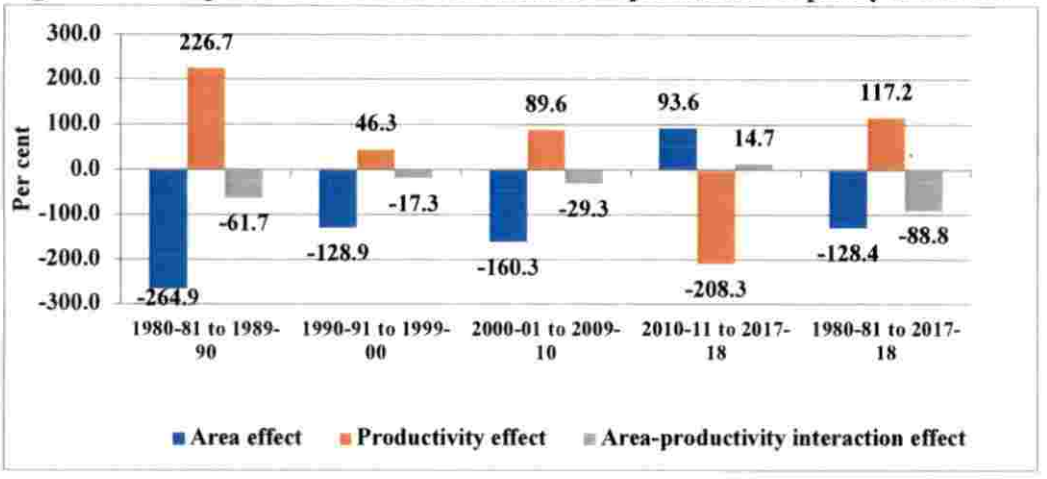
Table 4.2 Decomposition of sources of variation in production of paddy in Kerala

Period	Area effect	Productivity effect	Area-productivity interaction effect	Change in A-Y Covariance
1980-81 to 1989-90	-264.9	226.7	-61.7	0.045
1990-91 to 1999-00	-128.9	46.3	-17.3	0.023
2000-01 to 2009-10	-160.3	89.6	-29.3	0.028
2010-11 to 2017-18	93.6	-208.3	14.7	-0.005
1980-81 to 2017-18	-128.4	117.2	-88.8	0.091

Figure 1 Decomposition of sources of variation in production of paddy in Kerala



4.1.3 Progress and performance of crop insurance schemes in Kerala

The story of crop insurance in India trails back to 1920 (Mishra, 1995). Policy makers have burned their midnight oil to design and implement a fool proof crop insurance design that would act as a perfect solution for the distress of the farmers. Coming up with an effective crop insurance scheme has become a challenge for the governments and the policy makers. Large number of studies were undertaken to assess the feasibility, viability and performance of crop insurance schemes. Majority of such studies showed that the schemes were financially unsustainable and non-viable. NAIS, one of the most extensive and elaborate schemes in the history of crop insurance in India, failed to achieve its objectives due to low effectiveness and coverage. The Weather-Based Crop Insurance Scheme (WBCIS) was introduced in India because of the perceived

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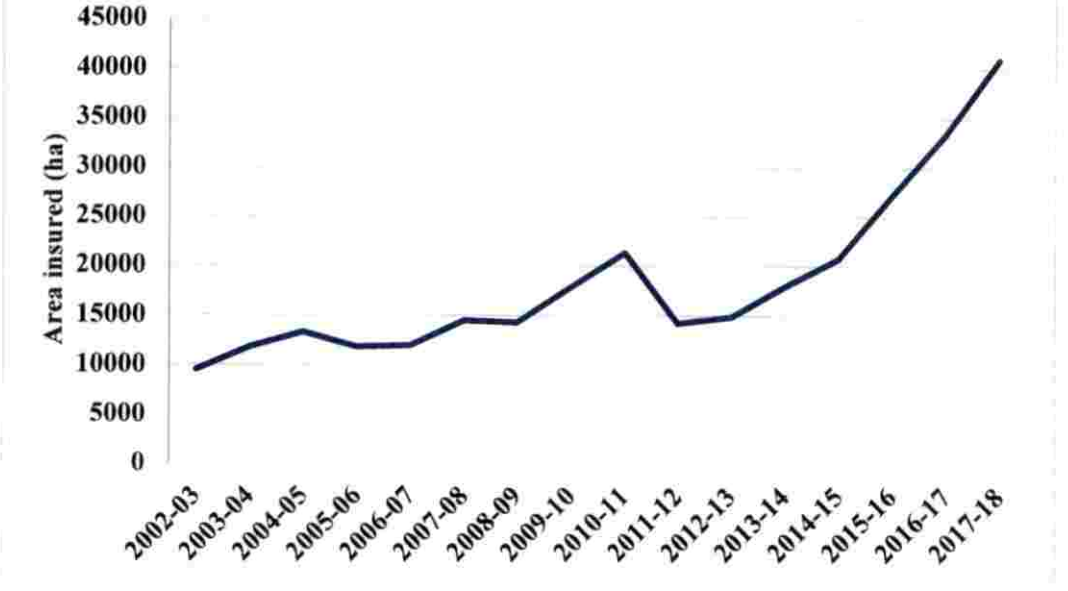
merits like transparency, faster claim calculations, elimination of moral hazard and adverse selection issues (Stoppa and Hess, 2003). Since WBCIS was confined to weather-based crop loss and creating weather index that accurately represented the actual crop loss triggered by the changes in weather variables was impossible to develop, its efficiency was below expectations (Collier *et al.*, 2009).

The central government on 13th January 2016 announced the Pradhan Mantri Fazal Bhima Yojana (PMFBY) as a comprehensive crop insurance product which aimed at bringing 50 per cent of the farmers under crop insurance coverage by 2018. Along with offering variety of attractive designs, government also enforced strict laws such as bundling crop insurance with crop loans to bring more farmers under the protection of crop insurance schemes.

In the above background the present study examined the performance of crop insurance schemes in the state of Kerala. The coverage of crop insurance schemes can be evaluated based on area insured, farmers insured and total area insured as a percentage of gross cropped area.

Figure 2 Area insured under crop insurance schemes in Kerala from 2002- 03 to 2017-18 (ha)



Source: Directorate of Agriculture, Thiruvanathapuram

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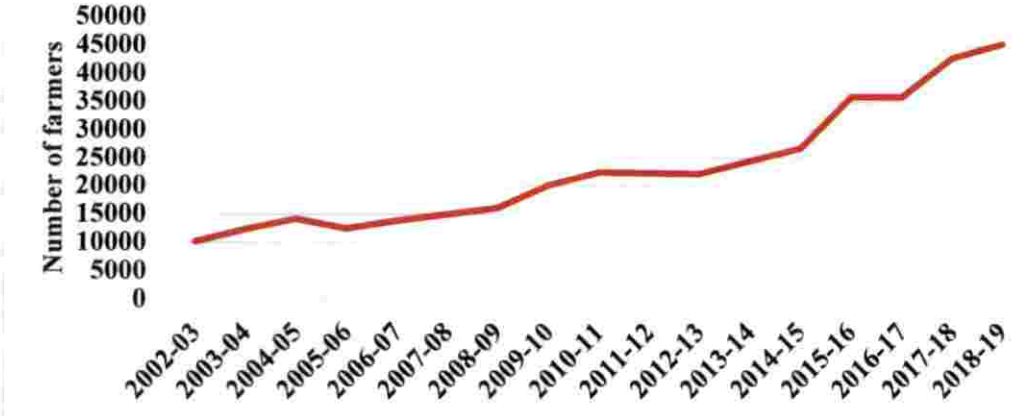
Figure 3 Number of Paddy farmers enrolled in crop insurance schemes in Kerala from 2002- 03 to 2018-19



Source: Directorate of Agriculture, Thiruvanathapuram

Figure 2 shows that the insured area under cultivation exhibited an increasing trend. It could be observed that after the inception of the PMFBY in 2016, subscription of crop insurance had exhibited a commendable increase in Kerala. The number of paddy farmers enrolled in crop insurance schemes also exhibited an increasing trend as depicted in Figure 3. The increased enrollment could be attributed to two reasons, the first being attractiveness of the scheme and the second being the enforcement of stringent measures to ensure compulsory subscription of loanee farmers. An analysis of the individual claim data for the 2017 Kharif and 2017-18 Rabi season for paddy revealed that about 97 per cent of the crop insurance subscribers were loanee farmers as presented in Table 4.3. Thus, the major reason for increased enrollment of farmers in the crop insurance programmes was attributed to bundling of crop insurance schemes with crop loans. The growth in total number of crop insurance users and insured paddy farmers exhibited an increasing trend.

Table 4.3 Distribution of insured farmers in Kerala

Season	Loanee (Per cent)	Non-loanee (Per cent)
Kharif 2017	99.73	0.27
Rabi 2017-18	97.37	2.63

Source: Claim report 2017-18, WBCIS

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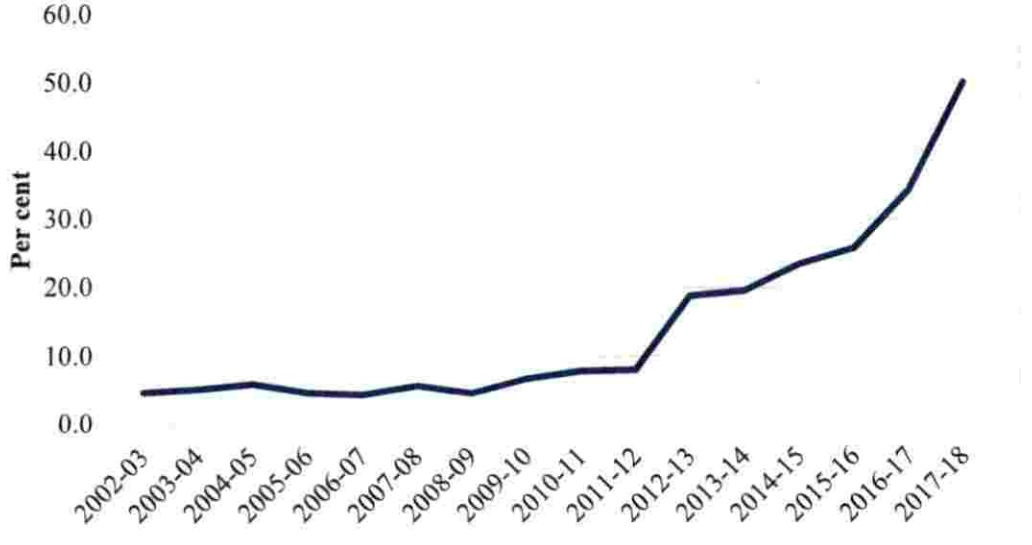
Table 4.4 showed that the total insured area under cultivation has increased from 9,531 ha to 38,927 ha for paddy and from 25,008.33 ha to 56,644.15 ha for all crops combined during the period from 2002-03 to 2018-19. It should also be noted that there was a sharp decline in the area under paddy over these years. As a combined effect of increase in area insured and decline in area cultivated, the percentage of insured area under paddy cultivation to total area under paddy cultivation showed an increasing trend as depicted in Figure 4. The Figure also shows that the share of insured area under cultivation in the total cropped area increased discernibly over years. This increase in the share of insured area to total cropped area is a positive sign demonstrating notable progress of the crop insurance schemes. Large number of risks associated with cropping will be brought under the protection of schemes, which would in turn make the income of farmers more stable. Figure 5 showed that the percentage of insured area under paddy cultivation to total area under paddy cultivation in Palakkad district had increased markedly from 2001-03 to 2017-18. This is a very positive sign that the regulations are able to bring more of the cultivated area under the protection of crop insurance schemes.

Figure 4 Share of insured area under paddy to total area under paddy cultivation in Palakkad district



Source: Directorate of Agriculture, Thiruvanathapuram

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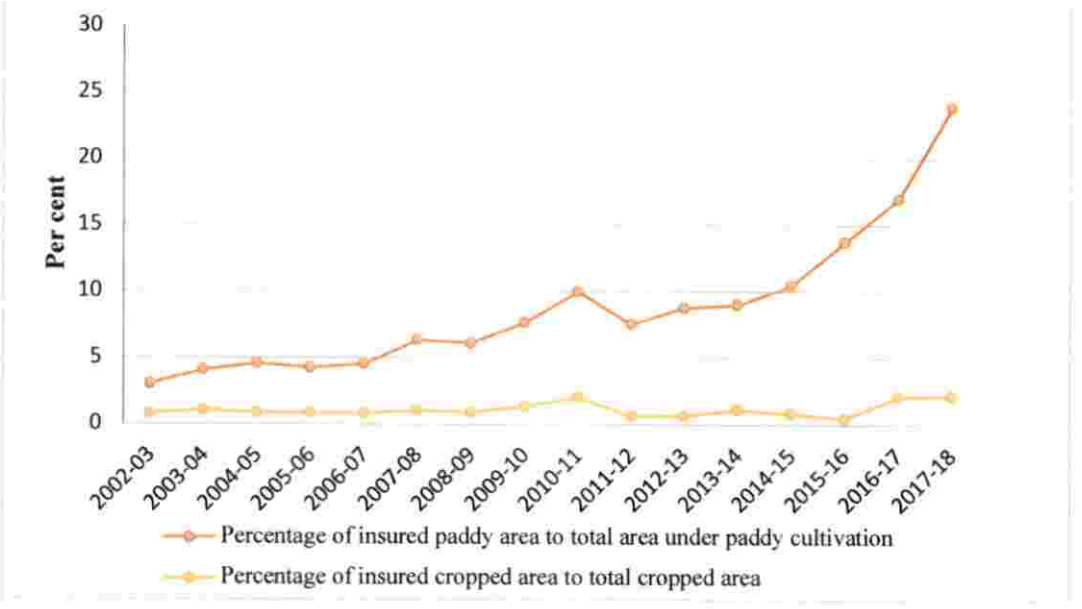
Figure 5 Share of insured area to total area under paddy in Kerala from 2002- 03 to 2017-18



Source: Directorate of Agriculture, Thiruvanathapuram

Table 4.4 Paddy area under crop insurance in Kerala from 2002-03 to 2017-18

Year	Total cropped area(ha)	Total insured area (ha)	Total paddy area (ha)	Paddy area insured (ha)
2002-03	2970384	25008.33	310521	9531.96
2003-04	2954454	32428.11	287340	11849.59
2004-05	2996293	27469.18	289974	13355.14
2005-06	2985727	27664.54	275742	11837.73
2006-07	2917541	24589.58	263529	11981.59
2007-08	2761094	29491.05	228938	14511.72
2008-09	2694943	25604.94	234265	14328.71
2009-10	2668678	37167.44	234013	17909.87
2010-11	2647461	54940.68	213187	21318.97
2011-12	2661757	18145.53	208160	14243.50
2012-13	2591734	17901.21	197277	14902.47
2013-14	2616670	30120.62	199611	17979.53
2014-15	2624624	23088.66	198159	20745.11
2015-16	2627577	12931.98	196870	10158.51
2016-17	2584007	54793.7031	196870	33415.48
2017-18	2579699	56644.1486	171398	40905.64

Source: Directorate of Agriculture, Thiruvanathapuram and Directorate of Economics and statistics, Government of Kerala

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The growth of subscription of crop insurance schemes in Kerala was analysed and the results are presented in Table 4.5. Growth rate in the area covered, number of farmers enrolled, gross premium collected, claims settled and number of farmers benefitted increased over the years. There was remarkable increase in the growth rate of gross premium and the number of farmers insured. Area insured and the sum insured also exhibited considerable rate of growth over the years. The higher magnitudes of growth rates showed the progress of crop insurance schemes in the state.

Table 4.5 Growth rate of crop insurance in Kerala (2002-03 to 2017-18)

Particulars	Area insured	Sum insured	Gross premium	Number of farmers insured
Compound Growth rate(per cent per annum)	7.84*	17.96*	32.37*	25.47*

Note: * indicates significance at 1 per cent level

4.1.4 Analysis of the state crop insurance programme

The state crop insurance scheme (SCIS) is being implemented in all the districts of Kerala, covering all the major crops grown in the state. It provides cover for paddy, coconut, arecanut, rubber, banana, pineapple, pepper, cardamom, ginger, turmeric, coffee, tea, cocoa, sesamum, groundnut, vegetables, nutmeg, clove, betel vine, pulses, tuber crops, sugarcane and tobacco. The scheme provides assistance to crop loss due to natural calamities like drought, flood, land slide, sea erosion, storm, cyclone, land slip, forest fire, lightning and wild elephant attack. Paddy farmers get an additional coverage if crop loss of 50 per cent or above occurs due to disease or pest attack.

The state crop insurance scheme works more like a multi-peril compensation scheme and is implemented directly by the Department of Agriculture. The data from 2015 to 2019 of the SCIS was collected from the Directorate of Agriculture, Thiruvananthapuram and analysed to study the progress of the scheme in the state. The results are presented in Table 4.6 and Table 4.7.

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Table 4.6 Details of state crop insurance scheme from 2014-15 to 2018-19 for paddy in Kerala

Year	Number of Farmers enrolled	Amount of Premium collected (₹)	Compensation Paid (₹)	Number of Farmers benefitted	Claims to premium ratio
2014-15	1,19,459	84,27,926	2,53,03,608	3,260	3.00
2015-16	1,33,188	66,98,695	2,19,60,430	3,252	3.28
2016-17	1,22,075	55,80,902.3	1,19,27,399	1,405	2.14
2017-18	1,10,962	1,64,42,565.3	2,98,80,292	9,473	1.82
2018-19	1,96,365	2,79,14,793.5	26,15,78,906	21,467	9.37

Source: Directorate of Agriculture, Thiruvananthapuram

Table 4.7 Details of state crop insurance scheme from 2014-15 to 2018-19 for all crops in Kerala

Year	Number of Farmers enrolled	Premium collected (₹)	Claims Paid(₹)	Number of Farmers benefitted	Claims to premium ratio
2014-15	1,31,950	1,25,68,289	3,05,38,593	4,369	2.43
2015-16	1,46,008	1,06,59,352.3	2,56,87,753	4,324	2.41
2016-17	1,61,326	1,05,98,025.3	1,59,87,097	2,478	1.51
2017-18	1,76,644	3,87,47,088.8	8,76,17,999	11,202	2.26
2018-19	2,53,068	5,33,33,746.4	39,96,47,315	28,177	7.49

Source: Directorate of Agriculture, Thiruvananthapuram

Table 4.6 and 4.7 showed that there was a huge gap between the number of farmers enrolled and the number of farmers benefitted by the state crop insurance scheme. The number of farmers enrolled in the SCIS displayed an increasing trend during the period of observation. When the enrolment of paddy farmers alone was considered, the numbers showed gradual increase over the years. The difference in the number of farmers enrolled and benefited out of a scheme might be due to the fact that crop losses suffered by majority of the farmers were under the threshold limit prescribed by the policy.

4.2 VIABILITY OF CROP INSURANCE SCHEMES

Crop insurance schemes are administered by insurance agencies in all the states. Before the commencement of every season, the bid document will be notified by the government and any general insurance company empanelled by Department of Agriculture, Cooperation and Farmers Welfare can participate in the bid, quoting the premium rates for all the notified crops. Selection of the

implementing agency will be made based the premium quoted by the companies. Since insurance agencies operate similar to any other profit oriented firm, the economic viability of the schemes is an important matter of concern for ensuring the sustainability of the crop insurance schemes. Claims to premium ratio is a simple measure that reveals the viability of a scheme. Ideally, claims to premium ratio should be less than one for a scheme to be viable. When the ratio is above 3.5, the loss of the company will be borne by the state and the central governments equally, which results in delayed claim settlement.

Analysis of the data on premium and claims over the years showed that the claims to premium ratio fluctuated above and below one as depicted in figure 6 and 7. Considering the cumulative value over the years, the claims to premium ratio was found to be 1.31, which meant that for every one rupee collected as premium the insurance companies paid 1.31 rupees as claims. It should be noted that the ratio had gone as high as 3.2 which created a huge economic burden on the insuring agencies and the government. The highest claims to premium ratio recorded when paddy alone was considered turned out to be 4.33, which implied that the insurer had to pay more than 4 times the amount collected as premium. During the years in which the ratio was below one, crop insurance companies made profits. The lowest ratio recorded was 0.23, when all the crops were considered and 0.13 when paddy alone was considered. The larger proportion of gross cropped area under rice and more frequent crop loss suffered by paddy farmers keep the claims to premium ratio high for paddy when compared to other crops. The ratio calculated and presented above included both premium paid by the farmer and the government (as the state and the central governments had to bear up to 98 per cent of the actuarial premium). If farmers' premium alone was considered, schemes would turn out to be highly unsustainable. When the claims to premium ratio crossed 3.5, the state and the central governments share the additional claim amount equally to assist the insurance agency. This again delayed the claim settlement and the farmers had to wait more for getting the claims released.

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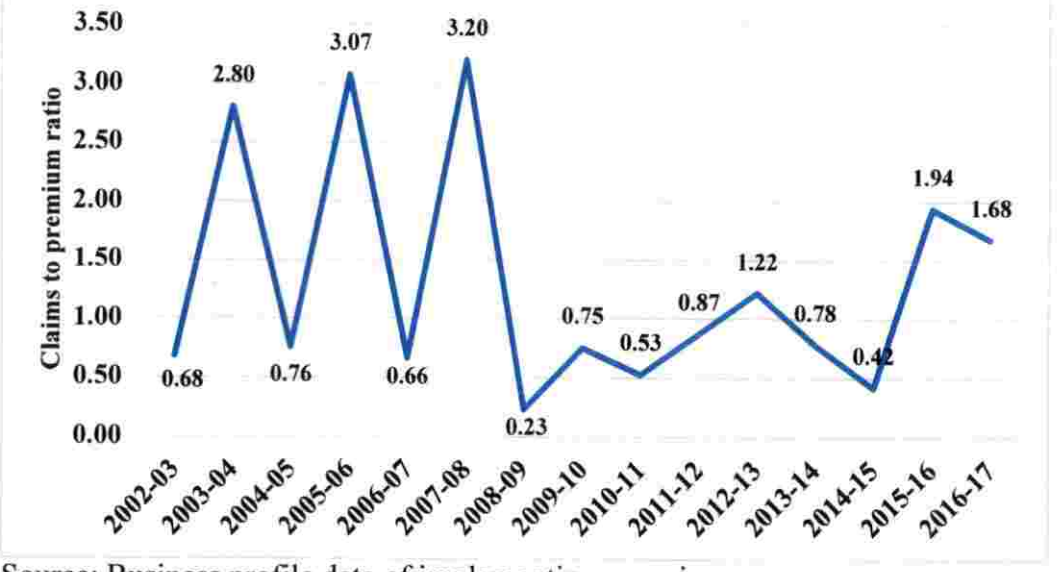
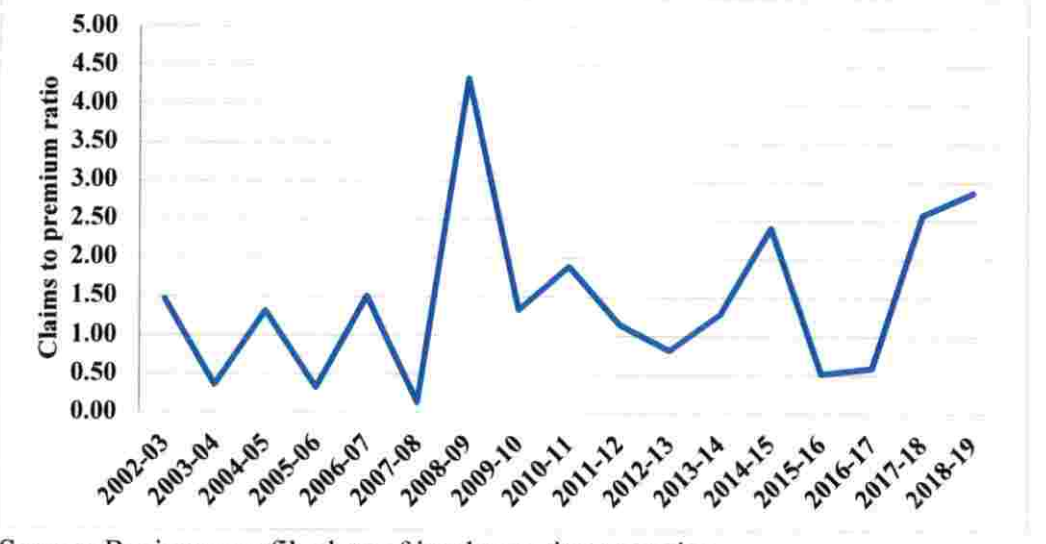
Figure 6 Claims to premium ratio of crop insurance schemes in Kerala from 2002-03 to 2016-17



Source: Business profile data of implementing agencies

Figure 7 Claims to premium ratio of crop insurance schemes in Kerala from 2002-03 to 2016-17for paddy



Source: Business profile data of implementing agencies

The claims to premium ratio of the State Crop Insurance Scheme was also analysed and is plotted in Figure 8. It is evident from the figure that the claims to premium had never gone below one suggesting that the government had to invest heavily in the scheme at all times.

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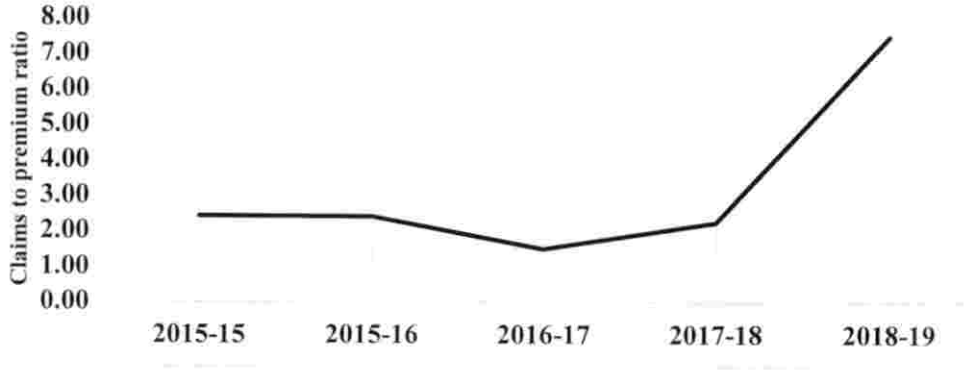
Figure 8 Claims to premium ratio of the State Crop Insurance Scheme



Source: Directorate of Agriculture, Thiruvanathapuram

4.3 CONSTRAINTS IN THE ADOPTION OF CROP INSURANCE

The constraints in voluntary adoption of crop insurance was analysed using the primary data collected from the respondent farmers. The socio-economic profile of the respondents, economics of paddy cultivation, constraints in the production of paddy, reasons for adoption of existing schemes, methods adopted for managing income variation and the constraints in the voluntary adoption of crop insurance are discussed in this section.

4.3.1 Socio-economic profile of the sample farmers

This section includes the general characteristics like age, education, income, occupation, experience in farming, gender and land holding size of the respondents from two blocks of the Palakkad district *viz.*, Nenmara and Kollengode. This helps in arriving at a better understanding about the social and economic status of the respondents included in the study.

4.3.1.1 Age of the respondents

The age-wise distribution of the sample farmers are presented in Table 4.8. The respondents were classified into six different groups based on their age. It was observed that majority of the sample farmers (42.78 per cent) were aged between 50 and 59. Almost one-fifth each of the total farmers were aged between 60 and 69 and between 40 and 49. It was interesting to note that there were no farmers in the age group below 30 years. This observation indicated the issue that the young generation was moving away from farming and this was an indication

of the mobility of youth from the farming communities to other sectors in search of better livelihood and income assurance.

Table 4.8 Age-wise distribution of sample respondents

Age (years)	Nenmara block	Kollengode block	Total sample
< 30	0	0	0
	(0.0)	(0.0)	(0.0)
30- 39	6	6	12
	(6.67)	(6.67)	(6.67)
40- 49	15	23	38
	(16.67)	(25.56)	(21.11)
50- 59	41	36	77
	(45.50)	(40.00)	(42.78)
60 -69	26	24	50
	(28.86)	(26.66)	(27.77)
>70	2	1	3
	(2.30)	(1.11)	(1.67)
Total	**90**	**90**	**180**
	(100)	**(100)**	**(100)**

Note: Figures in parentheses indicate per cent to column total

4.3.1.2 Gender

The classification of the respondents based on gender is presented in Table 4.9. Majority of the farmers in both the blocks were males. This was the general trend seen in the demographic pattern of the district and also in the state. About 77 per cent of the total respondents were males and 23 per cent were females.

Table 4.9 Gender-wise distribution of sample respondents

Gender	Nenmara Block	Kollengode Block	Total Sample
Male	68	70	138
	(75.56)	(77.78)	(76.66)
Female	22	20	42
	(24.44)	(22.22)	(23.34)
Total	**90**	**90**	**180**
	(100)	**(100)**	**(100)**

Note: Figures in parentheses indicate per cent to column total

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4.3.1.3 Educational background

The educational background of the sample respondents are presented in Table 4.10. It could be observed from the table that even though majority of the farmers were literate, about 40 per cent of them had attended schools only up to the upper primary level. 19 per cent of the respondents had primary level or lesser education while 16 per cent had graduation or post-graduation. Only 2.2 per cent of the respondents had professional degrees. The above discussed pattern showed that the better educated section moved away from agriculture and were employed in tertiary sectors.

Table 4.10 Educational status of sample respondents

Education	Nenmara Block	Kollengode Block	Total Sample
Primary	24 (26.67)	10 (11.11)	34 (18.89)
Upper Primary	17 (18.89)	22 (24.44)	39 (21.67)
High School and Higher Secondary	34 (37.78)	40 (44.44)	74 (41.11)
Degree and PG	13 (14.44)	16 (17.78)	29 (16.11)
Professional degree	2 (2.22)	2 (2.23)	4 (2.22)
Total	**90 (100)**	**90 (100)**	**180 (100)**

Note: Figures in parentheses indicate per cent to column total

4.3.1.4 Experience in farming

The farmers were classified based on their years of experience in farming. The farmers were asked to quote the number of years since they have been actively and directly involved in agriculture. The responses from farmers were categorised into three *i.e.,* less than 10 years of experience in farming, experience between 10 and 30 years, and more than 30 years. 68.33 per cent of the farmers in the sample population had an experience of 30 years or above. 15.56 per cent of the farmers were between 10 to 30 years of experience and 16.11 percent of the farmers had less than ten years of experience in farming. The details are given in Table 4.11.

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Table 4.11 Distribution of sample farmers according to farming experience

Year of experience	Nenmara Block	Kollengode Block	Total Sample
<10	10 (11.11)	19 (21.11)	29 (16.11)
10-30	16 (17.78)	12 (13.33)	28 (15.56)
>30	64 (71.11)	59 (65.56)	123 (68.33)
Total	**90 (100)**	**90 (100)**	**180 (100)**

Note: Figures in parentheses indicate per cent to column total

4.3.1.5 Land holding pattern

The respondents were classified based on the size of the operational holding. Majority of the farmers were small and marginal (less than one). 65.56 per cent of the farmers were marginal farmers with a land holding of less than one hectare, 25 per cent of the farmers were having operational holding between one and two hectares. The details are enlisted in Table 4.12.

Table 4.12 Distribution of sample respondents according to size of land holding

Area in hectares	Nenmara Block	Kollengode Block	Total Sample
Less than1	58 (64.44)	60 (66.67)	118 (65.56)
1 to 2	20 (22.22)	25 (27.78)	45 (25.00)
2 to 3	3 (3.33)	1 (1.11)	4 (2.22)
3 to 5	3 (3.33)	4 (4.44)	7 (3.89)
>5	6 (6.68)	0 (0)	6 (3.33)
Total	**90 (100)**	**90 (100)**	**180 (100)**

Note: Figures in parentheses indicate per cent to column total

4.3.1.6 Annual income

The respondents were classified based on the income levels and presented in Table 4.13.Majority of the respondents was in the category that earned less than 2 lakh per annum. Almost 23 per cent of the total sample farmers had income of between 2 lakh and 4 lakh rupees.

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Table 4.13 Distribution of sample respondents based on their annual income

Annual income (₹)	Nenmara Block	Kollengode Block	Total sample
<2 lakh	71 (80.01)	73 (81.11)	144 (80.00)
2 to 4 lakhs	10 (11.11)	13 (14.45)	23 (12.77)
4 to 6 lakhs	2 (2.22)	3 (3.33)	5 (2.78)
6 to 8 lakhs	2 (2.22)	1 (1.11)	3 (1.67)
> 8 lakhs	4 (4.44)	0 (0.00)	5 (2.78)
Total	**90 (100)**	**90 (100)**	**180 (100)**

Note: Figures in parentheses indicate per cent to column total

4.3.1.7 Occupation

The respondents were classified based on their occupation and the details are presented in Table 4.14. It was observed that the maximum number of respondents had agriculture as the main occupation (45.56 per cent). 12.78 per cent of the respondents who did unpaid family labour were also directly or indirectly engaged in agriculture. Only 3.89 per cent were employed in the government sector. Most of the respondents who were self-employed (18.89 per cent) were also engaged in agriculture for deriving additional income.

Table 4.14 Distribution of sample respondents based on their occupation

Occupation	Nenmara Block	Kollengode Block	Total Sample
Agriculture	42 (46.67)	40 (44.44)	82 (45.56)
Public sector	2 (2.22)	5 (5.56)	7 (3.89)
Aided / Semi governmental	7 (7.78)	11 (12.22)	18 (10.00)
Private sector	6 (6.67)	10 (11.11)	16 (8.89)
Self employed	18 (20.00)	16 (17.78)	34 (18.89)
Unpaid family labour	15 (16.66)	8 (8.89)	23 (12.77)
Total	**90 (100)**	**90 (100)**	**180 (100)**

Note: Figures in parentheses indicate per cent to column total

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4.3.2 Economics of paddy cultivation and constraints in production

The economics of paddy cultivation with respect to Palakkad district is presented in the following section. In this section, cost of cultivation and cost of production of paddy in the Nenmara and Kollengode blocks of Palakkad district were estimated separately. The results are presented in Tables 4.15 to 4.19 and discussed below.

4.3.2.1 Cost of cultivation and production

The cost of cultivation per hectare of paddy in Nenmara and Kollengode blocks of Palakkad district were estimated based on the cost concepts *viz.,* Cost A, Cost B and Cost C, and the results are presented in Table 4.15. Cost A1 and A2 were found similar because the respondents were not cultivating paddy on leased land. Cost A1 and Cost B1 were also found similar, as the implements used in the cultivation of paddy were owned by the workers, and not by the farmers. The rents of implements used were included in the wages paid to the workers. The cost of cultivation per hectare was found higher for Nenmara block (₹1,34,396) when compared to Kollengode block (₹1,31,646). The average cost of cultivation was ₹1,33,021 per hectare. Among the respondents in two blocks, maximum and minimum rental values for the owned land were recorded in Kollengode block. The major factors affecting the rental values for the owned land were the availability of water and fertility of the land. The higher rental values of owned land escalated the cost of cultivation.

The input-wise and operation-wise cost of cultivation were calculated and are presented in Table 4.17. The aggregate input-wise cost of cultivation was found to be ₹78,818 per hectare. Nenmara had slightly higher aggregate input-wise cost of cultivation compared to that of Kollengode. Human labour accounted for the maximum share of cost incurred for inputs followed by machine labour. Together, the two factors contributed about 78 per cent of the total cost of cultivation.

The aggregate operation-wise cost of cultivation was found to be ₹78,818 per hectare and the details are presented in Table 4.16. Nursery preparation and planting accounted for the maximum share of the operation-wise cost of cultivation followed by weeding. Together they contributed 67 per cent of the operation-wise cost of cultivation.

Table 4.15 Cost of cultivation of paddy in Palakkad district (₹ per hectare)

Cost	Nenmara (₹)	Kollengode (₹)	Total (₹)
Cost A1	82,382	81,453.	81,622
Cost A2	82,382	81,453	81,622
Cost B1	82,382	81,453	81,622
Cost B2	1,31,783	1,28,972	1,30,377
Cost C1	84,995	83,535	84,265
Cost C2	1,34,395	1,31,645	1,33,020
Cost C3	1,47,835	1,44,810	1,46,322

Table 4.16 Operation-wise cost of cultivation of paddy in Palakkad district (₹ per hectare)

Particulars	Nenmara	Kollengode	Total
Nursery preparation and planting	31,405 (39.5)	30,981 (39.7)	31,193 (39.6)
Fertilizers and Manuring	11,170 (14.0)	11,071 (14.2)	11,120 (14.1)
Weeding	22,288 (28.0)	21,582 (27.6)	21,935 (27.8)
Plant protection chemicals	3818 (4.8)	3385 (4.3)	3601 (4.6)
Cleaning and drying	4495 (5.8)	4806 (6.2)	4650 (5.9)
Harvesting	6355 (7.99)	6283 (8.0)	6319 (8.0)
Total cost	79,530 (100)	78,107 (100)	78,818 (100)

Note: Figures in parentheses indicate per cent to column total

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Table 4.17 Input-wise cost of cultivation in Palakkad district (₹ per hectare)

Particulars	Nenmara	Kollengode	Total
Human labour	49,013 (61.6)	48,114 (61.6)	48,563 (61.6)
Machine labour	12,826 (16.1)	12,780 (16.4)	12,803 (16.2)
Seeds	3,350 (4.2)	3,266 (4.2)	3,308 (4.2)
Manures	5,236 (6.6)	5,331 (6.8)	5,284 (6.7)
Fertilizers	4,096 (5.2)	3,979 (5.1)	4,038 (5.1)
Plant protection chemicals	2,586 (3.3)	2,266 (2.9)	2,426 (3.1)
Weedicides	2,423 (3.0)	2,368 (3.0)	2,396 (3.1)
Total cost	**79,530 (100)**	**78,106 (100)**	**78,818 (100)**

Note: Figures in parentheses indicate per cent to column total

The major factor which affected the cost of cultivation of paddy was the cost incurred in employing human labour for various operations in the paddy field. The cost incurred for nursery preparation and transplantation of paddy was found to be similar for almost all the farmers, whereas the cost incurred for weeding showed greater deviation among the farmers. The cost incurred for weeding depends on the weed growth, as the fields with higher weed growth had to employ large number of labourers for weeding in the field. The intensity of weed growth depended on factors such as availability of water, tillage and location of the field. The labour cost for weeding varied between ₹5,250 and ₹14,000 per hectare and thus, it was found to be the deciding factor in the increase or decrease in the cost of cultivation of paddy. Harvesting of paddy was carried out mechanically in most parts of the study area. During discussions with the agricultural officer and the lead farmers, it was noted that there was an emerging trend of assigning contracts to the immigrant workers for transplanting the seedlings at the rate of ₹ 4,500 to ₹ 5,000 per acre, because it was comparatively cheaper and cost effective than assigning native workers. Operations carried out mechanically had almost same costs in the

entire study area with changes only when the field was not suitable for such heavy machinery and required more time per acre.

4.3.2.2 Cost of production

The cost of production of paddy in Palakkad district was estimated and the details are presented in Table 4.18.

Table 4.18 Cost of production of paddy in Palakkad district (₹ per quintal)

Cost	Nenmara (₹)	Kollengode (₹)	Total (₹)
Cost A1	1,818	1,818	1,835
Cost A2	1,818	1,818	1,835
Cost B1	1,818	1,818	1,835
Cost B2	2,964	2,931	2,947
Cost C1	1,911	1,878	1,895
Cost C2	3,022	2,960	2,991
Cost C3	3,325	3,257	3,291

The cost of production per quintal of paddy in Nenmara was higher than that in the Kollengode region and the average yield was almost the same for both the blocks. The higher cost in Nenmara was attributed to the higher rental values of owned land. The average cost of production in the study area was found to be ₹2,991 per quintal.

4.3.2.3 Income measures

Various income measures were estimated for Nenmara and Kollengode blocks for comparing the insurance coverage with cost of production. The highest average gross income was recorded for Nenmara block. The reason for this was attributed to the fact that most of the farmers in the Nenmara sold the produce as seed. The paddy farmers producing seed fetched more price than the farmers selling produce to Supplyco, and the additional cost incurred for seed production was covered in the extra premium received during selling. Skilled labourers and

mechanization were required for the field level operations and therefore, the family labour income was found to be negative.

The estimates of different measures of income of paddy farmers in Palakkad district are presented in Table 4.19. Net income and Benefit-Cost (BC) ratio implied that farming was not a profitable venture when the rent for owned land and value of family labour were accounted in the cost of cultivation. The BC ratio at explicit cost was above one in both the cases and 1.70 on an average.

Table 4.19 Estimates of different measures of income of paddy farmers in Palakkad district (₹ per hectare)

Cost	Nenmara (₹)	Kollengode (₹)	Total (₹)
Gross income	1,38,381	1,35,636	1,37,008
Farm Business Income (GI- Cost A1)	55,998	54,773	55,386
Family labour income (GI- Cost B2)	6,598	6,663	6,631
Net Income (GI- Cost 3)	-9,733	-9,174	-9,453
BC (GI:C3)	0.94	0.94	0.94
BC at Explicit (GI:A1)	1.70	1.70	1.70

4.3.2.4 Constraints in production of Paddy in Palakkad district

Even though agriculture is often described as a gamble with the monsoon, it is a well-known fact that monsoon is not the only the risk farmer has to confront. Farmers are in constant struggle with weather parameters, resource availability, pests, diseases, weeds, procurement and price issues. The major challenges faced by farmers in the production and sales of the paddy were identified, listed and ranked using the Garrett's ranking method. The results are presented in Table 4.20.

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Table 4.20 Constraints production of paddy in Palakkad district

Sl. No.	Constraints	Garrett's score	Rank
1	Inadequate water supply	73.93	I
2	Excessive weed growth	66.02	II
3	Issues in procurement	65.03	III
4	Pest and disease attack	63.05	IV
5	Abnormal weather pattern	56.98	V

From the above results, it is evident that the most serious constraint for the paddy farmers in the study area was the inadequate availability of irrigation water. It was an irony that the study area is one of the regions with maximum number of dams built for irrigation in the state but still they were not able to cater to the requirements of the farming community. The Chuliyar dam, which supplies water to the Elavencehery block had silted canal inlets which affected the efficient draining of water from the catchment area into the dam. The fields in the tail end of irrigation canals from the dam did not receive water throughout the cropping season. Fields catered by the Moolathara regulator had better water availability compared to other regions under canal irrigation. Regions depending on sources such as the Chittoor River and Pothundi dam were having sufficient water availability for both the cropping seasons but only a small percentage of the respondents in the study area were depending on these sources of water. Even though, there was an elaborate network of canals and large number of open ponds in the Nenmara and Kollankode blocks, the inadequacy of quality irrigation water was one of the major constraints for the farmers in the region.

Problem of weed emergence was the constraint ranked second in the study area. Cost incurred for weeding accounted for the maximum share accounted by a single operation in the total cost of cultivation for majority of the farmers in the study area. Weed emergence had a linkage with inadequacy of irrigation water. Chauhan and Johnson (2010) quoted that standing water had a suppressive effect on the weed seed germination. Hence, when water was not available in required quantities weed growth would be high. Weed growth intensity varied from field to

field and depended on various factors including water availability, method of planting, previous crop grown and tillage as quoted by the respondents.

The third most ranked constraint was the issue with procurement. Most of the farmers sold their produce to Supplyco at the procurement rate that was fixed by the government. Issues arose as there was an upper ceiling of the quantity of produce that could be procured from a single farmer and when the mills which were given sub-contracts by the Supplyco delayed the procurement from the farmers. The farmers who sold their paddy seeds to State Seed Authority also faced the same issue, as the procurement agency was having an upper limit on the quantity that could be procured. Some of the procurement agencies were having strict norms regarding the quality of produce, but the farmers were not satisfied with these norms as they were thinking that their efforts were underpaid, and they had to invest huge amounts to maintain the required standards.

Using the Garrett's ranking method, the fourth constraint identified was the infestation of pests and diseases. Crops were always under the threat of pest and disease attack. But most of the times, the attack was kept under control by the application of plant protection chemicals. High variations in yield and income happened only when there was a wide spread and uncontrolled outbreak of pests and diseases. During all other periods, the pests and diseases were kept under a threshold level by adopting various control measures in an integrated manner.

Constraints due to weather were ranked least by the respondents. It should be noted that the decrease in total rainfall which caused shortage of irrigation water was already covered in the first constraint – inadequacy of irrigation water. In this constraint, other weather parameters like rains during harvesting, wind, extreme temperatures etc., were included. Farmers rarely faced such situations and for the same reason, it was ranked last.

4.3.2.5 Managing income variability

Agriculture has an element of risk blend into it as the changes in weather pattern, lack of resources including water, attack from pests, incidence of diseases and other unforeseen mishaps can lead to yield loss. The trend in monsoon decides the fate of agricultural production every year. With changes in this pattern, farmers will have to suffer crop loss and income variations (Rao and Suri, 2006). Farmers in lower income countries like India should incorporate this element of risk into their production arrangements but were least equipped to do so (Rajeev *et al*, 2016). Farmers depend on different sources to manage abrupt variations in income. Some of the important measures adopted by farmers were identified, listed and ranks were assigned based on the responses from the farmers. The ranks were converted into mean scores, analysed using the Garrett's ranking technique and the results are presented in Table 4.21.

Table 4.21 Measures for managing income variability

Sl. No	Measures	Garrett's Score	Rank
1	Availing gold loans	75.37	I
2	Borrowing from friends	65.97	II
3	Depending on savings	63.92	III
4	Borrowing from money lenders	61.98	IV
5	Sale of fixed assets	55.19	V
6	Insurance or government relief	50.37	VI

Majority of respondents resorted to gold loans for managing income variability. They approached both banking institutions and non-banking establishments for the gold loan. One of the major reasons for resorting to this method was the simplicity of procedures. Processing of gold loans has been made relatively faster in banks, especially cooperative banks and private non-banking finance establishments.

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The second most preferred method to cope with the variations and sudden needs of liquid money was to borrow from neighbors, friends and relatives. This would only give a temporary financial stability and could be opted for comparatively smaller amounts and short-term requirements. When the income variations happened for a large geographical area, this method was less likely to be an efficient measure. This method was popular as it acted like an aid without interest.

The third most opted measure was to use a part or whole of the savings of the farmer to handle emergency needs and was one of the easiest and cheapest measures. A vast majority of farmers, who were in the category of small and marginal farmers, were not having enough savings that could be used during the times of income fluctuations. The returns they obtained out of one crop was soon used for consumption and investment for the next crop. Thus, the ability of a small or marginal farmer to save was very limited. This was the main reason why this alternative became third in the ranking.

Another option that the farmers had was to get credit from the local money lenders, which is a non-institutional system prevalent in most of the study area. Though the procedures for lending money was very simple, the lenders were extracting exorbitant rates of interest compared to the institutional sources. Balasaheb (2008) in his study about agricultural indebtedness had quoted that farmers' suicide to be the most sensitive issue that the government had to handle and identified the pressure from money lenders as an important cause for this. He also noted that the farmers approached the lenders only when they failed to obtain credit from other sources. The same trend was observed in the regions surveyed. Farmers were aware of the exorbitant rate of interest that was charged by the money lenders and hence preferred institutional credit to non-institutional credit whenever it was available. But as the money lenders were easily approachable and procedures were simple, they were at times forced to choose this option. Singh *et al.* (2009) showed an increasing trend in adoption of institutional credit by farmers and a decreasing trend in the adoption of non-institutional credit, which

supported the observation. Selling of land or other fixed assets was another measure to manage income variability. This was also one of the least preferred options as most of the farmers were not in a condition to buy back the assets once sold. When there was a peril affecting a large area, the price of the assets would also go down.

It is important to note that the farmers considered insurance and government relief measures as the least preferred measures, with only less than a percent of the farmers selecting these options as their first alternative to manage income variability. The reason for such an outcome could be the recurrent delay in the settlement of claims. This observation was in line with the findings of Nair (2010), where he recorded that farmers were least confident about the insurance due to the delay in payments of claims. Most of the farmers received the claims two to three seasons after the crop loss. Mukherjee and Pal (2017) had concluded the same after analyzing the business profile data of the AICI. The inadequacy of the claim amount was another factor highlighted by the respondents for not depending on the crop insurance schemes for managing income variability. Government relief was usually administered only in the case of a wide spread crop loss and was also subjected to numerous conditions. This observation is in line with Veeramani *et al.* (2003).

Income variability mainly affects the small and marginal farmers. Variability in income from agriculture had severe consequence on those families that were solely dependent on agriculture. Families with other sources of income found it comparatively easier to handle such fluctuations in the income. With large number of designs being experimented and huge sums of money being pumped out of the public exchequer, the inefficiency of crop insurance systems to assure financial stability during times of crop loss needs to be investigated and the schemes must be made effective.

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4.3.2.6 Reasons for adoption of crop insurance schemes

Production risks and income variations go side by side with agriculture. Farmers face a plethora of challenges in raising every crop. Abrupt changes in weather variables result in mild to severe fluctuations in farmers' yield and income and thus, his ability to invest in the next crop and for family consumption. Crop insurance is considered as one of the best alternatives to manage these income fluctuations. Crop insurance has been made mandatory for loanee farmers in the country and is also declared mandatory to avail any service from the Krishi Bhavans in the state of Kerala. For the same reason, majority of the paddy farmers in the study area were insured. Therefore, the subscription rate of crop insurance in the study area cannot be used to make conclusions regarding the popularity of the schemes. Palakkad district was reported to be the district with maximum premium being collected from the paddy growers and only a field level investigation could help in getting a better understanding about reasons for such high rates of subscription.

Some of the important reasons for the subscription of crop insurance schemes were identified, listed and ranks were assigned based on the responses from the farmers. The ranks were converted into mean scores and then analysed using the Garrett's ranking technique and presented in Table 4.22.

Table 4.22 Reasons for subscription of crop insurance schemes by the respondent farmers

Sl. No.	Reason	Garrett's score	Rank
1	Mandatory for availing crop loans	76.46	I
2	Aware of benefits	67.99	II
3	Financial Security	64.43	III
4	Higher perceived loss	64.12	IV

From the results of Garrett's ranking, it was evident that most of the farmers opted for crop insurance as it was mandatory, both for availing crop loans and to receive any kind of assistance or service from the Krishi Bhavans. Most of the farmers in the study area had loans taken from either a Co-operative bank or a nationalized bank and for that, it was necessary that the farmer subscribed to crop

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insurance scheme. All the procedures were completed by the respective banks and the premium were automatically deducted from the loan amount. Another feature of the study area was that this region of the state was highly specialized in paddy cultivation and the Padashekara Samithies (registered groups of paddy farmers in a particular area) were very actively and efficiently operating in this region. The samithies collected the premium amount from all the farmers members and submitted it in the Krishi Bhavans (KBs), enrolling all the farmers in the state crop insurance programme. Thus, all the farmers with crop loans and membership in the Samithies were compulsorily enrolled in the crop insurance schemes. Majority of the sample population assigned first rank to this option. This was in line with the observations of Mukherjee and Pal (2017) that only 15 per cent of the insured opted for voluntary subscription.

The reason that ranked second was the awareness about the benefits of crop insurance schemes. Only 25 per cent of the sample population assigned first rank to this option. Rajeev and Nagendhran (2018) reported that 65 per cent of the population were not aware of the crop insurance schemes. In the study area of this research, people were aware about the existence of the schemes but were not having clarity about the operational guidelines and the benefits of the schemes. Even farmers who were aware about the incentives, were not sure if the claims will be settled in time.

Financial security offered by the insurance schemes was ranked third. The basic aim of any insurance scheme is to offer financial security to the farmers but in the study area, only less than one percent of the total sample assigned first rank to this option. This was an irony and such an observation might have resulted due to two reasons. First reason was the delay in the payment of claims. Most of the farmers complained that the claims were released two to three seasons after the crop loss and thus had a little role in stabilizing the immediate income fluctuation resulting from the crop loss. This observation is in line with the observations of Mukherjee and Pal (2017). Second reason was the low compensation amount which was not enough to stabilize the fluctuations.

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The least ranked reason was that the farmers' perception about the loss. A very few farmers opted insurance as they were sure about the loss. The crop loss depends on the availability of water and other weather parameters. Every time the farmers invest with a prospect of getting a good crop and very few subscribe to crop insurance with an anticipated crop loss in mind. Majority of the farmers were dependent on the relief funds from the government in the occurrence of a severe crop loss.

4.3.2.7 Constraints in adoption of crop insurance programme

The analysis of the factors that led to the adoption of crop insurance schemes showed that majority of the farmers subscribed crop insurance schemes as it was compulsory to avail crop loans. From the secondary data collected, it was seen that the proportion of non-loanee farmers availing crop insurance was extremely low. Reasons for the very low rates of voluntary subscription of crop insurance schemes were recorded and ranked using Garrett's ranking technique and is presented in Table 4.23.

Table 4. 23 Constraints in adoption of crop insurance schemes

Sl. No.	Constraint	Garrett's score	Rank
1	Delay in the payment of claims	75.23	I
2	Inadequate claim amount	72.05	II
3	Not satisfied with area approach	65.63	III
4	Complex documentation procedure	58.22	IV
5	Not aware of crop insurance schemes	53.87	V

The major constraint documented was the delay in payment of claims. Even though the schemes had a set deadline to settle the claims, it was observed that settlement of claims was delayed by one to two seasons. Due to the same reason, the farmers cannot depend on crop insurance schemes to manage the fluctuations in income which occurred immediately after the crop loss. Dissatisfaction due to delay in settlement of claims had been highlighted by Nair (2010).

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The respondents ranked inadequacy of claim amounts as the second most serious constraint in adopting crop insurance schemes. The farmers invest for profit and the present crop insurance schemes calculates claims based on cost of cultivation. Again, when the claims are calculated based on weather-based indices, farmers might be paid lesser amount compared to the actual loss. Farmers received a part of the cost incurred for farming in the form of subsidies from the government. But even with the subsidy availed in direct and indirect forms, farmers complained that the amount received as claims failed to stabilize the income fluctuations.

The third most ranked constraint was the dissatisfaction with area-based approach. The farmers complained that the crop loss incurred by different farmers with in a designated homogenous area differed widely and thus, paying same rate of compensation for different levels of crop loss made the schemes less attractive. The farmers who were outside the designated area but with the same or more severe crop loss, would not be eligible for the claims. Raju and Chand (2007) also recorded this as a potent issue affecting the popularity of the schemes.

Complexity in documentation of crop insurance schemes and lack of awareness of the schemes were ranked fourth and fifth respectively by the respondents. Even though documentation was a complex procedure, the farmers had limited role in doing that. Most part of the procedure is either completed by the bank staff or the insurance agent. That might be the reason why the constraint was ranked fourth. Meenakshi and Pranav (2019) observed that 65 per cent of the farmers of the country were unaware about the existence of the schemes. A similar observation was made by Cole *et al.* (2012). The results from the study area was contradictory to these findings. Majority of the farmers knew about the existence and operation of the crop insurance schemes. Hence, lack of awareness regarding crop insurance was one of the least ranked constraints in the study area.

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4.3.2.8 Analysis of the knowledge questions

A number of questions were asked to the respondents to get a basic idea about their knowledge on crop insurance programmes and the operation of the schemes. Analyzing the knowledge questions would help us in getting a better understanding about those aspects of crop insurance programmes which are to be delivered to the farming community through extension activities. The questions used and the percentage of farmers who had and did not have knowledge on that particular aspect is presented in Table 4.24.

Table 4.24 Knowledge questions and awareness levels on aspects of crop insurance

Sl. No.	Question	Percentage of farmers who answered correct	Percentage of farmers who answered wrong
1	Operation of PMFBY	33.33	66.67
2	Basic terms related to schemes	38.89	61.11
3	Calculation of compensation.	29.44	70.56
4	Crop cutting experiments?	21.62	78.83
5	Existence of other schemes.	29.44	70.56
6	Voluntary subscription.	57.78	42.22
7	Subsidies in premium	32.22	67.78
8	Reasons of compensation	37.78	62.22
9	Activities of crop insurance agents	59.44	40.56

It was remarkable to note that even though most of the farmers were aware of the existence of crop insurance schemes, they had limited knowledge about the different designs available to them. Almost all farmers in the region had received a letter stating the policy of PMFBY and still 66.67 per cent of the farmers were not aware of the existence of the scheme. Thus, it was obvious that even though the farmers had subscription, compulsory enrolment has made them less aware of the variety of schemes available to them. Farmers also lacked knowledge on basic terms related to insurance. This was attributed to large number of respondents falling in the category of primary and lesser levels of education. Another important observation is that 70 per cent of the farmers had no idea about the

calculation of compensation. This was a very important observation as lack of knowledge in this aspect can lead to higher degree of dissatisfaction when the claims are released to the farmers. Most of the farmers did not read the policy documents and suppose that they will be paid an amount close to the cost of cultivation in the event of a crop loss. If the farmers had a better understanding about the design, this over estimation of likely compensation, which lead to discontent can be brought down to a large extent. The authority implementing the scheme should try to give the farmers clarity on the calculation of compensation and the extend of compensation. Lack of knowledge on crop cutting experiments also lead to the fact that majority of the farmers were not aware of the field level procedures of claim calculation.

The knowledge about other existing designs was also very limited among the farmers. This might have happened as most of the farmers had adopted insurance due to the compulsion from the banks or the Padashekara Samithies and considered subscription as one of the steps in the procedure for obtaining a loan or a membership.

It could be noted that the awareness about voluntary subscription and that of the agents for crop insurance were almost the same. This was attributed to the activities of the insurance field agents engaged in the study area. It was an irony that even with the involvement of these agents, the farmers' awareness on other aspects of crop insurance was limited. After the bundling of crop insurance schemes with the crop loans, the role of field agents had become very limited.

Majority of the farmers had a little idea about the share of the state and central governments which they receive as a subsidy from the actuarial gross premium rates. It is interesting to note that some of the farmers who had awareness about the subsidies and the gross premium amount were utterly discontented about the schemes and claimed the actuarial premiums to be very high, considering the claims they had received in the past.

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Above 60 per cent of the farmers did not have accurate knowledge on the reasons for which they will be compensated. This might be due to the fact that most of them had not gone through the policy documents before subscribing. Those who had WBCIS subscription anticipated that they will be compensated for any weather-related peril and did not have clarity about the categories or quantum of deviation of weather parameters which would make them eligible for the claims.

4.4 FACTORS AFFECTING VOLUNTARY SUBSCRIPTION OF CROP INSURANCE SCHEMES

4.4.1 Logistic Regression Analysis

Logistic regression model was fitted to find out the factors affecting voluntary subscription of crop insurance schemes by the sample farmers. The lower value of residual deviance compared to that of the null deviance shows that the model is a good fit. The estimates of the logistic regression model are presented in Table 4.25.

Table 4.25 Estimates of logistic regression model for evaluating the factors influencing voluntary adoption of crop insurance

Variable	Unit	Coefficient	Odds ratio	z value	P value
Age	Years	0.032	1.03	0.926	0.3546
Area	Acre	0.008	1.00	0.020	0.3546
Experience	10-30 years	0.333	1.3	0.458	0.6469
	Above 30 years	0.239	0.79	-0.311	0.7555
Occupation	Government	1.226	3.40	1.148	0.2509
	Semi government	1.099	3.00	1.315	0.1885
	Private sector	1.077	2.93	1.289	0.1974
	Self-employed	0.774	0.75	-0.518	0.6044
	Un paid labour	.385	0.95	-0.64	0.9489
Education	Upper primary	1.356	3.88	2.040	0.0414
	High school and pre-degree	1.486	4.41	2.350	0.0188
	Degree	2.787	16.32	3.090	0.0020
	Professional degree	1.457	4.29	1.154	0.2485
Null deviance: 237.72 on 178 degrees of freedom					
Residual deviance: 198.36 on 163 degrees of freedom					

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It was observed that, only levels of education had significant influence on the voluntary adoption of crop insurance schemes. Farmers in the second and third category showed significance at five per cent level while those in the fourth category of education showed significance at one per cent level. The log odds of a farmer in the second category was 1.356 than that of a farmer in the base category, ie., primary education. Farmers in the fourth category had log odds of 2.787 of adopting insurance voluntarily than due to compulsion as compared to the farmers in the base category.

As inferred from the odds ratio, the chance that a farmer in the second category adopts crop insurance voluntarily, compared to adopting it due to compulsion was 3.8 times higher with respect to the first category as base. Similarly looking at the odds ratio, the third and fourth categories of farmers had 4.41-times and 16.23-times higher chances of subscribing the crop insurance voluntarily than due to compulsion, with the first category as the reference. The farmers with degree level of education were more attracted towards insurance as they were aware about the benefits of the insurance schemes. Thus, educating the farming community about crop insurance and its benefits could lead to an increase in the rate of voluntary subscription of crop insurance schemes. None of the other factors included in the model showed significant influence in the voluntary adoption of schemes

4.5 WILLINGNESS TO PAY FOR CROP INSURANCE PROGRAMMES

Farmers' premium, which is a part of the total premium paid to the insurance agency along with the share of central and state government was an important factor that determined the participation of farmers in insurance programmes (Swain, 2013). The premium rate for insuring for an acre paddy land at the time of the study was ₹400, which was 1.5 per cent of the actuarial premium. The rest of the premium was borne by the government in the form of premium subsidies. Though, the Government was paying high actuarial premium

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rates (Bhushan and Kumar 2017), the adoption of crop insurance was found to be very low in India (Mukherjee and Pal, 2017).

A major complaint against the crop insurance schemes was that the farmers were not getting enough compensation for the crop loss that they suffer. This was mainly due to the area-based approach in loss estimation in which all the farmer in a particular area were supposed to have faced equal crop loss. Therefore, if there was heterogeneity in damage across the region due to localized events, there were chances that individuals were not able to demand claim for the loss incurred. Even though there existed a provision for reporting the localized damages, there were lot of challenges and it also needed an additional cost to be incurred for administration. The emerging technology such as satellites and drones could help in assessing the damages at the individual level. But the field level implementation and use of these technologies are very expensive. The present study explored the WTP for a new insurance product (hypothetical) which could ensure loss assessment at individual level using such advanced technology.

The WTP for the proposed crop insurance scheme was elicited using Contingent Valuation Method (CVM). Single Bounded Contingent Valuation Method (SB-CVM) was used to estimate the WTP of the farmers. This method provides better estimates of WTP than direct elicitation. Some of the important biases in CVM are starting point bias, vehicle of payment bias, hypothetical bias, strategic bias etc. Due to starting point bias, the valuation gets anchored around the initial bid. So in the study, the bids were randomized to eliminate the starting point bias.

In the estimation process, there were totally six bids starting from ₹300 to ₹800, with ₹100-rupee difference between successive bids. The existing rate of payment for WBCIS was ₹400 and thus bids from ₹300 to ₹800 were included so as to avoid the anchoring effect and to get a better spread of values to both sides of the existing rate. Lots were drawn at random using random chit method in front of the farmers. The researcher checked for the distribution of initial bid amounts,

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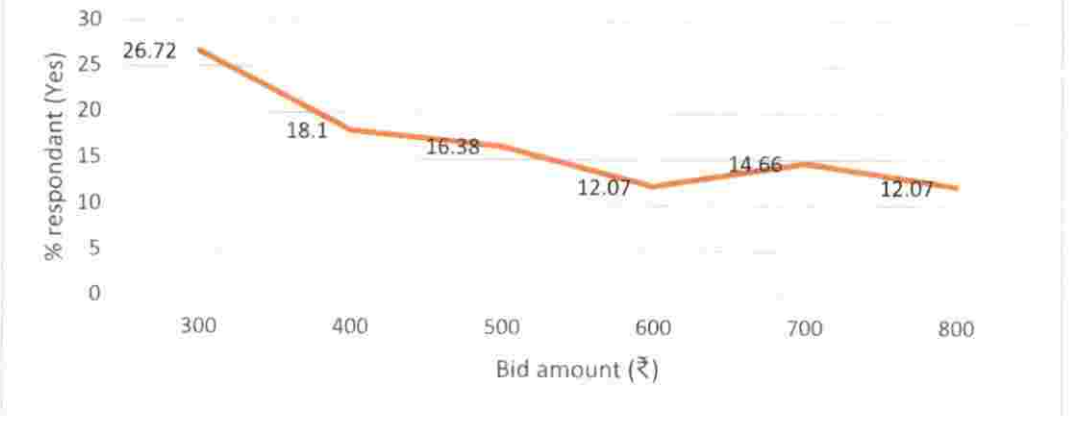
which ensured randomization of the initial bids. Table 4.26 showed that the frequency of initial bids was similar, inferring that the bids were drawn in random.

Table 4.26 Distribution of initial bid employed in contingent valuation method for estimating the Willingness To Pay

Sl. No.	Initial bid amount	Frequency	Percent
1	300	33	18.33
2	400	28	15.56
3	500	32	17.78
4	600	27	15.00
5	700	32	17.78
6	800	28	15.56
	Total	**180**	**100**

Another approach to estimate the robustness of the elicitation process is to do 'price test' (Carson, 2000). By demand theory, as the price of the product increases the demand for the product should decrease. The researcher tabulated the initial bid offer and the frequency of responses accepting the offer (captured as dummy; 1 = yes, 0 = no). Figure 9showed that, with increase in the amount of bid the share of people accepting the bid came down.

Figure 9 Distribution of initial bids and corresponding answers to estimate WTP



4.5.1 Model results

The WTP for the proposed crop insurance was estimated using probit model employing Maximum Likelihood Estimation procedure. The results from the probit model are shown in Table 4.27. The model parameters showed that the model fit is good (LR $chi^2(9) = 33.98$, Prob> $chi^2 = 0.0001$, Pseudo $R^2 = 0.1463$).

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One bid value and area under cultivation were found to be the significant at 1per cent and 10 per cent level of significance respectively. The signs of the variables used in the model were similar to the previous studies. Aditya and Kishore (2018) had shown that age of the farmer had a negative relationship, while experience and area under cultivation had shown a positive relationship. With the increase in age farmers are less reluctant to participate in insurance. On the other hand, demand for insurance for farmers with larger land holding is high as they are economically well-off and can afford crop insurance. Negative relationship between age and demand for crop insurance and positive relationship between cultivated area and demand for crop insurance was also observed in studies in other countries (Abebe and Bogale 2014; Liesivaara and Myyra 2014). The results of the probit model used for estimating WTP are presented in Table 4.27.

Table 4.27 Results of the probit model for estimating WTP for the proposed crop insurance scheme

	Model 1			Model 2		
Variables	Coefficient	Standard Error	P value	Coefficient	Standard Error	P value
Bid	-0.003	<0.000	0.000	-0.003	0.001	<0.001
Age (Years)	0.009	0.012	0.456	-0.010	0.020	0.604
Sex (Male/Female)				-0.400	0.258	0.120
Education						
Upper primary				0.380	0.326	0.243
High school/ Pre-degree				0.236	0.301	0.431
Degree				0.489	0.444	0.270
Farming Experience						
10 -30 years				0.079	0.389	0.840
>30 years				0.648	0.419	0.122
Area cultivated (Acre)	0.072	0.039	0.066	0.084	0.047	0.071
Constant	1.163633	.7230632	0.108	1.519	1.139	0.182

Note: P value <0.001 means significance at 1% and P value <0.100 means significant at 10 %.

The WTP for new insurance product was estimated using the coefficient estimates from model 1 and the estimated WTP was ₹710 per acre or ₹1,753 per

ha. The estimates were also statistically significant (Table 4.28). Estimates showed that farmers were ready to pay an additional ₹310 for a crop insurance scheme with the specified changes of individual crop loss assessment, calculation of claims based on farm gate/ procurement prices, use of satellite and other technology for crop loss assessment and ensuring claim settlement within 45 days of reporting of crop loss.

Table 4.28 Estimated WTP for new crop insurance

	Coef.	Std. Err.	Z	P>z	[95% Conf.	Interval]
WTP	710.0685	50.98718	13.93	0	610.1354	810.0015

4.6 SUGGESTIONS TO IMPROVE THE EXISTING CROP INSURANCE SCHEMES

Crop insurance schemes were designed to help farmers to stabilize their income during periods of yield fluctuations. But when the reasons for adoption of crop insurance were analysed using the Garrett's ranking method, it was found that majority of the farmers subscribed crop insurance schemes due to compulsion. The proportion of farmers with the opinion that crop insurance could provide financial security was very low. From this, it could be inferred that the crop insurance schemes had failed to attain the objectives that were intended during the product design. An attempt was made to find out the major drawbacks and record the suggestions of the farmers to improve the efficiency of the schemes. The suggestions were recorded and ranked using the Garrett's ranking technique and the results are presented in Table 4.29.

Table 4.29 Suggestions to improve the existing crop insurance scheme

Sl No.	Suggestion	Garrett's score	Rank
1	Timely settlement of claims	73.39	1
2	Ensuring adequate compensation	72.49	2
3	Introducing individual coverage	62.58	3
4	Administering through Krishi Bhavans	61.76	4
5	Delinking from crop loans	54.86	5

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The most common suggestion made by the farmers was the assurance of timely payment of the compensation. This is in line with the findings of Nair (2010) that one of the most serious issues associated with crop insurance schemes was the delay in settlement of claims resulting from the lengthy procedure of the assessment of crop loss. With the delay in settlement of claims, the farmers did not get the anticipated benefits from the schemes. With the delay in settlements, the farmers were forced to resort to other measures to cope with the shortfall in income, which in turn affected the ability of the farmer to invest in the next crop. Timely settlement of the claims could enhance the popularity of the crop insurance schemes to a greater extent.

The suggestion that ranked second was to ensure adequate amount of compensation. The claims are being calculated based on the levels of indemnity using the weather-based indices and the cost of cultivation. Farmers were dissatisfied as the changes in weather variables were not truly representing the yield loss. When the calculations were based on weather indices, farmers did not get adequate compensation even on the incidence of a major crop loss and at times they were paid compensation even without any actual yield reduction. Assuring farm gate price for the lost crop and improving the methods of crop loss assessment would have huge impact on the acceptability of the crop insurance schemes.

Third rank assigned through Garrett's ranking was to follow individual approach instead of the existing area-based approach. Farmers in a locality did not suffer equal crop loss for an equal change in a weather variable. The locations from where the data was collected may not truly represent the whole area. For a specific change in a weather parameter, the yield loss may depend on various factors specific to each farm like location, soil etc. When farmers with higher risks and lower risks were equally charged and compensated, one section will always remain dissatisfied and this will have a negative effect on the popularity and voluntary subscription of the schemes.

The fourth important suggestion was to administer the crop insurance schemes through the Krishi Bhavans. Farmers who chose this option quoted that they have more access to Krishi Bhavans and its officials than that of banks. The farmers had to be in constant contact with the Krishi Bhavans for various assistance and services. Thus, administering central schemes through Krishi Bhavans would give the farmers more access to information and clarification related to the schemes.

A very few farmers also wanted the crop insurance schemes to be delinked from the crop loans. The farmers who opted this were mostly dissatisfied with the crop insurance schemes and were not happy with the compulsory enrollment in the schemes. They stated that the risk of crop loss was different in different seasons and the farmer should have the freedom to decide on which season to purchase the insurance.

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Summary and Conclusion

6. SUMMARY AND CONCLUSION

The present study entitled "Crop insurance schemes for paddy in Palakkad district - An economic analysis" was conducted in the district of Palakkad, Kerala. The objectives of the study were to analyse the performance and progress of crop insurance schemes in Kerala, to assess the viability of crop insurance schemes, to identify constraints in the adoption of crop insurance, to determine the factors influencing the adoption of crop insurance for paddy and to estimate the Willingness To Pay (WTP) for crop insurance schemes.

Palakkad district was purposively selected for the study as Palakkad accounted for maximum number of claims under the WBCIS in 2017-18 for paddy and is one of the leading producers of rice in the state of Kerala. Two blocks with maximum claims under Weather Based Crop Insurance Scheme were selected for the study. Four panchayaths, two from each block having the maximum amount of claims distributed for the past season (2016-17) were selected again. The list of farmers was obtained from the Krishi Bhavans of the respective Panchayats and also from the regional office of the Agricultural Insurance Company of India Limited. From each of the selected Panchayath, 20 farmers who have subscribed the WBCIS and 25 farmers who have subscribed the state crop insurance scheme were selected, constituting a sample size of 180. Time series data on the area, production and productivity of paddy was collected from Economic Review, Government of Kerala and district-wise time series data on area and sum insured and claims paid over years were collected from the Directorate of Agriculture, Government of Kerala.

The secondary data on the area, production and productivity of paddy in the state and the district of Palakkad was analysed and it was found that area and production declined from 1980-81 to 2017-18, for both the state and the district as shown by the negative growth rates. Productivity of paddy increased for both Kerala and Palakkad, but the growth in productivity was higher for the state when compared to that of Palakkad district. Decomposition analysis of production showed that the combined negative area effect and the negative area-productivity

interaction effect more than offset the positive productivity effect, resulting in fall in production

The analysis of the secondary data on crop insurance subscriptions from 2002-03 to 2018-19 showed a positive Compound Annual Growth Rate (CAGR) of 25.47 per cent per annum and the gross premium collected showed a CAGR of 32.37 per cent per annum. The share of insured area under cultivation to that of gross cropped area also showed a positive growth. This was higher in the case of paddy than for all crops considered together. It was also observed that paddy contributed about 38 to 89 per cent of the insured area in the state. An examination of the distribution of insurance subscribers showed that about 97 per cent of them were loanee farmers which suggested that the main reason for the growth of crop insurance schemes as estimated was the enforcement of strict laws of compulsory enrolment of loanee farmers in crop insurance scheme. The viability of the schemes was analysed using the claims to premium ratio and it was found that both the state and national crop insurance schemes operational in Kerala showed a claims to premium ratio above one, which indicated that the schemes were not viable on their own.

The socio-economic characteristics of the respondents with respect to age, gender, education, experience in farming, land holding pattern, occupation and income were analysed using the primary data. The respondents were classified into six different groups based on their age. It was observed that majority of the respondents (42.78 per cent) were aged between 50 and 59. It was noted that there were no farmers below 30 years of age. This indicated that the young generation is moving away from farming. In the overall sample, about 77 per cent of the respondents were males and 22.78 per cent were females. Even though majority of the farmers were literate, about 40 per cent of the farmers had education only up to the upper primary level. Only 16 per cent of the respondents were graduates. About 69 per cent of the respondents had experience of 30 years or more in farming. Majority of the farmers had marginal holding of less than one hectare. Nearly 46 per cent of the respondents practiced farming as their primary

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occupation. About 80 per cent of the respondents had an annual income of less than ₹2 lakh.

The cost of cultivation of paddy in Nenmara and Kollengode blocks of Palakkad estimated based on cost concepts *viz.,* Cost A, Cost B and Cost C. Cost A1 and A2 were found to be similar because the respondents were not cultivating paddy in leased land. Cost A1 and Cost B1 were also found to be same, as the implements used for cultivation of paddy were owned by the workers, and not by the farmers. The rents of implements used were included in the wages paid to the workers. The cost of cultivation per hectare was found to be higher for Nenmara block (₹1,34,395) when compared to that of Kollengode block (₹1,31,645). The average cost of cultivation was estimated to be ₹1,33,021 per hectare. Cost A1 was ₹81,622. Cost A2 and B1 were also the same as mentioned above. Cost B2 was estimated to be ₹1,30,377 per hecatre. Labour was found to contribute maximum to the cost of cultivation. The major reason for the difference in cost of cultivation among farmers was due to the difference in amount spent for weeding which varied between ₹5,250 to ₹14,000 per hectare. The average cost of production of paddy was estimated to be ₹2,991 per quintal.

Various income measures were worked out for the cultivation of paddy in the district. Gross income was found to be ₹1,37,008 per hectare and the net income was ₹-9,453 per hectare. The B:C ratio was 0.94 and BC ratio at explicit cost was found to be 1.7. The major constraints in the production of paddy in the study area were identified and ranked using Garrett ranking technique. Inadequate water supply, excessive weed growth, issues related to procurement of the produce, pest and disease infestation and abnormal weather pattern were ranked first, second, third, fourth and fifth respectively.

In order to manage the income variability arising out of the crop loss, majority of the farmers depended on gold loans. Borrowing from friends and relatives, depending on savings, borrowing from the money lenders, sales of fixed assets and relying on crop insurance or government relief programmes were the

other measures adopted by the farmers. It has to be noted that the farmers chose crop insurance as the least preferred measure to cope with income variability. The reasons for such an observation were identified and ranked. It was found that the major reasons were delay in settlement of claims and inadequate compensation through crop insurance schemes followed by other reasons like dissatisfaction with area approach and complex documentation procedure. Analysis of the reasons for crop insurance subscription showed that majority of the farmers opted insurance as it was mandatory for availing crop loans and getting any kind of assistance from the Krishi Bhavans. Awareness about the benefits of crop insurance schemes, financial security offered by the schemes and high perception of loss received the subsequent ranks.

The analysis of the knowledge questions showed that even though the farmers were aware of the existence of crop insurance schemes, most of the farmers were not aware about the basic aspects of crop insurance such as computation of claims, crop cutting experiments, subsidies in premium and existence of schemes like coconut palm insurance. The factors affecting voluntary subscription of crop insurance schemes were found using logit regression model and the results revealed that education was the only factor that significantly influenced the voluntary adoption of crop insurance. The odds of a farmer with graduate level of education that he subscribes to crop insurance voluntarily than due to compulsion, was found to be 16 times higher as compared to a farmer with primary education.

The WTP for a crop insurance scheme with features of timely settlement of claims, usage of drones and satellite imageries for crop loss assessment and claims based on farm gate price of the produce was elicited using single bounded contingent valuation method. The WTP was estimated to be ₹1,753 per ha using probit model employing Maximum Likelihood Estimation method. The suggestions for improving the existing crop insurance schemes were identified and ranked. Majority of the farmers assigned first, second and third ranks to

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timely settlement of claims, ensuring adequate compensation and introducing individual coverage respectively.

Policy suggestions

- As delay in the settlement of claims is a major issue leading to the unpopularity of crop insurance schemes, measures should be taken to ensure that the claims are settled within the stipulated time period. Use of hand-held devices and other technologically advanced tools for crop loss assessment are to be encouraged. The state should make best use of the 50 per cent subsidy by the central government for developing infrastructure and purchase of advanced tools for faster crop loss assessment.

- Inadequacy of claim amount was one of the major constraints in the adoption of crop insurance by the farmers. The amount seems inadequate as sum insured is based on the cost of cultivation. Calculating claims and sum insured based on procurement price of the produce will make the schemes more appealing and popular.

- Introduction of schemes based on individual approach rather than area-based approach would enhance the voluntary adoption of crop insurance schemes. While designing schemes based on individual approach, care should be taken to eliminate issues of moral hazard and adverse selection.

- Farmers with higher levels of education were more aware of the benefits of the crop insurance schemes. So, to enhance voluntary adoption of crop insurance schemes, awareness about benefits of the schemes should be imparted to the farmers. Krishi Bahvans, Krishi Vignan Kendras and other extension networks of the state should be employed for the same.

- Farmers in the study area were found to be willing to pay higher premium rates than the existing ones, if claim settlement was made on time, claims were calculated based on procurement prices and provisions to accommodate individual losses were made practical in the existing schemes. WTP for crop insurance schemes can be elicited from farmers in different Agro-Ecological Zones to modify the existing premium rates for different crops.

- Administering crop insurance schemes such as PMFBY and WBCIS through Krishi Bhavans (KB), after ensuring adequate man power in the KBs will give the farmers more access to information related to crop insurance as KBs are more accessible and approachable to the farmers.

- Details of various phases from processing of the application to release of claims, to the farmers account may be intimated through Short Message Services (SMS) or ordinary mails to make the farmers aware about the status of their policy and to enhance transparency in implementation of the schemes.

- The role of Padashekara Samithies in enrolment of paddy farmers in the State Crop Insurance Scheme (SCIS) was found exceptionally commendable. The Samithies also helped farmers in various other aspects of crop production, marketing and sales. The administrators should try to expand such models to other crops and empower the Samithies as and when required.

- Weather based indices often fail in accurately predicting the amount of crop loss for a specified change in any of the weather parameters. Therefore, crop-weather relation studies should be given more importance and robust efforts may be taken to develop weather-based indices that are more accurate and have better precision in predicting crop loss.

- Risk mitigation measures such as irrigation management and crop protection should be made more efficient as ex-ante measures are considered better than ex-post measures of risk management.

- As the major share of the cost of cultivation is accounted by human labour, operations like transplanting and weeding should be mechanized to larger extent to cut down the cost. Better utilisation of the mechanisation facilities created by the state department of Agriculture through Agro-Machinary Operation Service Centre (AMOSC) and Agricultural Technology Management Agency (ATMA), the Mahila Kissan Sashaktikaran Pariyojna (MKSP) - Green Army and the food security army of KAU is suggested.

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Appendices

KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF HORTICULTURE

Department of Agricultural Economics

Interview Schedule

District: **Block:** **Village:**

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1). General:

Name :

Age :

Address :

Phone No :

2). Family particulars

Sl.No	Name	Sex	Age	Education*	Occupation		Income
					Main	Subsidiary	
1							
2							
3							
4							
5							
6							

*(Primary-1, Upper primary-2secondary -3 , Higher secondary-4, college -5 illiterate-6)

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3). Land Particulars:

(In acres)

Sl. No	Particulars	Wet Land		Garden land		Rain fed		Total value
		Area (Acre)	Value	Area (Acre)	Value	Area (Acre)	Value	
1	Owned							
2	Leased in							
3	Leased out							
4	Total							

4). Cropping pattern

Sl. No.	Crops	Var.	Season	Duration	Area	Production			Gross income
						Qnt. (kg)	Price (Rs)	Value (Rs)	
1									
2									
3									
4									

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5). Sources of Income

Sl. No	Source	Amount (Rs)	% Of total
I	**On Farm**		
a)	Crop		
b)	Livestock		
c)	Poultry		
d)	Dairy		
e)	Others		
II	**Off Farm**		
III	**Non Farm**		
IV	**Total**		

6). Asset particulars

Sl. No.	Particulars	Number	Value
1	**Livestock**		
	i) Cow		
	iv) Hen		
	v) Others		
2	**Machineries**		
	i) Tractor		
	ii) Tillers		
	iii) Power sprayer		
3	Farm House		
4	Cattle shed		
5	Tools and implements		
6	Others		
	i) Winnower		
	ii) Harvester/Thresher		
	iii) Buildings		

7). Farm Buildings:

Sl. No	Particulars	No	Type (P/K)	Year of construction	Value(Rs)
1	Farm house				
2	Cattle house				
3	Store house				
5	Implement shed				
6	Threshing floor				

8). Loans availed

S. No.	Purpose	Season / Year	Source	Amount Borrowed	Amount paid	Insured/ Non-insured
1.						
2.						

10). Ranking of risks associated (production and market centric)

Sl. no	Source	Rank
1	Weather	
2	Soil health	
3	Seed quality	
4	Fertilizer quality	
5	Water availability	
6	Pest	
7	Disease	
8	Weeds	
9	Calamity	
10	Storage constraints	
11	Transport constraints	
12	Communication constraints	
13	Issues in marketing	
14	Demand forecasting issues	
15	Price fluctuations	
16	Issues in procurement	
17	Others	

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11). Have you suffered yield fluctuations in the past (last five years)?

Sl. No	Parameter	Yes / No	Loss in yield	Loss in income
1.	Frequency of drought (Periodicity)			
2.	Delayed on set rainfall (No. Of days)			
3.	Erratic rainfall pattern			
4.	Too much rain			
5.	Low rain			
6.	Higher temperature			
7.	Earlier on – set of rainfall			
8.	Pest and disease			
9.	Loss during harvest/ drying due to erratic weather pattern			
8.	Others			

3). Is there any recurring factor leading to crop loss in the area?

12). Income management against climate variability:

Sl. No.	Source	Rank
1	Savings (Bank savings, deposits, bonds)	
2	Sale of stored produce	
3	Sale of fixed assets: sale of trees	
4	Borrowing from friends and relatives	
5	Borrowing from money lender	
6	Hypothecation of assets / jewelry	
7	Bank loan	
8	Agricultural labor	
9	Government relief	
10	Crop insurance	
11	Livestock insurance	
12	Others (Specify)	

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13). Awareness of farmer about crop insurance (Insured farmer)

1. Have you heard of PMFBY (Y/ N)
2. Insurance is for (Increase income/ Reduce risk)
3. What is the amount that we pay to get insurance is called as (Premium/ sum insured/ Compensation)
4. Do you know how compensation is calculated (Y/N). How?
5. Have you heard of Crop Cutting Experiments (Y/N), other methods of yield estimation
6. Do you know about the state insurance scheme?
7. Do you know about WBCIS?
8. Do you know that your premium is subsidized by the government?
9. Do you know the reasons for crop failure that you will be compensated for?
10. Do you know about agents for crop insurance?

14). Follows/Not

Have you insured crop during last season?

If yes / why? Reason: i)

If Not Reason:

15). What is the source of information about crop insurance scheme?

i) TV/ Newspaper ii) Development Agencies

iii) Friends relatives iv) Other farmers

v) Insurance Agent vi) Internet

vii) Dept. of Agriculture / Govt. viii) Others

16). Type of insurance: WBCIS/ State crop insurance

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17). Details on insurance by beneficiaries:

Sl. No.	Particulars		Remarks
1.	Season		
2.	Experience in crop insurance (Years)		
3.	Sum insured (Rs)		
4.	Premium paid (Rs) Affordability to premium rate (Yes/No)		
5.	Time of premium payment: 1. 2. 3.		
6.	Expected yield in the year (bags / kg)		
7.	Normal yield in the year (bags / kg)		
8.	Threshold yield (bags/kg)		
9.	Extent of loss Cause of loss	: In the area (bags/percent) : In your farm (bags / percent)	

18). History of crop loss in previous years? Yes / No

If yes, please give details:

Year/ Season	Premium (Rs.)	Cause of crop loss, if any	Total loss (Rs)	Claim amount (Rs.) (If received)

If you were offered crop insurance, would you go for it?

Yes /No

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19). If yes, what is reasonable premium you are willing to pay (revealed)

Percentage of sum assured	**Rs. per acre under the crop**
1- 2%	100- 200
2 – 3 %	200 – 300
3 - 4%	300 – 400
4 - 5%	400 – 500

A. Willingness to Join

1. Based on your knowledge and experience, will you join a crop insurance programme?
   (Yes=1, No=0) _____
2. If yes, why would you join
   _____
3. If No, why will not join _____

If yes in Q2. Ask Willingness to pay.

B. Willingness to pay

Quantity of "X" to be selected randomly from (1-10 bits). Make chits from 1-10 and draw one chit in random.

1. **Initial "X" drawn from the bit _____**

1.	Are you willing to pay "X" times the percentage of sum insured? [Yes=1, No=0]		If No go to Q3, If Yes go to Q2
2.	Are you willing to pay (X+1) times the amount quoted? [Yes=1, No=0]		If Yes go to Q4
3.	If No in Q1, are you willing to "X-1" times the amount quoted? [Yes=1, No=0]		Yes or No, go to Q4
4.	What per cent you are willing to pay?		

20). what extent you are willing to bear agricultural losses (%) ----------

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21). Factors influencing the adoption of insurance:

Sl. No.	Factors	Rank
1.	Mandatory for availing crop loan	
2.	Financial security	
3.	Encouraged by experienced farmers	
4.	Aware of the benefits of insurance	
5.	Easy access to loan	
6.	Lack of diversification	
7.	Sure of loss	
	Others (specify)	

22). Constraints in adoption of insurance:

Sl. No.	Constraints	Rank
1.	Lack of awareness about the scheme	
2.	Low premium paying capacity	
3.	Availability of relief fund	
4.	Less crop loss	
5.	**Administrative reasons:**	
a.	Lack of access to banks	
b.	Lengthy procedure in opening bank account	
c.	Lengthy procedures in claiming insurance	
d.	Loan not received in time	
e.	Difference in the cut off dates	
f.	Delay in payment of loan/indemnity	
g.	Indemnity level was very less	
h.	Reluctant in insuring a single crop	
i.	Others (specify)	

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23). Which insurance service provider would you prefer for availing crop insurance?

Rural agent at your door step	Co-operative Bank	NGO's
Insurance Agent 's Office	RRB	Post Office
Commercial Office	SHG	Others

24). Constraints and opinion farmers who did not accept crop insurance voluntarily

- Not aware of crop insurance
- No faith in scheme / agency (opinion)
- Lack of premium paying capacity
- Not aware of the facilities available
- Not satisfied with crops covered
- Not satisfied with area approach
- Inadequate publicity of the scheme
- Nearest bank at a distance
- Complex documentation and processing work
- Lack of service / co-operation from the bank
- No need of insurance (opinion)
- Delay in claim payment
- Not satisfied with indemnity level
- Difficulties in opening bank account
- Loan taken from sources other than banks

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25). Suggestions of farmers for improvement of crop insurance scheme

- Agricultural insurance office established at block or tehsil level
- Delinking of crop insurance with crop loan
- Timely payment of compensation
- Adequate compensation
- Compensation should be paid on the basis of individual farmer or village average crop productivity
- Creation of awareness
- Making the procedures easy for the non loanee farmers
- Assistance to central schemes via Krishi Bhavans

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Cost of Cultivation of Crops

a) Crop:	b) Area: Acres.	Particulars	Quantity	Value (Rs)
c) Duration: days	d) Variety:	Main Product		
e) Season:		By Product		

Sl. No	Operations	Machine power			Bullock Power			Number of Days Worked				Wages Rs/day of 8 hours		Materials used		Total Cost (Rs)	Remarks
		Hired Hours	owned	Rate (Rs)	Hired	Owned	Rate (Rs) Pair- days	Family Labour Male	Family Labour Female	Casual Labour Male	Casual Labour Female	Male	Female	Quantity	Value (Rs),		
i.	Preparatory Cultivation																
	a) Nursery																
	b) Main Field																
ii.	Manures and Manuring																
	a) FYM																
	b) Fertilizers																
iii.	Seeds and Sowing																
iv.	Irrigation																
V.	After Cultivation																
	a) Thinning																
	b) Gap Filling																
	c) Weeding																
	d)Earthing up																
	e) Others (Specify)																
vi.	Plant Protection Measures																
	a) Fungicides																
	b) Pesticides																
vii.	Harvesting																
viii	Threshing																
ix.	Cleaning																
X.	Transport to Yard																
xii.	Total																

CROP INSURANCE SCHEME FOR PADDY IN PALAKKAD DISTRICT - AN ECONOMIC ANALYSIS

By

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ABSTRACT OF THE THESIS

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ABSTRACT

Agriculture in India has become an inherently risky venture due to uncertainty in production and price volatility of agricultural commodities triggered by increased climatic aberrations and globalization. Hence, crop insurance plays an important role in stabilizing farm income, ensuring credit flow in agriculture and decreasing over dependence on public exchequer for relief measures. Various insurance products along with stringent measures to enforce them were taken to enroll the maximum number of farmers in crop insurance. In spite of all these efforts, the adoption rate of crop insurance was still low and Kerala is one of the states with lowest growth rate of voluntary subscription of crop insurance.

With this background, the present study was undertaken to analyse the performance and progress of crop insurance schemes in Kerala, estimate the impact of crop insurance on paddy cultivation, assess the viability of crop insurance schemes, identify constraints in the adoption of crop insurance and estimate the willingness to pay for crop insurance schemes.

The study is based on both primary and secondary data. The time series data on area, production and productivity of rice in Kerala and Palakkad district from 1980-81 to 2017-18 was analysed. It was found that the area and production exhibited a decreasing trend whereas productivity showed an increase over the years. Primary data was collected from 180 selected farmers of Palakkad district using pretested interview schedule by personal interview method.

Time series data on the area insured, number of farmers insured, gross premium collected and claims settled for a period from 2002 to 2019 were collected from the Directorate of Agriculture, Government of Kerala. From the analysis, it was observed that the crop insurance coverage also displayed an increasing trend. The distribution of crop insurance subscribers during Kharif 2017 and Rabi, 2017-18 highlighted the fact that more than 97 per cent of the subscribers were borrower farmers suggesting that the growth in subscription was attributed to bundling of insurance schemes with crop loans. The claims to premium ratio, which should ideally be less than one, showed a cumulative average of 1.31 for the period under consideration and reflected the un-sustainable nature of the design of crop insurance products.

The cost of cultivation of paddy in the study area was found to be ₹78,819/ha and the major constraint faced by the farmers in crop production was inadequate supply of irrigation

water. The other constraints encountered were excess growth of weeds, delay in procurement and abrupt weather changes. The most preferred method of coping with income variations was availing gold loans and the major reason for subscribing to crop insurance scheme was compulsory enrolment. Delay in settlement of claims, inadequate compensation and dissatisfaction with area based approach were the major constraints in voluntary adoption of crop insurance schemes.

Logit regression model was employed to ascertain the factors affecting voluntary subscription of crop insurance programmes using gross cropped area, education, income, cost of cultivation and farm experience as independent variables. Levels of education showed significant influence over the decision of voluntary adoption of crop insurance schemes. The odds of a farmer with graduate level of education, that he subscribes to crop insurance voluntarily than due to compulsion, was found to be 16 times higher compared to a farmer with primary education.

The Willingness To Pay (WTP) for a crop insurance scheme with features of timely settlement of claims, usage of drones and satellite imageries for crop loss assessment and claims based on procurement price of the produce was elicited using single bounded contingent valuation method. The WTP was estimated to be ₹1753/ha using probit model employing maximum likelihood method. The suggestions for improving the existing crop insurance schemes were identified and ranked. Majority of the farmers assigned first, second and third ranks respectively to timely settlement of claims, ensuring adequate compensation and introducing individual coverage.

Ensuring claims based on procurement price of the produce; using drones, satellite imageries and other advanced technology for quicker crop loss assessment and implementing schemes based on individual coverage are recommended to address the constraints faced by farmers in adopting crop insurance. Administering the crop insurance schemes through Krishi Bhavans will make it easier for the farmers to have access to information related to the schemes as they are more acquainted with KBs than banks. The farmers' share of premium may be raised as high as ₹1753/ ha with the suggested improvements over the existing schemes.