FARM-LEVEL ANALYSIS OF NATIONAL AGRICULTURAL INSURANCE SCHEME IN ERODE DISTRICT OF TAMIL NADU

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TAMIL NADU AGRICULTURAL UNIVERSITY

COIMBATORE – 641 003

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Thesis submitted in part fulfilment of the requirements for the degree of

MASTER OF SCIENCE (AGRICULTURE) IN AGRICULTURAL ECONOMICS

to the Tamil Nadu Agricultural University, Coimbatore-641 003.

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CERTIFICATE

This is to certify that the thesis entitled **"FARM-LEVEL ANALYSIS OF NATIONAL AGRICULTURAL INSURANCE SCHEME IN ERODE DISTRICT OF TAMIL NADU"** submitted in part fulfilment of the requirement for the degree of **MASTER OF SCIENCE (AGRICULTURE) IN AGRICULTURAL ECONOMICS** to the Tamil Nadu Agricultural University, Coimbatore is a record of bonafide research work carried out by **Miss N. BRINDHA** under my supervision and guidance and that no part of this thesis has been submitted for the award of any degree, diploma, fellowship or other similar titles and that the work has not been published in part or full in any scientific or popular journal or magazine.

Place: Coimbatore **(Dr. P. PARAMASIVAM)**

Date: Chairman

Approved by

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Members : **Dr. K. R. ASHOK**

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(N. BRINDHA)

ABSTRACT

FARM-LEVEL ANALYSIS OF NATIONAL AGRICULTURAL INSURANCE SCHEME IN ERODE DISTRICT OF TAMIL NADU

By

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Degree : **Master of Science (Agriculture) in Agricultural Economics**

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Agriculture is beset with a number of risks and uncertainties. The presence of risks posses serious problems and hampers the rational decision making in perceiving agriculture. Agricultural insurance is considered an important mechanism to effectively address the risk to output and income resulting from various natural and manmade events. Uncertainty of crop yield is one of the basic risks, which every farmer has to face. The yield uncertainty arises from the excessive dependence on the vagaries of nature, which prevents farmers from maximizing production. Crop insurance is a means of counteracting the uncertainties involved in crop production. In this context the present study attempts to analyze the agricultural production/yield risk and its one of the coping mechanism of crop insurance through the National Agricultural Insurance Scheme. This study aimed at understanding the contribution of crop insurance scheme to risk reduction of farmers and its awareness in the selected area.

This study was conducted in Gobi, Sathy and Bhavani blocks of Erode district in Tamil Nadu. Data were collected from 120 households in total spread over in 3 villages in each of the selected block with two categories of insurers and non-insurers. The crops selected for this study were paddy, banana and turmeric from the each block respectively. The data collected were analyzed using the appropriate statistical tools like averages, percentages, instability index, logit regressions and Garrett's ranking technique.

Though, majority of the respondents had agriculture as their main occupation, some were engaged in own business along with agriculture and employed in different services. Paddy

and turmeric was the principal crop in the sample farms. It accounted for 23.63 per cent and 19.53 per cent of the total cropped area. Banana was the principal fruit crop in the sample farms. It accounted for 18.87 per cent of the total cropped area. The average farm size of paddy, banana and turmeric was 0.91 ha, 0.72 ha and 0.75 ha.

Marginal and small farmers together constituted 80 per cent of the sample farmers. The total cost of cultivation, on an average per ha was more in turmeric farms followed by banana and paddy farms. The coefficient of variation in yield of paddy, banana and turmeric was 8.13 per cent, 31.39 per cent, 14.5 per cent, respectively in the sample farmers. The coefficient of variation of these crops was comparatively higher than the variation of district. The yield instability index of paddy, banana and turmeric was 0.014, 0.035 and 0.040 in the last 10 years and the fluctuation also high in banana and turmeric. These results indicate that the prevalence of production risk of these crops were higher in the sample farms.

Among the three crops banana (53.77 per cent) has higher yield loss followed by turmeric (17.41 per cent) and paddy (3.58 per cent). Number of farmers and area covered in crop insurance was maximum in turmeric crop followed by banana and paddy crops. The insured farmers in the study area are only the loanee farmers who availed crop loan from the financial institutions. The crop loan increases the adoption of insurance scheme. The logit model indicated that the family size and off-farm and non-farm income were the significant factors influencing the farmers' availing crop loan in the study area. Reasons for production risk as perceived by sample farmers were ranked using the Garret score and ranking.

From the past claims, it is observed that the crop loss restored by the sample farmers was only 35 per cent for paddy, 30 per cent for banana and 33 per cent for turmeric. The gap between the claims made and settled in the study area was also high.

Turmeric was having the maximum area of 22.89 per cent of the total area under the crop under insurance, followed by banana (8.95 per cent) and paddy (1.95 per cent). Almost all the insured and non-insured farmers were aware about crop insurance scheme, but their awareness was very much limited. The major lacuna in the crop insurance scheme was very much delay in the compensation and majority of the insured and non-insured farmers (68.89 per cent and 50 per cent) felt that crop insurance was the better way of reducing the impact of yield risk.

Policies implied from this study were 1) The cost of cultivation and price of the commodity should be taken into consideration during calculation of coverage level as against the coefficient of variation in the yields alone, which is beneficial to the farmers. 2) Monitoring mechanism by the insurance agencies could be strengthened and designed in order to facilitate appropriate compensation payment.3) Government should encourage the private agencies participation in the crop insurance sector to expand the area under insurance in the study area.

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CHAPTER I

INTRODUCTION

Agriculture remains an important economic sector in many developing countries. It is a source of growth and a potential source of investment opportunities for the private sector. Two-thirds of the world's agricultural value added is estimated to be created in developing countries (World Bank, 2008).

Agriculture is the mainstay of the Indian economy. Agriculture and allied sectors contribute nearly 17.1 and 16.3 per cent of Gross Domestic Product (GDP of India) during 2008-09 and 2009-10 respectively. India has reached a stage of self sufficiency but it is still dominated by nature, which means that the instability still haunts agricultural sector and seriously threatens the Indian farmer's ability to step up the agricultural output and their viability. The agricultural output, however, depends on monsoon as nearly 55.7 per cent of area sown is dependent on rainfall.

Agriculture in India is subject to variety of risks arising from rainfall aberrations, temperature fluctuations, hailstorms, cyclones, floods, and climate change. These risks are exacerbated by price fluctuation, weak rural infrastructure, imperfect markets and lack of financial services including limited span and design of risk mitigation instruments such as credit and insurance. These factors not only endanger the farmer's livelihood and incomes but also undermine the viability of the agriculture sector and its potential to become a part of the solution to the problem of endemic poverty of the farmers and agricultural labourers**.**

It has been observed that in the Indian sub-continent, fluctuations in crop yields have mainly been due to the inclemencies of weather. The presence of ups and downs in agricultural production over the years bears ample testimony to the continuing instability in agriculture. Instability in the agricultural sector cannot be completely eliminated, but its adverse effects can be minimized through various measures. Different strategies have been evolved by the government to combat these risks and uncertainities. Some of them include providing tax remissions, waiving off loans and interest on loans, drought or flood relied measures, etc.

However, a major hurdle in such types of relief is that such measures depend primarily on the policies as well as the resources of the government. Therefore, though these measures guarantee some security in a situation at uncertainity, it infact makes the farmers to wait in anticipation for some relief when there is a loss. Farmers on the other hand have sought to reduce those risks by utilizing modern technology, diversifying the agricultural operations, through intercropping or through the flexible use of fertilizers, pesticides, etc. But again, one major impediment here is that by and large financial facilities are utterly inadequate amongst the Indian farmers.

Thus, because of these drawbacks, the policy makers of the country have sought recourse to insurance of crops as a feasible measure to combat these risks and hazards and provide protection to the farmers. This will encourage them to carry on with their productive efforts, which not only improves the well being of the farmers but also ultimately help in stabilizing the agricultural output.

Agriculture is the single largest private sector occupation in the country and is also considered to be the riskiest business. Risk is a phenomenon when one realize that outcome of an event is very important but unsure about the occurrence of it. Risk is inherent in agriculture since it mostly depends on the vagaries of nature (Bhowmick, 2007). The vulnerable groups like landless labourers and sharecroppers face a variety of risks which have a bearing on their steady flow of income and their ability to build income generating assets (www.ifmr.ac.in).

In agricultural production, farmers expect certain yield. However, variability in such expected yield poses risks to farmer's ability to achieve financial goals. Production risks refer to the high variability of production outcomes due to the unpredictable nature of the weather, seasonal fluctuations, pest infestation and diseases which result in yield loss and ultimately revenue loss for the farmer (Report: XI five year plan, 2007-2012).

Agricultural production has always been risky, and production risk can be among the most uncertain and potentially devastating to a farmer. There are many risk management tools available to reduce production risk and it is essential to understand the options available when making risk management decisions. By utilizing these and other risk management tools to reduce the many different risks a farmer faces, producers can develop a stable and profitable farming enterprise despite the uncertainties inherent in agricultural production.

Agricultural insurance can help to stabilize farm income and investment and guard against disastrous effect of losses due to natural hazards or low market prices. Besides stabilizing the farm income, it also helps the farmers to initiate production activity after a bad agricultural year. It cushions the shock of crop losses by providing farmers with a minimum amount of protection. It spreads the crop losses over space and time and helps farmers make more investments in agriculture. It forms an important component of safety-net programmes as is being experienced in many developed countries like USA and Canada as well as in the European Union. However, one need to keep in mind that crop insurance should be part of overall risk management strategy. Insurance comes towards the end of risk management process. Insurance is redistribution of cost of losses of few among many, and cannot prevent economic loss.

Which tools a farmer uses should depends on his individual farm situation and risk-bearing willingness and ability. A major tool to manage production risk is insurance. Crop insurance policies are designed to protect farmers against yield loss from natural causes such as adverse weather conditions, disease, and insects. Agricultural insurance is one of the financial tools agricultural producers can use to mitigate the risks associated with adverse natural events that climate change may render more frequent and more severe in the future.

The agricultural insurance schemes both in developed and developing nations are highly dependent on the government support in various forms like subsidy on premium, reimbursement of administrative expenses of insurance companies, reinsurance support for risky crop lines, technical guidance and financial support. Subsidy on insurance premium in the recent years was estimated to be 60 per cent in USA, 70 per cent in Canada, 50-60 per cent in Philippines and 58 per cent in Spain. Over 100 countries in the world have some form of crop insurance. The USA, Canada, Mexico, and Spain dominate the world crop insurance market in terms of premium. The total annual agricultural insurance premiums, worldwide, in 2003 were US$ 7.1 billion which amounted to 0.6 per cent of estimated farm gate value of agricultural production. As against this, premium to farm gate value of output in India in the same year was 0.015. Geographically these insurance premiums are concentrated in developed farming and forestry regions, i.e. in North America (69 per cent), Western Europe (21 per cent), Latin America (5 per cent), Asia (3 per cent). Australia and Africa contributes 1 per cent each (Roberts, 2005). Index based insurance schemes operative in countries across the globe has been mentioned in Figure 1.1 (World Bank 2008).

India is an agrarian society with more than 75 per cent of the population depending on it, for their livelihood. Agriculture or crop insurance has assumed importance with large scale damage caused due to pest attacks, crop diseases and vagaries of weather. Crop insurance has been an important policy measure which has gained the attention of our policy makers ever since independence. Various studies regarding the modalities of the crop insurance programme were carried out since 1947. National Agricultural Insurance Scheme (NAIS) was introduced in the country from Rabi 1999-2000. This scheme provides for greater coverage compared to previous schemes in terms of farmers (i.e. non-loanee farmers brought under coverage).

The list of crops being covered for insurance differs from state to state. The crop insurance is based on either area approach or individual approach. Area approach is based on defined areas which could be a block/mandal, or a firka or gram panchayat levels. The indemnity limit originally was 60 per cent, 80 per cent and 90 per cent corresponding to high, medium and low risks areas. The actual average yield per ha of the notified crop for the defined area is determined on the basis of Crop Cutting Experiments (CCEs).

National Agricultural Insurance Scheme (NAIS) is being implemented from Kharif 2000 onwards in all the districts of Tamil Nadu through Agricultural Insurance Company of India Ltd., mainly to provide insurance coverage and financial support to the farmers. All the farmers (loanee and non-loanee farmers including tenant farmers) growing the notified crops are enrolled under this scheme. Generally, under National Agricultural Insurance Scheme (NAIS), Loanee farmers only are benefited as they are enrolled on compulsory basis. However, non-loanee farmers do not come forward to register under this scheme as they are enrolled on voluntary basis. Hence to encourage the non-loanee farmers to participate in this scheme, the Government during 2006-07 has extended 50% premium subsidy to non-loanee farmers. Further, from 2007-08 onwards, the Government of Tamil Nadu is extending 50% premium subsidy to both loanee and non-loanee farmers.

Currently, cooperative banks account for 80 per cent of AIC's (Agricultural Insurance Company of India Ltd) business in Tamil Nadu, since these banks were initially responsible for the promotion of crop insurance in the state, which has now taken over by the agriculture department. Moreover, the state government has set a target of covering 2.5 million farmers under NAIS during 2010-2011 period and allocated Rs.40 crore (Rs 400 million) as subsidy compared with Rs. 28.5 crore (Rs 285 million) in 2009-10.

The National Agricultural Insurance Scheme has again come out with new promises. It is expected that the area covered and the number of farmers to be insured would increase in the future. It is hoped that with the knowledge gained through experience and through further refinements it would help the scheme to fulfill its basic objectives.

1.1. Focus of this Study

All the agriculture plans, projects and schemes are subjected to yield risks. As these are highly dependable to weather, monsoon, rainfall and other natural calamities the amount of risk is unpredictable. In India most of the agriculturists don't have the awareness about the agricultural insurance plans and schemes provided by the Government in mitigating losses arising out of agriculture. If there is any loss due to natural calamities they demand only the writing off the agriculture credit availed. They don't avail the mitigating mechanisms, which are readily available to protect them from unexpected losses. This study provides a basic knowledge about the available insurance facility to mitigate the risk in agriculture.

For any programme, periodical appraisal is a must to find out the merits and demerits of the same. Although many attempts were made by various crop insurance agencies to address the crop insurance related issues faced by farmers, the success was very much limited. From the past experiences, it could be observed that agricultural insurance fared poorly, at least in part, because of problems related to moral hazard and adverse selection resulting from asymmetric information.

Some of the studies stated that lack of data on yield levels as well as risk position of the individual farmer puts the insurance company in a disadvantageous position. The high premium rates discourage majority participation and only high risk farmers participate leading to adverse selection. Moreover, farming or crop production being a biological process, converting inputs into output involves greater risks. So this study mainly focused to study the contribution of crop insurance scheme to risk reduction of the farmers and its awareness in the selected area.

1.2. Hypothesis

National Agricultural Insurance Scheme has helped the farmers to reduce their farm level production risks which increased agricultural losses arising from named or all unforeseen perils beyond their control.

1.3. Objectives

1. To assess the farmers' awareness about the crop insurance schemes and extent of their adoption
2. To estimate production/ yield risk involved in selected crops and its relationship to risk premium in the selected area
3. To estimate the actual risk covered by the insurer in the sample frame
4. To assess the constraints faced by the farmer' and suggest solutions

1.4. Scope of the Study

The finding of the present study would help to identify issues, constraints and problems faced by farmer in the operation of the scheme. Such information may be useful to the Agricultural Insurance Company of India Ltd., State government and District Central Co-operative Banks to formulate suitable policies to overcome the present problems and to frame appropriate strategies for strengthening the existing system of the scheme.

1.5. Limitations of the Study

The study was confined to Erode District of Tamil Nadu, where the production environment and cropping pattern are unique. Since the data collected were primary in nature, the information collected should have recall bias to some extent. There was limited data availability of area covered, premium collected and claims paid in Erode district. So only three crops (Paddy, Banana, Turmeric), which are mainly grown in kharif season, are taken for analysis. As the study was conducted in Erode district with limited sample size, the findings of this study may not be generalized except to the areas with similar agro-climatic features and socio-economic condition of the farmers.

1.6. Organization of the Thesis

The thesis has been organized in the following pattern.

Chapter I - Introduction: The importance of the topic, objectives, scope and limitations of the study are presented.

Chapter II - Concepts and Review: A brief review and definition of concepts, economic models and results of related studies are presented.

Chapter III - Design of the Study: Explains the sampling design, data collection and tools of analysis used in the study.

Chapter IV - Description of the Study Area: A brief account of the agro-climatic conditions, land use and other information relevant to the present study area is given.

Chapter V - Results and Discussion: A detailed discussion on the results of the study to draw specific inferences is made.

Chapter VI - Summary and Conclusions: A brief summary of work done and the salient findings, inferences drawn and their implications for policy are presented.

CHAPTER II

CONCEPTS AND REVIEW

A comprehensive and up-to-date review of literature is necessary in any field of scientific enquiry so as to understand the various concepts to be used in the proposed study and to gain a clear understanding of the gaps in the past studies. For a better understanding of the concepts, one need to be aware of what they actually refer to and how various economists have preferred to look at it. Moreover review of related concepts and past studies will give us a holistic picture and that will in turn help in analyzing and understanding the problems in proper perspective.

With this background, this chapter has been divided into two sections. Section I deals with review of concepts used in the study as viewed by different authors and section II consists of review of related studies in the past.

2.1. Review of Concepts

2.1.1. Risk and Uncertainty in Agriculture

2.1.2. Agricultural (Crop) Insurance

2.1.3. Methods used in Determining Premium Rates

2.1.4. Moral Hazards and Adverse Selection

2.1.5. Cost and Returns

2.2. Review of Past Studies

2.2.1. Risk and Perception of Farmers

2.2.2. Approaches to Crop insurance

2.2.3. Crop Insurance in India

2.2.4. Crop Insurance in other Countries

2.2.5. Logit Model and Garrett’s Ranking Technique

2.1.1. Risk and Uncertainty in Agriculture

Though risk refers to the chance of loss, damage or injury according to a common dictionary definition, in scientific analysis both risk and uncertainties have got several meanings.

Heady and Herald (1960) defined risk as the variability of outcomes which were measurable in a quantitative manner. The parameters of probability distribution could be established for outcomes that involve risk. In the case of uncertainty, it would refer to the future events, the probability of which could not be established in an empirical or quantitative sense, and hence it was entirely of a "subjective nature". In a broad sense, uncertainty would mean all circumstances in which decisions must be made without perfect knowledge of significant future events.

Randhawa *et al.* (1963) viewed the risk and uncertainty in Indian agriculture was due to uneven distribution of rainfall, pest and diseases and economic factors such as instability of prices, inadequate storage and transport facilities.

Mishra *et al*. (1964) indicated that in the absence of alternative stable and diversified enterprise for adoption, complete dependency on rainfall and occurrence of flood were the main source of uncertainty in agriculture.

Sen (1964) viewed risk as a phenomenon which would be related to a regular measurable behaviors being of the random nature, where as uncertainty as one that hardly obey any law of chance.

Ray (1967) broadly classified the risks in agriculture as i) property risk and ii) personal risk, according to the object of incidence of uncertainty. Risks to agricultural property was again classified into natural, social and economic, depending on whether the uncertainty involved was due to natural, social or economic factors.

Borch (1968) has conceptualized that in risky situation information would be available about the relative chances of different outcomes and in uncertainty, information would not available.

Stiglitz *et al.* (1970) remarked that it would be impossible to define risk to afford cardinal measure. Risk aversion was characterized by a concave utility function of wealth and risk that the risk averters had to pay to avoid the risk. This approach neither led to a definition of risk nor provided a basis for ranking probability distributions in the order of riskiness.

Dillon (1971) defined risk as the expected value of loss, the probability of loss and the probability of minimum semi variance or simply a random variable. He drew a comparison between two risky prospects citing that though riskier prospect would have the same outcome; its cumulative distribution would exceed that of less risk prospect.

According to Barry and Baker (1971) farm business risks were associated with uncertainty in prices, yields, technology and general economic conditions as well as with legal and other institutional uncertainty.

Knight (1971) brought out the difference between risks and uncertainties. He indicated that in case of risks the distribution of outcome in a group of instances is known while in case of uncertainty this is not true. The reason being that, it is impossible to form a group of instances. Thus risk is insurable since it is for one individual. However, if such individuals join together, the loss probability can be calculated and the premium can be estimated for a group of individuals.

Driver *et al.* (1976) mentioned that risk and uncertainty would assume personal attitude that would reflected in the resource mix and the structural and operational choices for their farm organization.

Johl and Kapur (1977) remarked that risks are measured in their parameters of probability but uncertainties are more or less random phenomena that cannot be estimated without any acceptable degree of accuracy.

Anderson *et al.* (1975) considered that risky returns would occur in the context of crop and livestock response processes because either yields or prices or both were uncertain.

Roumasset (1978) defined uncertainty as a state of mind in which the individual would perceive alternative outcomes to a particular action. Risk was concerned with the degree of uncertainty in a given situation.

Singh and Sharma (1988) attempted to highlight the risk element in farm business on unirrigated farms. The magnitude of risk in yields, product prices, variable cost and gross margins per farm were determined by computing the coefficients of variation. The findings indicated that livestock enterprises were relatively more stable than the crop enterprises. Further the live stock enterprises were associated with a smaller amount of risk compared with the crop activities.

Maleka (1993) in his study in Gwemby valley of Zambia viewed agriculture to be risky as it was carried out under stochastic nature of rainfall. Stochastic condition referred to some random character over which human lacked control.

Vaughan (1999) defined risk as the possibility of adversity or loss, and referred to "uncertainty that matters". Consequently, risk management involved choosing among alternatives to reduce the effects of risk. It typically requires the evaluation of tradeoffs between changes in risk, expected returns, entrepreneurial freedom, and other variables. Understanding risk is a starting point to help producers make good management choices in situations where adversity and loss are possibilities.

James (2004) defined risk as a condition in which there is a possibility of an adverse deviation from a desired outcome that is expected or hoped for. The degree of risk referred to the likelihood of occurrence of an event. It is a measure of accuracy with which the outcome of a chance event can be predicted.

Jan (2005) opined that the non-price factors like yield risk, yield of own and competing crops, rainfall and irrigation facilities, would be considered as relevant explanatory variables to the production risk.

Khemchand *et al*. (2005) listed paradigm shift in land use, mechanization and intensive cultivation extending to fallow lands, cultural wastes and sand dunes, water and vegetation resources are the major reasons for making agriculture a risky venture.

Nigel (2006) explained risk as not a mathematical phenomenon. It is intensely human linked by umbilical cord to human desires, impulses, instincts, sentiments and native beliefs.

Meera (2010) found that farmers perceived dependence on rainfall is more risky than any other factors influencing production, they perceived that selection of suitable crop would be a measure to avert the risk to some extent. They also perceived that selection of suitable crop would be a measure to avert the risk to some extent. Besides, provision of relief fund at times of crop loss would be a measure to overcome risk and losses faced.

Gurudev singh (2010) defined uncertainty refers to an event the outcome of which is not certain i.e. the outcome may be one of the many possible outcomes. As such it cannot be measured. But certain probability may be attached to individual outcome. Risk on the other hand refers to the impact of the uncertain outcome on the quantity or value of some economic variable. The value of the economic variable may be on either side of the mean value. Repeated events would result different outcomes having a range of values. Thus risk refers to the variations in value of an economic variable resulting from the influence of an uncertain event. Since the variations in the value are measurable risk can be measured.

The term risk thus could be defined as (1) the chance of loss, (2) the possibility of loss, (3) uncertainty, (4) the dispersion of actual from expected results, or (5) the probability of any outcomes different from the one expected. Thus risk is a condition in which there is a possibility of some adverse deviation from expected or desired outcome like yield that is expected or hoped for. However, for the present study, no attempt was made in distinguishing between risk and uncertainty.

It can be summarized from the above studies that (a) meteorological factors like rainfall, (b) economic factors like fluctuations in prices, demand, storage and transport, (c) policies like land reform, (d) technological improvements and c) biological factors like pests and diseases and variation is rainfall are the main sources of risk and uncertainty in Agriculture.

In the present context, the elements of risk in agriculture are production and weather which is the foremost elements and the rest are market fluctuations, pest incidence etc.

2.1.2. Agricultural (Crop) Insurance

Agriculture is subject to vagaries of nature such as flood, drought, tornado, and lightning. In the face of uncertainty and risk faced by the farming community, various schemes have evolved over time in different countries to protect farmers against risks, such as guaranteed prices, subsidized credit, and crop insurance.

Crop insurance is recognized to be a basic instrument for maintaining stability in farm income, through promoting technology, encouraging investment, and increasing credit flow in the agricultural sector. It contributes to self-reliance and self-respect among farmers, since in cases of crop loss they can claim compensation as a matter of right (Chandrakanth and Rebello 1980). Thus, crop insurance cushions the shock of crop loss by assuring farmers protection against natural hazards beyond their control. The Central Government and the State Governments in India have constituted in recent years several crop insurance schemes.

The basic principle underlying crop insurance is that the loss incurred by a few is shared by many in an area. Also, losses incurred in bad years are compensated from resources accumulated in good years (Dandekar, 1976).

In general, the principle of crop insurance may be outlined as follows:

(1) Uncertainty faced by individual farmers is transferred to the insurer through their participation in large numbers, for which benefit, the insured farmers pay a risk premium.

(2) Total loss is shared by all the participating farmers over a wide area, i.e., horizontal spreading of risks over a wide and vertical spreading over many years.

(3) The risk premium reflects the group risk assumed by the insurer; an indemnity is liable to be paid to the individual farmer when a loss is incurred due to causes beyond his control, as long as he maintains the insurance contract valid by paying the premium without default.

Insurance is the transfer of risk between the insured and the insurer at a cost which reduces the intensity of loss that would have otherwise been suffered by the insured. Insurance not only reduces the uncertainty faced by the insured, but it evens out the burden of a loss especially if the loss is of a large scale one.

Ray (1960) defines insurance as a "social device which aims at reducing the uncertainty of loss through combination of a large number of similar uncertainties and through the use of accumulated funds, distributing the burden at loss, should there be any over space and time".

Dandekar (1976) suggested that crop insurance should be linked with credit on a compulsory basis. He found that the crop insurance scheme offered insurance against a chance occurrence. The chance phenomenon underlying a crop insurance scheme is the fluctuations in the output of a crop from one year to another or from one crop season to another.

According to Chandrakanth and Rebello (1980) crop loss due to drought, excessive rains, pests, and diseases may be included in the hazards to be insured. They also remarked that if the entire crop is lost during the planting stage, the indemnity payable should cover the costs up to that stage. Another observation was that crop insurance should be made compulsory at least for all borrowers. In this case the insurance premium must be included in the crop finance.

Hogen (1982) stated that crop-credit insurance for farmers might be effective in stimulating adoption of new and risky technology in agriculture.

Dandekar (1985) noted that the crop insurance scheme is based on the area approach and that a *taluk* / *tehsil* is taken to be the area. Indemnities payable to farmers in the area are assessed on the basis of the average yield for the area; the variations in the yield within the area are neglected. This method is considered unsatisfactory.

Pathak (1986) argued that through crop insurance, farmers could purchase the right for compensation by paying only a small amount and that they are assured of protection against uncertainties.

According to Rustagi (1988) the pre-requisite to effective demand for crop insurance is the farmer's consciousness of risks arising from crop damage, namely exposure to risk. The degree of consciousness varied depending on the type of farm, size of farm, and environmental condition of the farm.

Jorge (1987) opined that the appraisal of loss is one of the momentous aspects of insurance. Moreover, in the case of crop insurance, a rapid loss adjustment procedure is essential. Since the farmers will wish to harvest the undamaged part of the affected crop in due time, it is necessary to set up and train an adequate number of local adjustment personnel capable of responding immediately to appraise losses. Since crop insurance is characterised by a very high degree of risk, it is risky for a primary organisation to bear an excessive insurance liability accepted from farmers. Therefore, the insurance carriers should be willing to spread their risk. One option is reinsurance.

Mutual aid schemes fit precisely with all insurance programmes as a mutual aid endeavour. The concept of mutual aid has obvious impact on the basic principles and practices of crop insurance. What distinguished crop insurance from pure mutual aid or mutual relief or public relief in the case of large-scale crop disasters is the link up between the actuarial techniques and the principles and operation of mutual aid. The actuarial technique is the application of appropriate statistical methods to determine certain behavioural patterns out of what seem to be *prima facie* irregular and unrelated happenings, for instance, the occurrence of drought or flood or insect infestations of crops or the extent of crop losses resulting therefrom (Ray, 1987).

When crop insurance is combined with some pricing strategies, it has been proven to be very effective in reducing both production and price risk for farm operators in developed countries (Makki, 2002).

There is no doubt that agricultural insurance plays a more and more important role in the agricultural development. The government wants to popularize agricultural insurance, so lots of subsidies are provided. The policy makers in developing countries place high priority on expanding agricultural supplies, because a positive supply response is not a complication but a strong argument for publicly financed crop insurance programs which remove or minimize the influence of risk on farm-level decision. The increasing financial subsidies have resulted in an increasing participation rate (Ramaswami, 1993).

However, there is a divarication on whether the government should provide subsidies for agricultural insurance. Especially in recent years, many scholars have studied the negative effects brought by agricultural insurance subsidy.

The negative effects could be summarized as follows:

1) The positive effects of agricultural insurance have not been proved to be as large as the theory described.

Babcock and Hart (2000) argued that, if the government provided financial subsidy to agricultural insurance, the benefit of increased crop production brought by agricultural insurance would be counteracted by the declined price due to the increased production. Glauber and Collins (2002) got the same conclusion. They thought that, if agricultural insurance effected agricultural production, the subsidy efficiency of agricultural insurance as the tool in the income security net would be depressed.

Sun (2003) considered the wrong theoretic model on which agricultural insurance was based as a principal course for the financial failures. That is to say, the wrong theoretical model considered the potential value of agricultural insurance too high.

2) Substitution for other tools of risk management.

Walker and Jodha (1986) studied the agricultural insurance policies in India. They found that the federal agricultural insurance program made some former effective tools (crop diversification, maintaining financial reserves, reliance on off-farm employment and income generation, production contracting, marketing contracting, forward pricing, futures options contracts, leasing inputs and custom hiring) of risk management out of use.

Then, Wright and Hewitt (1994) confirmed this issue again. They argued that, if subsidized agricultural insurance program was accepted widely, the other tools **(**Marketing and

Production Contracts**,** Derivative Contracts, diversification etc.,) of risk management would be pushed out.

3) The crowding-out effects for private insurers.

Skees *et al*. (1999) found that, in general, the governmental agricultural insurance programs suffered a problem of lack of cost-efficiency, and the direct intervention from government may result in crowding-out effects for private insurers.

Some scholars even draw a conclusion that there was no need to provide subsidy for agricultural insurance (Siamwalla and Valdes, 1986; Nelson and Loehman, 1987).

Nelson and Loehman (1987) thought that, agricultural insurance was a very effective mechanism for risk sharing in theory. However, in practice, it became a mechanism of high cost, which transferred the loss to the government or insurance organizations. They even thought that agricultural insurance subsidy should be unnecessary. If the information was collected effectively, and the contract was made according to proper principles, the insurance benefit would be realized at a lower cost than public subsidy. But the problem is that the conditions required are hard to get.

Nelson and Loehman (1987), Siamwalla and Valdes (1986) did not consider agricultural insurance as a public good, so the subsidy for it was unnecessary. But the government should provide appropriate subsidy for the research on agricultural insurance.

Many environmentalists express concerns about all aspects of agricultural chemical use, and are therefore worried about the potential extensive margin effects of the Multi Peril Crop Insurance (MPCI) program (Smith and Goodwin, 1996).

Manojkumar *et al.* (2003) found that the crop insurance scheme shall be made viable by spreading the risk horizontally by enrolling all the farmers in a locality in the scheme. The scheme should be attractive, credit-linked, and should have support facilities like a reinsurance package. A reassurance programme should be an integrated part of any insurance programme in which credit facilities are linked with the scheme. If the crop fails in a season covered in an insurance scheme, the insured farmers should be supported with credit facilities for going to the next crop season.

Raju and Ramesh Chand (2008) defined that agricultural insurance is one method by which farmers can stabilize farm income and investment and guard against disastrous effect of losses due to natural hazards or low market prices. Crop insurance not only stabilizes the farm income but also helps the farmers to initiate production activity after a bad agricultural year. It cushions the shock of crop losses by providing farmers with a minimum amount of protection. It spreads the crop losses over space and time and helps farmers make more investments in agriculture.

Crop insurance is based on the principle of large number. The risk is distributed across space and time. The losses suffered by farmers in a particular locality are borne by farmers in other areas or the reserves accumulated through premiums in good years can be used to pay the indemnities. Thus, a good crop insurance programme combines both self as well as mutual help principle. Crop insurance brings in security and stability in farm income.

Agriculture all over the world is fraught with risk and uncertainty. Provision of crop insurance facilitates stabilization of farm production as well as income of the farming community and helps in optimal allocation of resources in the production process.

2.1.3. Methods used in Determining Premium Rates

Premium rate is the definite amount payable to the insurers by the insured for the insurance protection offered to him. It is equal to the average of the indemnities paid to the farmers over years for a unit cropped area (Botts and Boles, 1958).

Botts (1941) made an attempt to estimate the premium rates for 'normal' citrus fruit yields by taking tree ages into consideration for formulating the area yield insurance plan. He considered the yield rating wherein the production of a particular fruit groove was compared with the normal yields. The procedure used was as follows:

$$\textbf{The yield rating} = \frac{\sum Y_i}{\sum N_i}$$

Where,

N = Normal yield based on a large sample for the ith year of tree age

$\sum N_i$ = The sum of the normal yields based on a large sample for different years of tree ages

Y = Actual yield of the trees at their i^{th} year of age

$\sum Y_i$ = Sum of the actual yields of different years of ages

E_i = Expected yield for the particular groove for the ith year of tree age

$$E_i = \frac{\sum Y_i}{\sum N_i} \times N_i$$

C_i = Coverage or protection which is a fixed percentage of expected yield Ei for each year of tree age and,

= Proportion x yield rating x E_i.

$$C_i = P\left(\frac{\sum Y_i}{\sum N_i} \times E_i\right)$$

The annual loss for the ith year = Coverage C_i – Actual yield Y_i.

$$\textbf{Premium rate} = \frac{\textbf{Total of annual losses for all years}}{\textbf{Number of seasons}}$$

In 1958, Botts and Boles presented a paper wherein the normal curve principle was used in premium rate calculation. This technique is presently used by the Federal Crop Insurance Corporation of the United States Department of Agriculture. A crucial condition to be fulfilled in using this technique is that the frequency distribution at annual yields of individual forms must be relatively normal, so as to facilitate the use of density and frequency functions.

Botts (1962) indicated that the premium amount should be a variable cost depending upon the yield obtained by the farmer and the number of hectares on which the insured crop is grown as well as a predetermined price. If this method is adopted, then the farmer would make most of the premium payments in years when he obtains high yields and would pay little in years when the yields are low.

Martin and Roland (1966) evaluated the basic principles of premium rate making. They indicated that the premium rates should be adjusted only when there exists a trend due to technology and cyclical movement in weather and in the distribution of crop yield over time. The major factors which influence the long term crop yields such as resource (R), technology (T), weather (W) and residual (F) were used in calculating the average premium. Borude and Joglekar (1971) observed that under tropical dry farming conditions, the average yields per acre were low and the fluctuation in yields was very high. The authors indicated that the premium should be expressed in terms of percentage of the average yield. They indicated that it would be useful in deciding whether the premium is within the paying capacity of the farmers.

Singh (1972) conducted a feasibility study of crop insurance in Uttar Pradesh wherein he has emphasized that crop insurance should be based on the principle that a portion of savings in the good years is used to compensate farmers by giving them indemnify for their low yields in years of natural calamities. The extent of crop yield variability was measured by variance standard deviation and coefficient of variation. To evaluate the effectiveness of crop insurance a linear programming model was used.

Dandekar (1976) developed a feasible crop insurance scheme based on area approach. The premium rates were calculated based on the yield variability. He also indicated that the area approach was more meaningful than the individual approach.

Battese and Francisco (1979) conducted a study on the distribution of indemnities for crop insurance programmes in South Wales. The general formulae for the distribution function and the mathematical expectations and indemnities for the insurance plan were presented in terms of distribution of crop yields. Three special cases were considered in which the original yields the square root of yields and the logarithms of yields were normally distributed. Given the distributional information on the crops obtained from a simulation model, the expected indemnities were calculated for different insurance plans.

Pandey *et al.* (1981) used the coefficient of variation to study the rainfall, yield and gross income variability over a period of eleven years. The premium rates were worked out for a few crops and the basis of selection of these crops was the degree of risk attached in crop production as well as the economic significance of the crop. The net premium rate was the annual average loss per hectare and was expressed in physical quantities. This was converted into money value of some previously agreed price. The level of guarantee or coverage is given as a certain percentage of the long term average yield varied according to the degree of risk involved in crop production. In India, the Central Government has introduced a country wide crop insurance scheme which commenced from kharif 1985. In this scheme the insurance charges or premium is 2 per cent of the sum insured for rice, wheat and millets and 1 per cent for oil seeds and pulses. The basis of indemnity is determined in the following manner. If there is a short fall in the actual average yield per hectare of the insured crop, all the insured farmers growing that crop in the defined area will be eligible for indemnity which is calculated as follows:

$$\text{Indemnity} = \frac{\text{Shortfall in yield* x sum insured per farmer}}{\text{Threshold yield}}$$

(*Threshold yield less the actual average yield for the defined area)

The threshold yield will be decided in the following manner :

The average yield per hectare of the crop for the “defined area” during the previous five years (or such shorter period as may be decided for a specific crop) for which data were available based on crop cutting experiments is obtained. The threshold yield is determined by considering 80 per cent of this five years average yield per hectare.

Subrahmanian (1984) suggested that premium rates have to be revised annually based on the cost of cultivation and the long-term average yield. In India, coverage is taken as a percentage of the long-term average alone. But it would be better to arrive at the coverage level based on cost of cultivation and price per unit of output in addition to the long-term average yield.

Abada (1987) in his paper provides possible measures for determining coverage, premium and premium rating. The author indicates the average yield on a per unit area, expected returns from cultivation, actual production cost, level of crop loan extended should serve as a basis for fixing the amount of cover or sum insured. He opined that whichever basis is used, the sum insured in all cases will be always below the actual value of the harvested crops under normal conditions.

Ryohel (1987) tried to examine the basic issues of management and financing of crop insurance scheme, based largely on the long Japanese experience. The amount of insurance is the maximum yield covered by the insurance scheme as an important element for indemnity computation.

Charles (1996) conducted a study on crop insurance and the relationship between indemnity price and expected output price. Crop insurance contracts typically constrain the choice of price at which indemnification occurs to be less than the expected output price. This restriction is first analysed assuming only risk averse farmers and yield and price uncertainty. General conditions under which the optimal price selection is bounded above by the expected output price are found to be difficult to derive. The results of numerical simulations based on a range of different utility functional forms are presented, and a strong tendency is observed for the optimal price selection to be bounded from below by the expected output price. The effect of increasing output price variability on the optimal price selection is also considered. The simulation results suggest that the optimal price selection is often non-increasing with a mean preserving spread of the output price distribution, it is noted that even in the presence of hidden-action moral hazard if the incentives for shirking area not too high. The constraint that price selections be lower than the expected output price may still be binding.

Coble *et al.* (1997) conducted a study on the expected indemnity approach to the measurement of moral hazard in crop insurance. This study includes a definition of moral hazard in multiple peril crop insurance that focuses on expected indemnities rather than input use. Five years of production and insurance data for a panel of Kansas wheat farms are used to empirically test this type of moral hazard. Results suggest that moral hazard affects multiple peril crop insurance indemnities in poor production years but that no significant moral hazard occurs in years when growing conditions are favourable.

Jerry *et al.* (1997) conducted study on designing and rating an area yield crop insurance contract. This study documents the design and rate making procedures used in the development of the group risk plan (GRP) – the new federal crop insurance product that insures based on area yield. The study suggested that the GRP indemnity payments are made based on percentage shortfalls in actual county yields relative to forecasted yield and historical country yield data are used to develop forecasted yields and premium rates.

According to Manojkumar *et al.* (2003) the premium rate is determined based on the statistical data on yield and planted area of crop to be insured, land revenue, and grants of emergency relief in the area to be insured. If the damage to the crop to be insured is classified by the extent of damage each year, the damage rates each year may be defined as follows:

$$\textbf{Damage rate} = \frac{\textbf{Damage acreage converted into complete loss}}{\textbf{Total planted acreage}} * 100$$

If the statistics obtained are amount of loss of the crop to be insured, the damage ratio will be according to the following formula:

$$\text{Damage rate} = \frac{\text{Amount of loss}}{\text{Normal yield X Total planted acreage}} * 100$$

Babcock *et al.* (2004) conducted a study on actuarial fairness of crop insurance rates with constant rate relativities. Increased availability and demand for low deductible crop insurance policies have increased focus on crop insurance rating methods. Actuarial fairness cannot be achieved if constant multiplicative factors used to determine how premiums change as coverage level increases. A comparison at premium rate generated by the factors used by the two most popular crop insurance products with those generated by a standard yield distribution shows that the popular insurance products over charge for low deductible policies in most countries suggested that this overpricing may explain why large premium subsidies were required to induce farmers to move from low-deductible to high-deductible policies beginning in 2001.

According to Jain (2004) for a viable crop insurance scheme, the premium rate needs to cover the pure risks, administration cost, contribution to catastrophe reserve and a reasonable return. The insurance premium may be on a net or gross basis. Net premium covers only the average loss over a period and possibly an additional amount to accumulate a small reserve. Gross premium involves some ‘loading’ to include cost of administration and some return or profit.

Ozaki et *al.* (2008) the premium rate was calculated using parametric and nonparametric approaches to estimate the conditional agricultural yield density. These methods were applied to a data set of county yield provided by the Statistical data for the period of 1990 to 2002 for soybean, corn and wheat. They concluded in a market where historically total loss ratio (indemnity divided by total premium) is greater than one, better actuarial methods (the nonparametric approach proposed in this article) should be taking into account by insurance companies to calculate the premium rate.

2.1.4. Moral Hazards and Adverse Selection

Moral hazard is often offered as an explanation for both low participation rates and high loss ratios (the ratio of indemnities to premiums) in agricultural crop insurance. The standard explanations for the failure of multiple risk crop insurance relate to problems of adverse selection and moral hazard. A number of theoretical models of these problems have been proposed (Ahsan *et al.,* 1982, Nelson and Loehman 1987, Chambers 1989).

Arrow (1985) suggests a simple and compelling definition of adverse selection as a problem of 'hidden information' and moral hazard as a problem of 'hidden action' on the part of an insured agent.

According to Laffont (1989) moral hazard means that the insured person's optimal decision may change as a result of taking out insurance. Because the insurance contract reduces the loss associated with the insured event, such changes in behavior will normally increase the probability of the insured event occurring or the severity of the loss. Adverse selection means that people who are more likely to suffer the insured event will be more willing to insure at a given rate. If the insurance company cannot detect such people, losses will occur.

Ramaswami (1993) studied the supply response to agricultural insurance, risk reduction and moral hazard effects. This paper examines the consequences of agricultural insurance for expected supply. The effect of insurance is shown to decompose into a "risk reduction" effect as well as a "moral hazard" effect. The direction and magnitude of these effects depend on the parameters of the insurance contract, producer's risk preferences, and the underlying technology. Two models are considered for this purpose. The author found that the insurance changes the marginal costs and input use in two ways. First, insurance reduces risk and therefore reduces the wedge between expected marginal product and input price due to risk aversion. Secondly, insurance reduces the marginal productivity of all inputs and suggested that in evaluating alternative insurance schemes, simulation exercises could be used to assess the tradeoff between risk reduction and moral hazard effects.

James Vercammen and Gornelis (1994) conducted research on moral hazard cycles in Individual Coverage Crop Insurance. The study suggested that individual coverage contracts are infomatically superior to standard contracts because the farmer's coverage is proportional to his average historical yield. The amplitude of the cycle and the variability in planned production is shown to be larger the lower the degree of production uncertainty. The fewer the number of years used in the averaging process, the higher the coverage threshold, and the lower the level of co-insurance.

Charles and James Vercammen (1997) conducted study on costly yield verification, moral hazard, and crop insurance contract form. This study is based on theories of hidden-action, moral hazard and costly state verification are drawn on to analyse crop insurance contract structure. The hidden action moral hazard model allows few clear predictions regarding optimal contract form. In particular, the conditions under which actual contracts are optimal are not clear. Posing crop insurance as a problem of costly yield verification, however results in optimal contracts with familiar properties a deductible indemnification if and only if yield is verified, and indemnification only when yield is low. However, these contracts require full insurance across low yield states, while actual contracts typically involve co-insurance. This model is then generalized to incorporate hidden-action moral hazard, and it is shown that optimal contracts then require co-insurance. Thus, this model reflects the essential features of actual contracts. It was suggested that recognizing the incentives for misreporting and for insurers to economies on yield verification costs will potentially result in a better understanding of crop insurance.

According to Reno Nevada (1997) the twin problems of moral hazard and adverse selection are often blamed for the lack of an active crop insurance market for fruits and vegetables. He also found that existing empirical measures of moral hazard and adverse selection in crop insurance consider lower yields by insured producers, or large deviations between expected and actual yields as evidence of their existence. And he added that the persons those who are less concerned about yield risk are willing to pay more for insurance.

According to Zahirul Islam *et al.* (1999) asymmetric information in the form of moral hazard and adverse selection results in sizeable efficiency losses. These costs are passed back to producers in the form of excessively high premium rates and also passed back to the government via the crop insurance subsidy program. He also indicated that insured farmers use less agricultural inputs than uninsured farmers in an attempt to maximize expected indemnities. Moral hazard was found to be a significant problem only at higher coverage levels.

According to Mark Wenner and Diego Arias (2003) the presence of asymmetric information, which can lead to adverse selection and moral hazard problems, raises the cost and risks of introducing crop insurance products more so than other types of insurance products.

Adverse selection in insurance markets refers to the situation where insurers find it impossible or very expensive to distinguish between high-risk and low-risk insurance applicants and thus prices insurance contracts at the average premium for all individuals, which is inappropriate and non-sustainable. This results in undercharging high-risk customers and overcharging low-risk customers for identical contracts. Over time the low-risk clients drop out of the market and the insurance company is left with a very high-risk pool of clients with higher expected indemnities that negatively affects insurer’s profitability.

Moral hazard refers to the situation where the granting of an insurance contract can lead to a reduction in the application of good husbandry practices or the complete altering of production practices on the part of the client, resulting in higher loss claims. These two problems affect all insurance markets but more so in agricultural ones because obtaining information on clients is more difficult and monitoring client behavior is more costly.

According to Michael *et al.* (2006) the asymmetric information problems of adverse selection and moral hazard can cause insurance markets to fail. Adverse selection occurs when those seeking insurance know more than insurers do about their risks. Agents facing greater risks are more likely to insure at average prices, causing those facing less risk to be priced out of the market. Moral hazard refers to the effect insurance contracts may have on the insured's hidden actions. When bad outcomes are indemnified, the insured may have less incentive to prevent these outcomes from happening. Insurers, understanding agents' incentives, may be less likely to provide insurance, and the private market for insurance can break down.

Debdatta Pal (2010) found that limited success in traditional crop insurance schemes is attributed to the financial non viability due to non – actuarial based premium as well as the serious problem of moral hazard, adverse selection and complex administrative procedures.

To overcome these two problems both Dandekar and the Expert Committee preferred the “area” approach to the “individual” approach. The individual approach requires individual ex ante assessment of risk and ex post assessment of loss for determining individual premium and claim payments.

The area approach treats all farmers in a defined area as identical in terms of risk and loss and, therefore, paying identical premium and receiving identical claim amount. These are based on the average risk and average loss characteristics for the entire area. It was recognized that the area approach would give rise to a basis risk. “It is impossible, of course, to expect that the crop-outputs of all farmers in an area would be below their own normals whenever the average crop-output of the area is below its normal and vice versa. But if the area is small enough and is agro climatically homogeneous, the crop output of a majority of the farmers therein would be highly correlated".

Therefore, even though the individual approach is the first best from the perspective of reducing the basis risk, the area approach is the preferred alternative in terms of the administrative costs of risk assessment and loss estimation, as well as being less susceptible to the moral hazard problem.

2.1.5. Cost and Returns

Economics of cultivation of crops would get greatly influenced by costs incurred and gross return received. The costs and returns were differently conceived by different researchers to suit their studies. A brief review of concepts like costs and returns is given below:

Cost

According to Maurya *et al*. (1996) the cost of production included the cost on production inputs like seed, manures, fertilizers, irrigation, plant protection chemicals, human and bullock labour, rental value of land at the prevailing market price and overhead cost, comprising of interest on working capital and fixed capital, repairs and depreciation.

Fixed Cost

Prasher *et al*. (1996) opined that fixed cost would include land revenue, depreciation on machinery and implements, interest on fixed capital and rental value of owned land.

Ahuja (1997) identified fixed costs as those, which were incurred in hiring the fixed factors of production whose amount would not be altered in the short run.

Maheswarappa *et al*. (1998) referred fixed cost in terms of land revenue and rental value of owned land.

Samuelson and Nordhans (1998) defined fixed costs as those costs, which do not vary with the output in the short run. They were often called overhead costs and committed for rental, maintenance, depreciation, overheads, salaries, wages, etc.

Dewett and Chand (2001) stated fixed costs were those costs that would be paid even though production had stopped temporarily and would not vary with the level of output. It included rent for buildings, interest on capital invested in machinery and salaries of the permanently employed staff.

Goswami and Challa (2007) referred fixed cost in terms of rental value of land, interest on fixed capital, depreciation, annual share of establishment cost, land revenue and plantation tax.

Variable Cost

Varma and Agarwal (1992) defined variable costs as those cost which would vary proportionately with the increase or decrease in sales or output.

Johl and Kapur (1996) defined the variable cost as the cost of using variable inputs, which would vary with the level of production.

Prasher *et al*. (1996) opined that variable cost include costs on labour, manures and fertilizers, plant protection chemicals and interest on working capital.

According to Ahuja (1997) variable costs were those costs that increased on the employment of variable factors of production whose amount could be altered in the short run.

Maheshwarappa *et al*. (1998) referred variable cost in terms of human labour, bullock labour, tractor power, seed, manures and fertilizers, plant protection chemicals, irrigation, repair and maintenance cost and interest on working capital.

Goswami and Challa (2007) included cost of manures and manuring, cost of labour for weeding, pruning, tapping, plant protection, watch and ward; other input cost, processing and marketing cost and interest on working capital in rubber plantations.

Return

Gross Return

Tandon and Dhondyal (1971) defined gross return as the difference between the total money income which a farmer would receive from the sale of the produce and the total expenses incurred in producing it.

Chaukan *et al*. (1972) included the value at prevailed prices of retained as well as marketed crop output and also the income from allied activities such as dairy, goats and poultry under gross farm income.

Kahlon *et al*. (1972) defined gross income as income from farm and non-farm sources and also borrowings from institutional and non-institutional resources.

According to Carlin and Reinsel (1973), gross income included the income derived through farm and non-farm sources. Non-farm income included wages and salaries, rental income, interest, dividends, retirement pension, social security and other transfer payments.

Mani (1982) calculated farm income by adding the value of crop and livestock products, value of FYM, income from sale of livestock, farm equipment and bullock labour and non-farm income from such sources as services.

Jeyakumar (1999) conceptualized income as the sum total of income received by all members of the family working in different categories or the same kind of work. The source of income included, farm, non-farm and any assistance from government programme.

Net Return

Tandon and Dhondyal (1971) defined net income as gross income minus total expenses on cost of seed, manures, irrigation charges, wages of hired labour and imputed value of family labour, depreciation, rent, interest on fixed and variable capital and marketing cost.

Mishra and Gupta (1975) opined that net farm income from farming included income from all enterprises after making deduction for cultural, maintenance and other expenses, which were paid by the family in cash and in kind in raising the various enterprises of the farm.

Singh *et al*. (1996) pointed out that the net income would include the difference between cost of production and total value of the products.

For the present study, the net income is conceptualized as the gross income minus total cost incurred in production. The total cost included both fixed and variable costs.

2.2.1. Risk and Perception of Farmers

Farmers accept risk and uncertainty as part of their way of life - no farmer can plant a crop and are absolutely certain that he will obtain satisfactory yields. A period of unseasonal weather, a sudden storm, a flood or outbreak of disease may ruin his crop and leave him with little or nothing to harvest. It is this risk which poses many problems to the extension workers and farm planners, and concerted efforts have been made in devising techniques by which this factor would be evaluated and assessed in a farm management programme. Several studies have focused attention on farm decisions as influenced by risk factors.

Agricultural production can vary widely from year to year due to unforeseen weather, disease/pest infestations, and/or market conditions causing wide swings in yields and commodity prices.Even though there are various types of risk influencing agriculture production, risk plays a vital role in farmer's production and farming environment.

According to Baon (1955) farmers regularly discounted an uncertain income sufficient to make it certain equivalent. They could be glad to have a lower certain price for the product than the higher one they expected with some uncertainty.

The observations made by Apte (1964) in his study support this discounting tendency of farmers. He concluded that perception on crop acreage was governed by three main considerations, namely desire to achieve self sufficiency in the cereals, the availability of seed for cash crops and incidence of pests and diseases. It is interesting to read his conclusion that consideration of labour input or prices did not weigh with the farmers in their decision, particularly in respect acreage under cotton and groundnut which declined heavily because of pests and diseases. It was perceived that these farmers would tend to discount very heavily the income from high return cash crops, on account of biological hazards.

Baliga *et al.* (1964) concluded in their study that farmers were mainly guided to a large extent by gross returns and its variability rather than that the net return. Their decisions were less influenced by net return. This conclusion about farmer's behavior was not much realistic, because under conditions of less than full certainty, farmers were not guided by economic interests in their action and they were found to choose the crops to be cultivated apparently independent of their expected net return.

Jakhade *et al.* (1964) concluded that the farmer's decision to raise a crop in any season may be influenced by a complex group of factors like consumption needs, weather conditions on the sowing time, prices of competing crops and requirements of crop rotation.

Gupta, (1964) had observed that price variability was lesser than yield variability and hence gross income variability was closely related to yield variability and thus price variability exerted little influence on expectation of farmers. Based on the variability indices for yields and prices, farmers might choose the crops depending on individual's capacity to bear risk.

Sen (1964) reported that both area and production were liable to risk and uncertainty. The gross cropped area fluctuated from year to year depending on the distribution of rainfall in sowing season. The yield per acre also varied with weather and rainfall, loss due to pests and diseases and price fluctuations compounded to the complexities of the problem. These problems increased marginal gap between demand and supply and produce a strain on the economy as a whole.

Vyas and Rarkhal (1964) had shown that at low level of out-turn, the crop experienced lesser uncertainty than the crops with higher level of out-turn. As the tendency of the farmer to take only low risk, area under groundnut increased at the cost of cotton, as cotton exhibited higher yield deviation that groundnut.

Blandford and Curie (1975) proposed that in the case of production lags and price uncertainty, there is likely to be allocation of resource based on the price.

Jodha (1977) observed that farmers perception in the process of adjustment were to maintain survival as well as productive capacity of his resource base including family labour during the drought, so as to enable reinitiate production in the post-drought year.

Kurian (1978) conducted a study on the behaviour under uncertainty and public policies in peasant agriculture. The study suggested suitable modifications in the existing public policies and recommend about measures in the light of the theoretical results obtained. These include the effective implementation of land reforms, systematic investments in minor irrigation and other risk reducing measures as well as social services and introduction of crop insurance programme along with the progressive agricultural income taxation.

Rajagopalan and Varadarajan (1978) in an attempt to study the impact of risks and uncertainties on farm production and income in the hilly areas, indicated that diffusion of technology helps in minimizing risks and also protects the farmers in general. The study also indicates that the hill farming was not only faced with a limited scope of diversification, but also an efficient investment decision in favour of modern farming. In order to minimize risks the authors recommended mixed cropping, mixed farming and improved marketing practices.

Mrunthyunjaya and Sirohi (1979) concluded due to erratic and uncertain rainfall, crop yields in drought prone areas are not only low but highly variable. Wide fluctuations in product prices are also common. These two factors together have made farm returns low and uncertain.

Barah and Binswanger (1982) considered the relative importance of production and price risks in crop income risk.

Singh and Jain (1983) undertook a study to workout risk efficient plans for different size and categories of forms. Quadratic programming has been suggested as the most important tool for incorporating risk in farm planning. In this study it was assumed that risk in net returns is due to yield and price factors. The results indicated that a high degree of risk was involved in the existing plans of the farmers. The authors suggested the need to provide alternative plans precisely indicating the degree of corresponding risk involved to the farmers. The farmers could choose the plans according to their personal attitude to the risk. This knowledge could be of immense help in farm decision-making under risky situations.

Kalirajan and Haysman (1984) adopted Swamy's random coefficient model to estimate the inter-year variability in the fixed effects of the decision input variables. The study indicated a strong responsiveness of output to the inter season variabilities. An increase in the scale of chemical inputs such as fertilizer, had a relatively mild impact on the marginal productivity. The authors indicated that under these circumstances, fertilizer subsidy may not yield fruitful results and suggested provision of new varieties to be a desirable incentive for rainfed conditions.

Walker *et al*. (1986) concluded from their study that homogeneous growing conditions were most likely to be satisfied in dry land farming where most farmers faced the same dominant risk of inadequate rainfall.

Awasthi *et al.* (1987) analyzed the nature and the extent of risk associated with the production of rice. The study was based on the time series data on area, production, yield and price of rice. The variation of each variable and production variability of rice was measured through coefficient of variation. The study concludes that the paddy crop is highly sensitive to weather and an important implication of such a situation was to have crop insurance in the form of a regressive tax.

Abbaspour (1996) conducted a study on Bayesian risk methodology for insurance decisions. This Bayesian risk methodology is outlined for making decisions under uncertainty. A practical example was given for crop insurance where the insurer decides how to take risks. Risk to the insurer arises from the uncertainty and variation in input variable of a previously developed deterministic yield model and suggested that this methodology is general and can be used in many situations to determine the risk in a project from uncertain inputs.

Nelson (1997) described the most common risk factors that farmers would be confronted were weather, crop and livestock diseases, pests, adoption of new technologies, fluctuating prices, government programs and policies.

Cynthia and Anupama (2002) explained that all models of decision making under uncertainty explicitly or implicitly include two concepts of risk perceptions and attitudes. Risk has to be perceived in a proper perspective so as to have the potential to influence adoption decisions. The sources of risk will differ markedly from region to region depending on the wider spatial variation in agro-climatic and soil characteristics.

Kshirsagar *et al*. (2002) reported that the element of risks and uncertainty might increase with the application of new technology for all types of farmers, but its consequences were more severe for the small farmers. Farmers in the developing world through their long experience had adopted certain varieties and agronomic practices to cope with the risk they faced under the situations to reduce substantial income-losses.

James Hanson *et al.* (2004) conducted a study on risk and risk management in organic agriculture views of organic farmers. In a series of focus groups during 2001 and 2002, organic farmers from different regions of United States identified a wide range of risks to their operations. The focus groups were facilitated by the University of Maryland in cooperation with a research team to explore the risks faced by organic farmers, how they are managed and needs for risk management assistance. Contamination of organic production from genetically modified organisms was seen as a major risk, particularly by grain, soybean and cotton farmers. Focus group participants producing grains and cotton were knew about and had obtained crop insurance but most fruit and vegetable producers participating in the focus groups had little knowledge of crop insurance.

Jan (2005) found that the non-price factors like yield risk, yield of own and competing crops, rainfall and irrigation facilities, were the identified as relevant explanatory variables to the production risk.

Mandal *et al*. (2005) analyzed the risk of financing agriculture in North East region and found that lack of input delivery system, lack of output delivery system, marketing of the surplus produce were major impediments contributing to the uncertainties of hill-farming. Additionally the Minimum Support Price (MSP) was totally ineffective in this region in view of the higher unit cost of production as compared to the announced MSP.

Dismuke (2005) described the five general types of risk namely **Production risk** arising from the uncertain natural growth processes of crops and livestock. Weather, disease, pests, and other factors that affect both the quantity and quality of commodities produced cause production risk. **Price or market risk** refers to uncertainty about the prices producers will receive for commodities or the prices they must pay for inputs. The nature of price risk varies significantly from commodity to commodity. **Financial risk** results when the farm business borrows money and creates an obligation to repay debt. Rising interest rates, the prospect of loans being lent by lenders, and restricted credit availability are also aspects of financial risk. **Institutional risk** results from uncertainties surrounding government actions. Tax laws, regulations for chemical use, rules for animal waste disposal, and the level of price or income support payments are examples of government decisions that can have a major impact on the farm business. **Human or personal risk** refers to factors such as problems with human health or personal relationships that can affect the farm business. Accidents, illness, death, and divorce are examples of personal crises that can threaten a farm business.

Rainfall fluctuations could be responsible for 50 per cent of variability in yields. Production risk which was mainly due to the weather parameters leads to market aberrations as reported by the National Commission on Farmers (2006).

Rathore (2007) opined that the global food system from producer to final consumer was subject to a wide range of risks and uncertainties. Economic and social benefits could be realized by minimizing the impact of these risks. Risk in agriculture could be broadly defined into several categories. Yield risk was probably the most commonly considered risk in agriculture, because it reflects directly the impact of weather on farm operations.

Reddy (2007) pointed out that the farmer earlier raised many crops and varieties and there was not much risk involved due to climatic changes and pest infestation.

Parashuram Samal (2007) studied the production loss estimates and indicated that the losses due to droughts are more than floods and cyclones. He suggested some short term, medium term and long term policy measures to bring about stability in rice production. In the short term, the presently available drought tolerant varieties should be exploited through extension agencies.

Ramasamy and Selvaraj (2008) observed that much of output variability was due to weather on crop yields than soil type or region or other factors such as land (irrigated or not). Rainfall was the pre-eminent weather variable that caused yield fluctuations.

Radhikarani and Praveenasri (2008) revealed that for small farmers, the production risk of crops like maize, sunflower groundnut and red gram was more than the area risk. But for medium and large farmer, the production risk was more in the case of oilseed crop like ground nut and castor.

Drollette (2009) studied that the agricultural production has always been risky, and production risk can be among the most uncertain and potentially devastating to a farmer. There are many risk management tools available to reduce production risk and it is essential to understand the options available when making risk management decisions. He suggests that a major tool to reduce production risk is insurance.

By utilizing these and other risk management tools to reduce the many different risks a farmer faces, producers can develop a stable and profitable farming enterprise despite the uncertainties inherent in agricultural production.

2.2.2. Approaches to Crop insurance

Halcrow (1978) was of the opinion that of the types of crop insurance i.e. the all-risk crop insurance, area yield crop insurance and the weather crop insurance, it was the area yield and weather crop insurance which were preferable and more reliable than the all risk crop insurance specially in providing income protection for the individual farmers against the risks of low crop yield.

Yamauchi (1980) has suggested three approaches to crop insurance. The initial approach is the study of demand of small-scale farmers for crop insurance in relation to their income and possibility of exposure to natural hazards. This information would provide an important insight into the formulation of a crop insurance scheme, which is sufficiently attractive even to the small-scale and low-income farmers. The second approach is to consider a suitable administrative organisation that would oversee the implementation of the scheme at all levels. The third consideration pertains to the technical procedures for crop insurance such as insurance unit, amount of coverage, and premium rate.

Ahsan *et al.* (1982) provided a simple, yet general theoretical framework of agricultural insurance that may be used to explore its possibilities as a market enterprise or a state run programme. The authors indicated that first it is the market insurance with the public sector as a source of information gathering and dissemination and, second, is the direct provision of crop insurance by the public sector. This paper focused on the latter and developed a model of public insurance as a decentralized plan where the farmer determines factor utilization taking the insurance contract as given. In turn, the insurance agency, taking factor utilization as determined by the farmer, chooses the optimal contract so as to maximize the value of aggregate output in the economy.

Walker and Jodha (1982) have highlighted a few implications of crop insurance. It was indicated that the programme should be designed with a minimum of lacuna so that the integrity of the farm risk management was preserved. It was concluded that heterogeneity of productive micro environment may allow regional crop insurance programmes to pool risks more widely over many areas and small farmers may also be able to diffuse risk through spatial diversification and other mechanisms.

Kouadio (1983) analysed the implications of the availability of the Federal Crop Insurance Programme on the risk taking behaviour and social welfare of the farmers in Arizona. Analytically, a simple model of the allocation of land among two crops can safe and the other risky in yield was used along with the behaviour hypothesis of expected utility maximization. A subsidized programme will in general induce greater risk taking behaviour. The impact of the programme on crop mix was however ambitious when the expected insurance indemnities fell short of the premium paid. If insurance was available, under some reasonable assumptions about farmers risk preferences, a premium subsidy would tend to induce greater risk taking. However, the results of the empirical study suggested that the Federal Crop Insurance Programme did not have a significant on crop mix.

Nieuwoudt (1984) studied the viability of the United States Crop Insurance Programme with a view to draw some policy conclusions on the feasibility of such a scheme for South Africa. The study concluded that when crop insurance is initiated through farmers' cooperatives, it should be welcomed since it promotes greater stability in agriculture and more rational decision making. The author also cautions that the programme should not rush into a comprehensive state supported crop insurance programme such as that is followed in the United States since it could absorb millions of money in state subsidies.

Hazell and Valdes (1985) indicated that risks and uncertainty pose a serious impediment to agricultural development. One method of setting risks to farmers is through crop insurance. This paper also covers the economic theory behind crop insurance. It was pointed that high administrative costs of crop insurance make government subsidies a requirement. It was suggested that if the crop insurance programmes are to be useful in agricultural development, it must be carefully reworked to maximize their efficiency for both farmers and governments.

Walker *et al.* (1986) indicated that the participation by Indian farmers in voluntary public sector crop insurance programmes has historically been low. This paper analysed the important determinant of farmer's participation and the potential for crop insurance to reduce household income variability. Based on simulated crop insurance designs carried out on household panel data, it was found that crop insurance was not effective in smoothing out fluctuations in income. The simulation results point to some general conditions that have to be satisfied if crop insurance is to generate measurable risk benefits. Crop insurance in dryland agriculture has to be content with area variability, which can largely be attributed to the response of households to rainfall events. It was concluded that the institutional alternatives were superior to crop insurance as a means of reducing income variability for a large number of rural households.

Vercammen (2000) conducted a study on constrained efficient contracts for area yield crop insurance with area yield crop insurance, indemnification occurs when area yield falls below a yield trigger that is chosen by the producer. The maximum value for this yield trigger is generally restricted (eg. 80% of the long term area average yield). The impact of this trigger constraint on the optimal design of an area yield insurance contract is examined. Within the constrained efficient contract, indemnities consist of both a lump sum payment and a payment that is proportional to the yield short fall. Because lumpsum payments may not be feasible to implement, suggested that efficiency enhancing modifications to standard contracts.

Roderick *et al.* (2005) conducted study on share tenancy, ownership structure and prevented planting claims in crop insurance. A conceptual model based on opportunity cost and expected utility principles establishes linkages between the likelihood of prevented planting claims in crop insurance and existing share leasing arrangements / internal farm business structures. Results of heterostedastic profit estimation procedures indicate that simpler internal business structures and more dominant tenant leasing position can increase the probability of submitting a prevented planting claim.

Geyser (2008) stated that weather has always been an unpredictable phenomenon whether it is temperature, rainfall, floods, cyclones, frost or snow. With weather patterns becoming more and more unpredictable and with the abnormal conditions experienced over the last two decades, many industries are affected by weather in a significant way. In the agricultural industry, for example, businesses have long used futures contracts of agricultural commodities to hedge weather-related risks.

Debdatta Pal (2010) as an alternative to the existing area approach based short-term credit-linked crop insurance scheme, he advocates peril-indexed insurance and options as a risk management technique aimed at stabilizing the revenue of farmers, which is highly dependent on Indian weather condition.

Reshmy Nair (2010) stated that enormous dependency of crop production on weather highlights the pressing need for an effective mechanism to cope with weather-related production risks faced by farmers.

2.2.3. Crop Insurance in India

Genesis of Crop Insurance in India

A crop insurance scheme linking institutional credit (crop loan based on area approach) was suggested by Prof. Dandekar in 1976 & this scheme called as CCIS (Comprehensive Crop Insurance Scheme) was implemented from Kharif 1985 on all-India level. The National Agricultural Insurance Scheme (NAIS) was introduced in the country from the 1999-2000 Rabi seasons, replacing the Comprehensive Crop Insurance Scheme (CCIS) which was in operation in the country since 1985. Initially, only 9 states/union territories opted for the scheme. This number increased to 17 in Kharif 2000. Over time the number of states and union territories opted for the scheme increased to 24 and two respectively. Arunachal Pradesh, Delhi, Manipur, Nagaland, and Punjab were the states which have not yet adopted the scheme. The scheme was in operation for last 23 seasons. The scheme is being implemented by the General Insurance Corporation (GIC) on behalf of the Ministry of Agriculture. Government set up an organization called Agriculture Insurance Company of India Ltd (AIC) with support from the general insurance companies and NABARD for effective implementation of the scheme. There are also other schemes as listed in Appendix I.

The Comprehensive Crop Insurance Scheme has some of the shortcomings like financial non viability, Predominance of rainfed crops like oilseeds, pulses and millets, Coverage of only loanee farmers and Coverage of limited number of crops and exclusion of important commercial and horticultural crops. .

Keeping in view, the demands of states, farming communities, etc., for improving the scope and content of comprehensive crop insurance scheme a new crop insurance scheme titled National Agricultural Insurance Scheme (NAIS) was introduced in the country from Rabi 1999-2000. The National Agricultural Insurance Scheme provides for greater coverage in terms of farmers (i.e. non-loanee farmers brought under coverage). The scheme is operating on the basis of both 'area approach', for widespread calamities, and 'individual approach', for localized calamities such as hailstorms, landslides, cyclones and floods.

In India the number of farmers covered over the 19 seasons (1999-2000 rabi to 2008-2009 rabi) added up to 1347 lakhs and insured area to 2109 lakh hectares under different crops in different seasons i.e. on an average 1.6 hectares per farmer in any season. The total sum insured grossed to Rs.148278 crores at aggregated premium of Rs.4427 crores. The sum insured averaged to Rs.7000 per cropped acre covered under NAIS. The premium collected was about 3 per cent of the sum insured. The subsidy to small farmers amounted to Rs.424 crores i.e. 9.6 per cent of the premium collected. The claims reported added to Rs.15230 crores or 10.3 per cent of the sum insured and were paid to nearly 27 per cent of the farmers who had opted for the scheme. The claims averaged to Rs.4245 per farmer or Rs.3000 per acre of cropped area covered. However the claims made were nearly four times the premium collected. From these simple statistics the scheme does not seem to be economically viable for the implementing agency. For farmers it is considered as another alternative of risk management at farm level and it adds the premium cost to the cost of cultivation of crops. The performance of NAIS for 19 seasons (10 rabi and 9 kharif) is given in Appendix II. The relevant data were processed and summarized in Appendix III.

Both the number of farmers and area covered showed increasing trend with some ups and downs in some years. The number of farmers covered in eight years had increased by 82 per cent (87 lakhs) compared to 63 per cent (102 lakh hectares) increase in area covered. (Gurdev Singh, 2010).

The efforts have been made to bring more farmers under the fold of Crop Insurance by introducing a Pilot Weather Based Crop Insurance Scheme (WBCIS) as announced in the Union Budget 2007 in selected areas on pilot basis. WBCIS is intended to provide insurance protection to the farmers against adverse weather incidence, such as deficit and excess rainfall, high or low temperature, humidity etc. which are deemed to impact adversely the crop production. It has the advantage to settle the claims within shortest possible time. Further, to provide competitive service to the farmers, private insurance companies i.e. ICICI-Lombard, IFFCO-TOKIO and M.S Cholamandalam General Insurance Companies have also been involved for implementation besides Agriculture Insurance Company of India (AIC).

Singh (1967) reviewed the importance of crop insurance in Uttar Pradesh. It was indicated that for a crop insurance programme to run on a sound basis the continued support of the farmers was essential.

Singh (1972) conducted a feasibility study of crop insurance in Uttar Pradesh measured the extent of crop yield variability. The results indicated that fluctuations in crop production were a chronic problem. Among the food crops during the period 1951-70, the degree of yield variability was the highest in bajra. He suggested crop insurance to be a feasible programme since it appears to be self sustaining in the long run. Diversification stabilizes farm income and was at a higher level than the crop insurance programme. The author suggested crop insurance to be a better alternative to diversification.

Chandrakanth and Rebello (1980) in his study on the feasibility of crop insurance for potato in Hassan taluk, Karnataka computed the premiums based on the normal curve plan, the area yield insurance plan, the quality based premium plan and the variable premium plan. The study results indicated that the normal curve approach was applicable for estimating the pure premiums. It was concluded that the failure of rains and the use of poor quality tubers were the main causes of yield variability. A pilot crop insurance scheme was suggested with a subsidy at least to the extent of administered cost by the government.

Choudary (1977) conducted a study on an evaluation study of the crop insurance scheme for commercial H-4 cotton. The study indicated that there has to be a better understanding and effective co-ordination between the insurance credit and marketing agencies. Individual approaches though more elaborate and scientific was not likely to succeed in practice. The area approach was considered as a better alternative. The primary responsibility of initiating the scheme, he indicated, was with the General Insurance Corporation and the state governments.

Pandey *et al.* (1981) made an economic study on the feasibility of crop insurance in Haryana state. It was indicated that customarily high risk agriculture and low risk agriculture were differentiated on the basis of variability of yield from year to year. The results indicated that insurance coverage was directly associated with productivity. Premium expressed in terms of percentage of average yield was useful to decide whether the premium and was within the paying capacity of the farmer.

Subramanyan (1984) made an attempt to analyse the nature and extent of yield variation, compute premium rates and to arrive at a feasibility of crop insurance for coffee, in south Kodago district, Karnataka. The study suggested that the crop insurance scheme to be introduced on a pilot basis for coffee covering all estates. The compulsory group premium scheme with individual indemnity was suggested.

Dandekar (1985) noted that the crop insurance scheme is based on the area approach and that a *taluk/tahasil* is taken to be the area. Indemnities payable to farmers in the area are assessed on the basis of the average for the area; the variations in the yield within the area are neglected. This method is considered unsatisfactory.

Pathak (1986) argued that through crop insurance, farmers could purchase the right for compensation by paying only a small amount and that they are assured of protection against uncertainties.

Subramanian (1986) used linear type of production function in paddy crop for pilot crop insurance scheme analysis to compare the resource use efficiency of beneficiaries and non beneficiaries.

Rustagi (1988) analysed the viability of the pilot crop insurance programme in India. He was of the opinion that crop insurance programmes for multiple risks suffer from the problems of moral hazards and adverse selection. It was concluded that for reasonable values of risk aversion and correlation between farmers and area yields, the subsidy required under the homogeneous area approach was lesser than under the individual yield approach.

Shobarani (1989) conducted a study on an economic analysis of crop insurance for ragi in Bangalore rural district and found that lack of awareness among the farmers about the scheme as a major lacuna. The study suggested that the existing premium rate of 2 per cent can be retained, while the limit of coverage should be 200 per cent of the loan.

Hemalatha Iyengar (1989) conducted a study on economic analysis of crop insurance for paddy in Bangalore district. The study revealed a promising sign about the viability of the programme in Karnataka and it was indicated that there was a lack of supervision by the bank officials after disbursement of loan.

Shanthi (1991) found that the crop loss was high in some areas of Kanyakumari Ditrict through her crop loss assessment method. But the loss restored by the insurance agencies in the study area was high in kharif season. She also found that the resource use pattern of the farmers in the comprehensive crop insurance operated area has increased and the farmers were realized higher yield.

Mishra (1994) analyzed the impact of a credit-linked Comprehensive Crop Insurance Scheme (CCIS) on crop loans, especially to small farmers in Gujarat. It is observed that CCIS had a collateral effect as reflected through the increased loan amount per borrower and reduction in the proportion of non-borrowers among small farmers. The implications of credit expansion are that increased availability of credit can enhance input use and output and employment that increased share of small farmers in the total loan can have desirable effects on equity and efficiency considerations.

Though crop insurance is based on area yield, it insures the loan amount. This leads to improved access of small and marginal farmers to institutional credit. In the event of crop failure or drought, loan is repaid in the form of indemnity and thus there is reduction in the cost of recovery of loans to lending institutions and reduction in the overdue and defaults.

It is observed that insured households invest more on agricultural inputs leading to higher output and income per unit of land. Interestingly, percentage increase in output and income is more for small farms. Based on 1991 data, CCIS was found to contribute 23, 15, and 29 per cent increase in income of insured farmers in Gujarat, Orissa and Tamil Nadu, respectively (Mishra 1994).

Khonarkar (1995) conducted a study on an economic analysis of crop insurance in Nagpur district. It was found that farmers have been definitely benefited by the crop insurance scheme. It was suggested that there is need to extend the scheme to non borrowers in addition to beneficiaries availing crop loans, so as to safeguard the interest of large farming community.

Toms Joseph *et al.* (1999) conducted a study on an evaluation of the insurance scheme for rubber plantation in the context of natural damage and he found that the need for insurance scheme for the rubber plantations arises mainly from the estimated magnitude at the natural damage and the resultant minority loss.

Niranjan Lal *et al.* (2000) conducted a study on farmers awareness about the crop insurance schemes. It was indicated that most of the farmers got information about the insurance schemes from the insurance agents but only a few farmers had adopted the crop insurance policy.

Bhende (2002) found that a properly designed and implemented crop insurance programme will protect the numerous vulnerable small and marginal farmers from hardship, bring in stability in the farm incomes and increase the farm production.

Bharat Ramaswami *et al.* (June 2003), found that there is no typical risk environment that obtains for all Indian farmers as it varies by location, weather conditions, soil type, access to irrigation and by the particular commodity market. Rainfall and drought risks dominate agriculture in arid and

semi-arid tropics. These risks are substantial and major. To protect farmers against production risks, the Central Government together with the State governments offer a crop insurance scheme based on the `area approach'. And he concluded that the scheme as yet covers a small minority of farmers. Even so, concerns have already arisen about the cost of this scheme. This is due to the fact that premiums are not yet in line with actuarial cost.
Such subsidisation makes it expensive to expand the crop insurance programme.

According to Mallikarjun S. Hasanabadi (2005), Uncertainty of crop yield is one of the basic risks, which every farmer has to face. Crop insurance is a means of counteracting the uncertainties involved in crop production. He found that he yield variation and price variation was more in post harvest period. Most of the sample farmers aware about crop insurance scheme but the farmers were not satisfied with the existing operation of the scheme. So the alternative model of normal curve method was suggested willfully to compensate loss of yield incurred by the farmers and the premium calculation compared to the existing method.

Raju and Ramesh Chand (2008) found that despite various schemes launched from time to time in the country agriculture insurance has served very limited purpose. The coverage in terms of area, number of farmers and value of agricultural output is very small, payment of indemnity based on area approach miss affected farmers outside the compensated area, and most of the schemes are not viable. Expanding the coverage of crop insurance would therefore increase government costs considerably. Unless the programme is restructured carefully to make it viable, the prospects of its future expansion to include and impact more farmers are remote. This requires renewed efforts by Government in terms of designing appropriate mechanisms and providing financial support for agricultural insurance. Providing similar help to private sector insurers would help in increasing insurance coverage and in improving viability of the insurance schemes over time. With the improved integration of rural countryside and communication network, the Unit area of insurance could be brought down to a village panchayat level.

Gurdev Singh (2010) discusses the dependence of Indian agriculture on uncertain rains. In addition the farmers experience other production risks as well as marketing risks related to different crop enterprises and for different agro-climatic regions and areas. He then argues on the need for crop insurance as an alternative to manage production risk. He also states about the major deficiencies that could be observed in the insurance products like National Agricultural Insurance Scheme and Weather Based Insurance Scheme.

2.2.4. Crop Insurance in other Countries

Ray (1960) in his paper reviewed the need and importance of crop insurance and also examined the countries operating crop insurance programmes. The author identified the major factors which seem to stand in the way of rapid progress of the crop insurance scheme. According to him, priority should be given for the improvement of various technical and physical factors affecting agriculture. On the economic side more attention should be given to more credit. Since experiences have shown that in many cases the allocations to agriculture have been adequate, thus the need for all risk or multi risk crop insurance will depend largely on the realization of its need by the appropriate authorities and also by lifting the well of skepticism and uncertainty that still prevails regarding the possibility.

Sanderatane (1969) highlighted the inherent difficulties in Ceylon's crop insurance scheme. Some of the difficulties pointed are that the scheme has run the risk of providing inadequate coverage inequitable premium rates due to the averaging of premium rates, a high level of government subsidization and the inability to collect premium dues. These difficulties suggest that crop insurance scheme should be effectively dovetailed and integrated with other agricultural programmes since the eligibility to the benefits at each of such programme depend upon on the commitment at all.

Sulzhik (1978) made a criticism of the methods used in the Soviet Union in calculating insurance performances for yield deficiencies in crop production the limiting of the insurance payment did not provide any help to the farms concerned. He suggested that in future the benefits should be granted for losses in crop production branch as a whole rather than the individual crop approach. In this way the number of cases of losses could be reduced by about half and in individual cases the sum to be paid could be raised.

Crawford (1979) excerpts some of the problems faced by the developing countries in the operation of such programmes which seriously limit the probability of success and decreases the level of benefits realized. Many of the problems faced by the programme involved institutional constraints which sometimes manifest themselves as an inability to perform the needed operational tasks. He indicated that the farmers lack of education, small and fragmented land holdings, vaguely defined tenured patterns and absence of land records greatly increased the cost and the administrative problems of operating a crop insurance programme in developing countries.

Yamauchi (1980) in his study describes the type, pattern and frequency of natural hazards for rice farming in Thailand and then examined the farmers demand for crop insurance in relation to farmers income and the possibility of exposure to natural hazards. Possible insurance units, amount and coverage, premium rating, loss adjustment method etc and recommendations for a pilot scheme were made.

Ahsan (1983) reviewed the pilot crop insurance scheme operated in Bangladesh since 1977 and pointed out that the practice of having a voluntary scheme with uniform highly subsidized premium rates throughout the country encourages adverse selection. An individual approach, coupled with inadequate provisions of co-insurance on the other hand increases the risk of fraud. Both these factors he indicated, have contributed towards the very high loss rates. It was thus suggested that in order to make the scheme a national programme, one has to move away from the individual approach to an area approach of insurance which would eliminate the risk of fraud. An area approach applied on some form of a compulsory basis also does way with the problem of adverse selection.

Mairo and Glauber (1997) studied systemic risk, reinsurance and the failure of crop insurance markets they felt that without affordable reinsurance, private crop insurance markets are doomed to fail because systemic weather effects induce high correlation among farm level yields, defeating insurer efforts to pool risks across farms. Using an empirical model of the U.S. crop insurance market, they found that area yield reinsurance contracts would enable crop insurers to cover most of their systemic crop loss risk, reducing their risk exposure to levels typically experienced by more conventional property liability insurers.

Mahul and Vermersch (2000) studied hedging crop risk with yield insurance futures and options. This study analyses the optimal hedging decisions for risk-averse producers facing crop risk, assuming crop yield insurance futures and options available. The first best optimal hedge requires either a futures position or an option proportional to the regression coefficient of individual yield on aggregate yield depending on whether the financial markets are unbiased or biased. Using yield data for a sample of wheat producers in France the producer’s hedge ratios are derived. The study suggests that these new hedging instruments are usually more effective to reduce farm yield variability than individual yield contracts.

Clover and Nieuwoudt (2003) conducted an economic evaluation of area yield insurance for small sale cane growers. In this study, principles of area yield insurance were applied to yield data on small scale cane growers in Kwazulu-Natal and used to calculate pure premium rates. The viability of a government subsidized area yield insurance scheme for small scale cane growers was assessed in terms of affordability to the government, the farmers and private insurance companies. The empirical results obtained from this study indicate that such a scheme may pose great expense to the government and as a result may not be viable in South Africa, and this topic needs further study, while other risk management strategies should also be considered.

Ulrich Hess (2003) crop loan insurance and risk management scheme can help banks significantly increase their lending volumes, especially in rainfed areas. At the same time, the scheme can help bring down default rates as well as transaction costs. It could help farmers stabilize their incomes and even allow farmers access to a greater credit line thanks to enhanced collateral.

Sherrick *et al.* (2004) conducted a study on crop insurance valuation under alternative yield distributions, the results of this study demonstrate that large differences in expected payouts from popular crop insurance products can arise solely from the parameterization chooses to represent yield distributions. The results suggest that the frequently unexamined yield distribution specification may lead to economically significant errors in crop insurance policy rating and assessment of expected payouts from policies.

Barry *et al.* (2004) studied an empirical analysis of acreage effects of participation in the lateral crop insurance programme. They considered multi-equation structural models of acreage response, insurance participation, CRP enrollment and input usage. This analysis focuses on corn and soybean production in the corn belt and wheat and barley production in the upper great plains, the results confirm that increased participation in insurance programmes provokes statistically significant acreage responses in some cases, though the response is very modest in every case. A number of policy simulations involving increases in premium subsidies are considered.

Edward Crowther (2007) concludes that drought insurance is an interesting and promising financial innovation with the potential to effect widespread and significant welfare gains for farmers (and other purchasers of it) across the developed world. 'Technical' issues obstructing its progress, as recognised by the project designers, include the paucity of weather data in certain regions of the developing world, and 'basis risk'. Furthermore, as is widely recognised, drought insurance is not a panacea, and is merely one tool which needs to be employed in tackling drought risks – the presence of functioning markets for crops and agricultural inputs are equally important. Other potential issues identified by this study include the psychology of the insurance decision, which suggests that (unless addressed) take-up of insurance could be less enthusiastic than expected, and the ever-present issue of inequality.

Olubiyo *et al.* (2009) carried out the study to examine whether agricultural insurance exerted any significant influence on the farming practices. The study found that the sampled farmers differ in their use of farm resources and the level of output produced. A higher proportion of insured farmers applied improved farming practices and was more commercially oriented. The insured farmers ventured into more risky enterprises and released a greater proportion of their output to the market for sale. However, contrary to expectations, uninsured farmers were found to be more productive and efficient in their resource use than the insured farmers.

2.2.5. Logit Model and Garrett's Ranking Technique

Logit Model

Nagaraj *et al.* (2003) stated that in anticipation of a well failure farmers resort to coping mechanisms to manage the reduced supply of groundwater so that they can at atleast wish to be on the same iso-revenue curve. The coping cost on different coping mechanisms varied with the different categories of farmers. The coping mechanisms like drilling of additional wells, well improvement (deepening) and adoption of drip irrigation which were capital intensive were generally adopted by large farmers. The coping mechanism such as adoption of indigenous drip system and buying water, which were less capital intensive were largely adopted by the small and medium farmers.

According Ponnarasi *et al.* (2008) the probability of a household being poor was dependent on the socio-economic characteristic of the households. The Maximum –Likelihood Estimate of the logit model indicated that literacy percentage, category, man-days of employment, percentage of earners in the household and income of the household had a negative and significant effect on the poverty. The coefficient of the independent variable age is positive and significant and social status was positive but not significant.

Tefera *et al*. (2010) analyzed the determinants of factors that affect the adoption of coffee husk manure by using the standard Logistic adoption model. It revealed that gender of household , education level, farm size, distance from home to nearby coffee processing plant, socio-economic status, labour availability measured in men equivalent units institutional support and number of contacts with development agent significantly influenced the adoption of coffee husk manure.

In the present study Logistic Regression Analysis is applied to find out the probability (Odds) of becoming adopter and non- adopter of crop loan.

Garrett's Ranking Technique

Sudalaimani (1991) adopted Garrett's ranking technique to rank the promotional activities on a marketing project in tissue culture cardamom plantlets and problems faced by the planters in the cultivation of cardamom.

Senthilkumar (1992) used Garret's ranking technique to rank the factors influencing the purchase of mushroom by the household consumers.

Jayachandran (2002) used Garrett's ranking technique to rank the constraints involved in maize production. He found that inadequate transport facilities was the major problem faced by farmers , followed by distant location of regulated market, inadequate storage facilities, price fluctuation, etc.

Senthilnathan (2004) used Garret's ranking technique to rank the benefits due to watershed implementation like soil and water conservation, soil fertility improvement, cropping pattern, and increase in cropping intensity and ground water recharge.

Sudha (2005) employed Garrett's scoring technique to find the constraints involved in adoption of Integrated Pest Management (IPM) Technology. She found that high wage of labour as the major problem with the score of 75.65 followed by non availability of labour, time, lack of IPM inputs, lack of extension follow up practices, lack of proper training facilities, lack of confidence, complex practice, fragmented land holdings and lack of assured irrigation.

Ganaprakasam (2006) using Garrett's ranking technique found delay in input supply as the major problem faced in coleus contract followed by insufficient input supply, seasonal labour scarcity and high cost of labour, forced insurance, yield loss due to climate and lack of fixed price policy.

Athiyaman (2007) used Garret's ranking technique to rank the reasons for labour migration, such as; family characteristics, drought, and change in cropping pattern, wage rates and nature the work.

Kiruthika (2009) used Garrette ranking technique to assess the problems faced by the turmeric growers in Erode district of Tamil Nadu. The results showed that price fluctuations, storage cost and low price were the major problems faced by the turmeric growers.

Loganathan (2009) used Garrette ranking technique to assess the reasons for the adoption of Bt and Non-Bt cotton and to identify the problems faced by the farmers in the adoption of Bt and Non-Bt cotton. He found that higher yield and higher profitability and lower pest problems were the important factors responsible for preference of Bt cotton.

In the present study Garret's ranking technique is used to identify the major reasons for production risk as perceived by the sample farmers.

CHAPTER III

DESIGN OF THE STUDY

The design of the study is an important component of research. In order to fulfill the objectives of the study, an appropriate methodology for conducting the study is inevitable. Therefore, in this chapter, the methodology adopted for the present study including the selection of study area, sampling design, the method of data collection and the different tools of analyses are discussed under the following sub headings:

3.1. Sampling Design

3.2. Data Collection

3.3. Tools of Analysis

3.1. Sampling Design

The present study attempts to analyze the agricultural production/yield risk and one of its coping mechanism viz. crop insurance, through the National Agricultural insurance scheme (NAIS). This study aimed at understanding the contribution of crop insurance scheme to risk reduction of farmers and its awareness in the selected area. Among 32 districts of Tamil Nadu, Erode District was chosen randomly to conduct the present study.

Erode district consists of five taluks and fourteen blocks. National Agricultural Insurance Scheme coverage in this district was significant in terms of coverage of area (11164.2 ha), number of farmers (11,918) and number of crops (9). Paddy, banana, turmeric, sugarcane, maize, groundnut, tapioca and potato were the crops covered under this scheme in 2010 kharif season. In this paddy, banana and turmeric crops together constituted about 33 per cent of total area and 36 per cent of the total number of farmers under the insurance coverage. This scheme is implemented through Primary Agricultural Co-operative Banks in both Kharif and rabi seasons. Since kharif crop was most severely affected by natural calamities such as drought, pest and diseases farmers raising kharif crops were considered for this study.

Among the 14 blocks Gobichettipalayam, Sathyamangalam and Bhavani blocks have been selected for present study, because of the existence of number of crop insurers of paddy (95 in number), banana (138 in number) and turmeric (161 in number) farmers are comparatively higher in these blocks based on the data collected from the District Central Co-operative Bank, Erode district.

Table 3.1. Selected Sample Size of Farmers in Erode District

(Number of Farm Households)

S. NO.	Name of the Block / villages	Insurers	Non-Insurers	Total
1.	**Gobichettipalayam Block – Paddy**			
	Nanjagoundanpalayam	10	4	14
	Karattadipalayam	10	3	13
	Pudhukaraipudhur	10	3	13
2.	**Sathyamangalam Block - Banana**			
	Periyur	10	4	14
	Ariyappampalayam	10	3	13
	Makkinangombai	10	3	13
3.	**Bhavani Block - Turmeric**			
	Periyapuliyur	10	4	14
	Pudhupalayam	10	3	13
	Oratchikottai	10	3	13
	Total	**90**	**30**	**120**

In the next stage of sampling, the total number of respondents was fixed at one hundred and twenty farm households. The sample size of ninety insurers was fixed which constituted nearly one fourth of the total insurers in the selected blocks and non- insurers were fixed at thirty. Since insurance still not voluntarily opted by farmers and only credit issuing agencies ensure insuring of crop loans, insurer household were selected by proxy. In as much as all crop loans are insured and no farmer opted for insurance without crop loan, the list of crop loan farmers was used for selecting farmers with crop insurance.

Three villages were selected at random in each block, the information about the villages and the crop wise insured farmers list was collected from the co-operative banks for the study. From that 10 insured farmers were interviewed in each of the selected villages and 3 to 4 non-insurers were selected at random in the same villages. Thus, the sample design resulted in sample size of thirty insures and ten non-insurers in each block. Thus, 120 holdings were selected for the present study and the distribution of the selected farm households is furnished in Table 3.1.

3.2. Data Collection

Both primary and secondary data were collected for the study.

3.2.1. Primary Data

The primary data were collected from the sample farmers through personal interview method. Based on the physical and socio-economic environment of farming in the study area an interview schedule was designed, pre-tested and finalized. For both insurers and non-insurers the same type of questionnaire was used to collect the primary data. Data regarding information on family composition, size of the holding, area under various crops, cropping pattern, extent of farm inputs used, cost and returns of crop and livestock activities, maintenance of fixed assets, utilization of family labour and permanent labour, losses for different crops, extend of risk, perception about risk, usefulness and awareness about National Agricultural Insurance Scheme (NAIS) and problems and suggestions on the usage of the insurance scheme were collected.

3.2.2. Secondary Data

Secondary data on location of the district, soil type, rainfall pattern, cropping pattern, demography, land use pattern, irrigation pattern, financial institutions and infrastructure facilities available, etc. were obtained from the office of the Assistant Director of Statistics, Erode and crop wise and season wise number of farmers insured, area covered and premium collected details in the district were collected from the District Central Co-operative Bank, Erode district and Primary Agricultural Co-operative Banks functioning in Gobichettipalayam, Sathyamangalam and Bhavani blocks.

3.2.3. Period of Study

The reference period for the study was the agricultural year of 2009 - 2010 and the collection of data from the sample respondents was taken up during the months from February to March, 2011.

3.3. Tools of Analysis

The choice of the statistical and econometric tools was decided with reference to the objectives of the study and the nature of data collected. The collected data were analyzed and tabulated to arrive at meaningful conclusions.

3.3.1. Conventional Analysis

The conventional methods of analysis viz., percentage and average analysis were carried out to estimate the distributions of socio-economic variables such as age, sex, education, land holding pattern, etc of the sample farm households.

3.3.2. Tabular Analysis

This provides the simplest and most intelligible tool to analyze the extent of coverage of crop insurance scheme and to analyze the opinion of insured and non-insured farmers. The results were interpreted by working out averages, standard deviation, coefficient of variation, percentage and ratios. It also helps to analyze the crop wise, season wise, premium collected and claims paid under insurance scheme and to calculate variation in yield, price and rainfall for selected crops in Erode district.

3.3.2.1. Cost of Cultivation

Tabular analysis was used to assess the cost, returns and profits of crops grown in the study area. The percentages and averages of variable costs and fixed costs were computed based on the methodology followed by Commission on Agricultural Costs and Prices, Government of India, New Delhi. The cost concepts like Cost A, Cost-B and Cost-C listed below were used for the study.

Cost A1: It includes the value of hired human labour, value of bullock labour (owned and hired), machine power (owned and hired), value of seeds (farm produced / purchased), value of manures (owned / purchased), value of fertilizers, value of plant protection chemicals, irrigation charges, interest on working capital, depreciation of implements and farm buildings, payments (land revenue, cesses and other taxes) and miscellaneous expenses (electricity charges).

Cost A2 = Cost A1 + rent paid for leased in land

Cost B1 = Cost A2 + interest on owned fixed capital (excluding land)

Cost B2 = Cost B1 + imputed rental value of owned land

Cost C1 = Cost B1 + imputed value of family labour

Cost C2 = Cost B2 + imputed value of family labour

Cost C3 = Cost C2 X 0.10 (10 % of cost C2 was added to Cost C2)

Cost C3 is the recently added concept to provide allowance for managerial functions undertaken by the farmers.

Cost of Production = (Cost C3 - Value of By-Product) / Quantity of Main Product Produced

Gross Return = (Quantity of Main Product x Price of Main Product (Rs)) + (Quantity of By Product× Price of By Product (Rs))

Net Return = Gross Return - Cost C3

3.3.2.2. Measurement of Variables used in Cost of Cultivation

The variables used in the analysis were measured as given the following.

1. Cultivation Cost

It included both operational and material cost in cultivating paddy, banana and turmeric in a year. The various costs included were cost of labour, manures, chemicals, depreciation, land revenue and interest on working capital.

2. Cost of Seed materials (Rhizomes)

Turmeric and banana are propagated through rhizomes. Paddy is raised through seeds. The quantity of seed materials was obtained directly from the farmers. The cost of the seed was calculated at the local market price for the farm produced seeds and actual expenditure incurred in case of purchased seeds.

3. Human Labour

Human labour was measured in terms of number of days separately for men and women. The hired labour was converted into common physical unit of man days of eight hours. Family labour were considered separately and added to the hired labour to calculate the total labour requirement. The labour cost were calculated based on the wage rates of Rs 200 for male and Rs 120 for female per day of eight hours prevailed in the study area during the reference year for the data collection.

4. Machine Power

Machine power was valued using the prevailing rates of custom hiring in the selected villages.

5. Cost of Organic Manure

The quantity of FYM used in the cultivation of crops was measured in terms of tractor load. The cost was imputed at the market price in the village including cost of transportation and other incidental charges.

6. Cost of Fertilizers and Plant Protection Chemicals

It included the cost of different forms of fertilizers and plant protection chemicals used. All the fertilizers and plant protection chemicals used by the farmers were valued at their respective market prices to calculate the total cost.

7. Irrigation

The irrigation variable was quantified in terms of the number of irrigations since the depth of irrigation does not show much variation across farms. Irrigation cost included labour cost for irrigating the field, amortized historical investment on wells, cost pertaining to operation and maintenance of pump sets used by the sample farmers for irrigating their paddy, banana and turmeric field.

8. Land Revenue

Land revenue charge was the existing charges levied by the government (Rs 6.25/ha for paddy and Rs 12.50/ha for banana and turmeric).

9. Rental Value of Land

It was imputed by taking the local average rental value which was at the rate of Rs 10,125/ha for paddy, 31,857/ha for banana and 49,652/ha for turmeric one year period.

10. Interest on Working Capital

The interest rate for working capital was worked at the interest rate for agricultural loans at the rate of seven per cent for paddy, twelve per cent for banana and turmeric. It was charged based on a period of duration of a particular crop.

11. Interest on Fixed Capital

Interest on fixed capital was computed at 12 percent rate, which is the interest charged for investment loans sanctioned by commercial banks in the study area

12. Depreciation

Depreciation was calculated by the straight line method. For fixed capital items such as farm machinery and irrigation structures used in paddy, banana and turmeric cultivation was calculated at the rate of five percent for buildings and ten percent for implements.

13. Yield

The total yield of paddy, banana and turmeric obtained by farmers was expressed in terms of quintals per hectare.

3.3.3. Percentage Analysis

The percentages and averages were worked out to evaluate the demographic and socio-economic variables such as age, education, family size, farm size, income, land holding pattern for the sample farmers and finally to elicit the opinion of insured and non-insured farmers percentage method was employed.

3.3.4. Crop Loss Assessment

Crop loss assessment is done by using the following method,

$$\textbf{Crop loss} = \frac{\textbf{Normal yield (N)} - \textbf{Actual yield (A)}}{\textbf{Normal yield (N)}} \times 100$$

Where, N- refers to the average yield in kg/ha for the past 5 years shown by agricultural department

A-Refers to the actual yield in kg/ha realized by the sample farmers

Crop loss restorability (CLR) is done by using the following method.

$$\textbf{CLR} = \frac{\textbf{Indemnity paid (in Rs.)}}{\textbf{Loss in rupees}} \times 100$$

3.3.5. Co-efficient of Variation

Co-efficient of variation for productivity of paddy, banana and turmeric over the years were estimated to know the nature of instability by using the formula,

$$\textbf{C.V.} = \frac{\textbf{Standard deviation } (\sigma)}{\textbf{Mean } (\mu)} \times 100$$

3.3.6. Instability Index

Risk associated with agriculture and various crops will be estimated by using instability index as an indicator of risk as below:

Instability index = Standard deviation of natural logarithm (Y_{t+1}/Y_t)

Where, Y_t is the crop yield in the current year and, Y_{t+1} represent the same in the next year. This index is unit free and very robust and it measures deviations from the underlying trend (log linear in this case). When there are no deviations from trend, the ratio Y_{t+1}/Y_t is constant, and thus standard deviation in it is zero. As the series fluctuates more, the ratio of Y_{t+1}/Y_t also fluctuates more, and standard deviation increases. Time series data is used to estimate this index.

3.3.7. Logit Regression Model

Logit model explains the dichotomous dependent variable (i.e, Y = 1, if yes or 0 otherwise). The standardized normal cumulative distribution function is used which estimates the probability of occurrence of the event i.e, P(Y=1/X). In the present study, Logistic Regression Analysis was applied to find out the probability (Odds) of becoming adopter and non- adopter of crop loan. A set of variables, such as Family size, Gross cropped area, Off-farm and non-farm income, Farm experience and Capital assets was considered to know their effect on adoption of crop loan.

The Logistic Regression (LR) model was constructed as:

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

Where,

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

1 = If the sample farmer is an adopter of crop loan

0 = If the sample farmer is not an adopter of crop loan

x_1 = Family size (Numbers/farm)

x_2 = Gross cropped area (ha/farm)

x_3 = Off-farm and non-farm income (Rs/farm)

x_4 = Farm experience (Years)

x_5 = Capital assets (Rs/farm)

$\beta_1, \beta_2, \beta_3 ..... \beta_i$ = Regression coefficients

3.3.8. Garrett's Ranking Technique

To identify the major reasons for production risk as perceived by the sample farmers, Garrett's scoring technique was employed. Ranks assigned to the factors by the farmers were converted into scores using percentage for each of the assigned rank with the following formula:

$$\textbf{Percent position} = \frac{100\,(R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij} = Rank assigned for the i th category by the j th group

N_j = Number of constraints assigned by j th individual

Using the table developed by Garrett, mean of the scores was arrived. Highest mean score was ranked first. According to the mean score, problems were listed in the descending order.

CHAPTER IV

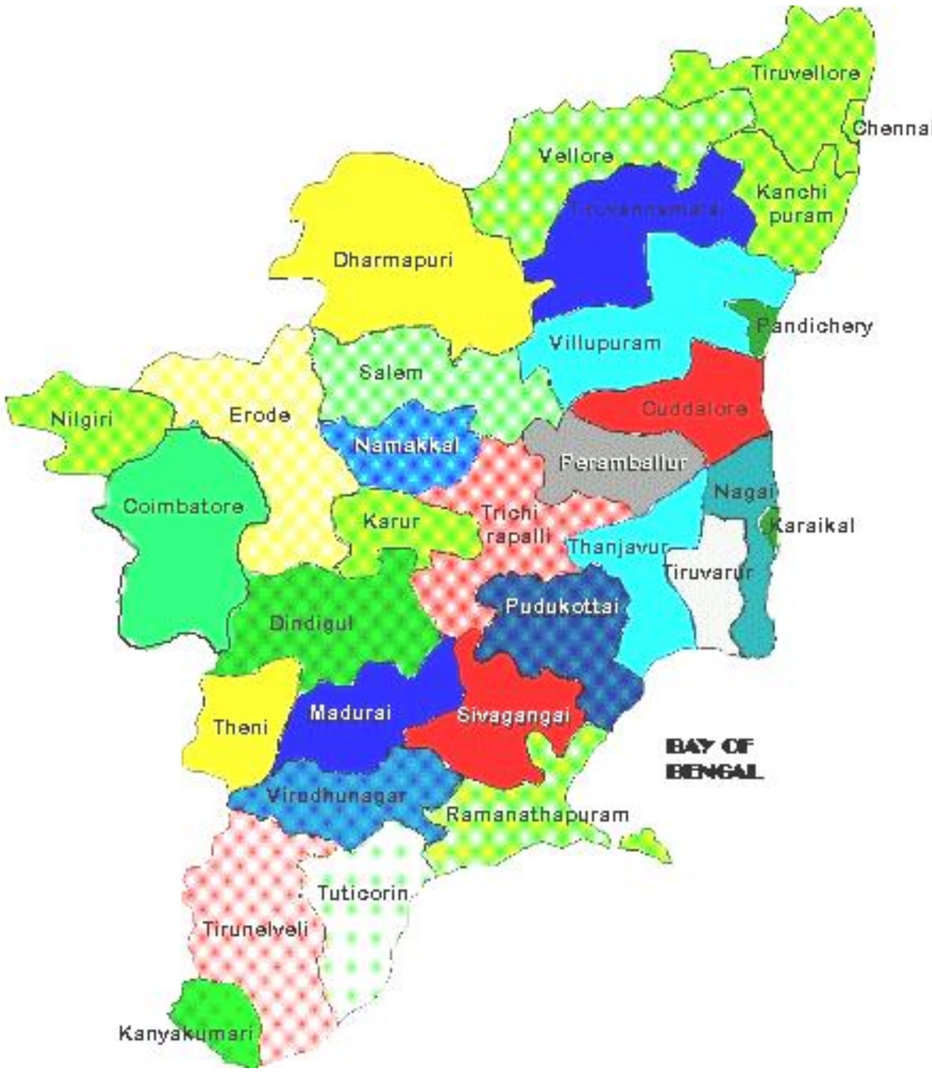
DESCRIPTION OF THE STUDY AREA

A proper perspective of the study region covering a brief description of geographical features such as location, climate, and land use pattern and agro socio-economic features such as agriculture, population and literacy is absolutely essential to have a better understanding of results of the study and in turn to draw meaningful conclusions. These are presented in the following sections:

4.1. Location

Erode district was bifurcated from the erstwhile Coimbatore district on 02.10.1971. Erode District lies between 10^0 36" and 11^0 58" North Latitude and between $76^0$49" and 77^0 58" East Longitude. The total geographical area of the district is 5714 sq.kms. Erode District lies on the extreme north of Tamil Nadu and it is bounded mostly by Karnataka State. Namakkal and Karur districts lie in the eastern side of the district. Dindigal district is its immediate neighbour in the South and on the West it has Coimbatore and Nilgiri districts, as its boundaries. Thus, Erode district is essentially a land-locked area having no sea-coast of its own. The region comprised in the district can be portrayed as a long undulating plain gently sloping towards the river Cauvery in the south-east. The three major tributaries of river Cauvery viz, Bhavani, Noyyal and Amaravathy drain the long stretch of mountains in the north. A part of the eastern boundary of the district is formed by river Cauvery, entering the district from Salem and flowing in a southernly direction. Location of Erode district in Tamil Nadu state is presented in Figure 4.1. The other details of the district are as follows.

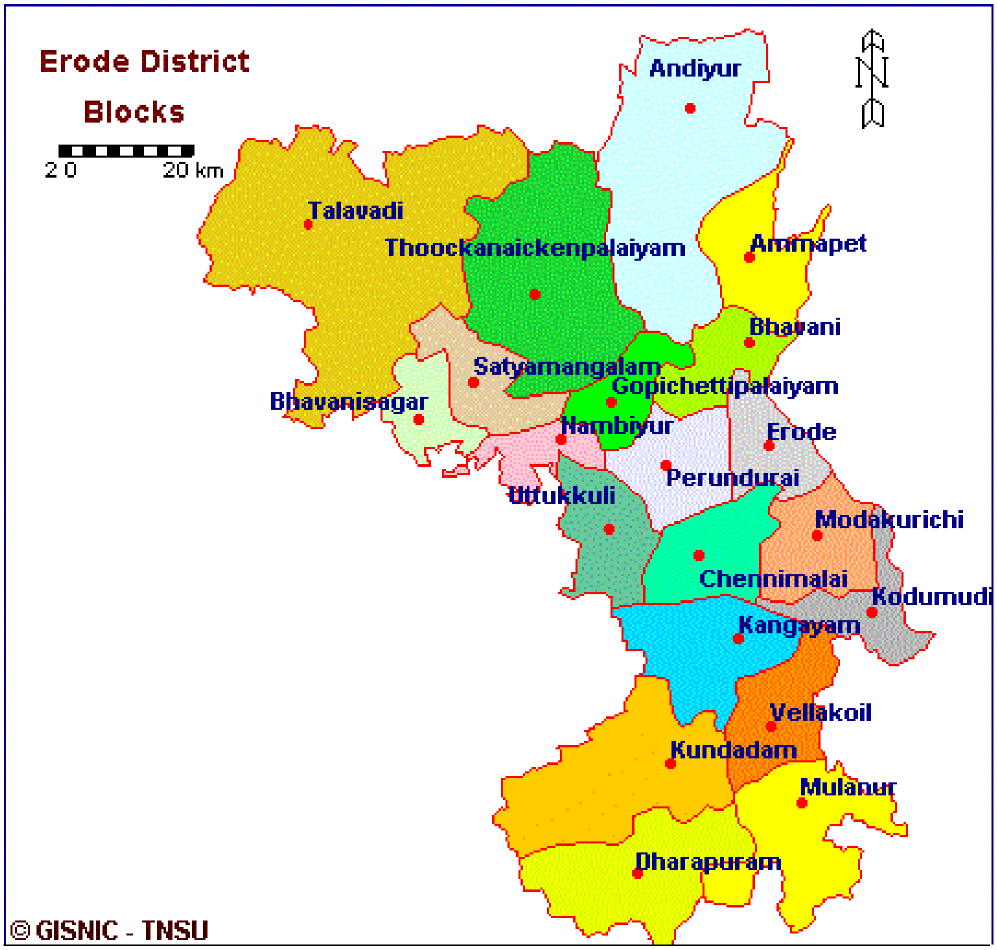
Figure 4.1. Map Showing Location of Erode District in Tamil Nadu



Study area

Erode District

Figure 4.2. Block Map of Erode District



Study Blocks

1) Bhavani

4.2. Revenue Divisions

The District has only two revenue divisions namely Erode and Gobichettipalayam. The district comprises of five taluks and fourteen blocks and there were 375 revenue villages in the district. The administrative set up indicating the list of taluks and blocks in Erode district is given in Table 4.1 and Map of Erode District showing selected blocks is presented in Figure 4.2.

Table 4.1. Administrative Set up - List of Taluks and Blocks in Erode District

S. No.	Taluks	Blocks
1.	Erode	1. Erode 2. Modakurichi 3. Kodumudi
2.	Perundurai	4. Perundurai 5. Chennimalai
3.	Gobichettipalayam	6. Gobichettipalayam 7. Nambiyur 8. Thukkanaikenpalayam
4.	Bhavani	9. Bhavani 10. Anthiyur 11. Ammapettai
5.	Sathyamangalam	12. Sathyamangalam 13. Bhavanisagar 14. Thalavadi

Source: Office of the Assistant Director of Economics and Statistics, Erode (2008-09)

4.3. Climate Conditions

The temperature in Erode district ranges from 18.9°C to 35.3°C. The normal rainfall in Erode district is 711.4 mm. Erode district receives the highest amount of rainfall (308.5 mm) during the North East Monsoon. The South West Monsoon supplies 229.9 mm of average rainfall. It receives very less rainfall during winter and summer seasons. The month-wise rainfall details for 2008-09 at Erode district are given in Table 4.2.

Table 4.2. Erode District Rainfall Details for the Year (2008-09)

(mm)

Month	**Rainfall**		
	Actual	**Normal**	**Deviation %**
June 2008	12.3	26.1	-52.9
July 2008	52.4	34.1	53.7
August 2008	119.9	56.4	112.6
September 2008	45.3	96.5	-53.1
October 2008	184.3	168.7	9.2
November 2008	101	108.1	-6.6
December 2008	23.2	46.7	-50.3
January 2009	0	8.9	-100
February 2009	0	11.8	-100
March 20009	66.5	18.1	267.4
April 2009	19.3	49.5	-61
May 2009	119	86.5	37.6
Total	**743.2**	**711.4**	**4.5**

Source: Office of the Assistant Directorate of Economics and Statistics, Erode (2008-09)

Rainfall is the major factor that determines the crop production activities. The temperature here is moderate throughout the year except during summer. The average rainy days are 50 in a year. It is exceptionally dry and its rainfall is scanty, uncertain and not well distributed. It is warm and humid for most of the year.

When the rainfall fluctuates more it leads to uncertainity in crop production. Normal rainfall of the district is 711.4 mm. During the year 2008-09, the actual rainfall of the district was 743.2 mm which was more than that of the normal rainfall. Distributions of Rainfall in Erode district over the years are given in Appendix IV.

4.4. Rivers and Irrigation

Bhavani and Cauvery are the main rivers of the district. The Bhavanisagar main canal and kalingarayan canal along with the above mentioned rivers provide proper drainage facilities for assured irrigation in the district. The lower bhavani project canal is a 125-mile long irrigation canal, runs majority in Erode and terminates in the border of Karur districts of Tamil Nadu. The Kalingarayan canal is a 90-mile long irrigation canal in the Erode. This runs parallel to Cauvery River. Bhavani is more or less a perennial river fed mostly by the South-West monsoon. North-East monsoon also supplements its water resources. This river runs for over hundred miles through Erode district traversing through Bhavani and Gobi blocks. It feeds the Bhavanisagar reservoir which takes an easterly course flowing through Gobi, Sathyamangalam and Bhavani blocks before it ultimately joins river Cauvery at the Salem district border. The areas irrigated by various sources are given in Table 4.3.

Table 4.3. Source wise Actual Area under Irrigation in Erode District in 2008-09.

S. No.	Source of Water	Number	Area irrigated (ha)			
			Gross	Percentage to the total	Net	Percentage to the total
1.	Govt. Canals	13	97091	50.33	87961	50.32
2.	Tanks	847	282	0.15	263	0.15
3.	Wells	117936	73733	38.22	66373	37.97
4.	Bore Wells	9520	18010	9.33	16489	9.44
5.	Other sources	7	3802	1.97	3702	2.12
	Total	**128316**	**192918**	**100.00**	**174788**	**100.00**

Source: Office of the Assistance Director of Statistics, Erode, 2008-09

The Net area irrigated in Erode district during 2008-09 was 1, 74,788 ha. Share of Government Canals in the net area irrigated was the highest in Erode district with 50.32 per cent followed by well irrigation (37.97 per cent), bore wells (9.44 per cent), tanks (0.15 per cent) and other sources (2.12 per cent). As regards gross irrigated area also, area under Government Canal irrigation was more and it was followed by wells, bore wells and tanks in Erode.

From Table 4.3, it could be inferred that the crop production in Erode district depends mainly on canal and well irrigation. Both of these are highly challenged due to fluctuation in rainfall, which may lead to production risk. In order to overcome these hazards farmers are need to be aware and adopt some coping mechanisms like crop insurance.

4.5. Demographic Pattern

The total population in Erode district was 2,016,582 according to 2000-01 census. Out of this, the male population was 1,024,214 and female population was 992,368. The density of population was 316 persons per square kilometer. The following table shows the details about different categories of population in Erode district.

Table 4.4. Demographic Pattern of Erode District (As per 2001 census)

(Numbers)

S. No.	Particulars	Erode District		
1.	Area (sq.km)	5714.00		
2.	Sex	Persons	Male	Female
3.	Population	2016582 (100)	1024214 (50.79)	992368 (49.21)
4.	Literates	1188228 (58.92)	691246 (58.17)	496982 (41.83)
5.	Rural Population	1028983 (51.02)		
6.	Urban Population	987599 (48.98)		
7.	Density / sq.km	316		

Source: Office of the Assistant Director of Statistics, Erode, 2008-09.

(Figures in parentheses indicate percentages to total)

4.6. Occupational Status

The working population determines the magnitude of all economic activities. Hence, the different categories of workers in the study area are furnished in Table 4.5.

Table 4.5. Occupational Pattern of Erode District (As per 2001 census)

S. No.	Particulars	Erode District	
		Population (Number)	Percentage
1.	Male Workers	675098	61.28
2.	Female Workers	426681	38.72
	Total	1101779	100.00
3.	Rural Workers	631575	56.30
4.	Urban Workers	490324	43.70
	Total	1121899	100.00
5.	Cultivators	196194	17.80
6.	Agrl. Labours	323597	29.37
7.	Household Industry	55375	5.02
8.	Marginal Workers	87179	7.91
9.	Other Workers	439219	39.86
	Total	**1101779**	**100.00**

Source: Office of the Assistance Director of Statistics, Erode, 2008-09.

In respect of workers' population, 61 per cent of total workers were male workers in Erode district indicating the dominance of male working force. Further, 56 and 53 per cent of the total work force constituted rural workers in Erode district respectively indicating more dependence on rural employment in the study area. 47 per cent of the workers were cultivators and agricultural labourers in Erode district. Therefore, it could be concluded that about half of the population were directly depending on agriculture in the study area.

4.7. Soil Classification

Soil type and its fertility are the important aspects deciding crop productivities. Hence, the soil types prevalent in Erode district are presented in Table 4.6.

The soils of the district are mostly red sand and gravel with moderate amounts of red-loam and occasional black loam tracts. Vast stretches of the upland regions are mostly gravelly. Red-loam occurs mostly in land under Kalingarayan channel and in beds of tanks in Erode Taluk and to some lesser extent in the valleys in Perundurai and Bhavani Blocks. It starts with a minor Dam called Kalingarayan Dam-Reservoir on River Bhavani, near Bhavani and flows through entire Erode and terminates at a place near Kodumudi.

Table 4.6. Soil Classification of Erode District (2008-09)

S. No.	Type of Soil	Places in the District (Taluks)
1.	Red Loam	Gobichettipalayam and Sathyamangalam
2.	Lateritic Soil	Bhavani, Sathyamangalam
3.	Red Sandy Soil	Erode, Perundurai, Bhavani

Source: Office of the Assistance Director of Statistics, Erode, 2008-09

Soils of Bhavani, Erode, and Perundurai blocks are mostly gravelly, stony and sandy of the red variety. Soils of Gobichettipalayam and Sathyamangalam Blocks are mostly of the red sandy variety. Red loam is prevalent mostly in Gobichettipalayam and Perundurai Blocks. In general, the soil in and around the district is of fertile nature and is good for agriculture purposes.

4.8. Land Use Pattern

A study on land use pattern would be more useful in deciding the cropping pattern and the possibility of diversification of farm activities. Hence, details of land use pattern in Erode District are given in Table 4.7.

As could be seen from Table 4.7, the total geographical area of Erode district is 571389 hectares. The net area sown accounted for 36.16 percent of the total geographical area, while the gross cropped area accounted for 41.81 per cent. The area under forest is very large accounting for 39.82 per cent of total geographical area. The area under land put to non- agricultural use is 51815 hectares with a significantly large share of 9.02 per cent, indicating agricultural lands being diverted to non- agricultural uses. Barren and uncultivable land covers 1.10 per cent of total geographical area. The cultivable waste occupies 0.3 per cent of the total area, while the current fallow and other fallow land have an share of 9.78 and 3.68 per cent indicating the scope for improving the use for agriculture to some extent. The area sown more than once is 5.65 per cent.

Table 4.7. Land Use Pattern in Erode District - 2008-09

S. No.	Particulars	Area in Hectare	Per cent
1.	Forest	227511	39.82
2.	Barren and uncultivable	6293	1.10
3.	Land put to non –agricultural use	51815	9.07
4.	Cultivable waste	1707	0.30
5.	Permanent pastures and other grazing Land	101	0.02
6.	Land under miscellaneous tree crops and groves not included in Net area sown	887	0.16
7.	Current fallows	55862	9.78
8.	Other fallows land	20626	3.61
9.	Net area sown	206587	36.16
10.	**Total geographical area**	**571389**	**100.00**
11.	Area sown more than once	32288	
12.	Gross cropped area (9+11)	238875	
13.	Cropping intensity (12÷9) (%)	115.63	

Source: Office of the Assistance Director of Statistics, Erode, 2008-09

4.9. Land Holding Distribution Pattern

A study on the distribution of land holdings helps in understanding the distribution of land based income and employment generation. Hence, the distribution of land holdings in the study area is furnished in Table 4.8.

Table 4.8. Number and Area of Operational Holdings in Erode District (2008-09)

S. No.	Size of holding	Type	Farmers (in Number)	Area (Ha)
1.	<1	Marginal	136960 (47.01)	70658.69 (14.64)
2.	1.1-2.0	Small	79586 (27.32)	114925.93 (23.81)
3.	2.1-4.0	Semi-medium	51389 (17.64)	141477.69 (29.31)
4.	4.1-10.0	Medium	21025 (7.21)	120583.69 (24.98)
5.	>10	Large	2345 (0.80)	34929.67 (7.23)
	Total		**291305 (100.00)**	**482575.67 (100.00)**

Source: Office of the Assistant Directorate of Economics and Statistics, Erode (2008-09)

(Figures in parentheses indicate percentage to total)

It could be observed that there were 2, 91,305 farm households in Erode District. The marginal farmers have accounted for 47.01 per cent followed by small farmers (27.32 per cent). Medium farmers constituted 7.21 per cent of total number of farm holdings. This classification is based on the Primary Agricultural Co-operative Bank. There was less number of large farms which constituted 0.80 per cent in the district. Therefore, it could be concluded that four-fifths of the total number of farm households belonged to marginal and small farm categories.

4.10. Cropping Season for Major Crops in Erode District

Generally, in Erode district, the cropping season starts from May-June, depending on the onset of monsoon. The cropping seasons for major crops are furnished in Table 4.9.

Table 4.9. Cropping Season for Major Crops in Erode District

S. No.	Main Crop	Season	
		Sowing Period	Harvesting Period
1.	Paddy	Apr – July (Kharif)	July - Oct
2.	Paddy	Aug - Nov (Samba)	Dec -Mar
3.	Paddy	Dec –Mar (Navarai)	Apr - May
4.	Cholam	January (irrigated)	April
5.	Cholam	September (unirrigated)	Dec- Jan
6.	Cumbu	April (irrigated)	July
7.	Cumbu	August (unirrigated)	November
8.	Ragi	December (irrigated)	March
9.	Ragi	August (unirrigated)	November
10.	Maize	January (irrigated)	April
11.	Maize	August (unirrigated)	Dec – Jan
12.	Green gram	January	April
13.	Black gram	January	April
14.	Red gram	August	January
15.	Sugarcane	Dec – Jan	Nov- Dec
16.	Cotton	October	March
17.	Groundnut	December (irrigated)	March
18.	Groundnut	June-July (unirrigated)	Aug-Sep
19.	Gingelly	March	May
20.	Gingelly	September	November

21.	Turmeric	May-June	Jan-Feb

(Source: Fasli 1418, Season and Crop report, (2008-09)

Most of the traditional crops were photosensitive and thus, the sowing time is the most important factor affecting the crop productivity. The traditional crops were sown during *Aadi pattam* (July-August) and commercial crops were sown in *Thai pattam* (January-February). Sugarcane and turmeric planting were taken up during December and May respectively.

4.11. Cropping Pattern in Erode District

Cropping pattern would determine the contribution of agricultural sector to the economy. Hence, cropping pattern in Erode district is given in Table 4.10.

Table 4.10. Area under Different Crops in Erode District in 2008-09

S. No.	Particulars	Erode District	
		Area (ha)	Per cent
1.	Cereals and millets	62236	26.05
2.	Pulses	6822	2.87
3.	Spices and condiments	9194	3.85
4.	Sugar crops	37047	15.51
5.	Fruits	12788	5.35
6.	Vegetables	12486	5.23
7.	Fiber crops	1761	0.74
8.	Oilseed crops	51901	21.73
9.	Fodder crops	37452	15.68
10.	Flowers	1405	0.58
11.	Other crops	5861	2.45
	Gross cropped area	**238875**	**100.00**

Source: Office of the Assistance Director of Statistics, Erode, 2008-09.

As could be seen from the Table 4.10, area under cereals and millets accounted a maximum of 26.05 per cent of total cropped area of the district followed by oilseeds (21.73 per cent), Fodder crops

(15.68 per cent), sugar crops (15.51 per cent), and so on. The crop wise area in Erode district is furnished in Appendix IV.

The district is one of the leading districts in the state in terms of productivity of many crops such as paddy, sugarcane, pulses, coconut and turmeric. Even in crops where the productivity is low it is mainly due to the erratic behaviour of monsoon, poor soils and inadequate irrigation facilities (NADP-District Agricultural Plan, 2008).

4.12. Livestock Population

Animal husbandry and agriculture are the twin occupations, which from time immemorial have played a significant role in improving the rural economy. Livestock rearing is a viable proposition, both as full-time and part-time occupation, and it provides assured income and ensures better utilization of human resources.

Table 4.11. Livestock Population of Erode District

(Numbers)

S. No.	Particulars	Erode
1.	Cattle	398572 (23.49)
2.	Buffalos	230004 (13.55)
3.	Sheep	506015 (29.82)
4.	Goats	562270 (33.14)
	Total livestock	**1696861 (100.00)**
5.	Poultry	5270334

Source: Office of the Assistance Director of Statistics, Erode, 2008-09.

(Figures in parentheses indicate percentage to total)

It is a major source of self-employment to a substantial number of rural populations, many of whom are women, who play a major role in the care and management of livestock.

From the Table 4.11, it could be inferred that the district was rich in goat and poultry population. The high cattle population would enhance the livelihood of the people in the study area. Among livestock, goat population is maximum in Erode district (33.14 per cent of the total livestock population) and it was followed by sheep (29.82 per cent), cattle (23.49 per cent) and buffalos (13.55 per cent). There were 709 milk producers' co-operative societies functioning in the district. The district had three milk chilling plants, 10 Veterinary Hospitals, 68 veterinary dispensaries, 90 Veterinary Sub Centers. Apart from these, four Mobile Veterinary Dispensaries were also functioning in the district.

If the crop production is affected due to some natural weather calamities, crop combinations maintained with livestock would ensure the farmers to manage their risk up to some extent.

4.13. Agricultural Machinery and Implements

The usage of machineries and implements would indicate the extent of mechanization and it also plays vital role in adoption of new technologies and income generation from farm activities.

Table 4.12. Agriculture Machinery and Implements of Erode District

(Numbers)

S. No.	Particulars	Erode
1.	**Ploughs**	
	Wooden	76956
	Iron	21534
	Total	**98490**
2.	**Water pumps**	
	i. Oil Engine	19381
	ii. Electric	65957
	Total	**85338**
3.	**Tractors**	
	i. Government	22
	ii. Private	3936
	Total	**3958**
4.	**Cane Crushers**	
	i. Electric Power	687
	ii. Oil Engine	93

	Total	**780**
5.	**Oil Granis**	**17**

Source: Office of the Assistant Director of Statistics, Erode, 2008-09.

From Table 4.12, it could be inferred that, in Erode district the commonly used machinery and implements were high in number except oil engine. It could also be inferred that number of oil engines was lesser than of electric engine in Erode District.

Increasing scarcity of labour due to sharp increase in migration from rural to urban areas is responsible for higher wage rates for agricultural labour which forces farmers to shift towards the adoption of machineries for the timely farm operations.

4.14. Financial Institutions

The details of financial institutions in Erode district are furnished in Table 4.13.

From Table 4.13, it could be inferred that the district had more number of Commercial banks with 257 (47 per cent) and followed by Primary Agriculture Co-operative Banks (PACBs) numbering 225 (41per cent) and private sector banks were 73 (13 per cent) respectively. These financial institutions provides better credit access to the people residing in this district both urban and rural areas. Commercial and private sector banks contribution in rural and agriculture sector development is very less compared to Primary agricultural credit societies.

Table 4.13. Financial Institutions in Erode District

(Numbers)

S. No.	Particulars	Erode	Per cent
1.	Commercial Banks	257	47.24
2.	Private Banks	73	13.41
3.	Primary Agricultural credit societies	225	41.36
4.	Primary Land Development Banks	12	2.20
	Total	**544**	**100.00**

Source: Office of the Assistant Director of Statistics, Erode, 2008-09.

The major agriculture oriented credit and non-credit facilities are provided through the primary agricultural credit societies, which is located in rural areas. This availability of credit facilities helps the farmers to reduce the financial risk at the time of crop production.

4.15. Sericulture

Mulberry was cultivated in about 1273.65 hectares in Erode district. Two government silk worm laying production centers were functioning in Erode district which catered to the demand of sericulture farmers of the district. Cross Bred Disease Free Laying (DFL) production has been increased from 4.11 lakhs to 13.34 lakhs from 2006 to 07. Erode District is the only district in Tamil Nadu, which has 12 private CRC's (Chawki Rearing Centers) functioning successfully. Mobile cocoon markets such as Gobi and a regular market at Thalavady are functioning successfully.

4.16. Industrial Development in Erode District

The district is also bestowed with strong industrial base. The district is having many categories of industries ranging from large scale to small and cottage industries. However many medium and small scale industries are established in the district as 74 per cent of the industries belonged to this category. The numbers of different category of industries are furnished in Table 4.14.

Table 4.14. Industries in Erode District

(Numbers)

S. No.	Particulars	Number of Units	Percentage to Total
1.	Large Scale Industries	2	0.15
2.	Medium Scale Industries	95	7.29
3.	Small Scale Industries	865	66.33
4.	Cottage Industries	302	23.16
5.	New Factories	40	3.07
	Total	**1304**	**100.00**

Source: Statistical Hand Book, Assistant Directorate of Economics and Statistics, Erode(2008-09)

The district has high concentration of power loom and handloom weaving, rice milling and edible oil expelling units. The other industries are tanneries, chemical and plastic products, paper products, Basic Metal Products industries etc.

The solid and liquid wastes discharged by these industries had lead to severe pollution of soil, surface and ground water quality and human and animal health of the community (Source: NADP-District Agricultural Plan, 2008). These are likely to become major constraints not only for increasing agricultural productivity but also for sustaining the productivity levels already reached.

The textile and food processing sectors dominate the industrial map of Erode district. Cotton textile is the leading industrial sector in this district followed by food processing sector. There are 457 cotton textile units and 437 food processing units, with a share of 37.2 per cent 35.6 per cent respectively in the total number of industrial units in the district.

4.17. Agri Business and Marketing Facilities

In Erode district 25 regulated markets and 5 sub-regulated markets are functioning. For marketing of vegetables, Uzhavar santhais were established at Erode, Gobi and Sathyamangalam. On normal days, 12 tons of vegetables arrive at Uzhavar santhai at Erode and eight tons in other three markets. Besides, storage facilities are also created in the Societies and Market committee for various commodities as shown in Table 4.15.

Table 4.15. Storage Facilities in Erode District

S. No.	Name of the Agency	Stored Goods
1.	Food Corporation of India	Turmeric, Paddy, Cumbu, Ragi, Lab lab, Samai, Cotton, Tamarind, Sorghum, Jaggary, Castor, Gingelly, Varagu, Red gram and Horse gram
2.	Tamil Nadu Warehousing Ltd	
3.	Tamil Nadu Civil Supplies Corporation Ltd	
4.	Erode District Central Cooperative Marketing Society	
5.	Erode Marketing Committee	
6.	Tamil Nadu State Marketing Cooperation	

Source: Statistical Hand Book, Assistant Directorate of Economics and Statistics, Erode(2008-09)

4.18. Transport and Road Facilities

From Table 4.16, it is observed that there is a well developed network of surface transport system. The roads are almost surfaced roads constructed by cement, concrete and black topped. Erode is well connected with Tamil Nadu State capital Chennai by road as well as by train.

Table 4.16. Transport and Communication in Erode District

S. No.	Particulars	Road length (Km)	Per cent

1.	National high ways	116.00	0.86
2.	State high ways	509.600	3.78
3.	Corporation and municipality road	1406.6	10.45
4.	Panchayat union and Panchayat road	6094.930	45.27
5.	Town Panchayat and Townships road	2171.810	16.13
6.	Major district roads	293.6	2.18
7.	Other district roads	2790.940	20.73
8.	Others (forest roads)	81.400	0.60
	Total	**13464.88**	**100.00**

Source: Statistical Hand Book, Assistant Directorate of Economics and Statistics, Erode(2008-09)

Erode district has 345 post offices and 120 telephone exchanges, fax, e-mail / internet facilities, libraries, cinema theatres and places of worship. The infrastructural facilities in Erode district are well established, which make the transporting of agricultural produce and manufacturing products an easy task.

4.19. Self Help Groups

There were 11863 Women SHG's and 683 Men SHG's in Erode district. Women under Mahalir Thittam were linked with Bank Credit. A large number of Women SHGs was formed and engaged in savings and various other economic and social activities resulting in overall well being of the women in rural areas.

4.20. Education

Increase in literacy helps in transfer of latest technologies to enhance crop production. Hence, the details of number of educational institutions are furnished in Table 4.17.

From Table 4.17, it could be inferred that the district had more number of pre-primary and primary schools compared to other districts in Tamil Nadu. The literacy level of this district is 77 per cent which is higher than the literacy level of Tamil Nadu (73 per cent).

Table 4.17. Educational Institutions in Erode District in 2008-09

(Numbers)

S. No.	Particulars	Erode district
1.	Arts and science colleges	14
2.	Medical college	1
3.	Engineering colleges	8
4.	Pre-primary schools	1,588
5.	Primary schools	1,338
6.	Middle schools	367
7.	High schools	83
8.	Higher secondary schools	111
9.	Teacher training institute	28
Total		**3,538**

Source: Statistical Hand Book, Assistant Directorate of Economics and Statistics, Erode (2008-09)

4.21. Agricultural Research Institution

The station is functioning from 1955 adjacent to Bhavanisagar dam, 15 km away from Sathyamangalam in Erode district on Sathy-Mettupalayam road (SH 15).The station is now known as Agricultural Research Station, Bhavanisagar. The station has been contributing mainly for the farmers of Erode and nearby districts by producing and supplying quality seeds in cereals, pulses, oilseeds, spices-especially in turmeric, vegetable crops like tomato, chilies, guards, moringa, etc. Apart from this, the farmers were given hands on training on hybrid rice seed production and many farmers are involved in participatory seed production programmes.

The water management scheme operating in this station, train the farmers in efficient usage of water by adapting different management technologies. Intensive research is also going on in groundnut to evolve high yielding groundnut varieties. The plant clinic centre operating in the station gives periodic counseling to the farmers about the effective and timely usage of pesticides and gives remedies to the problems due to biotic stresses. Horticulture Block Orchard where mango, guava, sapota, amla, cashew nut, pomegranate, tamarind, turmeric, chillies and other vegetables are grown and maintained here. The main income in this farm is through sales of mango and sapota fruits and amla grafts. BSR 1 amla is multiplied in larger scale.

4.22. Brief Description of Selected Blocks in Erode District

4.22.1. Gobichettipalayam

Gobichettipalayam is an important block in the North- Western part of Erode District. It is situated between 11.46° latitude and 77.26° longitude and at 213M above M.S.L. It is about 40 km from District headquarters.

As of 2001 India census, Gobichettipalayam had a population of 55,150. Males constitute 49% of the population and females 51%. Gobichettipalayam has an average literacy rate of 74%, higher than the national average of 59.5%: male literacy is 80%, and female literacy is 68%. In Gobichettipalayam, 9% of the population is under 6 years of age.

The Primary and tertiary activities are the Main Function of Gobichettipalayam block. This block can be considered as Bi-Functional block. The work force constitutes about 38% of the population 31% of the work force is engaged in agriculture, 13% in small industries (Small Scale and Cottage) and 56 % in trading and other activities. The block serves as an important source of supply for agricultural in-puts and implements to the adjoining areas.

Gobichettipalayam being an Agricultural block has got cultivable lands. An Anaicut namely "Kodiveri Anaicut" situated in Gobichettipalayam block, about 1.6 km. west of Gobichettipalayam block was constructed by the ancient Maharaja of Mysore in 17th century.

Two channels from the anaicut are taken around this block. One on the Northern side of Bhavani River and the other on the Southern side are called "Arakkan Kottai Channel" and "Thadapalli Channel" respectively. Lands North of Gobichettipalayam block are fertile due to the flow of Thadapalli channel. Cultivation of Sugar cane and paddy are predominant in this Area.

4.22.2. Sathyamangalam

Sathyamangalam block is situated on the southern side of Western ghats which extends towards the east from The Nilgiris. The block is located at 11 degree 14 minutes East longitude. The block lies close to the border of the adjoining Karnataka State. The block is situated at a distance of 65 kms from Erode.

The general topography of this block is not flat and the block is generally covered by the slopping lands with steadily lying land in the North towards ghat stretches. The river Bhavani flows at the center of the block from west to east.

Agricultural wet lands are predominant on both sides of the river. The dry lands are predominant in the northern side of the town. Due to the surrounding agricultural land, the weekly market at Sathyamangalam serves the marketing needs of the rural people.

Sathyamangalam is a medium size block with an agricultural linter land on all sides. Cultivation of banana, sugar cane, onion and flower crops are predominant in this Area.

The block has developed on both sides of Bhavani River and along the Highways Road. The rate of urban growth of Sathyamangalam is very low, because the Northern side of this Municipality is surrounded by reserved forests. Poor Industrial activities are also one of the reasons for slow growth rate of urban development. Only 10.46 % of area is developed as urban area and the remaining 89.54% area are left as undeveloped agricultural lands. There is lot of land available for the development, but the scope for the development in the near future is very low due to financial weakness among the public.

4.22.3. Bhavani

Bhavani is a Compact medium sized block in Erode District of Tamil Nadu, is located at the confluence of the river Bhavani and Cauvery. Developed areas constitute 80% of this and the remaining areas are agricultural and vacant lands. The growth of the town is being regulated by the zoning system under the master plan. The general topolography of the town is flat, slightly sloping towards the confluence of the rivers.

Bhavani block is located on the eastern part of Erode district. It is bounded on the north by Ammapet and Andhiyur block, west by Gobi and Thukkanaickenpalayam blocks, east bySankari block (Namakkal district) and south by Perundurai block.This block area falls within the coordinates of East Longitude $77_{o}30'15''$ to $77_{o}44'00''$ and North latitude $11_{o}23'00''$ to $11_{o}32'30''$ of G.I sheet 58 E/6, 7, 10 and 11.

The river Bhavani is flowing from west to east direction through the central part of the block. The Cauvery river is flowing in the eastern part of the block. Generally Dendritic pattern of drainage exists in this block.

The entire area of the block comes under hard, crystalline rock terrain of Archean age. The block is comprised of various rock types such as gneiss granites and pyroxenite. The gneiss is the predominant rock type of this block.

Almost the entire portion of the block (about 99%) of the block area varies between nearly level and very gently sloping category. A very little portion of the block falls under very steep sloping category (35%).

Major portion of the block area is agricultural land (around 80%). About 6% of the block area has been identified to contain problem soil. Cultivation of turmeric, sugar cane and ground nut are predominant in this Area.

4.23. Scope for Crop Insurance Scheme in Erode District

Erode District is well developed in Agriculture. Agriculture and allied activities provide employment to the major chunk of population. Further this sector provides basic raw material to the industrial sector leading to the deep-rooted growth of agro based industries in this part of the state. The district ranks top position in rice productivity and has a well developed market for turmeric which is an important commercial crop in the irrigated command areas of the district. Dry lands, mostly concentrated in the central and southern parts of the district offer potential for rainfed agriculture with a strong focus on livestock and poultry production.

In terms of rural infrastructure Erode district is well-placed as compared to the other districts in the state with the road density of 0.46 km per sq.km of geographical areas as compared to the state average of 0.43 km. Most villages in the district are connected by fairly good network of roads suitable for easy transportation of agricultural produces. In view of high level of urbanization with about 46 per cent of the total population in the district living in urban areas, the district has a good local market for its agricultural commodities especially for fruits and vegetable.

The farmers in the district are very progressive and innovative in adopting modern technologies and crop varieties. This is borne out by the fact the district is one of the leading districts in the state in terms of productivity of many crops such as paddy, sugarcane, pulses, coconut and turmeric. Even in crops where the productivity is low it is mainly due to the erratic behaviour of monsoon, poor soils and inadequate irrigation facilities.

The plains in the district receive an annual average rainfall of 600 to 700mm which mainly occurs during northeast monsoon season. Therefore, successful crop production depends heavily on the success / failure of monsoon thus making agricultural production riskier in many parts of the district. Limited availability of groundwater is a major weakness plaguing the agricultural development in this district. Increasing scarcity of labour due to sharp increase in migration from rural to urban areas is responsible for higher wage rates for agricultural labour which forces farmers to shift towards annual crops such as coconut.

In view of the progressive nature of the farmers and their willingness to adopt new techniques and take risks, there are ample opportunities to promote new crop varieties, new technologies and the expansion of risk coping mechanisms like crop insurance through proper guidance. There is also scope for introducing crop insurance technologies at farm level instead of existing block level, especially for high valued crops such as sugarcane, turmeric and banana.

CHAPTER V

RESULTS AND DISCUSSION

In this chapter the results of the analysis done within in the framework of specified methodology and also with reference to each of the objectives set forth for the study are presented. The results of the analysis are presented and discussed under the following sections.

5.1. General characteristics of the sample farmers

5.2. Analysis of risks involved in paddy, banana and turmeric production

5.3. The extent of crop wise coverage of insurance scheme in Erode district and its relationship to risk premium

5.4. Season wise premium rate, estimation of crop yield, indemnity level in the study area and the assessment of crop loss and restorability

5.5. Assessment of farmer’s awareness about the crop insurance scheme

5.1. General Characteristics of Sample Farmers

A brief description of the characteristics of the sample farmers would provide the necessary setting for the discussion. In this study the sample respondents were classified into three categories based on the crops grown, viz., Paddy farmers, Banana farmers and Turmeric farmers.

5.1.1. Family Size of Sample Farm Households

The size of the family has important implications with respect to income realization of the sample households. The information on family size is presented in Table 5.1.

It could be seen from Table 5.1 that among the producers 60 percent of the households had medium size family with four to five persons per family, 24.17 percent of the household had less than four members per household and about 15.83 percent were larger families with more than five persons. The average family size of all sample farms was 4.49.

Table 5.1. Family Size of Sample Farm Households

(Number of households)

S. No.	Family size	Paddy	Banana	Turmeric	Total	Average family size
1.	Small (<4)	10 (25.00)	9 (22.50)	10 (25.00)	29 (24.17)	2.62
2.	Medium (4-5)	24 (60.00)	25 (62.50)	23 (57.50)	72 (60.00)	4.49
3.	Large (> 5)	6 (15.00)	6 (15.00)	7 (17.50)	19 (15.83)	6.37
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)	4.49

(Figures in parentheses indicate percentage to total)

Hence it could be concluded from the table that medium to small sized families were predominant in the study area.

5.1.2. Annual Income of Sample Farm Households

The sample households were post-stratified into three different groups within the crops covered based on the annual income. Households with annual income less than Rs 100,000 were categorized as low income group, households with annual income between Rs 100,000 and Rs 200,000 were included under middle income group and those with annual income exceeding Rs 200,000 were included under high income group. Details regarding the distribution of households in three different income groups and their percentage share to total number of sample households are furnished in Table 5.2.

The low income group had 41 households accounting for 34.17 percent of the total sample, the middle income group had 35 households accounting for 28.33 percent and the high income group had 45 households accounting for 37.50 percent of total sample households.

The average annual income of households was Rs. 61,487.80, Rs. 1,39,636.36 and Rs. 3,70,597.83 for low, middle and high income groups in that order. The average annual income for all the sample households was Rs. 1, 90,574.

Table 5.2. Distribution of Households based on Annual Income

(Number of households)

S. No.	Annual income (Rs)	Paddy	Banana	Turmeric	Total	Average annual income (Rs)
1.	Less than 100,000	22 (55.00)	18 (45.00)	1 (2.50)	41 (34.17)	61487.80
2.	100,000 to 200,000	11 (27.50)	15 (37.5)	8 (20)	34 (28.33)	139636.36
3.	> 200,000	7 (17.50)	7 (17.50)	31 (77.50)	45 (37.50)	370597.83
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)	190574.00

(Figures in parentheses indicate percentage to total)

From the above result, it is concluded that among the three categories of income groups most of the paddy and banana farmers are in low income group and economically not well. But turmeric farmers are in high income group and economically strong.

5.1.3. Educational Status

Educational status of the farmers is also an important factor influencing the decision-making behaviour to a great extent. The details on educational status of the sample farm households are presented in Table 5.3.

It can be observed from the Table 5.3 that about 19 per cent of the farmers had completed only primary education. Among the sample farms, 53 farmers had completed their secondary school education and they accounted for 44.17 per cent of the total sample. Only 17 per cent of farmers had the collegiate level of education.

Table 5.3. Educational Status of Heads of Sample Farm Households

(Numbers)

S. No.	Education	Paddy	Banana	Turmeric	Total
1.	Primary (between 1-5th std.)	8 (20.00)	10 (25.00)	5 (12.50)	23 (19.17)
2.	Secondary (between 6-10th std.)	18 (45.00)	15 (37.50)	20 (50.00)	53 (44.17)
3.	Higher secondary (12th std.)	7 (17.50)	11 (27.50)	6 (15.00)	24 (20.00)
4.	Graduation (above 12th std.)	7 (17.50)	4 (10.00)	9 (22.50)	20 (16.67)
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)

(Figures in parentheses indicate percentage to total)

So it is evident from the table that majority of the sample farmers had only secondary level of education. The literacy level of the sample farmers was directly influencing the acceptance of new crop production technologies and awareness about the crop insurance schemes.

5.1.4. Age Distribution

Age of the head of farm households has been found to be an important determinant of production decisions of the farmers in many studies. The details of age distribution are given in Table 5.4.

The results furnished in Table 5.4 shows that among the sample farm households, 26.67 percent were in the age group of 31-40 years, 27.50 percent of the heads of the sample households were in the age group of 41-50 years, 35.83 percent were in the age group of more than 50 years and only ten percent were in the age group of below 30 years. It could be concluded that middle aged farmers (31-40 years and 41-50 years) constituted more proportion to the total number of head of households.

Table 5.4. Age of Heads of Sample Farm Households

(Numbers)

S. No.	Age	Paddy	Banana	Turmeric	Total
1.	Below 30 years	3 (7.50)	2 (5.00)	7 (17.50)	12 (10.00)
2.	31 - 40 years	11 (27.50)	9 (22.50)	12 (30.00)	32 (26.67)
3.	41 – 50 years	14 (35.00)	13 (32.50)	6 (15.00)	33 (27.50)
4.	Above 50 years	12 (30.00)	16 (40.00)	15 (37.50)	43 (35.83)
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)

(Figures in parentheses indicate percentage to total)

5.1.5. Experience in Cultivation

The experience of the heads of the sample farm household in cultivation is furnished in Table 5.5.

Table 5.5. Experience in Selected Crops Cultivation

(Numbers)

S. No.	Experience in years	Paddy	Banana	Turmeric	Total
1.	< 10 years	6 (15.00)	15 (37.50)	12 (30.00)	33 (27.50)
2.	10 – 25 years	24 (60.00)	17 (42.50)	15 (37.50)	56 (46.67)
3.	> 25 years	10 (25.00)	8 (20.00)	13 (32.50)	31 (25.83)
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100.00)

(Figures in parentheses indicate percentage to total)

It could be seen from the Table 5.5 that 46.67 percent of producers in the sample had an experience of 10-25 years in production, 25.83 percent had more than 25 years of experience, and 27.5 percent had an experience of less than 10 years. Hence it could be concluded from the table that 81 per cent of sample farmers had more than 10 years of experience.

5.1.6. Land Holding Pattern

Land holding pattern plays an important role in determining farm income, cultivation practices, production efficiency, as well as on marketing of farm produces.

Table 5.6. Land Holding Pattern of Sample Farm Households

(Numbers)

S. No.	Farm size (ha)	Paddy	Banana	Turmeric	Total	Average farm size (ha)
1.	Marginal (<1)	19 (47.50)	12 (30.00)	16 (40.00)	47 (39.17)	0.65
2.	Small (1-2)	11 (27.50)	22 (55.00)	16 (40.00)	49 (40.83)	1.44
3.	Large (>2)	10 (25.00)	6 (15.00)	8 (20.00)	24 (20.00)	2.50
	Total	40 (100.00)	40 (100.00)	40 (100.00)	120 (100)	1.53

(Figures in parentheses indicate percentage to total)

Among the sample farmers, marginal farmers constituted 39.17 percent, small farmers constituted 40.83 percent and large farmers constituted 20 percent. The average farm size of marginal, small and large farms was 0.65, 1.44 and 2.50 respectively. The average farm size for the sample as a whole was about 1.53 ha. For crop wise distribution also nearly 80 per cent of the paddy, banana and turmeric farmers were coming under small and marginal farm category. Hence it could be concluded from the table that small and marginal farmers were predominant in the study area.

5.1.7. Asset Position of Sample Farmers

Investment on farm assets plays a major role in assessing the infrastructure available in the farms. Farm assets included land, farm building, irrigation structures including open and bore well, pump set, tools and implements, farm machineries and livestock.

Among the assets, major part of investment was on land, a basic resource of a farmer to run the farm business. The asset position of the sample farms are presented in Table 5.7.

Table 5.7. Asset Position of Sample Farmers in Erode District

(Rs./Farm)

S. No.	Assets	Average value per farm	Percentage to Total
1.	Land	15,31,778.00	72.03
2.	Buildings	2,79,122.20	13.13
3.	Irrigation Structure	2,04,222.20	9.60
4.	Tools and implements	1,362.86	0.06
5.	Farm machinery	93,909.81	4.42
6.	Livestock	16,131.66	0.76
	Total	21,26,526.73	100.00

Total value of farm assets per farm was on an average Rs. 2126526. Land was found to be the most important asset and it formed 72.03 per cent of the total value of farm assets. Buildings constituted about 13.13 per cent of total farm asset followed by irrigation structure with 9.60 per cent and farm machinery with 4.42 per cent. Livestock was lowest with 0.76 per cent to the total value of farm assets.

Hence it could be concluded from the table that land, buildings and irrigation structures were the major assets in sample farms.

5.1.8. Livestock Population

Livestock is an important source of income for farm families. Income from livestock is continuous and less fluctuating. Adding livestock to cropping system significantly reduces the risks associated with farm income. The livestock products like meat, milk and milk products have a prominent role in the dietary habits of the people.

It also provides avenue for income generation particularly for agricultural labourers besides supplying farmyard manure and raw materials for biogas production. Further, it provides employment especially self-employment to a substantial number of rural and urban population.

Hence the details of livestock population are discussed in this section. Table 5.8 elaborates information about livestock population among the sample farmers.

Table 5.8. Livestock Population of Sample Farm Households

S. No.	Category	Number	Percentage
1.	Cow	188	50.54
2.	Buffalo	52	13.98
3.	Bullock	12	3.23
4.	Goat	35	9.41
5.	Poultry	85	22.85
	Total	372	100.00

It could be observed from the above table that the farm households showed higher preference towards rearing cow and poultry. They constitute 50.54 percent and 22.85 percent respectively, buffalo, goat and bullock constitute 13.98 percent, 9.41 percent and 3.23 percent respectively. Buffalo and bullock population are on the decline in the region and this is reflected by the population of these categories of livestock in the sample farm households. The high maintenance costs and increasing scarcity of fodder associated with mechanization of ploughing operations are the major reasons for the diminishing population of these two categories of livestock.

5.1.9. Cropping Pattern

Cropping pattern observed in sample respondent farmers is given in Table 5.9. It could be observed from the table that paddy and turmeric was the principal crop in the sample farms. It accounted for 23.63 per cent and 19.53 per cent of the total cropped area.

Sugarcane is the next main crop to paddy and turmeric. It occupied 18.82 per cent of total cropped area. Banana was the principal fruit crop in the sample farms. It accounted for 18.87 per cent of the total cropped area. Crops such as maize, sorghum, groundnut, red gram, tapioca, onion, coconut and mulberry were occupied lesser area. Cropping intensity of the sample farmer was 132.40.

Table 5.9. Cropping Pattern of Sample Farms

(Hectares)

S. No.	Crops	Gross cropped area	Net cropped area	Net cropped area Percentage to Total
1.	**Paddy**	**72.50**	**36.26**	**23.63**
2.	Maize	8.70	2.83	1.85
3.	Sorghum	8.40	0.71	0.46
4.	Groundnut	1.60	0.81	0.52
5.	Red gram	0.50	0.24	0.15
6.	**Turmeric**	**29.96**	**29.96**	**19.53**
7.	Tapioca	9.67	9.67	6.30
8.	Sugarcane	27.80	27.80	18.12
9.	**Banana**	**28.94**	**28.94**	**18.87**
10.	Onion	8.9	4.45	2.90
11.	Coconut	8.89	8.89	5.79
12.	Mulberry	2.84	2.84	1.85
	Total	208.70	157.68	100
	Cropping Intensity	132.40		

Hence it could be concluded from the table that paddy, banana, and turmeric occupied the major area among the sample farms. The sample farmers cultivated turmeric in the month of May-June and onion was cultivated as an intercrop in the month of July-Aug. Paddy and Banana was cultivated in the month of Apr-July and Jan-Feb. Sugarcane was also cultivated simultaneously starting from the month of Dec-Jan.

5.1.10. Cultivation of Paddy, Banana, and Turmeric in Sample Farms

The area and average production under paddy, banana and turmeric crops during the period 2009-10 and their proportion to total area of the sample farms are furnished in Table 5.10.

Table 5.10. Cultivation of Paddy, Banana, and Turmeric in Sample Farms

S. No.	Crops	Total Area in Hectares	Percentage	Average production in quintals/ha	Average farm size in ha
1.	Paddy	36.26	38.10	40.37	0.91
2.	Banana	28.94	30.41	244.24	0.72
3.	Turmeric	29.96	31.48	58.13	0.75
	Total	95.16	100		

It could be seen from the Table 5.10, in the sample farms the total area under paddy was 36.26 ha (38.10 percent), banana 28.94 ha (30.41 per cent) and turmeric 29.96 (31.48 per cent). The average farm size of paddy, banana and turmeric was 0.91 ha, 0.72 ha and 0.75 ha.

The banana farmers average yield in the selected block was half of the district during the period 2008-09. This is due to the block being situated in the rain shadow area of the Western Ghats, is prone to high radiation. The area is vulnerable to high velocity winds from April to July and also during the north-east monsoon period. Further, some of the sample farmers banana field were ravaged by elephants. Because of this reasons the banana yield was reduced in the study area.

Further in the study area the banana and turmeric crops are more vulnerable to wind, water logging condition, pests and diseases. Due to this the farmers have to face higher production risk in banana and turmeric cultivation. Hence it could be concluded that the total area of paddy farmers were comparatively higher than the banana and turmeric farmers.

5.1.11. Cost of Cultivation of Paddy, Banana and Turmeric for Sample Farmers

In order to know the economics of paddy, banana and turmeric production the cost of production for those crops in the sample farmers were estimated and presented in this section.

Table 5.11. Cost of Cultivation of Paddy, Banana and Turmeric for Sample Farmers

(Rs. /ha)

S. No.	Particulars	Crops					
		Paddy		Banana		Turmeric	
		Amount (Rs)	Percent-age to total	Amount (Rs)	Percentage to total	Amount (Rs)	Percent-age to total
A.	**Variable cost**						
1.	Human Labour	10523.00	27.45	56723.75	30.46	56294.50	18.83
2.	Machine Power	3268.13	8.52	12618.75	6.78	12796.88	4.28
3.	Seeds/Suckers	1449.95	3.78	7507.50	4.03	104893.60	35.09
4.	Manure and Fertilizers	4115.00	10.73	23182.50	12.45	17718.88	5.93
5.	Plant Protections	974.50	2.54	8025.425	4.31	12575.55	4.21
6.	Harvesting	2865.00	7.47	16350.00	8.78	10085.80	3.37
7.	Miscellaneous*	917.00	2.39	10490.55	5.63	1480.41	0.50
8.	Interest on Working Capital	1446.76	3.77	16187.82	8.69	25901.47	8.66
	Sub-total (1)	**25559.33**	**66.66**	**151086.30**	**81.12**	**241747.10**	**80.86**
B.	**Fixed Cost**						
1.	Rental Value of Land	10125.00	26.41	31857.14	17.10	49652.78	16.61
2.	Payments Land Revenue and Cess	6.25	0.02	12.50	0.01	12.50	0.004
3.	Depreciation of Implements & Buildings	1927.06	5.03	3291.25	1.77	1414.41	0.47
4.	Interest on Owned Fixed Capital	723.50	1.89	4219.307	2.67	6129.56	2.05
	Sub-total (2)	**12781.81**	**33.34**	**35160.89**	**18.88**	**57209.25**	**19.14**
	Total cost (A+B)	**38341.14**	**100.00**	**186247.20**	**100.00**	**298956.34**	**100.00**
	Gross Income	**48168.51**		**403186.00**		**675036.30**	

	Net Income	**9827.37**		**216938.80**		**376079.90**	

*Includes transportation costs, Cost refers to cost C3 (For details, vide cost concepts in Chapter III)

From the table 5.11, the paddy farms, on an average, a total cost of Rs. 38341.14 was incurred by all the sample farmers per ha. Out of the total cost, 66.66 per cent was incurred as variable cost and remaining 33.34 per cent was fixed cost.

Among variable cost, human labour charges accounted for a maximum of 27.45 per cent of the total cost, and they were followed by value of manures and fertilizers (10.73 per cent) and so on. Among fixed cost, rental value of land accounted for a maximum of 26.41 per cent of the fixed cost. The annual gross and net income of the paddy farms per hectare was Rs. 48168.51 and Rs. 9827.37.

As the area under cash crops such as turmeric and banana was less, but the net income was higher than that of paddy farms.

It could be inferred from Table 5.11 that in case of banana farms, on an average, a total cost of Rs. 186247.20 was incurred by all the sample farmers per ha. Out of the total cost, 81.12 per cent was incurred as variable cost and remaining 18.88 per cent was fixed cost.

Among variable cost, human labour charges accounted for a maximum of 30.46 per cent of the total cost, and they were followed by value of manures and fertilizers (12.45 per cent) and so on. Per hectare net income was realized by banana farmers was Rs.216938.80.

In turmeric farms, on an average, a total cost of Rs. 298956.34 was incurred by all the sample farmers per ha. Out of the total cost, 80.86 per cent was incurred as variable cost and remaining 19.14 per cent was fixed cost.

Among variable cost, seed/rhizome cost accounted for a maximum of 35.09 per cent of the total cost, and they were followed by, human labour charges (18.83 per cent), value of manures and fertilizers (5.93 per cent). Among fixed costs, rental value of land accounted for a maximum of 16.61 per cent of the fixed cost. The annual gross and net income of the turmeric farms per hectare was Rs. 675036.30 and Rs. 376079.90.

In the study area the cost of cultivation was same for all the sample farmers. There is no such difference found between insurer and non-insurer due to moral hazard and adverse selection problems. So all the data related to cost of cultivation pooled together and the average was calculated.

From this, the increase in the total cost was attributed by the increase in labour changes and cost of machine power, seed, manures, fertilizers and plant protection chemicals. In spite of the increase in costs, owing to increase in gross returns, the net returns in banana and turmeric farms was more than that in paddy farms. The crop loan availed by the farmers helped them to choose the cash crops and thereby their profitability also increased as indicated above.

5.1.12. Cost and Returns for the Selected Crops Cultivated in Farm Households

Cost of production and returns per unit of output of the crops, namely, paddy, banana, and turmeric of the sample farms are presented in Table 5.12.

From the table, it could be observed that the cost of production of paddy per kg was Rs. 9.5 and the net return per kg was Rs. 2.44 and the cost of production of banana per kg was Rs. 7.63 and the net return per kg was Rs. 8.89. In case of turmeric the cost of production per kg was Rs. 51.43 and the net return per kg was Rs. 64.70.

Table 5.12. Summary of Output and Returns

(Cost and returns in Rs. /ha)

S. No.	Output and Returns	Paddy	Banana	Turmeric
1.	Total cost of production	38341.14	186247.2	298956.3
2.	Average production quintal / ha	40.37	244.24	58.13
3.	Gross returns	48168.51	403186	675036.3
4.	Net returns	9827.37	216938.8	376079.9
5.	Cost of production / kg	9.50	7.63	51.43
6.	Net returns/kg	2.44	8.89	64.70

* Cost refers to cost C3 (For details, vide cost concepts in Chapter III)

5.2. Analysis of Risks Involved in Paddy, Banana and Turmeric Production

The yield variations and yield instability index of paddy, banana and turmeric crops over the years are calculated based on the secondary data of the district.

5.2.1. Yield Variations of Paddy in Erode District

Table 5.13. Depicts the yield variations of paddy in Erode district.

Table 5.13. Paddy-Yield Variations in Erode district

S. No.	Particulars	Mean (qt/ha)	Standard deviation (qt/ha)	Coefficient of variation (%)
1.	Last 3 years (2007 to 2009)	42.89	0.92	2.14
2.	Last 5 years (2005 to 2009)	41.85	1.85	4.41
3.	Last 10 years (2000 to 2009)	42.81	2.17	5.07

(Data Source: Season and Crop report)

From the Table 5.13, the mean yield was maximum in last 3 years to the tune of 42.89 quintals per hectare and this was minimum in last 5 years about 41.85 quintals per hectare. The coefficient of variation in yield of paddy was 2.14 per cent in last 3 years. It was increased to 4.41 per cent, 5.07 per cent in last 5 years and 10 years respectively. But the actual yield of paddy was 43.35 quintals per hectare in the year 2008-09. This indicates that there was medium risk in yield of paddy.

5.2.2. Yield Variations of Banana in Erode District

Table 5.14. Depicts the yield variations of banana in Erode district.

Table 5.14. Banana -Yield Variations in Erode District:

S. No.	Particulars	Mean (qt/ha)	Standard deviation (qt/ha)	Coefficient of variation (%)
1.	Last 3 years (2007 to 2009)	588.41	83.04	14.11
2.	Last 5 years (2005 to 2009)	528.28	107.36	20.32
3.	Last 10 years (2000 to 2009)	427.21	130.47	30.54

(Data Source: Season and Crop report)

From the Table 5.14, the mean yield was maximum in last 3 years to the tune of 588.41 quintals per hectare and this was minimum in last 10 years about 427.21 quintals per hectare.

The coefficient of variation in yield of banana was 14.11 per cent in last 3 years. It was increased to 20.32 per cent and 30.54 per cent in last 5 years and 10 years respectively. This indicates that there was high risk in yield of banana. This high coefficient of variation in the yield of banana for the last 10 years was due to prevalence of wind, wilt disease and stem weevil incidence in the district.

According to MYRADA- KVK Report 2008, banana is one of the major fruit crops of Erode district, wherein pseudo stem weevil is a specific insect, wide spread in banana growing region over the years causing major havock to the crop. The badly affected plants break of easily during heavy wind and cause yield loss to the farmers.

5.2.3. Yield Variations of Turmeric in Erode District

Table 5.15. Depicts the yield variations of turmeric in Erode district.

Table 5.15. Turmeric-Yield Variations in Erode District

S. No.	Particulars	Mean (qt/ha)	Standard deviation(qt/ha)	Coefficient of variation (%)
1.	Last 3 years (2007 to 2009)	68.18	7.29	10.69
2.	Last 5 years (2005 to 2009)	70.38	6.09	8.65
3.	Last 10 years (2000 to 2009)	63.18	9.85	15.59

(Data Source: Season and Crop report)

From the Table 5.15, the mean yield was maximum in last 5 years to the tune of 70.38 quintals per hectare and this was minimum in last 10 years about 63.18 quintals per hectare. The coefficient of variation in yield of turmeric was 10.69 per cent in last 3 years. It was decreased to 8.65 per cent and again increased to 15.59 per cent in last 5 years and 10 years respectively. This indicates that there was high risk in yield of turmeric. This high coefficient of variation in the yield of turmeric for the last 5 years was due to prevalence of rhizome rot disease in the district.

5.2.4. Yield Instability Index of Paddy, Banana and Turmeric in Erode District

Table 5.16. Depicts the yield instability index of paddy, banana and turmeric.

Risk associated with agriculture and various crops are estimated by using instability index as an indicator. When there are no deviations from trend, index is constant, and thus standard deviation in it is zero. As the series fluctuates more, the index also fluctuates more, and standard deviation increases.

Table 5.16.Yield Instability Index of Paddy, Banana and Turmeric in Erode District

S. No.	Particulars	Paddy	Banana	Turmeric
1.	Last 3 years (2007 to 2009)	0.014	0.0023	0.030
2.	Last 5 years (2005 to 2009)	0.016	0.008	0.053
3.	Last 10 years (2000 to 2009)	0.014	0.035	0.040

(Data Source: Season and Crop report)

From the table 5.16, the instability index of paddy, banana and turmeric was 0.016, 0.008 and 0.053 in the last 5 years and the fluctuation also high in banana and turmeric. Hence, it could be concluded that the prevalence of yield risk were higher in banana and turmeric crops in the district.

5.2.5. Yield Variations of Sample Farmers in Erode District

Table 5.17. Depicts the yield variations of sample farmers in Erode district.

Table 5.17. Yield Variations of Sample Farmers in Erode District

S. No.	Particulars	Mean (qt/ha)	Standard deviation(qt/ha)	Coefficient of variation (%)
1.	Paddy	40.37	3.28	8.13
2.	Banana	244.24	76.68	31.39
3.	Turmeric	58.13	8.43	14.50

From the Table 5.17, the mean yield of paddy, banana and turmeric was 40.37, 244.24 and 58.13 quintals per hectare. The coefficient of variation in yield of paddy, banana and turmeric was 8.13 per cent, 31.39 per cent, 14.5 per cent respectively in the sample farmers. The coefficient of variation of these crops during 2009-10 was comparatively higher than the previous year's variation of district. And the mean yield of the crops also decreased in this year. Hence, it could be concluded that the prevalence of production risk of these crops were higher in the sample farms.

5.2.6. Crop Yield Loss of Sample Farmers in Erode District

Table 5.18. Depicts the Crop yield loss of sample farmers in Erode district during the year 2009-10.

Table 5.18. Crop Yield Loss of Sample Farmers

S. No.	Particulars	Normal yield* (qt/ha) (1)	Mean actual yield ** (qt/ha) (2)	Average yield loss (qt/ha) (1-2)	Percentage (%) of yield loss
1.	Paddy	41.85	40.37	1.50	3.58
2.	Banana	528.28	244.24	284.04	53.77
3.	Turmeric	70.38	58.13	12.25	17.41

(*Normal yield= Five years (2005-2009) average yield in the district, ** Mean actual yield = Sample farmers average yield (2009-10), Average yield= Normal yield- Mean actual yield)

From the table 5.18, the average yield loss of the paddy, banana and turmeric in the sample farms was 3.58 per cent, 53.77 percent and 17.41 per cent respectively. Hence it could be inferred that among the three crops banana has higher yield loss followed by turmeric and paddy.

5.3. The Extent of Crop wise Coverage of Insurance Scheme in Erode District and its Relationship between Risk and Premium

5.3.1. Loan Received and Risk Bearing Ability of Insured Farmers

The main source of crop insurance awareness of the sample farmers in the study area is the primary agricultural co-operative banks during the period of crop loan availed. So the information on the loan received in the primary agricultural co-operative banks and risk bearing ability of the insured farmers are presented in Table 5.19.

Table 5.19. Loan Received and Risk Bearing Ability of Insured Farmers

S. No.	Parameter	Paddy	Banana	Turmeric
1.	Loan amount (Sum insured) (Rs./ Ha)	27500	75000	57500
2.	Premium (%)	2.50	6.00	4.45
3.	Total Premium amount (Rs./ Ha)	687.50	4950.00	2875.00
4.	Premium subsidy (Rs./ Ha)	343.75	2475.00	1437.5

5.	Willingness to bear agricultural losses (%)	35.00	40.00	50.00

Table 5.19 shows the amount of loan taken and premium by the paddy, banana and turmeric farmers in the study area. The premium amount is calculated with respect to the entire loan amount. The insured farmers were asked to what extent they would like the insurance agency to bear the crop loss and to what extent they themselves would bear the loss. On an average paddy, banana and turmeric farmers were willing to bear loss up to 35 per cent, 40 per cent and 50 per cent respectively.

5.3.2. Area Covered under Crop insurance in Erode District – Kharif 2010

Table 5.20. shows the percentage of paddy, banana and turmeric area covered under crop insurance scheme in Erode district.

Table 5.20. Percentage of Area Covered under Crop insurance in Erode District

S. No.	Crops	Total area under the crop (ha)	Insured area (ha)	Percentage
1.	Paddy	35552	695	1.95
2.	Banana	10986	983	8.95
3.	Turmeric	8365	1915	22.89

In the percentage of area under insurance against total area under different crops, the turmeric was having the maximum area (22.89%) under insurance, followed by banana (8.95%) and paddy. Hence the main reason attributed was, the banana and turmeric were riskier crops compared to paddy.

5.3.3. Farmers Coverage under Crop insurance Scheme in Erode District

Table 5.21. shows the total number of paddy, banana and turmeric farmers covered under crop insurance scheme in Erode district.

From the table, the total number of farmers covered was maximum under turmeric crop with 2438 farmers followed by banana crop about 1180 farmers and paddy about 673 farmers. Regarding area covered in crop insurance scheme the total area was maximum in turmeric crop i.e. 1915 hectares followed by banana crop of 983 hectares and paddy was having the area about 695 hectares.

Table 5.21. Farmers Coverage under Crop insurance Scheme in Erode District– Kharif Season 2010

S. No.	Crops	Total number of farmers	Total area in hectares	Total loan disbursed in Rs.	Total premium remitted in Rs.
1.	Paddy	673	695	19809390	199674
2.	Banana	1180	983	62564482	2064636
3.	Turmeric	2438	1915	109548133	2738712

Similarly the total loan disbursed and total premium remitted was maximum in turmeric followed by banana and paddy. This is due to the turmeric and banana crops requiring high production costs and more farmers avail loan facilities. Since loans are linked to insurance, premium also high in these crops. Hence it could be concluded that, the main reason for these variations is due to the level of production riskiness prevailed in the crops.

As a result the area covered was very less in paddy and high in banana and turmeric crops. Because these are the major crops commercially grown in Erode district and these are the high valued crops and also occurred severe losses due to natural calamities like wind, rainfall and sometimes incidence of pest and diseases. The detailed coverage of number of farmers and crops under existing crop insurance scheme is furnished in Appendix VI.

5.3.4. Results of Logit Model

The insured farmers in the study area are only the loanee farmers who availed crop loan from the financial institutions. The crop loan increases the adoption of insurance scheme. The factors determining the participation of farmers in availing crop loan in the study area was analyzed using Logit Function. Data were analyzed using the package Limdep 7.0 and the results are presented in Table 5.22.

The results of the Logit model (Table 5.22) indicated that the family size and off-farm and non-farm income were the significant factors influencing the farmers' availing crop loan in the study area.

Table 5.22. Parameter Estimates of Logit Model

S. No.	Variables	Regression Co-efficients	't' value
1.	Constant	1.2691	8.110
2.	Family size	-0.6456*	-2.244
3.	Gross cropped area	-0.4187	-0.692
4.	Off-farm and non-farm income	-0.7355***	-3.727
5.	Farm experience	-0.8320	-1.343
6.	Capital assets	0.1483	0.544

*** - Significant at one percent level, * - Significant at ten percent level

Family size had a negative effect in availing crop loan. As expected, the adoption of crop loan went down with the increasing family size. For every member addition in the family, the log odds went down 0.6456 or odds about 65 per cent per member. This indicates that as the number of household members increases, availability of family labour and substitution of hired labour would also increase. As the requirement of cash for wage payment decreases, loan requirement also declines.

Off-farm and non-farm income also had a negative effect in availing crop loan. An increase in off-farm and non-farm income of the sample farmers was found to reduce the availing of crop loan significantly. For every one rupee increase in off-farm and non-farm income, the log odds of adoption of crop loan went down 0.7355 or odds about 74 per cent per rupee from off-farm and non-form income. This indicates that the amount of off-farm and non-farm income increases in farm, the farmer could utilize this money for taking up cropping activities and thus, there would be less dependency on external source of finance.

5.3.5. Reasons for Production Risk as Perceived by Sample Farmers

Reasons for paddy, banana and turmeric production risks incurred by the sample farmers were asked and based on their opinion, those reasons were ranked using the Garret score as presented in Table 5.23.

For paddy farms, Most of the farmers reported that the major reason for production risk was low quality of seed/input and followed by plant diseases and pests and so on. In case of banana farmers, wind plays an important factor and then second rank was given to plant diseases which were followed by insects, excess rain and so on.

Table 5.23. Perceived Risks in Production of Selected Crops in the Sample Farmers

S. No.	Factors	Mean Score and Rank					
		Paddy		Banana		Turmeric	
		Score	Rank	Score	Rank	Score	Rank
1.	Plant diseases	67.20	II	69.90	II	74.13	I
2.	Insects	59.70	III	55.60	III	44.93	VI
3.	Excess rain	47.00	V	52.10	IV	70.88	II
4.	Drought	31.00	VII	24.90	VIII	32.05	VII
5.	Wind	24.90	VIII	75.10	I	22.95	VIII
6.	Low quality of seed/ input	73.80	I	31.90	VII	49.13	V
7.	Price fluctuations	45.10	VI	39.40	VI	55.43	III
8.	Labour availability	55.60	IV	30.47	V	52.10	IV

In case of turmeric plant diseases and excess rain plays an important role to cause production risky. In turmeric, it was inferred from the analysis price fluctuation also one of the important factor which is followed by low quality of inputs and so on. The farmers, perceived lack of labour is also risky because in most of the households family labour could do most of the operations.

5.4. Season wise Premium Rate, Estimation of Crop Yield, Indemnity Level in Erode District and Claims Paid for the sample farmers under NAIS

Table 5.24. shows the season wise premium rate of kharif and Rabi season in 2010-11.

From the table it could be inferred that the per cent of premium rate was higher in banana and turmeric crops as compared to paddy crop in the District. This is mainly due to high level of production risk of those crops.

Table 5.24. Season wise Premium Rate under Crop insurance Scheme

S. No.	Crops	Nominal rate of premium	Actuarial rate of premium
Kharif Season (2010)			
1.	Paddy-I	2.50%	3.50%
2.	Paddy-II	2.00%	8.90%
3.	Banana	6.60%	6.60%
4.	Turmeric	5.00%	5.00%
Rabi Season (2010-11)			
1	Paddy-III	2%	3.50%
2	Banana	7.05%	7.05%

Source: District Central Co-operative Bank, Erode district

5.4.2. Estimation of Crop Yield, Indemnity and Claim Settlement

The state government or union territory administration would plan and conduct the requisite number of Crop Cutting Experiments (CCEs) for all notified crops in the notified insurance units in order to assess the crop yield and maintain a single series of CCEs and resultant yield estimates, both for crop production estimates and crop insurance. CCEs would be undertaken per unit area for each crop on a sliding scale as indicated in Table 5.25. A Technical Advisory Committee (TAC) comprising of representatives from National Sample Survey Organization (NSSO), Ministry of Agriculture (GOI) and Implementing Agency would be constituted to decide the sample size of CCEs and all other technical matters.

Table 5.25. Minimum Number of CCEs for Unit Areas

S. No.	Unit Area	Minimum No. of CCEs Required
1.	Taluka / Tehsil / Block	16
2.	Mandal / Phirka/any other smaller unit are comprising 8-10 villages	10
3.	Gram Panchayat comprising 4-5 villages	8

Source: Agricultural Insurance Company of India Ltd., Chennai.

If the Actual Yield (AY) per hectare of the insured crop for the defined area on the basis of requisite number of CCEs in the insured season falls short of the specified TY (Threshold yield), all the insured farmers growing that crop in the defined area are deemed to have suffered shortfall in yield (SY). The scheme seeks to provide coverage against such contingency. Indemnity shall be calculated as per the following formula:

Indemnity = (SY / TY)*[Sum Insured for the Farmer]

where, SY = TY – AY for the defined area

In case of occurrence of localized perils such as hailstorm, landslide, cyclone and flood where settlement of claims would be on individual basis, loss assessment and modified indemnity procedures would be formulated by the implementing agency in coordination with state / UT. The broad seasonality discipline to be followed is given in Tale 5.26. It may be modified, if and where necessary, in consultation with state / UT and the Government of India.

Table 5.26. Seasonality Discipline for Kharif and Rabi Crops

S. No.	Activity	Kharif crops	Rabi crops
1.	Loaning period (loanee)	April – September	October – Next March
2.	Cut-off date for receipt of declarations (loanee)	November	May
3.	Cut-off date for receipt of proposals (non-loanee)	31st July	31st December
4.	Cut-off date for receipt of yield data (for all)	January – March	July – September

Source: Agricultural Insurance Company of India Ltd., Chennai.

Once the yield data is received from the state/UT as per the prescribed cut-off dates, claims are worked out and settled by the implementing agency. The claim cheque along with claim particulars is released to the individual Nodal Banks. The Banks at the grass-root level, in turn, credit the accounts of the individual farmers and display the particulars of beneficiaries on their notice board. In the context of localized phenomenon viz. hailstorm, landslide, cyclone and flood, the implementing agency would evolve a procedure to estimate such losses at individual farmer level in consultation with District Advisory Committee (DAC) / State / UT. Settlement of such claims would be on individual basis. The A&O expenses would be shared equally by the Central Government and respective State Government on sunset basis (100% in year 1, 80% in year 2, 60% in year 3, 40% in year 4, 20% in year 5 and 'zero' thereafter).

Crop wise indemnity level, normal premium in per cent, loan amount available per hectare and premium amount collected per hectare of the paddy, banana and turmeric crops are presented in the Table 5.27. Among the three crops indemnity level of both banana and turmeric was 80 per cent, and paddy it was 60 per cent.

Table 5.27. Crop-wise Indemnity Level and Normal Premium Rates for 2010-11 under NAIS in Erode District

S. No.	Crops	Indemnity Level (%)	Normal Premium (%)	Loan amount available Rs/ha	Premium collected Rs/ha
1.	Paddy	60.00	2.50	32500	812.50
2.	Banana	80.00	6.60	81250	5362.50
3.	Turmeric	80 .00	5.00	62500	3125.00

Source: District Central Co-operative Bank, Erode district

Crop wise calculated yield loss of the sample farmers in the study area and the level of risk of the paddy, banana and turmeric farmers are presented in the Table 5.28.

Table 5.28. Crop-wise Yield Loss and Risk Level of Sample Farmers

S. No.	Crops	Percentage (%) of yield loss	Risk level
1.	Paddy	3.58	Low
2.	Banana	53.77	High
3.	Turmeric	17.41	Medium

The indemnity under the scheme varies based on the nature of risks viz, low risk, medium risk and high risk. If the yield variation is 14 percent or less, it is considered as low risk. If the yield variation is between 16 to 30 percent, it is termed as medium risk and above 30 percent is termed as high risk. From the Table 5.28, it could be concluded that paddy, banana and turmeric crop farmers in the study area facing low, high and medium risk respectively. But the indemnity level was same for banana and turmeric crop. Among the three crops banana was riskiest crop due to prevalence of climatic condition.

5.4.3. Assessment of Crop Loss and Loss Restorability

Among the ninety insured farmers only 12 farmers got compensation for their yield loss in the past. The extent of crop loss faced by those sample farmers and the financial support provided by the insurance agencies for the year (2008-09) are given in the table 5.29.

Table 5.29. Extent of Crop Loss and Financial Support

S. No.	Particulars	Normal yield* (qt/ha)	Actual yield (qt/ha)	yield loss in per cent	Indemnity paid in Rs.
1.	Paddy	40.35	28.47	29.44	3754.65
2.	Banana	475.59	310.50	34.73	24840.80
3.	Turmeric	69.85	45.25	35.22	32255.52

Normal yield *- Crop cutting experiment yield of respective blocks
(Source-Primary Agricultural Co-operative Banks)

It could be seen from the table 5.29 that the average yield loss of the paddy, banana and turmeric crops in the study area was 29.44 per cent, 34.73 per cent and 35.22 per cent respectively. It could also be seen from the table that the average amount of indemnity remitted to farmer beneficiaries in the study blocks ranged Rs. 3754.65 for paddy, Rs. 24840.80 for banana and Rs. 32255.52 for turmeric.

The actual loss loss attained by the farmers and the percentage of loss restored were analysed and the results are presented in Table 5.30.

Table 5.30. Percentage of Loss Restored to Sample Farmers

S. No.	Crops	Loss in Rs.	Indemnity paid in Rs.	Per cent of loss restored
1.	Paddy	10692	3754.65	35.12
2.	Banana	82545	24840.80	30.09
3.	Turmeric	98400	32255.52	32.78

It is observed from the table that the crop loss restored by the sample farmers during 2007-08 was only 35 per cent for paddy, 30 per cent for banana and 33 per cent for turmeric. The variation in loss restored was due to homogenous area approach followed by the insurance agencies for assessing the crop loss. Under this approach, block is taken as a unit for deciding crop loss. If the actual yield of the block was below the threshold yield, then that block as a whole will be compensated. So, in the particular village, if the crop loss was high due to natural vagaries which was not inferred through the block average yield then that village is not fully compensated and vice versa. Details regarding claims made by the sample farmers and settled are presented in the table 5.31.

Table 5.31. Details regarding Claims Made and Settled under NAIS

S. No.	Crops	Month of claims made	Month of claims paid
1.	Paddy	December 2008	July 2009
2.	Banana	April 2009	June 2010
3.	Turmeric	April 2009	March 2010

From the table 5.31, it could be concluded that the gap between the claims made and settled in the study area was varied from seven months for paddy, fourteen months for banana and eleven months for turmeric. Due to this delayed compensation farmers are not getting timely risk mitigation measures under the scheme in the study area.

5.5. Assessment of Farmers Awareness about the Crop insurance Scheme

In this section the sample farmers' awareness about the National Agricultural Insurance Scheme, necessity of the proramme, extent of their adoption, impact of the scheme and suggestions regarding the premium rates charged, the amount of compensation paid improvement of the existing scheme and finally their willingness to insure their crops were collected, analysed and presented.

5.5.1. Opinion of the Insured and Non-insured Farmers about Crop insurance Scheme

The opinions of the farmers regarding various issues related to crop insurance were collected and analysed. Following were the responses given by 90 insured and 30 non insured farmers. The responses were shown in Table 5.32.

Crop insurance programme is yet at its immaturity in Erode district. Hence, it was felt necessary to know the awareness of the farmers regarding crop insurance programme. It was observed that 77.78 per cent of the insured farmers and 53.33 per cent of the non-insured farmers were aware of the insurance programme. However, their awareness of the programme was very much limited. They had no idea about the actual operational and administrative aspects and the other details involved in the programme. Hence all the respondents were initially briefed about the scheme and then their opinion was collected regarding the different aspects of the existing crop insurance programme.

Table 5.32. Opinion of the Insured and Non-insured Farmers about the Crop insurance Scheme

S. No.	Particulars	Insured Farmers		Non-insured Farmers	
		Numbers	Percentage	Numbers	Percentage
1.	Awareness about the crop insurance programme	70	77.78	16	53.33
2.	The crop insurance programme is necessary	65	72.22	9	30.00
3.	Farmers interested in continuing the insurance programme	65	72.22	0	0.00
4.	Farmers who are satisfied with the existing programme	35	38.89	0	0.00
5.	Crop insurance is the better way of reducing impact of losses	62	68.89	15	50.00
6.	Mixed and Diversified farming is a better way of reducing losses	8	8.89	3	10.00
	Total number of farmers interviewed	90	100.00	30	100.00

From the Table 5.32, it could be inferred that maximum farmers i.e. 77.78 per cent of insured and 53.33 per cent of non-insured farmers contended for the necessity of the crop insurance as it equips the farmers to face loss. About 65 per cent of the insured farmers were interested in continuing the programme whereas 66.67 per cent of non-insured farmers also liked to be covered by the programme. As high as 38.89 per cent of the insured farmers were satisfied with the existing programme and all of them wanted one or two modifications.

Majority of the insured and non-insured farmers (68.89% and 50%) felt that crop insurance was the better way of reducing the impact of losses and remaining 8.89 per cent insured and 10 per cent non-insured farmers felt that mixed and diversified farming was a better way of reducing losses.

5.5.2. Awareness regarding Premium and Indemnity, Yield Calculations and Farmers Opinion regarding Impact of Crop insurance

The awareness regarding various aspects related to crop insurance were collected and analysed. The responses are presented in Table 5.33.

From the table 5.33.A, it could be observed that about 61.11 per cent of insured farmers and 23.33 per cent of the non-insured farmers were aware about the premium charged for their crops. Out of 90 insured farmers, 30 farmers (33.33%) opined that the premium rate charged was reasonable but 15 non-insured farmers (50%) felt that premium charged was reasonable.

Majority of insured sample farmers (66.67%) and non-insured farmers (53.33%) were willing to pay premium to insuring agency in order to insure their crops. Out of 90 insured farmers only 12 farmers (13.33%) have received compensation. None of the insured farmers received compensation at the right time i.e. before next sowing season and the sample insured farmers received compensation after one year. Significant proportion (83.33%) of the insured farmers who has gained indemnity opined that compensation paid was adequate. Farmer's awareness about the basis for fixing the compensation amount was very less. Regarding approaches for calculation of compensation amount more than 72.22 per cent of the insured and 43.33 per cent non-insured farmers opined individual approach was the better way of calculation of compensation.

Table 5.33. Awareness of the Insured and Non-insured Farmers about the NAIS

S. No.	Particulars	Insured Farmers	Non -insured Farmers

		Numbers	Percentage	Numbers	Percentage
A.	**Awareness regarding Premium and Indemnity**				
1.	Awareness of the premium rate	55	61.11	7	23.33
2.	The premium rate charged is reasonable	30	33.33	15	50.00
3.	Farmers willing to pay premium to insure their crops	60	66.67	16	53.33
4.	Farmers who have received compensation	12	13.33	0	0.00
5.	Farmers who have received compensation at the right time	0	0.00	0	0.00
6.	The compensation paid was adequate	10	11.11	0	0.00
7.	Opinion on the compensation amount paid be decided on Individual basis	65	72.22	13	43.33
B.	**Awareness regarding Yield Calculations**				
1.	Awareness about the method of calculating threshold yield	12	13.33	2	6.67
2.	Awareness about the method used in conducting crop cutting experiments	8	8.89	2	6.67
3.	Threshold yield should be considered	70	77.78	12	40.00
4.	Threshold Returns should be considered	20	22.22	18	60.00
C.	**Opinion regarding Impact of Crop insurance**				
1.	Crop insurance should be tied up with the crop loan	55	61.11	13	43.33
2.	The existing coverage crops under crop insurance scheme is sufficient	65	72.22	10	33.33
3.	Crop insurance is necessary for both dry land and irrigated crops	62	68.89	16	53.33
4.	Farmers feel that crop insurance is a good measure against risk and uncertainty	70	77.78	21	70.00
	Total number of farmers interviewed	90	100.00	30	100.00

From the table 5.33.B, it is observed that only 13.33 per cent of insured and 6.67 per cent of the non-insured farmers were aware about method of calculating threshold yield. And 77.78

per cent of insured farmers suggested that threshold yield should be taken for calculating compensation whereas 60.00 per cent of the non-insured farmers suggested that threshold returns should be considered for calculating compensation. Only 8.89 per cent of insured and 6.67 per cent of non-insured farmers were aware about the method used in conducting crop cutting experiments. Most of insured and non-insured farmers said that present method of calculating crop cutting experiment was an ideal method.

From the table 5.33.C, it could be concluded that regarding the impact of crop insurance, 61.11 per cent of insured and 43.33 per cent of non insured farmers opined that crop insurance should be tied up with the crop loan. Majority of insured farmers (72.22%) and non-insured farmers (33.33%) expressed their satisfaction with coverage of crops under the scheme.

Most of the insured farmers (68.89%) and non-insured farmers (53.33%) opined that crop insurance was necessary for both dry land and irrigated crops. Keeping in mind the benefits occurring due to insurance scheme, majority of sample farmers (77.78%) of insured and (70%) of non-insured felt that crop insurance was a good measure against risk and uncertainty.

5.5.3. Suggestions of the Insured and Non-insured Farmers

The suggestions of the insured and non-insured farmers regarding the improvement of the existing crop insurance scheme were collected, analysed and presented in the table 5.34.

From the table 5.34, it is observed that after implementation of National Agricultural Insurance Scheme there was more delay in payment of compensation. Therefore 77.78 per cent of the insured and 53.33 per cent of the non-insured farmers suggested that compensation should be paid before starting of next season.

Proper guidance to be given for bank officials and farmers regarding its smooth operation was suggested by 28.89 per cent of insured and 40 per cent of the non-insured farmers. Only 8.89 per cent of the insured farmers suggested about information regarding amount of compensation and time of payment compensation amount and 11.11 per cent of the insured farmers suggested that village should be considered as unit area instead of Block.

About 13.33 per cent of insured and 10 per cent of non-insured farmers suggested that creation of separate insurance cell. Nearly 32 insured (35.56%) and 5 non-insured (16.67%) farmers suggested for the simplification of procedure for filling up of insurance application and the regular visits by insurance officials to the plots of insured farmers was suggested by 17 insured farmers (18.89%) and 1 non insured farmer.

Table 5.34. Suggestions of the Insured and Non-insured Farmers

S. No.	Suggestions	Insured Farmers		Non-insured Farmers	
		Numbers	Percentage	Numbers	Percentage
1.	Compensation should be paid before starting of next season	70	77.78	16	53.33
2.	Proper guidance to be given for the staff and farmers for its smooth operation	26	28.89	12	40.00
3.	They should give information regarding payment of compensation	8	8.89	2	6.67
4.	Village should be considered as unit area instead of Block	10	11.11	0	0.00
5.	Creation of separate insurance cell	12	13.33	3	10.00
6.	Training regarding filling up of insurance application	32	35.56	5	16.67
7.	Regular visits by insurance officials to the plots of insured farmers	17	18.89	1	3.33
	Total number of farmers interviewed	90	100.00	30	100.00

From the above results, it could be concluded that almost all the insured and non-insured farmers were aware about crop insurance scheme, but their awareness was very much limited. Hence all the respondents were initially briefed about the insurance scheme and then they were asked to give their opinions regarding the various aspects of the programme. Most of the insured and non insured farmers contended that crop insurance was necessary and said that they were interested in continuing the insurance programme.

However, the farmers were not satisfied with this existing set up of the programme and they wanted one or the other modification, especially regarding the payment of compensation amount. Majority of the farmers did not know about calculating threshold yield and they disapproved with the present procedure of considering previous year's yields. And majority of the farmers felt that crop insurance was a good measure against risk and uncertainty.

The major lacuna in the crop insurance scheme was very much delay in the compensation especially during drought situations and all the insured and non-insured farmers viewed that compensation should be paid before starting of next season. Another suggestion made by both the category of farmers was simplification of procedure and payment of premium amount.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Agriculture is beset with a number of risks and uncertainties. The presence of risks posses serious problems and hampers the rational decision making in perceiving agriculture. Under conditions of risk, farmers develop a conservative outlook and this result in low capital investment as against the vast scope that exists for profitable application of capital in Indian agriculture. Agricultural insurance is considered an important mechanism to effectively address the risk to output and income resulting from various natural and manmade events.

Uncertainty of crop yield is one of the basic risks, which every farmer has to face. The yield uncertainty arises from the excessive dependence on the vagaries of nature, which prevents farmers from maximizing production. Crop insurance is a means of counteracting the uncertainties involved in crop production. In this context, the present study was taken up with the following objectives.

The overall objective of the study is to assess the risk and farmers awareness about existing crop insurance scheme in the study area. However, the specific objectives of the study are:

i) To analyze the existing cropping pattern and allied activities of sample farms
ii) To estimate the cost and returns of Paddy, Banana and Turmeric cultivation
iii) To identify and analyze the risks involved in Paddy, Banana and Turmeric production

iv) To examine the extent of crop wise coverage of insurance scheme in Erode district

v) To elicit the opinion of the insured and non-insured farmers about crop insurance scheme

vi) To suggests policy measures for better performance of crop insurance scheme

6.1. SUMMARY

6.1.1 Sampling

This study was conducted in Gobichettipalayam, Sathyamangalam and Bhavani blocks of Erode district in Tamil Nadu. Data were collected from 120 households in total spread over in 3 villages with two categories of insurers and non-insurers. The crops selected for this study was paddy, banana and turmeric from the each block respectively. It was decided to select 30 insurers and 10 non-insurers for each crop in the study area.

6.1.2. Data collection and Analysis

The details regarding family composition, size of the holding, area under various crops, cropping pattern, extent of farm inputs used, cost and returns of crop and livestock activities, maintenance of fixed assets, losses for different crops, extend of risk, perception about risk, usefulness and awareness about National Agricultural Insurance Scheme (NAIS) and problems and suggestions on the usage of the insurance scheme were collected through a structured interview schedule. The data collected were analyzed using the appropriate statistical tools like averages, percentages, instability index, logit regressions and Garrett's ranking technique. The results of the analyses are summarized below:

6.1.2.1. Socio-Economic Characteristics of the Sample Households

Among the sample farms 60 percent of the households had medium size family with four to five persons per family, 24.17 percent of the household had less than four members per household and about 15.83 percent were larger families with more than five persons. The average family size of all sample farms was 4.49. The average annual income for all the sample households was Rs. 1, 90,574.

Majority of the sample farmers (35.83 per cent) belonged to the age group of more than 50 years and only ten percent were in the age group of below 30 years. Among the sample farms, 53 farmers had completed their secondary school education and they accounted for 44.17 per cent of the total sample. About 19 per cent of the farmers had completed only primary education and 17 per cent of farmers had the collegiate level of education in the study area.

6.1.2.2. General Characteristics of Sample Respondents

About 81 per cent of sample farmers had more than 10 years of experience in cultivation of crops. Among the sample farmers, marginal farmers constituted 39.17 per cent, small farmers constituted 40.83 per cent. The average farm size of marginal and small farms was 0.65 and 1.44

respectively. The average farm size for the sample as a whole was about 1.53 ha. Total value of farm assets per farm was on an average Rs. 2126526. Land was found to be the most important asset and it formed 72.03 per cent of the total value of farm assets. Buildings constituted about 13.13 per cent of total farm asset followed by irrigation structure. Livestock was lowest with 0.76 per cent to the total value of farm assets.

6.1.2.3. Cropping Pattern and Allied Activities

Paddy and turmeric was the principal crop in the sample farms. It accounted for 23.63 per cent and 19.53 per cent of the total cropped area. Sugarcane is the next main crop to paddy and turmeric. It occupied 18.82 per cent of total cropped area. Banana was the principal fruit crop in the sample farms. It accounted for 18.87 per cent of the total cropped area. Crops such as maize, sorghum, groundnut, red gram, tapioca, onion, coconut and mulberry were occupied lesser area. The average farm size of paddy, banana and turmeric was 0.91 ha, 0.72 ha and 0.75 ha. The farm households showed higher preference towards rearing cow and poultry. They constitute 50.54 percent and 22.85 percent respectively. .

6.1.2.4. Cost and Returns of Selected Crops

In the paddy farms, on an average, a total cost of Rs. 38341.14 was incurred by all the sample farmers per ha. Out of the total cost, 66.66 per cent was incurred as variable cost and remaining 33.34 per cent was fixed cost. In case of banana farms, on an average, a total cost of Rs. 186247.20 was incurred by all the sample farmers per ha. Out of the total cost, 81.12 per cent was incurred as variable cost and remaining 18.88 per cent was fixed cost. In turmeric farms, on an average, a total cost of Rs. 298956.34 was incurred by all the sample farmers per ha. Out of the total cost, 80.86 per cent was incurred as variable cost and remaining 19.14 per cent was fixed cost.

On an average, among the variable cost human labour charges accounted for a maximum of the total cost, and they were followed by value of manures and fertilizers and seed materials . Among the fixed cost, rental value of land accounted for maximum in all crops.

In the study area the cost of production of paddy per kg was Rs. 9.5 and the net return per kg was Rs. 2.44 and the cost of production of banana per kg was Rs. 7.63 and the net return per kg was Rs. 8.89. In case of turmeric the cost of production per kg was Rs. 51.43 and the net return per kg was Rs. 64.70.

6.1.2.5. Risks Involved in Paddy, Banana and Turmeric Crops in the Study Area

The coefficient of variation in yield of paddy, banana and turmeric crops were estimated for using the past ten years of district yield data. The coefficient of variation in yield of paddy was 2.14 per cent in last 3 years. It was increased to 4.41 per cent, 5.07 per cent in last 5 years and 10 years respectively.

The coefficient of variation in yield of banana was 14.11 per cent in last 3 years. It was increased to 20.32 per cent and 30.54 per cent in last 5 years and 10 years respectively. And the coefficient of variation in yield of turmeric was 10.69 per cent in last 3 years. It was decreased to 8.65 per cent and again increased to 15.59 per cent in last 5 years and 10 years respectively. This high fluctuation of coefficient of variation in the yield of turmeric and banana over the years indicates that the presence of yield risk in the study area.

The coefficient of variation in yield of paddy, banana and turmeric was 8.13 per cent, 31.39 per cent, 14.5 per cent respectively in the sample farmers. The coefficient of variation of these crops was comparatively higher than the variation of district. And the mean yield of the crops also decreased. Hence, it could be concluded that the prevalence of production risk of these crops were higher in the sample farms.

6.1.2.6. Results of Yield Instability Index of Paddy, Banana and Turmeric

Risk associated with agriculture and various crops are estimated by using instability index as an indicator. The yield instability index of paddy, banana and turmeric was 0.014, 0.035 and 0.040 in the last 10 years and the fluctuation also high in banana and turmeric. Hence the prevalence of yield risk of these crops were higher in the banana and turmeric farms in the district.

6.1.2.7. Results of Crops Yield Loss Assessment

The average yield loss of the paddy, banana and turmeric in the sample farms was 3.58 per cent, 53.77 percent and 17.41 per cent respectively. Among the three crops banana has higher yield loss followed by turmeric and paddy in the sample farms.

From the past claims, it is observed that the crop loss restored by the sample farmers was only 35 per cent for paddy, 30 per cent for banana and 33 per cent for turmeric. The gap between the claims made and settled in the study area was also high.

6.1.2.8. Results of Logit Model for Identification of Factors Influence for Availing Crop Loan

The insured farmers in the study area are only the loanee farmers who availed crop loan from the financial institutions. The crop loan increases the adoption of insurance scheme. A set of variables, such as Family size, Gross cropped area, Off-farm and non-farm income, Farm experience and Capital assets was considered to know their effect on adoption of crop loan. The model indicated that the family size and off-farm and non-farm income were the significant factors influencing the farmers' availing crop loan in the study area.

6.1.2.9. Garrett's Ranking Technique for Identification of Reasons for Production Risk

Reasons for production risk as perceived by sample farmers were ranked using the Garret score and ranking. The results revealed that major reason for paddy production risk was low quality of seed/input and followed by plant diseases and pests. In case of banana farmers, wind plays an important factor and then second rank was given to plant diseases which were followed by insects, excess rain. In case of turmeric plant diseases and excess rain plays an important role to cause production risky. The sample farmers, perceived lack of labour is also major reason for the production of crops become risky.

6.1.2.10. The Crop Wise Coverage of Insurance Scheme in Erode District

The percentage of area under insurance against total area under the selected crops, the turmeric was having the maximum area (22.89) per cent under insurance, followed by banana (8.95 per cent) and paddy (1.95 per cent).

6.1.2.11. Opinion of Insured and Non-Insured Farmers about Crop Insurance Scheme

Most of the insured farmers and some of the non-insured farmers were aware about crop insurance scheme and felt that crop insurance was necessary and the sample farmers were interested in continuing the programme but most of the farmers were not satisfied with existing operation of scheme, especially in payment of compensation.

Farmers awareness regarding calculation of threshold yield, calculation of compensation and method of conducting crop cutting experiment was limited. Most of the farmers satisfied with existing coverage of crops under National Agriculture Insurance Scheme.

All the sample farmers suggested that compensation amount should be paid to farmers before starting of next season and also for the simplification of the procedure during payment of premium amount by the farmers.

6.2. CONCLUSIONS

Based on the analytical results, the following conclusions were drawn.

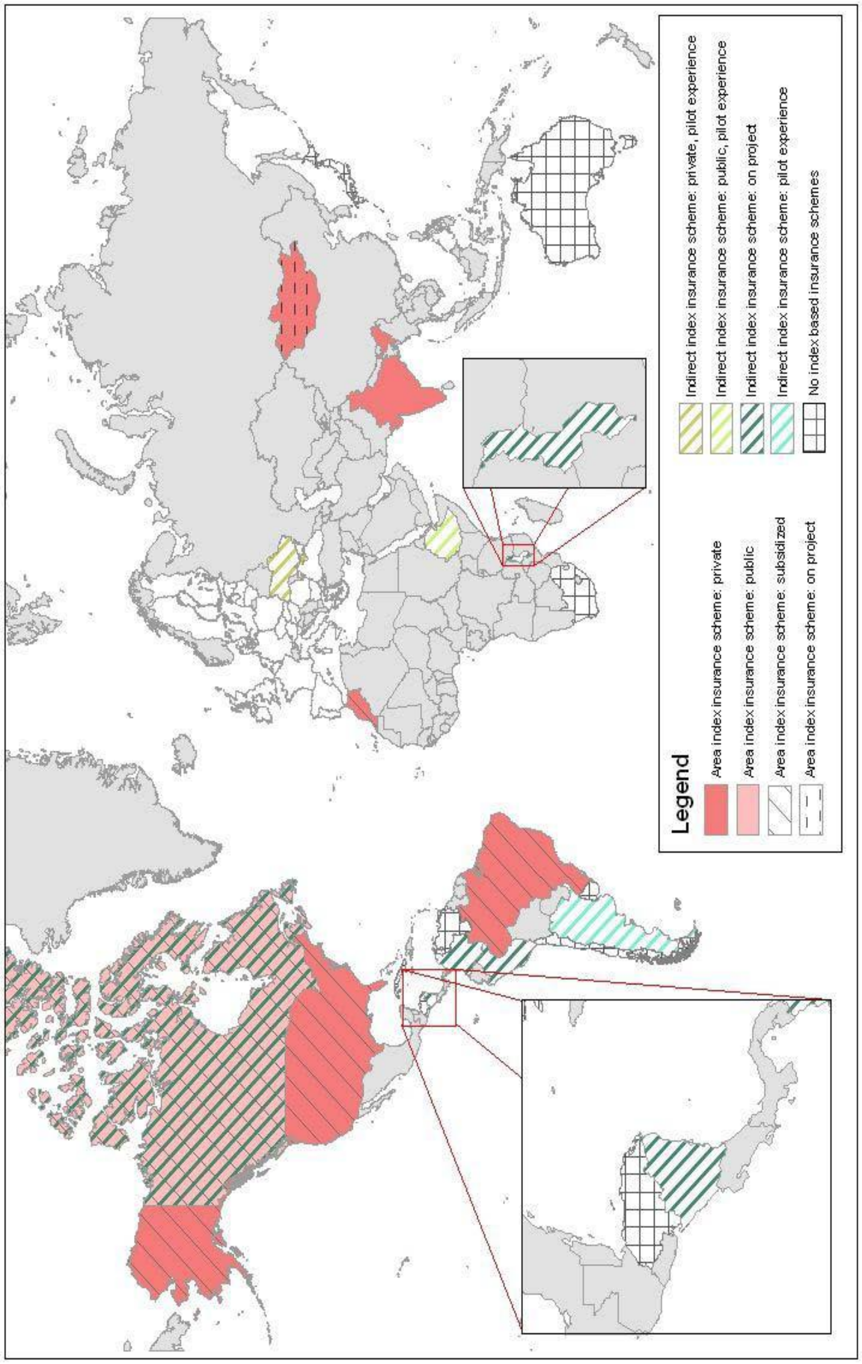
- ► Marginal and small farmers together constituted 80 per cent of the sample farmers. The total cost of cultivation, on an average per ha was more in turmeric farms followed by banana and paddy farms.
- ► Yield variations and yield instability index of turmeric and banana crops in the sample farms were higher. Hence, it could be concluded that the prevalence of yield risk of these crops were higher in the banana and turmeric farms.
- ► Among the three crops banana (53.77 per cent) has higher yield loss followed by turmeric (17.41 per cent) and paddy (3.58 per cent). This is mainly due to the prevalence of wind and diseases in the study area.
- ► Regarding number of farmers and area covered in crop insurance was maximum in turmeric crop followed by banana and paddy crops.
- ► Similarly the total loan disbursed and total premium remitted was maximum in turmeric followed by banana and paddy. This is due to the turmeric and banana crops requiring high production costs and more farmers avail loan facilities. Since loans are linked to insurance, premium also high in these crops.
- ► The insured farmers in the study area are only the loanee farmers who availed crop loan from the financial institutions. The crop loan increases the adoption of insurance scheme.
- ► Most of the insured farmers and some of the non-insured farmers were aware about crop insurance scheme. Majority of the insured and non-insured farmers (68.89 per cent and 50 per cent) felt that crop insurance was the better way of reducing the impact of yield risk.
- ► Regarding approaches for calculation of compensation amount more than 72.22 per cent of the insured and 43.33 per cent non-insured farmers opined individual approach was the better way of calculation of compensation.
- ► Almost all the insured and non-insured farmers were aware about crop insurance scheme, but their awareness was very much limited.
- ► The major lacuna in the crop insurance scheme was very much delay in the compensation especially during drought situations and all the insured and non-insured farmers viewed that compensation should be paid before starting of next season.

6.3. POLICY IMPLICATIONS

Based on the analytical results and the established conclusions, the following policy prescriptions were drawn.

- ► The total area under paddy, banana and turmeric was more but the area covered under insurance scheme in these crops (paddy-1.95 per cent, banana-8.95 per cent and turmeric-22.89 per cent) was less. Hence the measures should be taken to cover more area under insurance scheme in these crops.
- ► There is a need of training for staff involved in implementing crop insurance scheme and also training programmes would be conducted for farmers on benefits and procedural aspects of crop insurance.
- ► The cost of cultivation and price of the commodity should be taken into consideration during calculation of coverage level as against the coefficient of variation in the yields alone, which is beneficial to the farmers.
- ► There is a need to take a strong step against delay in payment of compensation and unnecessary delay should be avoided in payment of compensation.
- ► There is a need to reduction of existing block level insurance unit to village panchayat level for rapid access to the farmers in the rural area.
- ► Government should encourage the private agencies participation in the crop insurance sector to expand the area under insurance.

Figure 1.1. Index based Insurance Schemes in the World



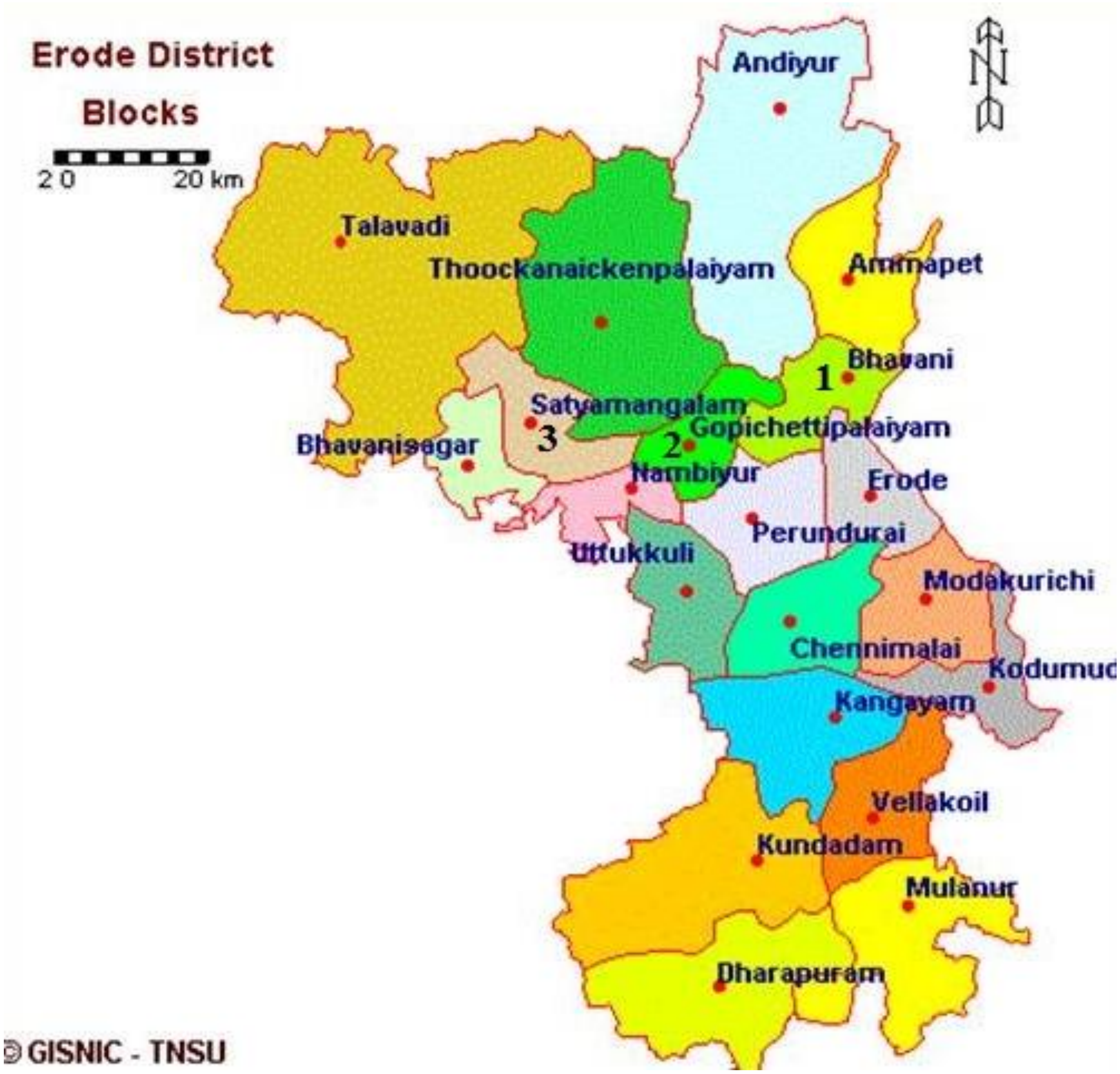
Source: World Bank Survey (2008)

Figure 4.1. Map Showing Location of Erode District in Tamil Nadu

<u>**Study area**</u>

Erode District

Figure 4.2. Block Map of Erode District



Study Blocks

1) Bhavani

2) Gobichettipalayam

3) Sathyamangalam

Appendix I. Various Schemes Related to Crop Insurance in India and their Features

Insurance schemes	Period	Approach	Crops Covered	Farmers covered (lakhs)	Amount (in crore Rs) Premium	Amount (in crore Rs) Claims
Crop Insurance Scheme	1972-78	Individual	H-4Cotton, groundnut, wheat and potato	0.03	0.05	0.38
Pilot Crop Insurance Scheme	1979-84	Area	Cereals, millets, oilseeds, cotton, potato and chick pea	6.23	1.95	1.56
Comprehensive crop Insurance Scheme	1985-99	Area	Food grains and oilseeds	763	404	2303
National Agricultural Insurance Scheme	1999-Continuing	Area and Individual	Food crops, annual commercial and horticultural crops	1155	3626	11607
Farm Income Insurance Scheme	2003-04	Area	Wheat and rice	2.22	15.68	1.5
Weather Based Crop Insurance Scheme	2007-Continuing	Individual	Food crops, annual commercial and horticultural crops	1.40	3.50	N.A

Source: Raju , S. S., and Ramesh Chand (2009). Note: N.A. - Not Available

Appendix II. NAIS - All India Year wise / Season wise Statistics for 19 Seasons since Rabi 1999-2000

No.	Season	Farmers covered	Area(ha)	Rs. In Lakhs				Farmers benefited
				Sum insured	Premim	Subsidy	Claims	
1.	Rabi 1999-00	579940	780569	35641	542	166	769	55288
2.	Kharif 2000	8409374	13219829	690338	20674	4740	122248	3635252
3.	Rabi 2000-01	2091733	3111423	160268	2779	824	5949	526697
	Total 2000-01	**10501107**	**16331252**	**850606**	**23453**	**5564**	**128197**	**4161949**
4.	Kharif 2001	8696587	12887710	750246	26162	4762	49354	1741873
5.	Rabi 2001-02	1955431	3145873	149751	3015	779	6466	453325
	Total 2001-02	**10652018**	**16033583**	**899997**	**29177**	**5541**	**55820**	**2195198**
6.	Kharif 2002	9768711	15532349	943169	32547	4486	182431	4297155
7.	Rabi 2002-03	2326811	4037824	183755	3850	673	18855	926408
	Total 2002-03	**12095522**	**19570173**	**1126924**	**36397**	**5159**	**201286**	**5223563**
8.	Kharif 2003	7970830	12355514	811413	28333	2445	65268	1712269
9.	Rabi 2003-04	4421287	6468663	304949	6406	624	49706	2098125
	Total 2003-04	**12392117**	**18824177**	**1116362**	**34739**	**3069**	**114974**	**3810394**
10.	Kharif 2004	12687104	24273394	1317062	45894	2009	103817	2674743
11.	Rabi 2004-05	3531045	5343244	377421	7585	412	16057	772779
	Total 2004-05	**16218149**	**29616638**	**1694483**	**53479**	**2421**	**119874**	**3447522**
12.	Kharif 2005	12673833	20531038	1351910	44995	2044	105994	2666221
13.	Rabi 2005-06	4048524	7218417	507166	10482	523	33830	980511
	Total 2005-06	**16722357**	**27749455**	**1859076**	**55477**	**2567**	**139824**	**3646732**
14.	Kharif 2006	12934050	19672930	1475925	46730	2655	177491	3131511
15.	Rabi 2006-07	4977980	7632882	654221	14288	797	51596	1390430
	Total 2006-07	**17912030**	**27305812**	**2130146**	**61018**	**3452**	**229087**	**4521941**
16.	Kharif 2007	13398561	20754384	1700756	52431	2665	91337	1589973
17.	Rabi 2007-08	5044016	7387156	746663	15871	1469	80945	1576748
	Total 2007-08	**18442577**	**28141540**	**2447419**	**68302**	**4134**	**172282**	**3166721**
18.	Kharif 2008	12983876	17693192	1565832	51166	3410	237155	4206590
19.	Rabi 2008-09	6169515	8864475	1101333	28989	6895	123742	1645564
	Total 2008-09	**19153391**	**26557667**	**2667165**	**80155**	**10305**	**360897**	**5852154**
	Grand Total	**134669208**	**210910866**	**14827819**	**442739**	**42378**	**1523010**	**36081462**

Appendix III. Progress of NAIS in India

Particulars	Farmers covered (lakhs)	Area covered (lakh ha)	Rs in crores			Farmers benefited(000)
			Sum insured	Premium collected	Claims made	
harif Season						
umulative total	996	1569	106067	3489	11351	25655
bsolute increase	46	45	8755	305	1149	571
er cent increase	54	34	127	148	94	16
GR (%)	6.8	4.2	15.9	18.4	11.7	2
GR (%)	5.6	3.7	10.8	12	8.6	1.8
abi Season						
umulative total	351	540	42212	938	3879	10426
bsolute increase	41	58	9411	284	1178	1119
er cent increase	195	185	587	943	1980	212
GR (%)	24.4	23.1	73.4	117.9	247.5	26.5
GR (%)	14.5	14	27.2	34.1	46.1	15.3
verall						
umulative total	1347	2109	148278	4427	15230	36081
bsolute increase	87	102	18165	567	2327	1690
er cent increase	82	63	214	242	182	41
GR (%)	10.3	7.8	26.7	30.2	22.7	5.1
GR(%)	7.8	6.3	15.4	16.6	13.8	4.4

Source: Gurudev singh (2010).

Appendix IV. Distribution of Rainfall in Erode District over Years (in mm)

S. No.	Year	South West Monsoon (June-Sep)		North East Monsoon (Oct-Dec)		Winter (Jan-Feb)		Summer (Mar-May)		Tota
		Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal
1.	1998-99	183.40	289.70	307.60	323.70	21.50	0.00	660.10	151.60	660.10
2.	1999-00	183.40	99.80	307.60	493.80	21.50	39.70	660.10	81.90	660.10
3.	2000-01	183.40	308.60	307.60	243.30	21.50	17.48	660.10	117.70	660.10
4.	2001-02	183.40	160.30	307.60	294.10	21.50	2.10	660.10	81.20	660.10
5.	2002-03	183.40	113.90	307.60	317.40	21.50	2.10	660.10	134.80	660.10
6.	2003-04	213.10	136.10	323.50	347.20	20.70	1.80	711.40	326.70	711.40
7.	2004-05	213.10	203.10	323.50	290.00	20.70	31.60	711.40	274.90	711.40
8.	2005-06	213.10	244.40	323.50	640.20	20.70	7.90	711.40	129.50	711.40
9.	2006-07	213.10	174.50	323.50	386.20	20.70	0.60	711.40	66.40	711.40
10.	2007-08	213.10	203.90	323.50	446.70	20.70	27.00	711.40	215.90	711.40
11.	2008-09	213.10	204.30	323.50	448.70	21.30	21.00	154.10	213.40	711.40

Source: Office of the Assistant Director of Economics and Statistics, Erode (2008-09).

Appendix V. Cropping Pattern in Erode District, 2008-09

Sl.No	Crops	Gross Cropped Area (in ha)	Percentage
A.	**Cereals and Millets**	**62236**	**26.05**
1.	Paddy	38053	15.93
2.	Sorghum	98	0.04
3.	Cumbu	242	0.10
4.	Ragi	6146	2.57
5.	Maize	17685	7.40
6.	Others	12	0.005
B.	**Pulses**	**6822**	**2.87**
7.	Red gram	1488	0.62
8.	Black gram	1793	0.75
9.	Green gram	1038	0.44
10.	Horse gram	852	0.36
11.	Cowpea	1081	0.44
12.	Avarai	492	0.21
13.	Other pulses	78	0.03
C.	**Spices and Condiments**	**9194**	**3.85**
D.	**Sugar crops**	**37047**	**15.51**
E.	**Fruits**	**12788**	**5.35**
F.	**Vegetables**	**12486**	**5.23**
G.	**Fiber crops**	**1761**	**0.74**
H.	**Oilseed crops**	**51901**	**21.73**
I.	**Fodder crops**	**37452**	**15.68**
J.	**Flowers**	**1405**	**0.58**
K.	**Other Crops**	**5861**	**2.45**

	Total Gross Cropped Area	238875	100.00

Source: Office of the Assistance Director of Statistics, Erode, 2008-09.

Appendix VI. Loanee Farmers Crop insurance Details - Kharif 2010 - Return upto December 2010 in Erode District

S. No.	Name of the crop	Number of Farmers			Areas(in Ha)			Sum insured I.e 100% of Loan disbursed			Premium Remitted		
		SF/MF	Others	Total	SF/MF	Others	Total	SF/MF	Others	Total	SF/MF	Others	Total
1.	Potato	3	1	4	2	0	2	82500	16500	99000	557	112	669
2.	Groundnut	273	44	317	228	99	327	5302350	2007750	7310100	92793.63	35137	127930.63
3.	Tapioca	34	0	34	81.654	0	81.654	1324400	0	1324400	41056.5	0	41056.5
4.	Paddy-I	19	1	20	17	1	19	544250	87500	631750	6803	1094	7897
5.	Paddy-II	569	84	653	480	196	676	13562270	5615370	19177640	135623	56154	191777
6.	Banana	1052	128	1180	795	188	983	51917063	10647419	62564482	1713270.74	351365	2064635.74
7.	Turmeric	2135	303	2438	1573	342	1915	90710038	18838095	109548133	2267759	470953	2738712
8.	Sugarcane	5838	1431	7269	4770	2387	7156	242070558	112476592	354547150	3994179	1855873	5850051
9.	Maize	3	0	3	4.55	0	4.55	43600	0	43600	545	0	545
	Total	**9926**	**1992**	**11918**	**7951.204**	**3213**	**11164.2**	**405557029**	**149689226**	**555246255**	**8252586.87**	**2770688**	**11023273.9**

Source: District Central Co-operative Bank, Erode district

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