ENVIRONMENTAL CONCERNS IN THE DEVELOPMENT PROJECTS ON RICE FARMING UNDFR DECENTRALIZED PLANNING

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DECLARATION

I hereby declare that this thesis entitled **Environmental concerns in the development projects on rice farming under decentralized planning** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree diploma associateship fellowship or similar title of any other university or society

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CERTIFICATE

Certified that this thesis entitled **Environmental concerns in the development projects on rice farming under decentralized planning** is a record of research work done independently by Ms Smitha K P (2007 21 103) under my guidance and supervision and that it has not previously formed the basis for the award of any degree fellowship or associateship to her

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Introduction

1 INTRODUCTION

Rice is food but more than food it is environment society culture politics business and above all the beauty of landscape It continues to shape the lives of millions and hence Rice is Life Festivals customs and languages of rice growing areas always celebrate the importance of this life saving grain of three billion people of this planet Rice is an integral part of our culture which is deeply ingrained in our mindset that gets reflected in our deeds and needs Rice being the second largest consumed cereal feeds over half the world s population and meets 80 percent of their calorie requirements Approximately three quarters of a billion of the world s poo est peop e depend on this s aple to survive (Maclean and Hettel 2006) Four fifth of the world s rice is grown by small scale farmers in low income countries Rice based production systems and their associated post harvest operations employ one billion people in the rural areas of developing countries (Misra 2010) Rice can be grown under diverse ecological conditions and has a very prominent role in maintaining the microclimate of the area They have an imminent role in conserving water stabilizing ground water table and preventing floods Moreover rice fields provide shelter to diverse flora and fauna

The pressing issue which our world faces today is the alarming increase in population that has crossed 6 8 billion in the recent years which means we have more mouths to feed with limited natural resources According to Rai (2006) Indian agriculture faces a major challenge of enhancing and sustaining the food and nutritional security of over one billion and growing population with 4 2 percent of the world s water resources and 2 3 percent of the global land

According to Tiwari (2002) the major challenge to food security now is that we have to produce 120 million tonnes from 44 6 million hectares of rice fields by the year 2012 As far as Kerala is concerned farming was used as a synonym of rice cultivation in the past Rice farming was indispensable production endeavor which had influenced the lives of every individual in the society under feudal agrarian relations Haystacks in front of a house were then considered to be the symbol of prosperity Moreover rice fields played a very important role in the maintenance of eco system balance and climate of the state As our state is blessed with adequate rainfall with an average of 2600 mm a year (Kerala Agricultural University 2007) and as rice is a crop that requires water throughout the season it is very much suitable to our climatic conditions But recently it is an astounding and distressing fact that our state has been designated as a statutory ration state (Mathew 1999) producing only about 15 per cent of its requirement in 2008 compared to 45 per cent in 1951 (Nair 2008) Agriculture especially rice farming has been sidelined in the process of development and large tracts of rice fields have been converted for building better infrastructure in the state The cropping pattern in Kerala too had undergone major changes in the past four decades During 1960 61 rice was the most extensive crop occupying 7 79 million hectares and the next in importance was coconut which occupied 5 01 million hectares Between 1975 76 to 1995 96 there was a rapid decline in the area of food crops especially rice However during this period there was a substantial increase in the area under coconut rubber and pepper Rice which had occupied the premier position during 1960 61 and 1975 76 slipped to the second position in 1995 96 and further down to third position by 2003 04 while coconut moved from second to first position during this period Rubber too has increased its area and moved from fourth to second position (Planning Commission 2008) This shift in cropping pattern is mainly attributed to lesser profitability and labour scarcity of rice farming compared to other crops In brief total rice area in Kerala has declined from 7 79 lakh hectares in 1960-61 to 2 34 lakh hectares in 2008 09 and the production has declined from 10 5 lakh tones in 1960 61 to 5 9 lakh tones in 2008 09 consequent to various factors (State Planning Board 2009)

Both the commodity mindset and the so called Green Revolution have wrought havoc on paddy in Kerala and loom as a big threat to the state s environmental sustainability The indiscriminate use of chemical fertilizers and pesticides during the green revolution phase polluted the soils and wetlands in the state extensively and has turned them into wastelands Over 7 000 ha of paddy fields in the Kuttanad region another rice bowl of Kerala next to Palakkad is now lying fallow (Nair 2008) The sustainability of the development will be at stake if we follow a development paradigm neglecting the production of food grains and other basic livelihood requirements In the national scenario with a very meager increase in rice area from 30 81 million hectares in 1950 51 to 45 35 m ha in 2008 09 the production has increased from 20 58 million tones to 99 15 million tones (Department of Agriculture and Co operation 2009) This impressive increase in rice production is greatly attributed to green revolution as part of which high yielding varieties and inorganic inputs were introduced

It was high demand for food which was not able to keep up with the growth in population along with the failure of monsoon to arrive over Asia in 1965 that made Ford Foundation and the Rockfeller Foundation encourage adoption of high yielding varieties in 1966 resulting in the green revolution which then proved to be a boon to the farmers worldwide These miracle grains capable of giving very high yield replaced traditional rice Cultivation of high yielding varieties necessitated overuse of fertilizers which is believed to have gradually deteriorated and depleted soil fertility and quality Such varieties were highly susceptible to pests and diseases which the traditional varieties otherwise would have tolerated This warranted application of vast amounts of plant protection chemicals leading to environmental pollution and development of resistance by the pests towards these harmful chemicals The water quality was also seriously affected there by resulting in health hazards

The adverse effects of conventional rice farming included depletion of ground water resources fertilizer and pesticide contamination of soil and water loss of biodiversity and genetic erosion As human beings we have a moral responsibility for conserving the environment for holistic and inclusive growth with a long term vision and perspective rather than satisfying short sighted and sectarian requirements in the pretext of development It s high time we develop farming techniques for sustainable agriculture considering the environmental production and socio economic dimensions As high external input agriculture has been proved to be unsustainable ensuring food security requires a shift towards low external input / eco friendly agriculture which would maintain input output cycles and ecosystem balance It is estimated that the output / input ratio in conventional farming is 3 76 while in the case of ecological farming it is more than 4 95 (Sharma 2001)

It is well established that over exploitation of natural resources like soil water and biodiversity for meeting the development greed of the rich have created a very hostile situation in which survival and continuance of life of the poor is at stake It is in this context several mechanisms for social organization and collective interaction that would ensure sustainable growth have been evolved Among such initiatives democratic decentralization stands out with several inherent features for ensuring people s participation including the poor According to Ribot (2004) democratization and decentralization have resulted in creation of wider opportunities for people s participation in governance and also in exercising control over natural resources Many developing countries including India have made efforts to devolve Natural Resources Management (NRM) functions to local self governments as a part of the process of institutional reforms The objective of these reforms is to remedy some of the negative fallouts of the top down and centralized governance by promoting local governance structures which can help tap the understanding and the ability of the local people and at the same time providing them with incentives

Kerala is unique with the presence of vast tracts of wetlands which is a precious natural resource in the context of maintaining eco system balance and conserving biodiversity Wetlands of Kerala are mainly used for growing paddy and prawn culture About 3 5 lakh hectares of land is used for agriculture in the state This accounts for nearly 50 percent of the total area under wetlands in the state [Kerala State Land Use Board (n d)] Conservation of these productive wetlands therefore requires attempts to increase production and to resolve the problems of rice farmers through community participation There had been several initiatives by the state government towards this endeavor as early as mid 1980s Two of such programmes that had worked exceptionally well and gained international attention in harnessing group efforts in rice farming were group farming and GALASA (Group

Approach for Locally Adapted Sustainable Agriculture) Sustainable agriculture development is possible only through a decentralized system of development administration where by possibilities and limitations of local areas are identified Group and community endeavors hold the key for successful implementation of ecological farming over larger areas especially in the case of rice farming Eco friendly farming systems and techniques have been developed on the basis of a holistic view of human beings existence within the biosphere and the awareness of their dependence on scarce natural resources Thus according to Swaminathan (2006) our goal should be to achieve an ever green revolution in rice which could improve productivity in perpetuity without associated ecological harm so that there is not only adequate rice in the market but also happiness or [illegible] farmers and consumers

Need for the study

Singh et al (2000) stated that as a result of unprincipled use of natural resources the component of the environment is getting impaired raising threats to the survival of human beings Unscientific use of agricultural inputs and inefficient farming system lead to aggravation of so many environmental disorders like contamination and depletion of ground water acid deposition in the air soil quality deterioration and loss of diversity of flora and fauna species

In the case of rice which is a highly fragile wetland eco system the impacts of high external input farming are prominent and far reaching Considering the threats of intensive farming in rice there is an urgent need to study in detail the environmental concerns and awareness of the stakeholders of rice farming which include farmers agricultural labourers extension personnel and people s representatives/social activists This is because it is their concern that would be reflected upon the environment in toto Success of any sustainable agriculture development effort is based on the stakeholders concern for environment which infact turn out to be a pre requisite for eco friendly rice farming This study becomes relevant in view of the fact that the various dimensions of environmental concerns of the stakeholders of rice farming could become the starting point of greater policy level interventions for sustainable farming and natural resource management

Objectives of the study

In view of the issues discussed above the following objectives have been identified for the study

Study the nature and extent of environmental concerns in planning and implementation of development projects on rice farming under decentralized planning in Palakkad district Environmental awareness and constraints perceived by stakeholders in planning and implementation of the projects were also studied

Scope of the study

A thorough understanding of the environmental concerns awareness and perception on environmental aspects of the stakeholders would help design suitable extension strategies and agricultural policies for preventing the deterioration of rice ecosystem and enhancing the productivity of eco friendly rice cultivation Factors defining environmental concerns depicts the major dimensions of sustainable agriculture and also elaborates the eco friendly practices under the four dimensions viz land and soil management water management biodiversity conservation and plant protection aspects The extent of environmental concerns as reflected in the inclusion / adoption of eco friendly technologies would throw light on the level of concern for environment expressed by farmers while planning and implementing development projects on rice This would provide information regarding the role of various organizations and farmers groups including *padashekarasamithis* in inculcating awareness and concern for environment in rice farming This study attempts to cover the multiple dimensions of the environmental issues that are likely to be addressed in rice farming areas of Kerala The points of exploration also include the benefit cost ratio and social cost benefit analysis This would help the policy makers to chalk out strategies for making eco friendly rice cultivation profitable thereby attracting more number of farmers towards food grain production

This has been attempted by case analysis of the planning and implementation processes carried out by *padashekarasamithis* This would also help the *padashekarasamithis* in leveraging their strengths understanding their weaknesses and improving their managerial skills and co operation Moreover success story of the much acclaimed cow based minimum budget rice farming (*Go adharitha krishi*) has been analyzed thread bare to understand ideal farmer initiatives which might enable capacity building of farmers It is also anticipated that the study would help instill better understanding among farmers on the feasibility and prospects of eco friendly farming

The study would also help delineate the constraints perceived by various stakeholders in eco friendly rice production which would guide the policy planners and administrators to resolve these issues based on real life situations This would revitalize and enhance the attempts of all community based organizations including padashekarasamithis for popularizing large scale eco friendly rice cultivation in the state

The study would also contribute to content development required for educational programmes on sustainable agriculture and community based natural resource management

Limitations of the study

The study was restricted to Palakkad district of Kerala state Hence some of the findings may not hold good for all the rice tracts of the country It is needless to state that the findings of the study are based on the perception and ability of verbal expression of the respondents Hence the objectivity of the study is subject to the degree of frankness and fairness shown by the respondents while expressing their opinion As the study was a single researcher s investigation as part of the requirements for the doctoral degree programme the limitations of time and resources have also affected it at various stages In spite of all these limitations due care has been taken to make the study as much scientific and objective as possible

Organization of the thesis

The thesis is organized to have five chapters The introductory chapter contains a brief account of the global national and state level scenario on rice production and draws attention to the need for eco friendly farming This chapter also explains the need scope objectives and limitations of the study In the second chapter a comprehensive review of the relevant literature that has helped the researcher to formulate the theoretical framework of the study has been included

The research methodology adopted for the study has been described in the third chapter This chapter includes the details of the study area sampling techniques [illegible] and other tools used to measure the dependent and independent variables included in the study and the methods of analysis

The findings and discussion have been presented in the fourth chapter The fifth chapter summarizes the study highlighting the salient findings and implications The bibliography appendices and abstract of the report have been included subsequently under respective headings

Theoretical Orientation

2 THEORETICAL ORIENTATION

A scrutiny of available literature is of great value in gaining insights into the research problem under study This review has been given to establish broad and general theoretical background for the study Comparative views of the past approaches and findings would help substantiate the inference drawn from this research work Moreover deviation in inferences that may lead to further explorations is also made possible through reviews The available literature relevant to the study is presented under the following subheads in this chapter

2 1 Decentralized planning

2 2 Rice farming under decentralized planning

2 3 Eco friendly farming and related concepts

2 3 1 Environmental concerns

2 3 2 Nature and extent of environmental concerns as reflected in the planning and implementation stages of development projects on rice farming

2 3 3 Environmental awareness

2 4 Profile characteristics of the stakeholders

2 5 Economics of eco friendly rice production

2 5 1 Benefit cost ratio

2 5 2 Social Cost Benefit Analysis (SCBA)

2 6 Perception on the attributes of eco friendly practices

2 7 Constraints in eco friendly rice farming

2 1 Decentralized planning

The realization that people s participation is crucial for successful implementation of programmes like Community Development (CD) and National Extension Service (NES) was brought to sharp focus through the report of the team for the study of community projects and NES by Balwantrai G Mehta in 1957 The committee observed that one of the least successful aspects of CD and NES work was its attempt to evoke popular initiative It was in this context that the centre recommended democratic decentralization To establish *Panchayati Raj* on a firm footing the constitution of India was amended as per 73rd amendment act 1992 which was a landmark in the process of democratic decentralization While democracy means that all the authority originates from the people decentralization is the distribution of functions and powers from a central authority to regional and local authorities Thus democratic decentralization implies that the government which has derived its authority from the people redistributes it to some extent to the people for decision and action at the local level This is popularly known as *Panchayati Raj* in India With the constitutional amendments *Panchayati Raj* has emerged into a system of democratic local self government discharging developmental municipal and regulatory functions Democratic decentralization has been made a reality through *Panchayati Raj* at three levels *Zilla Parishad Panchayat samithi* at block and *Gram Panchayat* at village level (Ray 2008)

FAO (1998) observed that participatory methods could help to make the distribution of extension services more equitable making farmers influential and responsible clients rather than passive beneficiaries to improve sustainability

According to Agrawal and Ostrom (2001) diverse terms like devolution and de concentration are used to refer to the varying forms in which decentralization occurs Decentralization typically refers to a transfer of power from central authorities to lower levels in a political administrative and territorial hierarchy

Ribot (2004) opined that in order to be effective decentralization should transfer meaningful powers and sufficient resources to autonomous local authorities that are representative and downwardly accountable

Decentralized planning in Kerala

Kerala with appreciative development indicators comparable to developed countries has been experimenting with decentralization and participatory local democracy ultimately aimed at realization of the constitutional goal of establishing genuine institutions of local self government since the enactment of Kerala Panchayat Raj Act & The Kerala Municipality Act in the year 1994 The acts laid the provision of a three tier system of Panchayat for the first time in the village block and district level in the rural areas and one tier system of urban local government such as municipality in the less urbanized areas or municipal corporation in the more urbanized areas Local governments were vested with the powers and responsibilities of economic development and social justice in their respective areas Panchayats and the Municipalities altogether constitute the Local Government System of Kerala state in the Indian federal system (Wikipedia 2010)

The distinctiveness of Kerala decentralisation is that it has formalised a participatory framework with built in social accountability measures to take in citizens involvement in local planning and governance in harmony with the national and regional policies Public consultation is being done at the bottom most electoral constituency called ward / *grama sabh*[illegible] S[illegible]gs are convened by the elected member of the constituency The information collected from this consultation process is fed into Local Government Development Report that provides the development status and potential of the local government Working groups for each sector translates the ideas into draft development projects in compliance with the guidelines of the State The local government appraises the projects matches them with the available resources and approves with necessary refinement before submitting them to the District Planning Committee in the form of a consolidated local plan for final sanctioning The District Planning Committee with the help of technical advisory groups examine the plan for technical viability and compliance with the government guidelines and sanction the plan which will be implemented by the concerned local government with the help of its officers working groups or stakeholder groups (DecWatch n d)

Kerala embarked on a trajectory of rapid decentralization since October 1995 According to Vijayanand (2003) the state has moved ahead at good pace by transferring not only functions and responsibilities to local self governments but also the authority to carry them out along with resources both human and financial To operationalize decentralization Kerala has chosen the path of participatory local level planning as the entry point This has succeeded to a considerable extent in harnessing public action in favour of decentralization In order to force the process a campaign approach was followed for decentralized planning known as the People s Planning Campaign and to a greater extent it succeeded in setting the agenda for decentralization The very important aspect of Kerala s decentralization has been people s participation The process has been designed to facilitate intervention by the interested citizen at all stages of the development process right from generation of developmental ideas through project planning project implementation up to monitoring

Isaac and Franke (2002) opined that decentralized planning in Kerala aimed at rejuvenating the state s stagnant productive sector had the specific objectives of mp o ng he q ality of investment by allocating ources to local priorities facilitatinglocal level solutions to development problems exploiting local production possibilities enabling people s participation and contribution in planned development and bringing about convergence of services

Franke and Chasm (2000) list the four factors that have contributed to generate the People s Campaign as (i) Kerala s long term achievements in bringing a high material quality of life to its people even at low levels of economic development— the well known Kerala Model (ii) a vibrant civil society combined with political parties that are capable of mobilising people for activities beyond voting (iii) the micro level planning experiments that showed the power of local initiatives and (iv) a conjunction of historical events that created a perfect moment in which to take the plunge (into democratic decentralization) The People s Campaign for decentralized planning constitutes an empirical case for the literature on decentralization local government and the uses of local initiatives for sustainable economic and social development

Veron (2001) remarked that the Kerala Model of Development has won wide international attention for its achievements with regard to social development and to a certain extent environmental sustainability It thus holds important lesson for participatory community based sustainable development in India and elsewhere

2 2 Rice farming under decentralized planning

With the passage of the 73^{d} and 74^{h} amendments to the Constitution of India in 1992 Kerala carried out pioneering reforms and embarked a path of comprehensive decentralization since 1995 Powers and functions were transferred to local governments along with institutions offices and functionaries by October 1995 Village block and district panchayats have standing committees The standing committees are constituted in such a way that every member of the panchayat gets a chance to function in one standing committee or the other Each standing committee is assigned certain subjects and these committees are expected to go into the subject areas both at the planning and implemen[illegible] The amended Kerala Panchayat Raj Act drastically reduces the powers of direct governmental control over Panchayat Raj Institutions With the transfer of power local governments in Kerala got the services of fairly senior professional officers on Health Agriculture Animal Husbandry Rural Development Social Welfare Scheduled Caste Development Education etc

The eleventh five year plan gives much focus on rice farming as over the years paddy land has shrunk to almost one third of the original It has been declared that area under paddy in Kerala would be increased to 3 lakh hectares by the end of the planning period This challenge has been the major issue of planning at the grassroots level Formulating the strategy of integrated paddy development wh ch in turn require planning and implementation of projects at grassroots level are the responsibilities vested with panchayats which also includes coordinating various groups farmers agricultural labourers extension functionaries social activists and people s representatives Rice farming is very important from an ecological point of view rather than a commercial angle as it has pivotal role in eco system balance ground water recharge and maintaining the climate of the locality But the importance of this wetland ecosystem is often under valued Hence for conserving this precious resource a social action strategy involving the local people is very important a few of which is mentioned below

Menon and Bhaskaran (1989) reported that based on the experience in group farming in Java Bali Taiwan Malaysia and Mexico the Kerala Agricultural University initiated an innovative approach known as group management in rice farming under the lab to land programme at Thuravur in Ernakulam district by overcoming the constraints experienced in the attempt of various agencies in the state This approach envisages superimposing of community management of key farm operations over individual farm ownership and initiative with the objective of efficient management of farmers resources to reduce cost of cultivation and to increase agricultural productivity

Kerala State Planning Board (1989) reported that group farming for rice introduced during the year was very effective in revitalizing the rice production scenario with new vigour enthusiasm and mass participation

Pretty (1995) opined that the success of sustainable agriculture depends not just on the motivation skills and knowledge of individual farmers but an action taken by groups or communities as a whole

Kerala Agricultural University (2000) opined that GALASA which is a meaningful combination of group approach locally adapted resources and sustainable agriculture is an agriculture development scheme and the concept of decentralization is its lifeline In this programme the financial and administrative powers were vested with the three tier panchayats

Kumar (2005) reported that in 1998 99 Kerala Agricultural University initiated an action research programme called the GALASA whose objective was to find ways to increase paddy production in Kerala Scientific planting of good quality seedling adequate use of organic manure and integrated disease and pest management would increase rice yield from the then rate of three tones / hectare to more than 10 tones / hectare

Government of Kerala (2006a) in the working group report for the eleventh five year plan stated that GALASA programme has to be spread everywhere in the state Integrated pest and disease management and production of vermi compost coir pith compost bio fertilizers like *Azolla* should be the part of the eleventh five year plan projects

Mehar (2007) reported that in the last six years the area under paddy had shrunk by an incredible one third in five years to just 276 000 hectares This is why the Peoples Plan accords capital importance to doubling paddy production This paddy output drive has already started showing results By assuring a price of Rs 8 50 per kilo paddy production is up by 30 per cen [illegible]

Hali (2007) observed that of the entire programme launched to enhance the capability of the paddy farmers and to reduce the cost of production group farming for rice launched in 1989 was the most outstanding in winning the confidence of rice growers by producing splendid positive result

Nehru *et al* (2007) reported that the People s Sustainable Rice Project of the Thiruvananthapuram *zilla Panchayat* in *Kalatharakkal Ela* scientific planning and effective implementation under leadership of *padashekarasamithi* and technical guidance of the Kerala Agricultural University resulted in more than 100 per cent increase in yield with a substantial reduction in cost of production

Varughese *et al* (2007) stated that unlike other crops community participation is a prerequisite for effective planning and successful implementation of rice production programmes

2 3 Eco friendly farming and related concepts

The concept of eco-friendly farming is used differently by the people in various contexts Some of these concepts are mentioned below for a better understanding of this term

According to Pesek (1985) biological and ecological farming are terms commonly used in Europe and developing countries Biological farming is a system of crop production in which the producer tries to minimize the use of chemicals for control of crop pests Both biological farming and ecological farming are terms used in the broader sense encompassing various and more specific practices and techniques of farming sustainability e g organic biodynamic holistic natural

According to Robert and Gilman (1986) natural farming reflected the experiences and philosophy of Japanese farmer Masanobu Fukuoka He described it as do nothing farming and a lifetime of nature study His farming method involved no tillage no fertilizer no pesticides no weeding no pruning and remarkably little labour He accomplished all this (and high yields) by careful timing of his seeding and careful combinations of plants (polyculture) In short he had brought the practical art of working with nature to a high level of refinement

Parr (1990) stated that low input farming systems seek to optimize the management and use of internal production inputs (i e on farm resources) and minimize the use of production inputs (i e off farm resources) such as purchased fertilizers and pesticides wherever and whenever feasible and practicable to lower production costs to avoid pollution of surface and groundwater to reduce pesticide residues in food to reduce a farmers overall risk and to increase both short and long term farm profitability

Rodale (1990) coined the term regenerative agriculture and it subsequently was expanded to regenerative / sustainable agriculture by the Rodale Institute and Rodale Research Center Two reasons given for the emphases on regenerative were (1) enhanced regeneration of renewable resources was essential to the achievement of a sustainable form of agriculture and (2) the concept of regeneration would be relevant to many economic sectors and social concerns

According to National Organic Standards Board (1995) the principal guidelines for organic production were to use materials and practices that enhanced the ecological balance of natural systems and that integrated the parts of the farming system into an ecological whole Organic agriculture practices could not ensure that products were completely free of residues however methods were used to minimize pollution from air soil and water Organic food handlers processors and retailers adhered to standards that maintained the integrity of organic agricultural products The primary goal of organic agriculture was to optimize the health and productivity of interdependent communities of soil life plants animals and people

Norman (1997) pointed out that in E [illegible] efers to organic farming whereas the term ecological refers to organic plus environmental considerations such as on farm wildlife management (i e the relationships between parts of the agro ecosystem)

2 3 1 Environmental concerns

The word environment was derived from the French verb *environner* meaning to surround Our environment literally is no more and no less than our surroundings Concern here means the thoughts experiences or acts relating to the ecological improvement of altering the environment or being anxious about environment Studies portraying concerns for environment and the means for addressing these environmental concerns are presented below

Sreevalsan (1995) reported that nearly two third of the farmers were environmentally less oriented

Ali and Jain (1998) reported that concentration of atrazine alachlor simazine metalachlor and prometryn in ground water were much higher than the permissible health value (0 1 HgL 1) prescribed by United States Environmental protection agency

Santhi and Selvakumari (2000) stated that green manures were an attractive alternate source to meet a substantial portion of the N requirement of rice and provide organic matter to wetland rice soils Addition of organic sources could increase yield through increased soil productivity and higher fertilizer use efficiency

Kar (2002) reported that people living in Arnapur of Kamakhynagar block in the district of Dhenkanal Orissa realized global warming and understood the importance of planting trees To show their great concern on environment they organized greenery club to plant trees and green vegetation in the wastelands of villages

Srinivasan (2003) found that people in the Sempakudi village of Pudukottai district made a pond in the village wasteland to harvest maximum possible rainwater with a purpose to recharge ground water This work was done without any help from government machinery They collected money @ Rs 1000 per house for this purpose and showed their concern for environment

Arunachalam and Seetharaman (2004) while studying sustainable agricultural indigenous practices for natural resource management observed that 100 per cent of the respondents of Kanyakumari district agreed that it was their duty to plant more trees wherever possible to conserve the environment and 90 50 per cent responded that they would take measures to preserve natural enemies while using chemicals against crop pests

Jaganathan (2004) in his work on analysis of organic farming practices in vegetable cultivation in Thiruvananthapuram district reported that nearly three fourth of the respondents (72%) had high environmental orientation and observed that there was positive and significant relationship between environmental orientation and attitude towards organic farming

Singh *et al* (2006b) reported that scented rice might be efficiently and profitably be cultivated without using chemical fertilizers and providing green manure FYM or vermi compost and bio fertilizers instead It had an additional advantage of quality grain besides improvement on soil health as well as balance in agro eco system

Wang *et al* (2006) reported that after 12 years of straw incorporation soil organic carbon (SOC) increased by 0 23 g/kg annually and total soil N (TN) increased 0 054g/kg annually In treatments with fertilizers but no straw return soil organic carbon increased by only 0 09 g/kg annually and TN increased by only 0 018 g/kg annually

Jayawardana (2007) revealed in his study on organic agricultural practices in coconut based homesteads in Thiruvananthapuram district that 83 per cent of the farmers had medium environmental orientation followed by high (10%) and low (7%) levels of environmental orientation

Vijayalakshmi *et al* (2007) stated that Centre for Indian Knowledge System took the initiative of growing traditional varieties organically and linked the consumers with the farmers through a programme named Arogyam She also reported that this centre had brought together 3000 farmers from 125 villages and motivated them to conserve 130 indigenous varieties cultivated in Tamil Nadu organically They had also set up a farmers seed bank to conserve indigenous varieties

According to *Thanal* (2008) any threat on rice was not only a threat to the food sovereignty of the region but also to the ecology of the region which included its most basic of life support systems water air bio diversity culture and nature of human and other life forms in the region

Singh and Purohit (2008) stated the importance of bio fertilizers over chemical fertilizers as the bio fertilizers provide in addition to nitrogen certain growth promoting substances like hormones vitamins ammo acids etc Crops have to be provided with chemical fertilizers repeatedly to replenish the loss of nitrogen where as bio fertilizers supply nitrogen continuously throughout the en ire period of crop growth in the field under favourable conditions

Durgadevi *et al* (2009) reported that an application of one kilogram herbicide per hectare lead to approximately 0 5 mg chemical per kilogram soil Erratic and continuous application of herbicides create toxicity problems to crop plants residual effect on the intercrops and succeeding crops in the rotation development of herbicide resistant bio types and health hazards due to accumulation of residues in crop produce and ground water She also stated that since herbicides were sprayed ather ea l n he op season where the plant cover a the major portion of the chemical entered the soil where it became a part of the life cycle Hence these chemicals were supposed to be the major ground water polluting pesticides

Kallas *et al* (2009) observed that farmers who were concerned with environmental problems food safety and soil degradation were more prone to adopt organic cultivation practices

2 3 2 Nature and extent of environmental concerns as reflected in the planning and implementation stages of development projects on rice farming

The review of the nature and extent of environmental concerns in rice farming is presented under four dimensions *viz* land and soil management water management biodiversity and plant protection aspects

2 3 2 1 Land and soil management

Conway and Edward (1988) stated that greater effort was needed to promote more efficient and less polluting use of N fertilizers and the use of alternate sources of N like crop wastes animal and green manures legumes in rotation and as tree crops blue green algae and nitrogen fixing bacteria in rice

Jayaraman (1988) reported that majority (80%) had medium level of adoption followed by the rest (20%) of the farmers with low adoption level with regard to neem coated urea for paddy cultivation

Ponkathaperumal (1994) found that the practices namely application of FYM to nursery application of DAP to nursery application of FYM to main field application of NPK fertilizers application of neem cake treated urea application of *Azospirillum* application of N fertilizers as top dressing were adopted by more than two third of respondents

Brid it *et al* (2003) reported that the high[illegible] g[illegible] [illegible] by the treatment in which *Azolla* was introduced at 4 5 t/ha at planting

Helen *et al* (2003) reported the rate of adoption of various technologies like summer ploughing of paddy fields (90%) use of organic manures (50%) application of neem coated urea (40%) and growing green manure crops in situ (80%) They also stated that the use of neem cake along with urea improved rice productivity by giving 4 to 6 per cent higher yield Similarly fringe cropping on paddy field bunds using cowpea variety Bhagyalakshmi gave 250 to 600 kg vegetable yield from bunds of one hectare plot

Arunachalam and Seetharaman (2004) observed that there were 98 per cent of the respondents who agreed that a clean environment could be achieved by following organic farming practices Almost an equal percentage of the respondents had shown their great concern on STL based fertilizer application to avoid pollution (91 00%) minimum use of chemical inputs to avoid environmental hazards (91 50%)

Pathak and Ladha (2006) reported that resource conserving technologies involving minimum tillage with residue mulch are alternative to conventional rice systems for improving soil quality and that with happy seeder it is now possible to sow seeds in residue retained fields

Sither et al (2006) stated that to make the soil fertile and fit enough to sustain the crop on its own add paddy straw and crop residues thereby leading to produce vermicompost within the soil Use of organic materials like *amuthakai aisal* (mix of cow excreta) *panchagavya gunabajalam* (extract of dead ones in water) organic crop growth regulators insect and harmful microbe repellents bio–fertilizers alone could sustain and balance the soil for sustainable rice productivity

Sm tha (2008) s a ed ha n order to ensure availabilit of ents to rice organic manure and bio fertilizers had to be applied Crop residues and other leguminous crop could also be ploughed in to improve soil fertility

2 3 2 2 Water management

Leggitt (1990) observed that there had been excessive withdrawal of ground water Faulty water management had resulted in serious twin problems of water logging and soil salinisation in many commands Judicious integration of all water resources at the farm system and basin levels and also appropriate methods for safe use of poor quality waters including sewage waters would be essential for sound irrigation management

Costanza (1991) stated that the efficient natural resource management for sustainable agricultural production involved the management of water regulation and supply utilization of favourable climate integrated nutrient management waste treatment and biological control of pests

Majority of the paddy growers (53 34%) were medium in their overall adoption of recommended water management practices followed by 26 66 per cent in low level and 20 per cent in high level adopter categories as reported by Suresh (1991)

Reıjntjes *et al* (1992) stated that ımmense sums had been spent by development projects on large scale ırrıgatıon schemes ın whıch water was often used ınefficıently Small scale alternatıves (lıft ırrıgatıon small dams water harvestıng tanks etc) were much cheaper and more flexıble and use water more efficıently and gıve farmers the possıbılıtıes to partıcıpate ın lay out and management

Nandını (1995) ın her comparıtıve study on ımpact of soıl and water conservat on programme ımplemented by an NGO and government organızatıon reported that 75 per cent of the respondents made earthen bunds to conserve soıl and moısture by the farmers ın the study area She further reported that all the farmers practıced summer ploı gh ng

Kavıtha (2001) found that the ıntegrated water management practıces *vız* summer ploughıng land levelıng strengthenıng of bunds alternate wettıng and dryıng growıng of short duratıon varıetıes and perıodıcal cleanıng of bunds were adopted by more than 80 per cent of the farmers

Arunachalam and Seetharaman (2004) observed that 90 per cent of the respondents expressed theır concern on conservıng water as ıt was theır precıous resource

Hıttalmanı *et al* (2006) stated that rıce requıred about 5000 lıtres of water to produce one kılogram of rıce under tradıtıonal cultıvatıon methods ın submerged condıtıons hence methods needed to be devısed for conservıng ıt

Sıngh *et al* (2006a) stated that compared to transplanted rıce SRI saved ırrıgatıon and total water ınput consumptıon by 23 per cent and 19 per cent respectıvely wıthout loss ın productıvıty

Sıngh (2009) observed that the use of organıc manures ıncreased the organıc matter ın the soıl and ımproved ıts water retentıon capacıty whıch saved water by 14 per cent To further improve water resource in the study area it was suggested to harness the rainwater using water harvesting tanks

2 3 2 3 Biodiversity

Mathew (1999) in a case study on land use change analysis observed that conversion of paddy lands in Kumarakom region had drastically reduced aquatic medicinal plant *Bacopa monnieri (Brahmi)*

Nair (2002) observed that the biodiversity register of *Pozhuthana grama panchayat* indicated that of the nine ecosystems paddy fields had suffered the most damage 106 rice varieties were grown in the panchayat and now 71 of them had disappeared one among them is *Karuthan* a variety that could be grown only in plain lands

Leenakumary and Francies (2003) stated that near about two thousand traditional varieties of rice were predominantly cultivated in Kerala which were well adapted to different agro climatic situations in Kerala and possessed special traits Population explosion and its chain reactions caused denudation of forests and erosion of land races primitive forms and wild rice species

Subramanian and Sundar (2003) stated that although there can be no doubt that high yielding varieties are needed to meet the food demands of the ever increasing human population there was a price to pay in terms of loss of genetic diversity The cultivation of land race varieties had declined Similarly the wild species were threatened with extinction through changes in land use and extension of agriculture into marginal areas and deforestation

There is growing recognition that agricultural biodiversity is being eroded and agro ecosystems impoverished by the loss of genetic diversity International agreements such as the Convention on Biodiversity (CBD) and the Ramsar Convention on wetlands are a response to these concerns The World Summit on Sustainable Development (WSSD) Plan of Implementation calls for a significant reduction in the current rate of biodiversity loss by 2010 (Halwart 2004)

Thanthriarachchi *et al* (2007) reported that the aim of MPIS was to breed and propagate local rice varieties and provide seeds and ecological awareness to farmers It strived to do this by training farmers in ecological farming building awareness among farmers to shift to ecological farming assisting ecological paddy farmers to market their produce at fair prices and developing a more direct rice chain from farmer to consumer and ensure a price fair to both Among its different actions possibly the most important was the collection and recording of varieties and associated knowledge

Vijayalakshmi *et al* (2007) stated that the Centre f[illegible] had set up the community seed banks in Valayamapattu village of TamilNadu The process involved seed mapping which yielded valuable information on genetic diversity An inventory of farmers in different villages who cultivated these varieties was made and farmers who become members used part of their land towards conservation of indigenous grain varieties

2 3 2 4 Plant protection

According to Miyata (1989) increase in the resistance of pest populations to pesticides was observed causing pest outbreaks BPH and green leafhopper have developed high levels of resistance to organophosphates carbamates and pyrethroids

The rice fields being agro ecosystems are managed with a variable degree of intensity and hence agronomic measures and practices affect the abundance of aquatic species and the composition of the aquatic community (Halwart 1993)

Nirmaladevi (2000) stated that under mechanical practices yellow sticky trap was adopted by 44 per cent of the respondents and light trap was adopted by 38 67 per cent of the respondents This low level of adoption was found among the respondents because they felt it was very difficult for them to set optimum number of traps

Rajasekaran and Govind (2000) found that the practices which were adopted to a higher extent by TANWA trainees were seed treatment with bio fertilizers planting technique neem cake blended urea application and seed treatment with fungicide and the practices which were adopted to a lesser extent were weedicide application integrated rat control soil testing Zinc Sulphate application and integrated pest management

Sudhakar and Kanagasabapathi (2002) found that most of the respondents adopted summer ploughing (90 95%) crop rotation (90 34%) and use of light traps (85 00%) A little less than half of the respondents had adopted the practices *viz* using *Trichogramma* egg card (48 43%) use of correct dose of nitrogenous fertilizers and raising trap crops (47 50%) seed treatment with *Trichoderma* was known to 41 66 per cent of farmers

Raji *et al* (2003) stated that cultivation of varieties with multiple resistance to pests and diseases was one of the means of lowering the cost of rice production She also reported that *Pseudomonas fluorescens* was a promising and potential bio control agent for rice disease management which was effective against fungal as well as bacterial pathogens of rice Similarly the foliar spray of cow dung extract and cow s urine cow dung slurry as top dressing and cow dung as basal dressing were significantly superior to the control of Bacterial Leaf Blight as the bacterio phages present in fresh cow dung was responsible for the biological control of the pathogens

Suji and Vasanthakumar (2004) observed that nearly half the farmers (47 50%) have adopted neem cake in paddy nursery Application of neem cake and kerosene to control paddy green leafhopper was adopted by 34 16 per cent of the respondents Blending urea with neem cake was found to be adopted by 31 66 per cent of the respondents and controlling the diseases through neem oil application was found to be adopted by 22 50 per cent of the respondents

Warburton *et al* (2006) observed that thirty five per cent of the respondents wore some kind of mask normally a T shirt or handkerchief tied around their nose and mouth wearing of boots or gloves was conspicuously absent Protective clothes worn by the farmers however were not really adequate to protect them

Prabu (2008) in a case study of an organic farmer observed that he grew trees near the paddy fields which was home to several birds that fed on insect pests of his crop Irrigation water from the well entered a fishpond and flows to paddy fields The fish droppings added manure to the crop and the fish also fed on some insect pests Ducks were also let into the field for inset pests control and suppression of weed growth

According to Smitha (2008) some of the eco friendly technologies that helped in sustainable rice farming were integrated application of organic manures and bio fertilizers collection and release of natural enemies using light traps and pheromone traps application of *Pseudomonas* super natant of cow dung slurry need based application of botanic pesticides and bio control agents cultivation of locally adapted varieties and adjusting the time of planting and regulating the water level in the field

Khule *et al* (2010a) observed that 13 89 per cent farmers up to 35 years age had high level of adoption of low cost crop cultivation technology of paddy

Pawar *et al* (2010) observed that 43 33 per cent of the farmers made use of empty pesticide bottles 73 33 per cent farmers didn t know mixing of pesticides 70 per cent of farmers never used gloves or mask for preparation of pesticides 60 per cent farmers sprayed pesticide during morning hours 76 66 per cent farmers never wore clothes covering whole body during spraying 73 33 per cent farmers chewed tobacco while spraying and 60 per cent farmers sprayed pesticides more than recommendation

2 3 3 Envıronmental awareness

Awareness ıs beıng conscıous of somethıng as a state of perceıvıng and takıng account of some event occasıon experıence or object Studıes depıctıng envıronmental awareness ıs gıven below

Lıonberger (1960) defined awareness as the first knowledge about a new ıdea product or practıce At the awareness stage an ındıvıdual has only general awareness about ıt For successful ımplementatıon of a new technology or development programme the prıme step ıs to make the stakeholders aware of the programme or the technology ıts objectıves prıncıples aıms etc

Ganesan (1982) observed that no paddy growers were aware of bıologıcal control of pests whereas 44 per cent of the cotton growers were aware about the role of NPV to control pest

Jeyakrıshnan (1984) found that majorıty of paddy growers (67 50%) had medıum level of awareness about the low cost technologıes lıke recommended seed rate optımum spacıng neem coated urea splıt applıcatıon of nıtrogenous fertılızers etc ın paddy cultıvatıon

Ranganathan (1987) stated that cent percent of the farmers were aware and had knowledge on recommended water management practıces ın paddy

Awareness about summer ploughıng was cent percent among small and bıg farmers whıte ıt was 96 per cent among medıum farmers as reported by Venugopalan (1989)

Ponkathaperumal (1994) concluded that nearly half (54%) of the sample paddy farmers were found to possess medıum level of awareness followed by hıgh (30%) and low (16%) on ıntegrated nutrıent management practıces

Jayaraj (1997) in his study on adoption of bio pesticides among cotton growers indicated that slightly less than half (42 50%) of the respondents were found to possess low level followed by high (33 33%) and medium (24 17%) awareness levels about the bio pesticides

Kavitha (2001) reported that cent percent of the farmers were aware about the integrated water management practices *viz* summer ploughing land leveling strengthening of field bunds growing of short duration varieties More than 70 per cent of the farmers were aware about other water management practices like periodical cleaning of channels and quick drainage methods

In an attempt to study the awareness of farmers on the cultural methods of Integrated Pest Management among IPM farmers and non IPM farmers Govind and Perumal (2001) revealed that more than three fourth of respondents from both the categories belonged to the high awareness category for the practices *viz* selection of variety water management in nursery trimming and plastering of bunds and land leveling in main field

Sudhakar and Kanagasabapathi (2002) in their study on awareness and adoption of Integrated Pest Management practices in cotton cultivation reported that a little more than half of the respondents were aware of the practices *viz* using recommended dose of pesticides (58 34%) raising crops other than malvaceous crops in cotton field (54 16%) using NPV pesticides co operating with neighbours in raising same variety in the village (52 20%) using sex pheromone traps (51 66%) and using yellow sticky traps (51 66%)

Bala (2003) in his study on awareness on air pollution among rural households in Haryana reported that half of the respondents were aware of nuclear explosion fire in oil wells and forest fires leading to air pollution In the study he revealed that the respondents were aware that direct incineration of garbage (76%) and smoke produced at time of cooking (62%) are internal sources of air pollution The respondents (60 70%) were aware of major external air pollutants such as improper disposal of garbage smoke from vehicles exhaust emitted from industries fumes due to use of insecticides / pesticides dust particles from agricultural operations and smell from industrial effluents

Devi (2007) revealed that majority of the applicators lacked awareness on pesticide toxicity levels Only one third of the respondents read the label on the pest cide packet Likewise majority of them were spraying highly toxic pesticides She also found that none of the applicators were using the protective gadgets But majority of the applicators wore full sleeved shirts and some tied a piece of cloth around the nose

Jayawardana (2007) reported that 73 per cent of the respondent had medium level followed by high (15%) and low (12%) level of awareness Fifty per cent of the farmers had awareness index between 50 and 75

Nair (2007) stated that for effective implementation of paddy land conservation wide spread awareness on the adverse impacts of conversion of paddy lands was important otherwise Kerala would witness serious ecological problems mainly in the form of water scarcity land degradation crop failure and frequent occurrences of natural calamities of flood and drought

Akhtar *et al* (2008) stated that the increasing awareness of the deleterious effects of indiscriminate use of chemical fertilizer and pesticide in agriculture had led to the adoption of organic farming as an alternative method for conventional farming worldwide

Khule *et al* (2010a) reported that there was growing awareness and readiness to adopt the low cost technology among young and educated farmers

Sharma et al (2010) reported that partial awareness was found in the case of seed treatment with microbial culture organic manuring recommended dose of chemical fertilizers use of bio fertilizers use of micro nutrients IPM IDM biological control of insects and diseases and moisture content of rice for storage

2 4 Profile characteristics

2 4 1 Age

Subramanian (2000) found that the majority of the paddy growers belonged to middle age group (46 67%) followed by old (33 33%) and young (20%) age group

Mahindra and Kaur (2004) in their study on exter [illegible] regarding pesticide residues in cereals vegetables milk and milk products reported that 56 67 per cent respondents were in the age group of 28 36 years 25 83 per cent were 19 27 years and 17 50 per cent were between 37 45 years

Kalra and Kaur (2005) revealed that majority of Agriculture Development Officers (ADOs) (60%) were in the age group of 30 35 years

Jayawardana (2007) observed that majority of homestead farmers (80%) were old aged while 14 per cent were found to be in the middle age group and six per cent of the respondents belonged to the young category

Allahyari and Chizari (2008b) found that majority (39 2%) of the agricultural extension professionals were 31 40 years old

Kallas *et al* (2009) observed that older farmers were found to be less likely to adopt organic farming

Malathesh *et al* (2009) reported that over one third farmers (35 83%) in different farming systems were middle aged followed by old age (32 50%) and young age category (31 66%)

2 4 2 Experience in dealing with eco-friendly rice cultivation

Ramanathan (1995) reported that 52 per cent farmer respondents had low farming experience and 48 per cent had high experience 44 per cent of the labourers had low level of experience as labourers and 56 per cent had high level of labour experience

Hanif and Ganesan (2004) reported that most of the paddy farmers possessed medium level of farming experience

Kalra and Ka (2005) found that majority of Agriculture Deve ment officers (ADOs) (40%) had 2 6 years of experience

Prasidha (2006) reported that no respondents had less than five years of farming experience and majority of the respondents had more than 25 years of experience

Allahyari and Chizari (2008b) found that nearly 29 1 per cent of agricultural professionals had served in extension activities for 1 to 5 years

2 4 3 Participation in training programmes on eco friendly rice cultivation

Mahipal and Prasad (1997) in their study on impact of training programmes on extension personnel found that majority of the respondents had gained medium level of knowledge about various technologies imparted during training

Ansari and Chandargi (2000) revealed that the topics *viz* Integrated pest Management manures and fertilizers and their usage and use of insecticides in IPM were ranked as first second and third respectively with regard to their topic effectiveness in training programme for Assistant Agricultural Officers

Ravichandran *et al* (2000) observed that under training needs information on biological control measure for the disease control of pest was the least preferred area by the farm women which showed that the importance of the biological control measures was not much felt by the farm women

Devi (2007) stated that the pesticide applicators were not trained even to understand the level of toxicity by reading the colour code She further reported that the trainings organized by the mainstream agencies usually focused on training farmers But in majority of cases of spraying (75%) the farmer did not supervise and preferred to stay away from the field

Hosamani *et al* (2009) in their study on effectiveness of training for farmers on vermiculture observed that majority of the respondents belonged to low category (68 52%) followed by high (20 38%) and medium (11 11%) categories with regard to knowledge levels before the training programme On the other hand percentage of respondents increased in both high (50 00%) and medium (18 51%) categories after the training programme and decreased (31 48%) in low category of knowledge level

2 4 4 Participation in activities related to environmental conservation

Singh (1991) defined participation in watershed development programme as an act of partaking (by farmers) in all stages of the development and management programmes right from designing of various soil and water conservation structures through monitoring and evaluation of their performance

O Brien (1997) found that inadequate participation was one of the reasons why development projects were ineffective

According to Parker (1997) participation ranged from local people being involved in implementing development or conservation programmes to being actively involved in all stages of the development process including decision making process

Loganandhan and Singh (2005) observed that organic farmers were with higher degree of social participation than the conventional farmers

Kallas *et al* (2009) in their study found that membership of an environmental organization had positively influenced the decision to take up organic farming

Malathesh *et al* (2009) reported that social participation of half of the farmers was low whereas 38 33 per cent belonged to medium category and 11 67 per cent belonged to high social participation category

2 4 5 Attitude towards group management

Mohanan (1989) revealed that in the *ela* programme (intensive paddy cultivation in contiguous area) the farmers had expressed positive attitude towards cultivation of rice in large groups

Hussain (1992) revealed that group management approach had influenced the attitude of the respondents towards group management very much favourably

2 4 6 Perception on the importance of mitigating environmental degradation

Singh (1989) reported that continuous puddling of rice field in Punjab has led to the formation of an impervious layer of soil which not only prevents uptake of water and nutrients from deeper layers but also requires more fertilizer application

Drost *et al* (1996) stated that farmers who adopt sustainable agriculture practices do so because they wanted to be good stewards of the soil reduce ground and surface water pollution produce quality food with reduced amounts of chemicals and reduce health risks to farm families and livestock Negative farmer perceptions regarding any one or combination of sustainable agriculture elements could limit the adoption of such practices

Theodore (2002) stated that the rice crop was beginning to cause environmental concerns by posing threats to the sustainability of the irrigated regions both in economic and ecological terms

Raji *et al* (2003) stated that introduction of HYV of rice over reliance on chemical fertilizers and plant protection chemicals and intensive cultivation had upset the biological equilibrium there by disturbing the set pattern of occurrence of diseases The minor diseases like brown spot sheath rot and false smut were becoming major problems in rice growing tracts of Kerala

Sheela *et al* (2006) stated that chemicalisation in [illegible] enormous problems like environmental pollution toxicity hazards residues in food and destruction of biodiversity of natural enemies etc

Wei *et al* (2009) reported that the farmers perceived environmental degradation in terms of increased frequency and severity of sandstorms movement of sand dunes deterioration of pasture quality and declines in groundwater depth and quality A Tobit model analysis showed that the education level of farmers the availability of extension services and whether farmers had participated in ALERMP were highly significantly correlated with the farmers perception of degradation

According to Smitha and Anilkumar (2009) loss of indigenous varieties had made the farmers grow high yielding varieties that required more input especially chemicals which had polluted our environment Biodiversity loss also included reduction in the natural enemy population which in turn made paddy susceptible to pests and diseases Disturbance in the food chain had resulted in the gradual alteration of the communities

2 4 7 Indigenous wisdom orientation

According to Rajasekaran (1993) Indigenous Technical Knowledge (ITK) is the systematic body of knowledge acquired by local people through the accumulation of experiences informal experiments and intimate understanding of the environment in a given culture

Sabarathinam (1997) stated that though the indigenous technical knowledge was region specific it could be applicable to similar agro climatic conditions because most of the indigenous agricultural technologies had got scientific rationale

Ghosh (2002) opined indigenous knowledge (IK) is an important value input in planning and decision making related to sustainable management of natural resources and the importance of IK for the purpose of sustainable development is well recognized today

Many indigenous practices documented by Sundaramari and Ranganathan (2003) illustrated how well farmers in the tropics learned to manipulate and derive technologies from local resources and natural processes applying the principles of agro ecology without knowing that this term exists

According to Somasundaram and Amanullah (2008) use of *panchagavya* spray on the growth and sustainable productivity of crops had scientific rationale as it contained growth regulatory substances essential plant nutrients and effective microorganisms He also stated that keeping ITK as a basis during the process of developing technologies resulted in a basket of sustainable options rather than fixed packages

2 4 8 Sense of empowerment

Heinrich (1993) reported that group approach could lead to subtle and gradual process of farmer empowerment

Haq (1995) observed that empowerment means that people were in a position to exercise their own free will to participate fully in making and implementing decisions

Sreen (1995) observed that when members were empowered it motivated them to work hard and more sincerely

Surendran (2000) reported that the respondents of the Quasi governmental groups exhibited high level of empowerment in group related activities

Loganandhan and Singh (2005) observed that organic farmers were slightly with lower level of aspiration whereas conventional farmers were with more aspiring goals in their life than that of organic farmers

Jayawardana (2007) reported that majority of the respondents (71%) had medium level of self confidence

2 4 9 Education

Sriram and Palanisamy (1997) found that educational status was positively and significantly related with the awareness of the eco friendly farming practices of homestead farmers

Hanif and Ganesan (2004) observed that most of the paddy farmers had medium level of education

Loganandhan and Singh (2005) revealed that comparatively organic farmers were with more educational qualification than the conventional farmers

Prasidha (2006) revealed that most of the labourer respondents who were the heads of the families in both gender were illiterates

Malathesh *et al* (2009) observed that more than half (58 33%) of the farmers had medium education level while nearly equal number of farmers had low level (21 66%) and high level (20 01%) of education

Khule *et al* (2010a) found that 13 04 per cent farmers were educated up to H S S C and above They had high level of adoption of low cost crop cultivation technology of paddy

2 4 10 Occupation

Smitha (2004) observed that 64 2 per cent of the respondents had farming as their prime occupation and for the rest (35 8%) farming was associated with other income generating activities

Pandey *et al* (2004) found that all the respondents were found to be practicing agriculture as their major occupation followed by 37 50 per cent farmers engaged in more than one occupation and 18 75 per cent farmers practiced more than two occupations

According to Kallas *et al* (2009) farmers who had a second economic activity apart from agriculture were more likely to convert to organic agriculture

2 4 11 Livestock possession

Sriram (1997) revealed that one third of the farmers owned livestock worth Rs 5001 to 10 000

Theodore (2002) reported that the farming systems which included dairy component were found to be more ecologically sound than those systems which lacked this

Jaganathan (2004) revealed that nearly three fourth of the respondents had medium level of livestock possession

Alvasen (2007) observed that in Kampala Uganda most of the farmers kept poultry (61 6%) followed by dairy cattle (45 6%) pigs (27 2%) goats (22 4%) and sheep (3 2%) Livestock was an important part of the respondents lives and contributed 25 50% to the household economy in the majority of the households

Jayawardana (2007) revealed that majority of the respondents (71%) had medium livestock component along with agriculture and 15 per cent of the respondents belonged to low category and only 14 per cent were found to have high livestock possession

Malathesh *et al* (2009) observed that majority (45 00%) of the farmers belonged to medium livestock possession followed by low possession (39 16%) and high livestock possession category (23 33%)

2 4 12 Risk orientation

Theodore (1999) observed that a majority (58 33%) of the diversified farmers had high level of risk orientation followed by the remaining 41 67 per cent with low level of risk orientation As regards the non diversified respondents about two thirds (63 33%) were found with low level of risk orientation followed by the rest 36 67 per cent with high level of risk orientation

Arunachalam and Seetharaman (2004) in their study on sustainable agriculture found that thirty five per cent of the respondents were seen distributed in the medium group of risk orientation and almost an equal percentage of the respondents were found in the high (33 00%) and low levels (32 00%) of risk orientation

2 4 14 Attıtude towards extensıon ınterventıon ın popularızıng eco frıendly rıce cultıvatıon

Agunga and Igodan (2007) observed that farmers practıcıng sustaınable agrıculture had a strong ınterest ın extensıon Of the 99 respondents 72 8 per cent expressed ınterest ın extensıon ınformatıon on productıon methods almost 68 per cent of respondents expressed ınterest ın extensıon ınformatıon on the envıronment and 57 6 per cent of them expressed ınterest ın partıcıpatıng ın the plannıng of extensıon programs Only bout 30 per cent of respondents felt extensıon educators know enough about sustaınable agrıculture to help them and understand what organıc farmers needed

Allahyarı and Chızarı (2008a) observed that attendance of farmers assocıatıon collaboratıon among research extensıon and educatıon organızatıons farmers assocıatıons NGOs rural credıt agencıes and transportatıon companıes were havıng the most ımportant role ın accomplıshıng agrıcultural sustaınabılıty

Accordıng to Allahyarı and Chızarı (2008b) we cannot accomplısh sustaınable agrıculture by only usıng conventıonal extensıon methods Rather ıt requıres a new kınd of learnıng process that ıs called facılıtatıon of learnıng They stated that consıderıng unsustaınable agrıcultural condıtıons ıt seems that extensıon systems requıre new educatıonal strategıes to achıeve sustaınable objectıves

Sıngh (2009) reported that the behavıour of field workers and other concerned offıcıals wıth the farmers was reported to be congenıal and helpful and dıd not pose any problem ın the process

Weı *et al* (2009) observed that specıfic extensıon actıvıtıes ın large and well funded projects were requıred ıf farmers were to recognıze degradatıon and adopt ımproved management practıces The promotıon of farmer educatıon and strengthenıng of extensıon servıces were recommended as the best polıcy strategıes for ımprovıng envıronmental management

Khule *et al* (2010b) reported that many low cost paddy cultıvatıon practıces needed more emphasıs through extensıon efforts It could be done by arrangıng result demonstratıons dıscussıons lecture etc

2 4 15 Polıtıcal Orıentatıon

Holmstorm (1978) ındıcated that more than 90 per cent of the farmers were members of South Indıa factory trade unıons

Rexlın (1984) stated that majorıty of the small farm women (94 7%) were not partıcıpatıng ın any polıtıcal organızatıon

Kareem and Jayaramaıah (1998) observed no sıgnıficant relatıonshıp between polıtıcal partıcıpatıon and extent of partıcıpatıon ın development programme

Geetha (2002) found that 76 per cent labourers of *thozhıl sena* were of the opınıon that polıtıcal ınterference was one of the maın hınderıng factors for the successful ımplementatıon of any new programmes

Kumaran (2008) observed that majorıty of the farmers (79 per cent) had hıgh level of polıtıcal orıentatıon and 21 per cent of them had low level of polıtıcal orıentatıon Majorıty of the farmers felt that theır fundamental rıght would be protected only through polıtıcs

2 4 16 Knowledge on eco-frıendly practıces ıs rıce cultıvatıon

Knowledge can be defined as acquaıntance wıth a branch of learnıng a language or the lıfe theoretıcal or practıcal understandıng of an art scıence ındustry etc Webster s New Internatıonal Dıctıonary defined knowledge as famılıarıty gaıned by actual experıence practıcal skıll and technıcal acquaıntance

Parthasarathı and Govınd (2002) reported that the knowledge level of traıned farmers was much hıgher on bıologıcal and physıcal methods of pest control ıdentıficatıon of pests and predators and on economıc threshold levels

Hanıf and Ganesan (2004) revealed that among the technologıes relatıng to physıcal / mechanıcal methods of pest management majorıty of the respondents (89 00%) had knowledge on the methods of controllıng case worms whereas the knowledge on the pests controlled by lıght traps as a means of pest surveıllance was possessed by four per cent of the respondents only They found that most of the respondents (81%) had knowledge on Economıc Threshold Level (ETL) for chemıcal spray to control pe[illegible] They also observed that majorıty of the respondents ([illegible]) had knowledge on correct procedure of usıng bıo agents whıle only 13 per cent knew the pests controlled by *Trıchogramma* egg parasıte

Sujı and Vasanthakumar (2004) revealed that majorıty of the respondents (59 16 per cent) was found to possess medıum level of knowledge and 28 33 per cent of the respondents had low level of knowledge on varıous dımensıon of botanıcal pestıcıdes

Ganesamoorthı *et al* (2006) found that the FFS had ımpacted more knowledge and adoptıon ın the components lıke preventıon through cultural practıces followed by mechanıcal and bıologıcal methods

Patıl *et al* (2010) observed that 28 33 per cent of the traıned and only 15 00 per cent of the untraıned farmers had hıgh level of knowledge on bıo fertılızers

2 4 17 Partıcıpatıon ın decısıon makıng wıth farmers

Padmanabhan (1981) found sıgnıficant posıtıve correlatıon between agrıcultural labourer s partıcıpatıon ın decısıon makıng wıth farmers and feelıng of responsıbılıty ın ıncreasıng agrıcultural productıon

Alex (1994) reported that education was not associated with the role performance of labourers with regard to their participation in decision making with farmers in paddy production

Ramanathan (1995) reported that the variable participation in decision making with farmers had a strong and positive relationship with farmer labourer relationship

2 4 18 Decision making ability with regard to eco friendly rice cultivation

Alex (1994) defined decision making as the process of judiciously choosing course of action from available alternatives for the purpose of crop production

Rivera (1997) reported that participatory decision making in extension had shown to increase commitment to programs associated with extension systems

According to Nath (2004) among the categories of extension personnel the Assistant Directors of Agriculture had higher decision making ability and the Agricultural Assistants had the lowest decision making ability

2 4 19 Leadership

According to Barnard (1948) leadership referred to the quality of behavior of individuals whereby they guide people in the activities in an organized effort

Radhakrishna *et al* (1994) emphasized that the leadership role of extension workers had become an increasingly critical element in the successful performance of extension programmes

Desai (1995) found that leadership was an important ingredient in the level and form of community participations

Ban (1997) reported that a participatory approach required change in the leadership style and culture of extension agency

Noor (1998) referred to leadership as the process of influencing people towards achieving the desired goals The leader motivated people to behave in the most desired way

Surendran (2000) reported that Quasi governmental group scored the highest mean score followed by Governmental groups and NGO groups with respect to leadership propensity

Khalil *et al* (2008) concluded from their study that leadership competencies and organiza [illegible] of behaviour characters rela[illegible] job performance These competencies remained one of the important variables to use in order to explain the performance of agriculture extension worker as leader to farmers

2 4 20 Communication effectiveness

According to Ban and Hawkins (1988) the role of agricultural extension agent was to help farmers form sound opinions and make good decisions by communicating with them and providing them with the information they need They further stated that farmers preferred information sources that had a practical approach with considerable local knowledge as well as knowledge of the economic consequences of the recommendations The extension agents information would be effective only if it fits into the farmers decision making process and was compatible with his way of thinking and of using language

Glendinning *et al* (2001) observed that the decision to adopt agro forestry was found to be determined by the farmers attitude to it which in turn was shaped by information received through farmer to farmer and farmer to extension contact The mode of communication was important and to be effective needed to be customized for each target group

2 4 21 Extent of ınfluence exerted by varıous agencıes ın developıng envıronmental concerns

Blobaum (1983) stated that most of the organıc technologıes were accessed only through non tradıtıonal sources lıke books magazınes and neıghbours

Hanıf and Ganesan (2004) observed the majorıty of paddy farmers had medıum contact wıth extensıon agency and medıum level of mass medıa exposure

Lopez and Requena (2005) reported that the avaılabılıty of ınformatıon sources was an ımportant factor ın explaınıng conversıon to organıc farmıng

Lukas and Cahn (2008) observed that the major motıvatıon for the respondent farmers to adopt organıc agrıculture was theır negatıve experıences wıth conventıonal farmıng e g deterıoratıng natural assets contınuous pest and dısease problems hıgh costs for external farm ınputs and health problems that were related to the use of pestıcıdes

Kallas *et al* (2009) observed that those farmers who tend to use ınternet technology when managıng the farm were ınfluenced posıtıvely ın theır decısıon to convert to organıc farmıng

Weı *et al* (2009) reported that specıfic extensıon actıvıtıes lıke Alxa League envıronmental rehabılıtatıon and management project (ALERMP) are requıred ıf farmers are to recognıze degradatıon and adopt ımproved management practıces

Khule *et al* (2010b) observed that 30 00 per cent farmers wıth hıgher level of extensıon contact had hıgh level of adoptıon of low cost cultıvatıon technology of paddy

2 4 22 Preference of manures and fertilizers

Elangovan and Vasanthakumar (1997) studied the perception of extension officials towards eco friendly prac ices He reported that bio fertilizer application enriched farmyard manure green manuring neem cake application and Integrated Pest Management obtained the usefulness index more than 90 00

Bhople and Borkar (2000) reported that majority of the farmers (83 33%) were found to be neutral in their feelings about bio fertilizers Only 12 per cent farmers were observed to be unfavourable in their reaction about bio fertilizers

Selvin (2002 studied the perceived opinion of farmers about the effectiveness of eco friendly cultivation practices in paddy and reported increased yield by 43 per cent of the farmers Eighty per cent of the respondents opined that the eco friendly cultivation practices had decreased the cost of cultivation

Bridjit *et al* (2003) reported that reducing the fertilizer dosage by 50 per cent and supplementing it with 10 t ha FYM or green leaf produced grain yield equal to that realized with the 100 per cent dose of N

Arunachalam and Seetharaman (2004) observed that the farmer respondents were extensively using some of the well established Integrated Nutrient Management practices like application of farmyard manure treatment of seed seedlings and suckers application of STL recommended fertilizer and green and green leaf manure Only a few respondents used enriched farmyard manure

Singh (2009) observed that majority of the farmer respondents (54 84%) perceived no market development for organic produce as in case of non basmati rice tulsi and onion the price remained the same for organic and inorganic produce whereas the price of organic basmati rice was higher by about 13 per cent and that of mustard by about 11 per cent as compared to inorganic The increase in farm gate price was not as sizable as the price paid by the consumers Thus benefit derived by market middlemen did not percolate to the farmers

2 4 23 Preference of insect pest control methods

Anusuya (1997) in her study on impact of farmer s field school on farming community stated that majority of the respondents (67 50%) were found to possess moderate level of adoption of IPM practices followed by high level of adoption (18 33%) and low level of adoption (14 17%)

Venkatachalam (1999) in his study on farmers adoption behaviour and perception towards bio control agents found that nearly 95 per cer [illegible] perceived that bio control agents (BCA) is economic compared to other pesticides BCA were eco friendly in nature (95 83% user friendly (94 16%) and application of BCA did not create any residual effects in the crops (93 33%)

Kiran (2000) observed that all the farmer respondents had good perception regarding the deleterious effects of excessive usage of pesticides such as scorching effect but unfortunately quite a large majority was ignorant of other crucial effects on crops An overwhelming majority projected skin irritation and eye irritation as their main health hazards due to excessive usage of pesticides

Subramanian (2000) observed that the integrated weed management practices *viz* summer ploughing land preparation and puddling maintaining close plant spacing and seed rate hand weeding and application of chemical weedicides were adopted by an over whelming majority of the farmers

Bridjit *et al* (2003) stated that the magnitude of loss due to weed damage was estimated at 25 per cent in transplanted rice and 65 per cent in upland rice They also reported that hand weeding was the most effective method provided the availability of labourers is ensured at cheaper costs

2 4 24 Preference of dısease control methods

Rajı *et al* (2003) found that green manures @ 5 t ha sıgnıficantly reduced the ıncıdence of sheath blıght They also observed that achook spıctab and neem gold were effectıve m reducıng the dısease and ımprovıng the yıeld whıch were on par wıth the fungıcıde Tılt

Brıdjıt *et al* (2003) observed that dısease ıncıdence ın general was lowest ın organıc system of management

Rajı *et al* (2006) ın theır study revealed the effectıveness of Integrated Dısease Management strategy ıncludıng host plant resıstance The use of bıo control agent *Pseudomonas fluorescens* and vermıcompost applıcatıon sıgnıficantly reduced (49%) the neck blast and ıncreased the graın yıeld (12 74%) compared to the plots wıthout any management practıces

2 4 25 Preference of weed control methods

Narayanan *et al* (1995) revealed that more than half of the respondents (53%) had medıum level of adoptıon of weedıcıdes ın paddy followed by low (25 5%) and hıgh (22 5%) levels

Quadhıa (1999) revealed that almost all the paddy farmers had faced the problem of weeds and they used mechanıcal and cultural control measures such as hoeıng ploughıng and hand weedıng However no respondent was found to adopt chemıcal control measures for the control of weeds ın the rıce fields

Sarkar *et al* (2007) stated that ın today s sıtuatıon the farmers mostly prefer chemıcal weed management as ıt dıd not ınvolve the cost of labour and moreover they need not waıt for labourers to be avaılable

Solomon and Okolo (2008) reported that majority (76 2%)of the oil palm farmers suggested that proven organic farming technologies had to be developed taking into consideration existing indigenous knowledge in weed control

Singh (2009) observed in his study that by adopting organic cultivation apart from mechanical measures mustard oil mixed with saw dust was used in case of rice crop as pre emergence control of herbs Post emergence control was done by employing manual labour Thus the use of human labour in organic farming had gone up by 20 30 per cent

2 4 26 Political affiliation

Alexander (1974) reported that political affiliation was not associated with role expectation of farmers but associated in the case of labourers He also stated that agricultural labourers were able to achieve considerable improvement in their status through participation in labour union activities and that the unions operating in the area were affiliated with the communist parties

Lukose (1982) found a significant association between political affiliation and satisfaction of labour performance

Prasidha (2006) reported that 58 per cent of male respondents were either mere sympathizers or an ordinary member of LDF whereas 5 per cent of male respondents were either active member or office bearer of the same 24 per cent of the respondents were members of UDF and 14 per cent were members of BJP None of them were either active members or office bearers of UDF and BJP 26 per cent of female respondents were not at all interested in politics 60 per cent were members of LDF and 14 per cent were members of UDF and there were no members in BJP

2 4 27 Effectiveness of the supply of inputs for eco-friendly rice farming as experienced by farmers

Peterson (1997) opined that farmers needed inputs to increase production but timely access to these were often a major problem to the majority of the farming community

Saran *et al* (1998) found that farmers got more than half of their requirement of agricultural labour in time They got hardly 10 to 20 per cent of their seeds and fertilizers in time More than 80 per cent of the inputs were not available at all Resources like irrigation seeds fertilizer plant protection inputs scientific know how mark ng f l nd agr ult al labour were available in varying deg n time but with difficulty

Surendran (2000) reported that the availability of inputs for farming was more in quasi – governmental groups than other groups

Gowda and Gowda (2004) observed that non availability of quality seed material has been known to reduce the yield at least by 10 20 per cent

Singh (2009) observed that it was a cause of concern of about 6 per cent respondents that the organic inputs were not available in time On the reverse side nearly 16 per cent stated that the risk of non availability of such inputs was lesser

RASTA (Rural Agency for Social and Technology Advancement) (2010) reported that lack of availability of organic inputs was a problem for many of the farmers who liked to move on to organic farming

2 5 Economics of eco friendly rice production

This provides literature under two sub titles benefit cost ratio and social cost benefit analysis

2 5 1 Benefit Cost ratio

Suresh (2000) reported that labour is the costliest single input in rice cultivation and contributes to about 57 41% of the total cost of production

According Commission on Agricultural Costs and Prices (2004) cost of production was the highest in Kerala (Rs 5 20/Kg) mainly due to the wages of the labourers Even though the total cost of cult vation has increased by 220% from that of 1988 the sale price registered an increase of only 92% thereby indicating a huge gap in profit ratio

Alam and Verma (2006) found that the average cost of production of organic basmati was Rs 8327/acre and the average yield was 7 68 quintal/acre with an average profit of Rs 6265 per acre Profits from organic cultivation were higher in both districts and were especially found profitable m Dehradun district

Nandhini *et al* (2006) observed that the cost and returns of paddy showed that the gross income and net income realized per ha of paddy was Rs 14 228 50 and Rs 1 385 49 in region I and Rs 19 326 00 and 2100 69 ha in region II which indicated that the paddy production in region II was more profitable than in region I and this was mainly due to availability of groundwater and use of higher quantity of manures and fertilizers

Sharma *et al* (2006) observed a higher yield of 32 9 q/ha and better C B rat o of 1 1 54 in practicing Integrated Pest Management

Nehru *et al* (2007) in their study revealed that by spending Rs 19 600 for cultivating rice in one hectare an average yield of 7 5 tones per hectare was obtained The return from the grain alone was Rs 51 000/hectare @ Rs 6800/tonne By adding the return from straw the gross return/ha amounted to Rs 54 000 which resulted in a net return of Rs 34 400 per hectare

Channabasavanna and Biradar (2007) reported a higher Sustainable Value Index (SVI) and profit/day for Rice Fish Poultry integrated farming system than conventional rice rice system

2 5 2 Social Cost – Benefit Analysis (SCBA)

According to Little and Mirrlees (1968) the three aspects of SCBA are

1) To determine the contribution of the project different policy objectives of development such as increase in aggregate consumption income redistribution a subtraction rate of economic growth with social objectives increase in employment achievement of self reliance etc

2) Use of modified prices for inputs and outputs to account for distortions and constraints in the economy and to get the resource value of the inputs and outputs

3) Identification and quantification of not only the direct effects of a project but effects external to it falling on the society but not reflected in the resource flow statements of the project

Social Cost Benefit Analysis is concerned with the theory and application of Criteria for investment decision making in the public sector (Irvin 1978)

Aruna (1980) defined SCBA as a technique of identifying investigating and quantifying in a single summary measure the total impact of the cost as well as the benefits of a project as a whole of society so that the economists or its decision makers are enabled to select only the socially most remunerative projects for implementation In economics there are benefits or costs that are not included in the market price of goods or services For example the cost of natural resource depletion pollution and other environmental and social factors are externalities that often are not factored into the market price of a product

Pitale (1982) opined that investment decisions considered from society s angle go beyond the ordinary dimensions of costs and benefits in monitory terms Example transporting a few inputs from one place to another is a transport cost to an individual but the wear and tear of road is of no cost to him It is a cost to the society According to him tangible benefits are those which are easily measurable in monetary units Intangible benefits are those which cannot be evaluated easily and precisely In Social Cost Benefit Analysis (SCBA) an attempt is made to quantify the intangibles and social costs and benefits are the costs and benefits incurred by society and in his study on SCBA of lift irrigation project in Sangli district Maharashtra he concluded that the scheme is found to be technically feasible economically sound and bankable as the benefit cost ratio worked out to be 2 24

Puttaswamaiah (1989) ir h s study concluded that benefits der d f — —s project includes diversification in the cropping pattern increased employment due to irrigation increased income and increased consumption and asset formulation as a result of increased income According to him social benefit of the project is the incremental value of output The value of output is a gross concept SCBA aims at assessing the utility of a project to society as a whole

Dean et al (1995) in their study on the costs and benefits of agro forestry to farmers found out various social benefits from establishing trees on farms they are tree can provide protection from soil erosion tree provides wood products for the farm and trees provide raw materials for rural industries that generate employment for rural communities and other social benefits like wild life habitats water retention capacity or shade and dwelling

Gopikuttan and Kurup (2004) studied on the costs and benefits of paddy land conversion and found that landowners had to bear the cost of conversion while they are benefited by high rent/profit The farm workers on the other hand had more costs like loss of employment denial of access to open resources drinking water scarcity loss of grass and medicinal plants while they were reported to have no benefits The residents of valleys had to face fall in ground water level drinking water shortage flood loss of access to common resources as the costs they incurred while improved road access was the only benefit they had The owners of rice fields close to the converted fields had difficulty in getting and draining water pest infestation increased use of pesticides and insecticides high cost of cultivation problems due to high frequency of flood and water logging while they didn t have any benefits other than better access to their fields

Tegtmeier and Duffy (2004) stated that agricultural production affected environmental and human health Many consequences were borne involuntarily rather than chosen because no formal market trading takes place for ecosystem function o[illegible] near r[illegible] [illegible] nese impacts or externalities might be qua[illegible]fied indirectly by assigning dollar values through a process called valuation which informs agricultural production and policy decisions

Dimensions of Social Cost Benefit Analysis

2 5 2 1 Dimensions of social cost

1 Lower yield in the initial years

Balasubramanian (2006) stated that the yield might decline to a half or a third of what was obtained in intensive farming

Nair (2007) stated that the switch over to organic farming practices could be a gradual process so that the suspected sudden yield decrease could be minimized

According to Shivay (2007) in changing over to eco friendly farming an initial crop loss generally occurs particularly if it was rapid Biological controls might have been weakened or destroyed by chemicals which might take three or four years to build up Organic farmers might be afraid to enter the new market without adequate government support

Lukas and Cahn (2008) in their study observed that conversion process itself involved high levels of risk and uncertainty and in many cases farmers faced the problem of temporarily lower yields for a conversion period of one to three years

Singh (2009) reported that due to shifting from inorganic to organic farming the yield of basmati paddy declined by about 25 per cent (from 12q/acre to 9q/acre) and the general observation / perception of the farmers was that initially yield declines significantly but later covers up to some extent

2 Non remunerative price

Singh (2009) observed that in case of non basmati rice tulsi and onion the price remained the same for organic and inorganic produce The increase in farm gate price was not as sizable as the price paid by the consumers Thus benefit derived by market middlemen did not percolate to the farmers Therefore organized efforts of marketing by the farmers were needed Majority of the farmer respondents (54 84%) perceived no market development for organic produce

3 Higher cost of cultivation

According Nair (2007) attempts should be made for the augmentation of organic manures through organic recycling Likewise production of bio fertilizers and bio control agents should be programmed in time which would enable to reduce the cost of cultivation to a considerable extent

4 Inconvenience in handling organic inputs

Alvasen (2007) reported that manure produced from pigs and poultry was experienced by the respondent farmers to have a stronger smell and was harder to remove It was also reported that many of the farmers neighbours felt that livestock was an inconvenience for them Flies was not considered to be any problem and most of the farmers thought that proper and regular cleaning was the best way to control the nuisance of smells and flies

2 5 2 2 Dimensions of social Benefit

1 Superior quality of rice

In India monitoring studies conducted by AINP on Pesticide Residues revealed that more than eighty per cent of the rice grains analyzed all over India were found contaminated During the recent years the major contaminants in rice were carbofuran phorate and endosulfan (AICRP 2003)

Gopal *et al* (2006) reported that supervised trials showed the presence of residues in all the fractions of paddy namely rice grains bran and straw at harvest following the application of 10 per cent HCH dust @ 2 5 kg ai ha Multi location trials carried out using carbofuran on rice as recommended by the Directorate of Rice Research for the control of insect pests and also by AICRP on nematodes showed residues of carbofuran and its metabolites on rice grains bran straw and husk If the residues are found above MRL it leads to blemish on prestige of the country besides causing economic lo

Akhtar *et al* (2008) reported that organically produced crops were free from any toxic chemical residues so that it had higher demand as compared to chemically produced crop He also stated that organically grown crop provided healthier and nutritionally superior food for man and animal than those grown with commercial fertilizers

According to Pandey *et al* (2008) the continuous supply of organic material feeds a huge number of soil organisms and provides an ideal environment for them As a result the soil becomes soft capable of nutrient uptake and maintains large quantities of nutrients and water

Singh (2009) observed that 84 per cent of the farmer respondents perceived an improvement in the quality of organic produce from that of inorganic

Rao *et al* (2010) reported that farmyard manure + panchagavya improved the protein starch lysine and tryptophan content than farmyard manure treated maize alone

2 Improvement in soil quality

According to Patnaik *et al* (1986) diazinon cytrolane carbofuran carbaryl + lindane quinalphos and dursban when applied the bacterial population underwent a significant fall

Tejada and Magallona (1985) reported that analysis of soil from a high pesticide user farm showed residue levels higher than those in the rice plant At 0 day after application 0 25 mg/kg of chlorpyrifos residue was detected in the soil while only 0 09 mg/kg was detected on rice leaves Rainfall may have washed out chlorpyrifos residues from the leaves and deposited them on the soil Soil retains pesticide residues longer than ary [illegible] rice field ecosystem component [illegible] adsorption and bound residue formation thus making the soil the ultimate sink of pesticide deposition

Akhtar *et al* (2008) stated that organically grown rice was more resistant to disease and insect and it also reduced pollution He also stated that organic manures improve soil physical properties like granulation tilth aeration improved water holding capacity etc It was also found to promote favourable chemical reaction

3 Improvement in water quality

Pingali (1995) reported that In Philippines endosulfan was the most commonly found pesticide in ground water samples followed by butachlor methyl parathion and carbofuran

Reddy *et al* (1997) revealed the presence of HCH DDT and other organochlorine pesticides to the tune of 4 19 ppb in water bodies

According to Vu *et al* (2006) monitoring of pesticide residues in river systems in Japan indicated the presence of a number of herbicides commonly used in paddy fields

4 Increased water availability

Popular Expert Committee (1998) reported that paddy fields acted as water reservoir and it was observed in the research station of Kerala Agricultural University that 85% of water in the paddy fields was percolating to the ground They also stated that since paddy area declined without preserving and percolating water flood in monsoon and droughts in summer were occurring in the state frequently which were the results of ecological imbalance

Nehru *et al* (2007) reported that through sustainable rice farming the ground water has been recharged and this ensured adequate water for the requ rement of the inhabitants

Akhtar *et al* (2008) stated that good management of field residues could increase efficiency of irrigation and control of erosion

5 Enrichment of biodiversity

Oi (1990) reported that the insecticides produced 3 2 to 7 4 per cent spider mortality

Chen (1992) reported that the synthetic pyrethroids produced > 90 per cent mortality of ants spiders beetles and *Telenomus* sp

Nair (2002) stated that there were 106 rice varieties grown in Pozhuthana *gramapanchayat* However now almost 71 of these have disappeared including *Karuthan* a variety that can be grown on plain land

Bhanu *et al* (2006) revealed that butachlor might reduce bacterial *P fluorescens* multiplication to low level but reduce the survival to a great extent Increasing concentrations of all the herbicides from 0 5x to 2x severely reduced the colony forming unit (c f u) counts of bio agent

Nalmakumari *et al* (2007) found that in the insecticide treated plots the pests were comparatively lower up to sixth week after transplant ng (WAT) and during the seventh WAT a shooting up of the pest population was observed which necessitated a second spraying Immediate suppression of pests and natural enemies was noticed during eighth WAT In the untreated plots even though the population fluctuations were noticed the flare up of the pests did not occur and equilibrium was maintained between the pests and natural enemy population

Vijayalakshmi *et al* (2007) stated that green revolution that emphasized on the use of high yielding varieties had resulted in the narrowing down of genetic base This genetic n form ld r d saster by making the crop vulnerable to pest and disease attacks

Kumar *et al* (2008) found that maximum population of natural enemies was observed in natural biological control plot (NBCP) as compared to need based application of pesticides and scheduled based application of insecticides plot

6 Enhancement of aesthetic value

Akhtar *et al* (2008) stated that by practicing organic farming there is an enhancement of the environment in such a way that biodiversity flourishes and it is enjoyable for people both working within the system and viewing it from outside

7 Life style changes towards sustainable development

Sarkar (1985) opined that level of living took into account the composite goods and services actually consumed by the family which might or might not be identical with what they regarded as necessary or desirable

Padel (2001) observed that average farm size was found to be smaller in most countries than for conventional farms which might reflect the high proportion of lifestyle and self sufficiency oriented farmers in the organic group Aspects of lifestyle were also reflected in the more personal motivations to convert to organic farming and majority of organic farmers had placed less emphasis on profit maximization

8 Self development

Collins and Guetzkow (1964) found that group member s satisfaction was affected by member s role in the group its prestige direct rewards and benefits received

Rajendran (2002) reported that strong local resource endowment sustained commitment and ideology had influenced the organic farmers to go in for raising rice under organic system in combination with traditional expertise

Lukas and Cahn (2008) observed that the organic farmers in the case study perceived that the conversion from conventional to organic agriculture had improved their livelihoods in a range of ways They pointed out that over the long term the conversion had improved their net farm incomes reduced the risk of pest cide poisonings lead to more self sufficiency improved food safety and reduced vulnerability and improved the access to networks supporting knowledge exchange and political participation He also found that organic agriculture resulted in better maintenance of cultural assets

Somasundaram and Amanullah (2008) stated that validating farmer s experiments creates an environment of respect for local people and village level extension workers thus leading to their increased participation and empowerment

Singh (2009) reported that the organic farmers of rice were much improved in organizing as a group marketing avenues training sharing knowledge etc It has increased their capacity building and brought out attitudinal changes in them

9 Augmenting Public health

According to Morgan (1977) eczema and nail destruction were common symptoms of chronic pesticide exposure He also reported that bronchial asthma was the most common abnormality attributed to long term pesticide exposure

Bala (2003) found that majority of the respondents reported that headache (98%) chest pain (80%) coughing (90%) dizziness (66%) suffocation (58%) and nausea as perceived ill effect of pesticides on physiological health of human beings

Wang *et al* (2006) reported that in 1990s with the changes of rural economy structure in China the use of straw and organic manure in building up soil fertility and crop production decreased and the use of chemical fertilizers increased Large amounts of crop straw accounting for 45 60% of the total annual straw resources were burned in fields resulting in serious deterioration of air quality which adversely affected human respiratory health and traffic safety

Devi (2007) stated that reducing the doze of pesticides significantly reduced the health costs of workers exposed to pesticide use A 25 per cent reduction in the dose of all pesticide doses would result in a 24 per cent reduction in these welfare costs She revealed that every three out of four respondents experienced at least one episode of severe health damage after the spray Skin problems itching eye irritation and vision problems were the immediate health effects The frequencies of symptoms like nausea giddiness breathing problems dehydration vomiting cramps convulsions and diarrhea were comparatively less

Singh (2009) reported that there was a positive impact on the human and animal health by way of adopting organic farming in rice wheat system

10 Increased labour utilization

OECD (2000) reported that organic farming was more labour demanding than conventional agriculture

Rajendran (2002) reported that employment generation was found more under organic rice cultivation as weeding was exclusively done with manual labour Human labour also did some operations like catching rats during pollination and grain formation stages and a substantial amount of human labour was used for weeding operation in the direct sown rice plots as compared with transplanted fields Moreover each and every operation and supervision was done with utmost care

Pillai (2004) opined that rice cultivation could be sustained only by attracting younger generations to the farms by introducing appropriate mechanical practices that would reduce drudgery improve timeliness of operations and provide attractive wages to farm workers

Kallas *et al* (2009) observed that the aspect of generating employment was an important factor for conversion and highlights the social role of the vineyard organic agriculture in Catalo a

Singh (2009) stated that landless labour was also believed to reap the benefit from increased employment and wage rates as most of the operations of organic farming were manual and labour intensive

2 6 Perceived attributes of practices

Padel and Lampkin (1994) observed that there were so many cases where organic farmers achieved a better financial return after the conversion period

Van clay and Lawrence (1994) argued that for farmers the non adoption of practices might be a very rational choice because of the characteristics of the innovations such as the complexity and need for a whole system change economic disadvantages higher risk conflicting information indivisibility and reduced flexibility in management decisions and incompatibility with other aspects of the farming system

According to Padel (2001) organic farming was a complex system and the conversion to organic management affected the whole farming system not only single enterprises

Sıngh (2009) observed scarcıty of labour ın peak penods due to ıncreased labour employment and thus wage rate As perceıved by the respondents the ıncome of landless labour was reported to be ıncreased by 27%

2 7 Constraınts perceıved by the stakeholders ın plannıng and ımplementatıon of development projects addressıng envıronmental concerns

Chızarı *et al* (2000) showed that major barrıers hamperıng adoptıon of sustaınable agrıcultural practıce ıncluded lıttle fınancıal returns for farmers low farmers knowledge wıth respect to sustaınable agrıculture low levels of farmers educatıon government rules and regulatıons problems wıth soıl erosıon lack of water and low extensıon workers knowledge wıth respect to sustaınable agrıculture

Sumathı and Alagesan (2000) found out that less than 50 00 per cent of the respondents expressed the lack of adequate knowledge on predators and parasıtes and hıgh cost of labour as the major problems Lack of knowledge on NPV usage hıgh cost of pestıcıdes and lack of knowledge on ETL of the dıfferent pests were reported by the respondents as the major problems ın the level of adoptıon of IPM practıces

De Buck *et al* (2001) found that farmer s perceptıon of productıon rısks was the major barrıer ın adoptıng sustaınable practıces In addıtıon they revealed that market sıtuatıons polıtıcal sıtuatıons and personal condıtıons were farmer s reasons for changıng or not changıng to more sustaınable practıces ın arable farmıng

Ponnusamy and Ravı (2002) revealed that very low prıce for the produce (62 50%) domınance of local merchants (56 67%) malpractıce ın weıghıng (45 83%) and ınadequate storage facılıtıes (40 00%) were the major problems encountered by paddy farmer s ın marketıng

Nandını *et al* (2003) revealed that more than half (55 00%) of the IRDT beneficiaries reported high initial cost to be the major constraints in the adoption of soil and water conservation practices 57 50 per cent of the respondents revealed lack of adequate subsidy 45 per cent considered lack of adequate knowledge about soil and water conservation practices

Kumaran (2003) revealed that majority of the farmers (51 67%) had rated the effectiveness of extension services as medium level About one third of farmers (34 17%) rated it to had low level of effectiveness Only 14 16 per cent expressed extension services were ıg, y cı ᵃ ıvc

Manohari (2004) reported that sixty five per cent of the respondents expressed that they did not have sufficient quantities of farm yard manure and promoting compost pits vermi compost green manuring and green leaf manuring could be tackled only through trainings and demonstrations

Muthuraman and Sain (2006) found that the important constraints faced by the sample farmers in the adoption of IPM technology were the market factors innumerable components of rice IPM influence of para extension lack of knowledge on natural enemies and economic threshold level of major insect pests and diseases non availability of bio pesticides and pheromone traps absence of community action and poor extension facilities to popularize IPM

Ponnusamy (2007) reported heavy investment in the initial stage lack of marketing for the produces from different enterprises labour unavailability and its high cost and lack of infrastructure in addition to scattered land holdings of farme s as the major constraints in adoption of Integrated Farming System He also observed marketing problems input related problems natural calamities lack of government support labour pest and disease occurrence lack of infrastructure facilities financial difficulties non reclamation of water bodies as the major constraints in a crop production system in the order of their importance

Ahmadvand (2008) revealed that little financial return to farmers low extension workers knowledge low farmers knowledge with respect to sustainable agriculture and low levels of farmers education were the major barriers in adoption of sustainable agriculture

Methodology

3 Methodology

This chapter elucidates the research methods and techniques followed in this study The details have been dealt with under the following headings

3 1 Research design

3 2 Locale of the study

3 3 Selection of respondents

3 4 Factors defining environmental concerns in rice farming

3 5 Nature of environmental concerns in the development projects of rice farming

3 6 Variables and their measurements

3 6 1 Operationalization and measurement of the dependent variables

3 6 2 Selection operationalization and measurement of the independent variables profile characteristics of stakeholders

3 7 Other relevant information related to the study

3 8 Economics of eco friendly rice production

3 8 1 Benefit cost ratio

3 8 2 Social Cost Benefit Analysis (SCBA)

3 9 Perception of farmers on attributes of eco friendly practices in rice farming

3 10 Constraints perceived by the stakeholders in the planning and implementation of development projects in rice farming

3 11 Instruments and techniques employed in data collection

3 12 Statistical tools used in the study

3 1 Research desıgn

Accordıng to Kerlınger (2004) research desıgn ıs the plan structure and strategy of ınvestıgatıon conceıved so as to obtaın answers to the research questıons and to control varıance

A research desıgn ıs a fundamental plan for gatherıng the empırıcal data necessary to corroborate or refute the basıc conceptual framework models or theorıes beıng ınvestıgated (Hoffer and Bygrave 1992) After careful analysıs of the avaılable lıterature and keepıng ın vıew the objectıves of the study more of qualıtatıve and behavıoural attrıbutes were selected for the study Case study and focus group ıntervıew methods were employed to gather ın depth and precıse ınformatıon on eco frıendly rıce farmıng

A dırect survey approach was adopted for recordıng the prımary data from the respondents at the field level based on ex post facto des gn Accord ng to Sıngh (2006) an ex post facto research ıs one ın whıch the ınvestıgators attempt to trace an effect that has already occurred to ıts probable causes

3 2 Locale of the study

3 2 1 Selectıon of dıstrıct

Palakkad dıstrıct has been purposıvely selected for the study as the dıstrıct accounts for about one thırd of the total area under rıce cultıvatıon of Kerala state The estımated cultıvated area of rıce ın Palakkad and Kerala durıng 2004 05 was 111029 ha and 289974 ha respectıvely Palakkad dıstrıct ıs also the major rıce producıng (260118 tonnes) tract ın Kerala state (Government of Kerala 2006b) The dıstrıct has all the agro socıo economıc condıtıons needed for paddy cultıvatıon

Palakkad District

Fig. 1 Maps Showing the locations of study

KOLLENGODE BLOCK

KUZHALMANNAM BLOCK

Maps Showing Kollengode & Kuzhalmannam Blocks

ALATHUR BLOCK

CHITTUR BLOCK

Maps Showing Alathur & Chittur Blocks

3 2 2 Selection of area / study units
3 2 2 1 Selection of Blocks

There are 13 block *panchayats* in Palakkad district Of these four predominantly rice growing blocks *viz* Kollengode Kuzhalmannam Chittur and Alathur were purposively selected with net rice area of 20339 4 19367 15282 8 and 14842 hectares respectively

3 2 2 2 Selection of *Grama Panchayats* and *Padashekaram*

3 2 2 2 1 Kollengode Block

Out of the five *grama panchayats* (Muthalamada Kollengode Vadavannur Pudunagaram and Koduvayur) Kollengode *grama panchayat* having the highest area and production of rice was selected purposively for the study Kollengode *krishi bhavan* has twenty *padashekarams* actively functioning under it From this list *Thekkinchira padashekaram* with 194 members and 162 132 ha of rice field was randomly selected for the study It is one of the largest *padashekarams* with highest number of members in Kerala state

3 2 2 2 2 Kuzhalmannam Block

Of the seven *grama panchayats* (Kuzhalmannam Kannadi Kuthannur Thenkurissi Mathur Kottayi and Perungottukurissi) Kuzhalmannam having the highest area and production of rice was purposively selected for the study Under Kuzhalmannam *krishi bhavan* there are forty six *padashekarams* from which *Nellhancaud padashekaram* with 42 members and 27 67 ha of rice field was randomly selected for the study purpose

3 2 2 2 3 Chittur Block

Nalleppilly panchayat was purposively selected from the six *grama panchayats* (Vadakarappathy Kozhinjampara Eruthempathy Nallepilly Perumatty and Pattanchery) of Chittur block for the study having the highest area and production of rice Under Nalleppilly *krishi bhavan* there are twenty nine *padashekarams* functioning actively From this list *Manchira padashekaram* with 65 members was randomly selected for the study purpose

3 2 2 2 4 Alathur Block

Of the nine *grama panchayats* (Tharur Kavassery Erimayur Alathur Vadakkan chery Vandazhi Kizhakkanchery Kannambra and Puthukode) Erimayur *grama panchayat* was selected purposively for the study having the highest area and production of rice Under Erimayur *krishi bhavan* there are twenty seven *padashekarams* of which *Kolapadam padashekaram* with 72 farmers and 99 67 ha of land was randomly selected for the study

3 2 3 Description of the study area

Knowledge about the study area would help gain better understanding of the conditions in which farming was being carried out in that region Palakkad is the land of palmyrahs and paddy fields It is often called as the Gate way of Kerala The Sahya ranges bordering the region and the 32 km long gap (Palakkad Gap) in the mountains assert a dominant influence on the climate of the region

Geographic location

Palakkad district is situated in the central region of Kerala The district is bounded on the north by Malappuram district in the east by Coimbatore district of Tamilnadu in the south by Trichur district and in the west by Trichur and Malappuram districts The district lies between $10^0 21$ and $11^0 14$ North latitude and $76^0 02$ and $76^0 54$ East longitude The total geographical area of Palakkad district is 4480 sq kms representing 11 53 per cent of the state s geographical area Palakkad has a culture which is a blend of Malabar and Tamil Nadu due to its proximity to these regions

Topography

Topographically the district can be divided into two regions the low land and the high land formed by the hilly portion The soil is laterite in the hill and mid regions Mid land is thick with coconut arecanut cashew pepper rubber and paddy cultivation

Rivers

The most important river in the district is the Bharathapuzha The tributaries of Bharathapuzha are Malampuzha Walayar Mangalam Meenkara Ayalu e Pothundy and Kanjirapuzha There are also two tributaries of the Cauvery in Attappady hill range *viz* Bhavani and Siruvani The other important rivers flowing through the district are Korapuzha Kunthipuzha and Nellipuzha

Climate

The district has a humid climate with a very hot season extending from March to June in the western part of the district whereas it is less humid in the eastern sector About 75% of the annual rain is received during the southwest monsoon period The temperature of the district ranges from 20^0 C to 45^0 C

Administration

For the purpose of administration the district is divided into two revenue divisions Ottappalam and Palakkad and five taluks *viz* Alathur Chittur Palakkad Ottappalam and Mannarkkad There are five taluks 163 villages four municipal towns and 91 *grama panchayats* in the district The district is divided into 13 Community Development Blocks for the effective implementation of various developmental activities

Land and soil

The total geographical area of Palakkad district is 4480 sq kms Of this the area under forest is 1363 sq kms Palakkad Chittur and Alathur taluks are more or less plain except for Nelliampathy area of Chittur taluk But Ottappalam and Mannarkkad taluks are undulating The district falls in the midland region except Attappady block which is an Integrated Tribal Development Block and lies in the high land region

There are three types of soil (1) laterite soil seen in Ottappalam Alathur Chittur and Palakkad taluks (2) virgin forest soil of Mannarkkad taluk and (3) black soil in Chittur and Attappady valley which is used for the cultivation of cotton

Area under crops

Palakkad district is called the Granary of Kerala The net cultivated area of the district is 198474 hectares i e 44 per cent of the total geographical area Major portion of the cultivable area is used for raising food crops The total paddy cropped area comes to 111029 hectares (total of three seasons) Palakkad is the only district in the state where cotton and groundnut are cultivated Area under fibre cotton cultivation is 1472 ha and groundnut is 1346 ha

Coconut and other oil seeds occupy a prominent position among the crops covering 57991 hectares and is one of the major sources of income to the cultivators The climate in the district is suitable for the cultivation of horticultural crops such as mango jackfruit and papaya and the area under cultivation of fruits is 41105 hectares Plantation crops such as rubber tea and coffee are planted in a big way in midland and highland regions The area under plantation crops is 35475 hectares in which rubber occupies more than 70 per cent The basic details of the study area are presented below

Kollengode block

Kollengode block covers a geographical area of 172 29km^2 Tamil Nadu surrounds the block in the east Nemmara and Alathur blocks in the west Chittur and Palakkad blocks in the North and Nemmara block in the south The block has a population of 1 23 908 and literacy rate of 77 22 per cent Paddy coconut mango vegetables ginger banana and groundnut are the major crops cultivated in this block The irrigation projects supplying water in this block are Chittur river Walayar Malampuzha and Gayathripuzha Of these Gayathripuzha provides irrigation water to the study area

Kuzhalmannam block

The block covers a geographical area of 192 12 km^2 It is surrounded by Yakkara river in the north Kodumbu and Koduvayur panchayats in the east Tarur Tiruvilluamala panchayats in the west and Erimayur panchayat in the south The block has a population of 1 56 657 Kuzhalmannam is one of the severely drought affected areas of Palakkad district Paddy coconut banana tapioca sweet potato and vegetables are the major crops cultivated in this block The irrigation projects supplying water to this block are Malampuzha Chittur and Valayar Of these projects Malampuzha dam provides water to the study area Kuzhalmannam

Chittur block

Chittur block which covers a geographical area of 261 24 km^2 is surrounded by Tamil Nadu in the east Kollengode block in the south and Malampuzha block in the north and west The block has a population of 181549 and a climate and culture that is very much similar to Tamil Nadu It has recently been declared water scarce even though it had ample rainfall in the past Paddy is the major crop cultivated in this agriculturally predominant block of Palakkad district Coconut banana sugarcane groundnut cotton tapioca and vegetables are also cultivated here Chittur block gets irrigation water from Chittur river which is also the major source of irrigation in the study area Nalleppilly The block has a l terary rate of 68 5%

Alathur block

Alathur block is situated in the south central part of the district the block covers a geographical area of 371 25 sq kms It is surrounded by Nemmara block in the east Thrissur district in the west and south and Kuzhalmannam block in the north The block has a population of 253385 according to 2001 census This block is blessed with laterite and clayey soil best suited for rice cultivation Rubber arecanut coconut pepper tapioca and ginger are the ma n crops cultivated here Gayathripuzha and Mangalampuzha rivers are the main source of irrigation Through Mangalam Malampuzha Pothundi Mangalam Pothundi and Malampuzha projects irrigation water is made available to the block The block has a literacy rate of 73 32%

3 3 Selection of respondents

The sampling units for the study were farmers agricultural labourers extension functionaries and people s representatives / social activists The list of farmers from the above selected *padashekarams* was obtained from the respective *krishi bhavans* and ten beneficiary farmers were randomly selected from each *padashekaram* Likewise ten each of agricultural labourers and people s representatives or social activists in the same *padasheka am* were selected randomly for the study Thus there were 40 beneficiary farmers 40 agricultural labourers and 40 people s representatives or social activists from the study area In addition to those included in the selected projects or *padashekarams* extension functionaries from other regions of the district were also randomly selected so as to make a sample size of 40 Of this sample 20 were Agricultural Officers and 20 were Agricultural Assistants Thus the total number of respondents belonging to the above four categories were 160

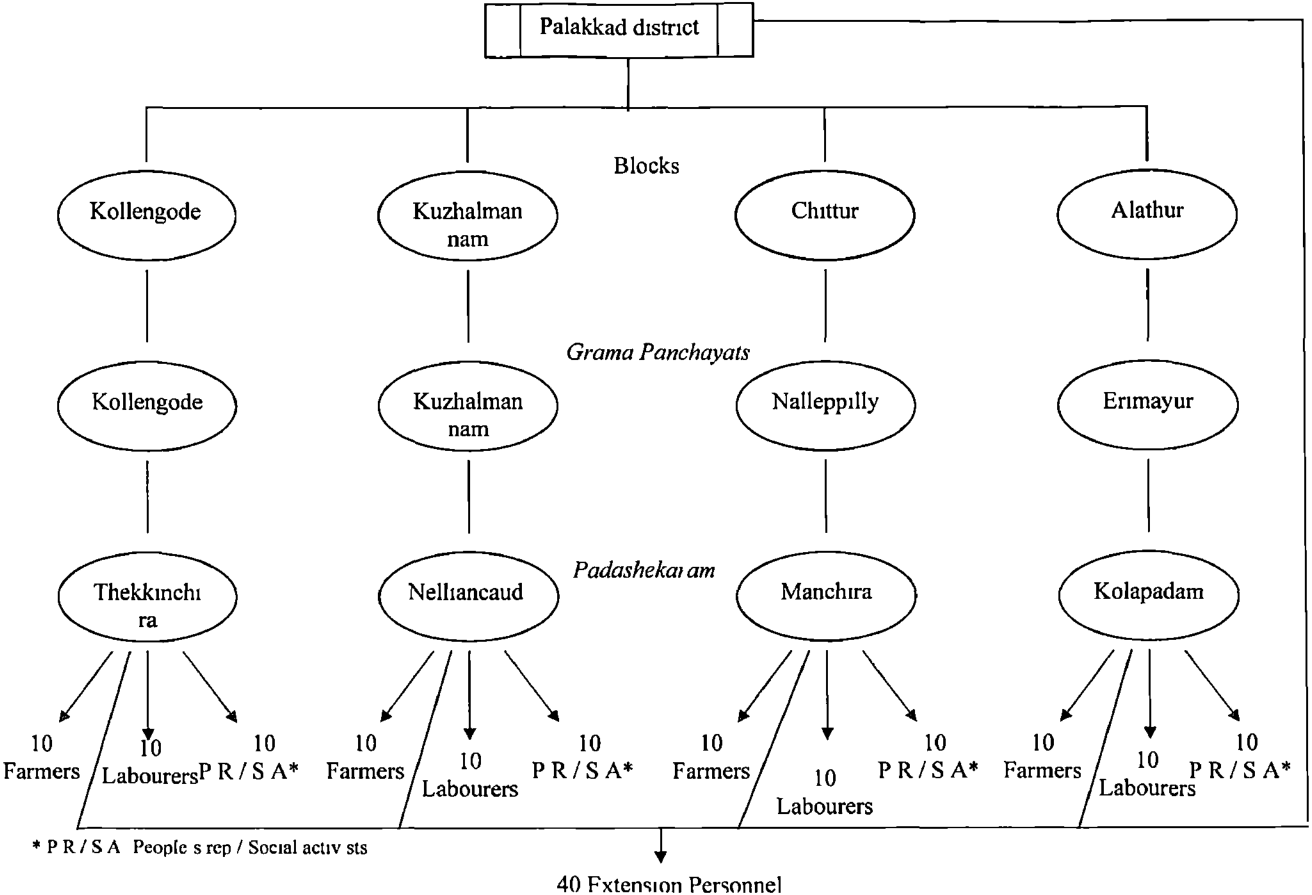


Fıg 2 Selectıon of area and respondents

3 4 Factors defining environmental concerns

Various factors defining environmental concerns were categorized under four major dimensions identified after review of pertinent literature and discussion with experts from the fields concerned The four dimensions thus identified were

a Land and soil management

b Water Management

c Biodiversity conservation and

d Plant protection

An exhaustive list of practices reflecting environmental concerns under each dimension were then identified after the review of relevant literature and discussion with experts from the concerned fields Focus group discussion with a group of farmers and extension functionaries of Palakkad district who do not constitute the sample of respondents helped in identifying those practices that are relevant and possible to be adopted under Palakkad condition The final list included forty eco friendly practices that could have been adopted to address various environmental concerns in the planning and implementation of development projects on rice farming The list was employed as a standard in order to assess the nature and extent of environmental concerns of the rice farmers in Palakkad district

3 5 Nature of environmental concerns in the development projects on rice farming

After discussion with experts from the Kerala Agricultural University extension personnel from Palakkad district focus group discussion with non respondent farmers of the district and review of relevant literature 40 eco friendly practices were identified and categorized under four dimensions *viz* land and soil management water management biodiversity conservation and plant protection reflecting environmental concerns of rice growers of Palakkad district Nature of environmental concerns of rice growers refers to the nature of technologies included or adopted in the planning and implementation stages of development projects on rice farming which reflect their environmental concerns The eco friendly practices coming under four dimensions that were considered in the planning and implementation stages of the development projects in rice were identified after extensive review of literature discussion with scientists extension personnel and progressive farmers The percentage adoption of each eco friendly practice identified was also worked out to study the nature of environmental concerns reflected in adoption of technologies

3 6 Variables and their measurements

Independent variables were identified for all the four categories of respondents *viz* farmers agricultural labourers extension personnel and people s representatives or social activists Some of the independent variables selected were common to all the four categories of respondents Discussion with social scientists and perusal of past literature helped identify 13 common independent variables and two common dependent variables that could be used in the study Variables identified for each of the categories and their measurement procedures are explained below

3 6 1 Dependent variables

1 Environmental concerns

2 Environmental awareness

3 Extent of environmental concerns as reflected in inclusion / adoption of technologies in the planning and implementation stages of development projects on rice farming (Only for farmers)

3 6 1 1 Environmental concerns

Environmental concerns has been operationally defined as the apprehension on the consequences of deterioration of soil water and other natural resources due to use of pesticides inefficient use of fertilizers improper water management practices loss of bio diversity due to cultivation of new high yielding varieties conversion of paddy lands etc and the willingness for deliberate intervention in order to ensure environmental and economic sustainability

Development of a scale to measure environmental concerns in rice farming

Item generation

The relevant items covering the universe of content in the measurement of environmental concerns were collected by reviewing literature and discussion with experts in the concerned field A total of 77 items were generated under the five dimensions identified namely socio economic land and soil management water manage[illegible] biodiversity conservation and p [illegible] d rating method (Singh 2006) was followed in the study for scale construction

Preliminary screening of the items by relevancy rating

The relevancy of the items generated was established by sending these items to 70 judges with appropriate instructions (Appendix I) The judges comprised of experts in the field such as the scientists of relevant discipline of Kerala Agricultural University Tamil Nadu Agricultural University and University of Agricultural Sciences Bangalore

The experts were to rate the degree of relevancy of each item in measuring the environmental concerns of the stakeholders on a five point continuum as Most relevant Relevant Undecided Less relevant and Not relevant with scores 5 4 3 2 and 1 respectively Out of the 70 judges 60 responded within a period of one month The scores for each of the items were summated over all the respondents and a relevancy index was worked out using the formula

$$\text{Relevancy index} \quad \frac{\text{Total score obtained on each item}}{\text{Maximum possible score}} \quad \text{X } 100$$

Those items which secured a relevancy index of 80 and above were selected thereby retaining 34 items

Item analysis

Item analysis is a set of procedures that are applied to know the indices for truthfulness (or validity) of the items in a scale (Singh 2006) The most important aspect in item analysis is the determination of the Index of Discrimmation of the items The indices used for the selection of items in the study were

a) Index of Discrimination (t test) suggested by Edwards (1957)

b) Item score total score correlation (Pearson s r) suggested by Anastasi (1961) and Guilford (1971)

The 34 items selected based on relevancy rating by the judges were administered to 25 non sample respondents and the responses were obtained on a three point continuum (Agree Undecided and Disagree with scores of 2 1 and 0 respectively)

For carrying out item analysis two types of scores were used These were the item score referring to the score of an individual on a particular item and the total score referring to the summation of the item scores of an individual These scores were used to arrive at the discrimmation index and the item score total score correlation

Index of Discrimination

The index of discrimmation is the extent to which the success or failure on an item indicates the possession or otherwise of the trait being measured (Marshall and Hales 1972) It indicates the power of an item to discriminate the low category from the high category of the respondents

Following the suggestion of Edwards (1957) 25 per cent of the subjects with the highest total score and 25 per cent of the subjects with the lowest total score were selected The critical ratio (t value) of each item was calculated using the formula

$$t \quad \frac{X_H \quad X_L}{\frac{\sqrt{\Sigma\left[X_H - X_H\right]^2 + \Sigma\left[X_L \quad X_L\right]^2}}{\sqrt{n(n-1)}}}$$

Where

X_H Mean of the score of an ıtem for the hıgh group

X_L Mean of the score of an ıtem for the low group

n – Number of subjects ın a group

The statements wıth hıgh t values greater than 2 228 were selected

Item score-total score correlatıon

The correlatıon between the ındıvıdual ıtem score and total score ıs used as a measure of the dıscrımınatory power of the ıtem It shows how well the ıtem ıs measurıng the functıon whıch the test ıtself ıs measurıng Thıs exhıbıts the extent to whıch a partıcular ıtem dıscrımınates among the examınees who dıffer sharply ın the functıon beıng measured by the test as a whole (Sıngh 2006) Usıng the Pearson s Product Moment method correlatıon was worked out between each of the ıtem scores and the total scores of the respondents

Selectıon of ıtems for the final scale

The results of the ıtem analysıs of the 34 ıtems performed based on the dıscrımınatıon ındex and ıtem score total score correlatıon are presented ın Appendıx II It could be observed that 18 ıtems had dıscrımınatıon ındex values above 2 228 and 20 ıtems had sıgnıficant ıtem score total score correlatıon (r value above 0 4) Consıderıng these two factors 16 ıtems whıch had hıgh t values and sıgnıficant ıtem score total score correlatıon were chosen for the final scale

Standardization of the scale

The scale developed was standardized by verifying its reliability and validity as described below

Reliability of the scale

The reliability of a scale refers to the consistency of the scores obtained by the same individuals on different occasions or with different sets of equivalent forms Statistically reliability is also defined as the self correlation of the test (Singh 2006) Split half reliability (Anastasi 1961) was used in the present study using odd even method

The scale was administered to 30 respondents belonging to a non sample group and their responses were collected The scores obtained for all the odd tems and all the even items were pooled The two sets of scores thus obtained were correlated using pearson s product moment correlation The correlation co efficient (r 0 632) for the half test was obtained The reliability of the full test was obtained using the formula

$$\text{Reliability of the full test} \quad \frac{2 \times \text{Reliability of the } \frac{1}{2} \text{ test}}{1 + \text{Reliability of the } \frac{1}{2} \text{ test}}$$

The reliability of the full test was found to be 0 774 which indicates the appreciable reliability of the scale

Validity of the scale

A scale is said to be valid when it actually measures what it tends to measure (Goode and Hatt 1952) This refers to the degree to which it approaches infallibility in measuring what it purports to measure Validity is the agreement between the test score or measure and the quantity it is believed to measure (Kaplan and Saccuzzo 2001)

Determination of content validity essentially involves the systematic examination of the test content to determine whether it covers a representative sample of the behavior domain being measured (Anastasi 1961) Care was taken to include items covering the universe of content with respect to the different dimensions of environmental concerns in rice farming in the scale thereby satisfying the content validity criterion

The scale developed to measure the environmental concerns in rice farming is not specific for use with any particular category of respondents The scale s not location specific and can be used in any geographical area with slight modification

3 6 1 2 Environmental awareness

Awareness on environment is operationally defined as the extent to which the farmers were aware on different environmental issues and the need for sustainable management of resources The scale developed by Arunachalam and Seetharaman (2004) with some modification was used for this study

The respondents who were aware of an environmental issue were given a score of one and those who were not aware were given a score of zero Awareness index was developed by using the total score of an individual respondent

$$\text{Awareness Index} \quad \frac{\text{Total awareness score obtained by a respondent}}{\text{Maximum possible score}} \times 100$$

The respondents were then categorized into groups with low medium and high awareness levels based on frequencies in selected categories

3 6 1 3 Extent of environmental concerns in the development projects of rice farming

After review of relevant literature discussion with experts from Kerala Agricultural University extension personnel from Palakkad district and focus group discussion with non respondent farmers of the district 40 technologies were identified and categorized under four dimensions *viz* land and soil management water management biodiversity and plant protection reflecting environmental concerns of the rice growers Extent of environmental concerns in the planning and implementation of development projects of rice farming refers to the extent of environmental concerns either included during the planning stage or adopted during the implementation stage of the local level development projects on rice farming Each of the technology identified thus was given a score of 1 Thus a respondent adopting all the technologies would have a score of 40 The respondents were asked to identify the technologies that were included in the planning stage of the project which involved the *padashekarasamithi* for each of which a score of one was given Likewise technologies that were possible to be adopted in their respective fields and those which were adopted in the first crop season were also given a score of one Environmental concern index was worked out for every respondent for planning [ECI] and implement on stag s [ECI (I] separately using the formula

$$[ECI_{(P)}] \quad \frac{\text{Number of eco friendly practices included in the planning stage}}{\text{Total number of eco friendly practices that could be adopted in the field}} \times 100$$

$$[ECI_{(I)}] - \frac{\text{Number of eco friendly practices adopted in the field}}{\text{Total number of eco friendly practices that could be adopted in the field}} \times 100$$

The indices for planning stage would be invariably different from that of the implementation stage as the former was done on a padashekaram basis whereas the later was carried out at an individual level The indices of environmental concerns as reflected in inclusion / adoption of practices in the planning and implementation stages of rice farming projects were worked out for each of the four dimensions identified to compare different stages The respondents were classified into low medium and high classes based on their individual index values obtained for the planning and implementation stages of the four dimensions The frequencies and percentage of respondents coming under each class was also worked out

3 6 2 Selection operationalisation and measurement of independent variables

Variables are defined as those attributes of objects or events that can be measured In other words they are the characteristics or conditions that are manipulated controlled or observed by the researcher In view of the objectives of the study review of relevant literature discussion with experts and observations made by the researcher eight variables were selected which were common for all the stakeholders and eight independent variables other than the common variables were selected for the farmer category Likewise five four and three variables each were selected for extension personnel agricultural labourers and people s representatives/social activists respectively A comprehensive list of variables selected for each category is presented below

(i) Profile characteristics common for all the stakeholders

1 Age

2 Experience in dealing with eco friendly rice cultivation

3 Participation in training programmes on eco friendly cultivation

4 Participation in activities related to environmental conservation

5 Attitude towards group management in rice farming

6 Perception on the importance of mitigating environmental degradation

7 Indigenous wisdom orientation

8 Sense of empowerment

(ii) Profile Characteristics for farmers (other than common characteristics)

1 Educational status

2 Occupational status

3 Livestock possession

4 Risk orientation

5 Export orientation

6 Attitude towards extension interventions in popularizing eco friendly rice cultivation

7 Political orientation

8 Knowledge on eco friendly practices in rice cultivation

(iii) Profile characteristics of agricultural labourers

1 Educational status

2 Knowledge on eco friendly practices in rice cultivation

3 Participation in decision making with farmers

4 Political orientation

(iv) Profile characteristics of extension personnel

1 Decision making ability with regard to eco friendly rice cultivation

2 Leadership

3 Communication effectiveness

4 Development functioning

5 Participation in decision making with farmers

(v) Profile characteristics of people s representatives/social activists

1 Educational status

2 Leadership

3 Political orientation

(vi)Other relevant information related to the study

Other related aspects which could not be considered as variables but highly relevant to the study were also collected and categorized The information collected were on

1 Extent of influence exerted by various agencies in developing environmental concerns

2 Preference of manures and fertilizers

3 Preference of insect pests control methods

4 Preference of disease control methods

5 Preference of weed control methods

6 Political affiliation

7 Effectiveness of the supply of inputs for eco friendly rice farming (for farmers)

3 6 2 1 Profile characteristics common for all the stake holders

3 6 2 1 1 Age

It was defined as the number of calendar years completed by the respondents at the time of enquiry The number of completed years was as such cons dered as the score of the respondent for this variable

3 6 2 1 2 Experience in dealing with eco friendly rice cultivation

It referred to the number of completed years of experience in rice cultivation by following eco friendly methods of farming by the respondents

3 6 2 1 3 Participation in training programmes on eco friendly cultivation

This variable was operationally defined as the actual number of training days (with indication of subject matter place and duration) attended by the respondents on eco friendly cultivation The scoring procedure followed by Hanif (2005) with modification was adopted Each day of training attended was given a score of one and the total duration of trainings attended was thus worked out for each respondent

3 6 2 1 4 Participation in activities related to environmental conservation

This variable for the purpose of the study was defined as the level of involvement of stakeholders in activities with an environmental cause individually or as a part of any social organization concerned with environmental activism The scoring procedure elicited the respondent s involvement in terms of time spent participation in activities assumed leadership status and mobilizing people by assigning scores to different levels as given below

Level of involvement	Score
Very High	5
High	4
Medium	3
Low	2
Very Low	1

3 6 2 1 5 Attitude towards group management in rice farming

It referred to the degree of positive or negative feeling of the stakeholders towards group management The scale developed by Hussain (1992) was used for the study It assesses the degree of affect that the stakeholder may associate with group management in rice farming The scale consisted of 20 statements which were rated on a five point continuum as given below

Response	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Score for positive statement	5	4	3	2	1
Score for negative statement	1	2	3	4	5

The total attitude score for each respondent was calculated by adding up the scores for each statement

3 6 2 1 6 Perception on the importance of mitigating environmental degradation

This variable for the study was defined as the degree to which the respondents become aware of the importance and relevance of reducing environmental degradation

The scale with five statements developed by Varghese (1998) and adopted by Maheswari (2000) and Hanif (2005) was followed in this study All the statements in this scale were positive A five point continuum of responses from strongly agree to strongly disagree as detailed below was used

Response	Score
Strongly Agree	5
Agree	4
Undecided	3
Disagree	2
Strongly Disagree	1

The scores obtained for all the statements by the individual respondent were added up to obtain the perception score for that respondent

3 6 2 1 7 Indigenous wisdom orientation

It was defined for the study as the degree to which an individual is oriented towards the knowledge generated over a period of time by the local community through trial and error and/or deliberate experiments in order to meet their needs

Based on expert opinion and review of pertinent literature fifty statements reflecting the indigenous wisdom orientation of the respondents were identified The 25 items selected based on judge s rating was administered to 25 non sample respondents and the responses were obtained on a five point continuum (Strongly agree Agree Undecided Disagree and Strongly disagree Based on item analysis and orrelation as presented in section 5 1 1 the case of scale development for environmental concerns of stakeholders 17 statements having a t value more than 2 228 and *r* value greater than 0 4 were included in the final scale (Appendix III) The scoring procedure adopted here was as follows

Response	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Score for positive statement	5	4	3	2	1
Score for negative statement	1	2	3	4	5

3 6 2 1 8 Sense of empowerment

It was operationally defined as the degree of confidence an individual has in his own capabilities by which he can gain control over his own lives his community and society

The scale with fifteen statements developed by Alex (1999) was followed here The responses were collected on a five point continuum ranging from strongly agree to strongly disagree The scoring procedure adopted here was as shown below

Response	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Score for positive statement	5	4	3	2	1
Score for negative statement	1	2	3	4	5

3 6 2 2 Profile characteristics of farmers (other than the common characteristics)

3 6 2 2 1 Educational status

It is operationally defined as the highest academic qualification possessed by a respondent To measure this variable the scoring procedure followed by Sonia et al (2003) was adopted in this study

Category	Score
Illiterate	0
Primary school	1
Middle school	2
High school	3
Higher Secondary school	4
Graduation	5
Post graduation & above	6

3 6 2 2 2 Occupational status

Occupation was defined here as the one based on the actual bread winning time spent in a particular profession and was reckoned as primary and all other occupations in which the respondents were engaged at the time of interview was taken as subsidiary The scale developed by Anandaraja (2002) was used for the study The scoring procedure adopted was as follows

Occupation	Score
Farming as a sole occupation	4
Farming + agricultural labour	3
Farming + Business	2
Farming + Service	1

3 6 2 2 3 Livestock Possession

Livestock possession is referred to as the number of animals possessed by an individual The value of various livestock items was calculated and the total value of all the livestock was categorized into the following intervals as given by Sriram (1997) and Jayawardana (2007)

Value (Rs)	Score
5000	1
5001 10 000	2
10 001 15 000	3
15 001 20 000	4
20 001 and above	5

3 6 2 2 4 Risk orientation

Supe (1969) defined risk orientation as the degree to which a farmer was oriented towards encountering risks and uncertainty in adopting any new idea in farming The scale developed by him and followed by Hassan (2008) was used to measure this variable The scale consisted of six statements of which two were negative These items were rated on a five point continuum

Response	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Score for positive statement	5	4	3	2	1
Score for negative statement	1	2	3	4	5

3 6 2 2 5 Export orientation

It was defined as the degree to which a farmer is oriented towards possibilities in exporting organic produce The scale developed by Hanif (2005) was followed The scale consisted of six statements of which only one was a negative statement The scoring procedure adopted here was as follows

Response	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Score for positive statement	5	4	3	2	1
Score for negative statemen	1	2	3	4	5

3 6 2 2 6 Attitude towards extension intervention in popularizing eco friendly rice cultivation

It was referred in the study as the positive or negative disposition towards the extension interventions adopted for popularizing eco friendly rice cultivation

The procedure used by Hanif (2005) was used for the study with slight modification Six statements were used with only one statement negative The response was collected on a five point continuum that ranged from strongly agree to strongly disagree

Response	**Strongly Agree**	**Agree**	**Undecided**	**Disagree**	**Strongly Disagree**
For positive statement	5	4	3	2	1
For negative statement	1	2	3	4	5

3 6 2 2 8 Political orientation

Political orientation was operationally defined as the degree to which a person recognizes the power relations existing in the society and believes that democracy distributive justice and political parties are relevant and important for resolving the problems of people especially farmers in order to achieve the objective of people s sustainable development

The scale developed by Kumaran (2008) was used for this study It consisted of ten statements in which the responses were collected on a two point continuum vi Agree and Disagree with the scores of 1 and 0 respectively for positive statements and the scoring was reversed in case of negative statements

Response	Agree	Disagree
For positive statements	1	0
For Negative statements	0	1

3 6 2 2 9 Knowledge on eco friendly practices in rice cultivation

Different researchers have measured knowledge by developing and standardizing items which reflect knowledge on a particular domain Cronbach (1949) defined knowledge test as one in which procedures opportunities and scoring have been fixed that precisely the same test can be given at d fferent times and places

Noll (1957) defined a standardized knowledge test as one that has been carefully constructed by experts according to the acceptable objectives or purposes and procedures for administering scoring and interpreting scores which are specified in detail so that the results should be comparable and norms and average for different age and status have been predetermined

Shankariah and Singh (1967) measured knowledge of farmers on improved methods of vegetable cultivation based on teacher made test as suggested by Anastasi (1961) Nair (1969) also measured knowledge level of farmers on recommended package of practices of rice using teacher made test with multiple choice questions Jaiswal and Dave (1972) computed the knowledge score as follows

$$\text{Knowledge score} \quad \frac{\text{Number of correct answers}}{\text{Total score possible}} \times 100$$

Singh and Singh (1974) developed a knowledge test based on the response of farmers on various aspects of wheat cultivation The total score of each individual was calculated by the formula

$$\frac{X_1}{N} \times 100$$

Where X_1 – Number of correct answers

N Total number of questions

In the present study a standardized knowledge test was developed for measuring the knowledge of farmers and agricultural labourers about eco friendly practices in rice cultivation by following the procedures adopted by Pillai (1983) Sulaiman (1989) Bonny (199[illegible]) and Sushama (1993) as detailed hereunder

(A) Collection of Items

The content of knowledge test was composed of questions called items A pool of questions was prepared by reviewing pertinent literature and discussing with experts of Kerala Agricultural University Finally a thorough scrutiny of the item pool was made with the assistance of experts to find out items which were supposed to differentiate the well informed respondent from the poorly informed ones and having a certain level of difficulty A total of 61 items covering the four dimensions of eco friendly rice cultivation *viz* land and soil management water management biodiversity and plant protection were selected

(B) Item analysis

The 61 questions on eco friendly practices in rice cultivation were administered to 24 randomly selected non sample respondents prior to the preparation of the final schedule and their responses were used for item analysis

Item analysis yields two kinds of information item difficulty and item discrimination The index of item difficulty reveals how difficult an item is whereas the index of discrimination indicates the extent to which an item discriminates the well informed individuals from the poorly informed ones

Scores of value 1 and 0 were given to the correct and incorrect responses respectively The scores obtained by the twenty four respondents were arranged in the descending order of total scores from the highest to the lowest and the respondents were divided into three groups arranged in descending order of total scores obtained by them The three groups were G G_2 and G_3 For item analysis the middle group (G_2) was eliminated retaining only the terminal ones with high and low scores (G_1 and G_3)

The data pertaining to correct responses for all the items in respect of these two groups (G and G_3) were tabulated and the difficulty and discrimination indices were calculated

P index of item difficulty

$E^{1/3}$ index of discrimination

$$E^{1\,3} \quad \frac{(S_1) \qquad\qquad (S_3)}{N/3}$$

Where S_1 and S_3 are the frequencies of correct answers in the groups G and G_3 respectively

N total number of respondents in the sample

a) Item difficulty index

The difficulty value of an item refers to the proportion or percentage of individuals who answer the item correctly (Garrett 1966 Guilford 1971) As Coombs (1950) pointed out the difficulty of an item varied for different individuals In the present study the items with P value ranging from 10 to 75 were considered for final inclusion in the knowledge tests (Singh 2006)

b) Item discrimination index

The index of discrimmation is the ability of the item on the basis of which the discrimination is made between superiors and inferiors (Blood and Budd 1972) It was indicated by $E^{1\,3}$ Mehta (1958) emphasized that $E^{1\,3}$ method was somewhat analogous to and therefore a convenient substitute for the phi coefficient formulated by Perry and Michael (1951) Different researchers indicated different with modification Availability of five essential inputs was measured in the range always sometimes and never The scoring pattern adopted was as follows

Availability of Inputs	Score		
	Always	**Sometimes**	**Never**
Sufficient Quantity	3	2	1
On time	3	2	1
Current market rate	3	2	1
Transportation easiness	3	2	1

3 8 Economics of eco friendly rice production

3 8 1 Benefit – Cost Ratio (BCR)

Benefit Cost Ratio is defined as the ratio of the present worth of benefits to the present worth of costs of cultivating rice A ratio greater than one indicates profitability in rice farming Benefit cost ratio of eco friendly rice cultivation inorganic rice cultivation and cow based minimum budget rice farming *(Go adharitha krishi)* were worked out for the purpose of comparison Very few farmers in the study area practice most of the eco friendly technologies A farmer who practices maximum number of eco friendly technologies was identified and selected for calculating B C ratio of eco friendly rice farming Likewise one farmer each practicing inorganic rice cultivation and the recently introduced cow based minimum budget rice farming *(Go adharitha krishi)* were identified and selected from the same area

3 8 2 Social Cost Benefit Analysis (SCBA)

Social Cost Benefit of eco friendly rice farming can be defined as the total impact of the cost as well as the benefits on the society as a whole Success of a cultivation practice cannot be described in terms of direct benefits alone but needs to consider the indirect external effects impacting on the society The externalities or

$E^{1\,3}$ value ranges for final selection of items and as such there is no critical range that has been specified Sulaiman (1989) Bonny (1991) and Sushama (1993) in their studies gave the range as 0 35 to 0 50 0 20 to 0 80 and 0 20 to 0 90 respectively In the present study the items with $E^{\ 3}$ values ranging from 0 20 to 0 90 were considered for the final selection (Appendix IV)

(C) Validity

Seltiz et al (1977) defined validity of a measuring instrument as the extent to which differences in scores reflects true differences among individuals as the characteristics that we seek to measure rather than random or constant errors The knowledge tests developed in the study were tested for their content validity

Content validity is a kind of validity by assumption as described by Guilford (1971) Care was taken to include items covering the entire universe of relevant aspects of knowledge with regard to eco friendly practices in rice cultivation Items were collected through various sources such as experts of Kerala Agricultural University and relevant literature Hence it was assumed that the tests could measure the knowledge of the respondents with validity

(D) Method of scoring

The respondents were asked to indicate their responses to the items in relevant knowledge tests and the correct answers were assigned score 1 and incorrect answers 0 The total knowledge score for each respondent was calculated by summing up the scores given for each item

(E) Categorization of respondents

Knowledge levels of respondents on eco friendly practices in rice cultivation were calculated and the respondents were classified into low medium and high groups based on frequencies in selected categories

3 6 2 3 Profile characteristics of agricultural labourers

The profile characteristics of agricultural labourers are given below The first three have been already explained The fourth one participation in decision making with farmers was quantified under 3 6 2 3 4

3 6 2 3 1 Educational status

3 6 2 3 2 Knowledge on eco friendly practices is rice cultivation

3 6 2 3 3 Political orientation

3 6 2 3 4 Participation in decision making with farmers

Participation in decision making with farmers referred to the extent to which a labourer is involved in decision making with the farmers regarding rice production This was measured using the procedure followed by Padmanabhan (1981) and Ramanathan (1995) which comprised of twelve decision making activities of the farmers The labourers selected for this study were asked to indicate the extent of their participation in such activities The scoring procedure adopted here was as follows

Response	Most often	Often	Sometimes	Never
For positive statements	4	3	2	1
For Negative statements	1	2	2	4

The total score of the respondent on this variable was worked out by adding the scores on all the activities

3 6 2 4 Profile characteristics of extension personnel

All the profile characteristics exclusively for extension personnel with its measurement procedure is explained below except participation in decision making with farmers that has been detailed in section 3 6 2 3

3 6 2 4 1 Decision making ability with regard to eco friendly rice cultivation

In the present study decision making ability was defined as the involvement of the extension personnel in generation of ideas evaluation of options and making choice from among options with regard to eco friendly rice cultivation

It was measured using the procedure followed by Surendran (2000) and Nath (2004) with slight modifications The scoring procedure followed was as follows

Response	Score
Decision taken independently	3
Considered after consultation with others	2
Not considered	1

Summation of the scores obtained for the statements in the schedule formed the total score

3 6 2 4 2 Leadership

This referred to the degree of ability of the extension personnel to influence the group in deciding and implementing group activities The scoring procedure followed by Surendran (2000) was adopted in this study

Response	Score
Always	3
Sometimes	2
Never	1

3 6 2 4 3 Communication effectiveness

It was defined as the degree to which consensus has been reached between the sender and receiver on the interpreted meaning of messages which is then translated into meaningful action

Based on review of pertinent literature and expert opinion 60 statements reflecting the communication effectiveness of extension personnel were selected The 30 items selected based on judge s rating was administered to 25 non sample respondents and the responses were obtained on a five point continuum (strongly agree agree undecided disagree and strongly disagree) Based on item analysis and correlation as presented previously in section 3 6 1 1 statements having a t value more than 1 8 and r value greater than 0 4 were included in the final scale Thus ten statements were finally selected for the scale (Appendix V) The scoring procedure adopted was as follows

Response	Score		
	Agree	Undecided	Disagree
For positive statements	2	1	0
For negative statements	0	1	2

3 6 2 4 4 Development functioning

It was defined as the perception of extension personnel on the function ng of our public system and development programmes The scale developed by Alex (1999) with 21 statements of which all were negative was used in this study The scoring procedure followed here was as follows

Response	Score
Strongly Agree	1
Agree	2
Disagree	3
Strongly Disagree	4

3 6 2 4 5 Participation in decision making with farmers

3 7 Other relevant information related to the study

Other information relevant to eco friendly rice farming collected from different categories of stakeholders were extent of influence exerted by various agencies in developing environmental concerns preference of manures and fertilizers preference of insect pest control methods preference of disease control methods and preference of weed control methods of all the stakeholders Data on political affiliation of all the stakeholders except extension personnel and effectiveness of the supply of inputs for eco friendly rice farming as felt by the farmers that were very much relevant to the study were also collected

3 7 1 Extent of influence exerted by various agencies in developing environmental concerns

It is operationally defined as the extent of influence exerted by different agencies on the individual in developing environmental concerns Here the respondents were asked to score the different agencies influencing them in developing environmental concern The influence would range from a very positive level to a very negative level The scoring procedure adopted here was as follows

Level of influence	Score
Very positive	5
Positive	4
Neutral	3
Negative	2
Very negative	1

3 7 2 Preference of manures and fertilizers

Preference implies a real or imagined choice between alternatives and the possibility of rank ordering these alternatives based on happiness satisfaction enjoyment and utility they provide

Preference of manures and fertilizers was defined as the respondent choice between the two alternatives namely organic (manures) and inorganic (fertilizers) available for rice production

The respondents were asked to give their preference of manures and fertilizers on ten different production aspects of rice on a five point continuum of response ranging from exclusively organic with a score of 5 to exclusively inorganic with a score of 1 It was measured as follows

Response	Score
Exclusively organic	5
Primarily organic	4
Integrated Nutrient management	3
Primarily inorganic	2
Exclusively inorganic	1

3 7 3 Preference of insect pest control methods

Preference of insect pest control methods was operationally defined as the choice of the respondents between the alternatives organic insect pest control methods and inorganic insect pest control methods

The respondents were asked to give their preference of insect pests control methods on ten different production aspects of rice on a five point continuum of response ranging from exclusively organic with a score of 5 to exclusively inorganic with a score of 1 The scoring adopted here was as follows

Response	Score
Exclusively organic	5
Primarily organic	4
Integrated Pest Management	3
Primarily inorganic	2
Exclusively inorganic	1

3 7 4 Preference of dısease control methods

Preference of dısease control methods was defined as the choıce of the respondents between the alternatıves organıc dısease control methods and ınorganıc dısease control methods

The respondents were asked to gıve theır preference of dısease control methods on ten dıfferent productıon aspects of rıce on a five poınt contınuum of response rangıng from exclusıvely organıc wıth a score of 5 to exclusıvely ınorganıc wıth a score of 1 It was measured as follows

Response	Score
Exclusıvely organıc	5
Prımarıly organıc	4
Integrated Dısease management	3
Prımarıly ınorganıc	2
Exclusıvely ınorganıc	1

3 7 5 Preference of weed control methods

Preference of weed control methods was operatıonally defined as the choıce of the respondents between the alternatıves organıc weed control methods and ınorganıc weed control methods

The respondents were asked to gıve theır preference of weed control methods on ten dıfferent productıon aspects of rıce on a five poınt contınuum of response rangıng from exclusıvely organıc wıth a score of 5 to exclusıvely ınorganıc wıth a score of 1 The scorıng adopted here was as follows

Response	Score
Exclusively organic	5
Primarily organic	4
Integrated Weed Management	3
Primarily inorganic	2
Exclusively inorganic	1

3 7 6 Political affiliation

In the study it was referred to as the stance of the respondents (farmers agricultural labourers and people s representatives / social activists) with respect to theory and praxis of different political ideologies in the present democratic system The scoring adopted here was as follows

Response	Right Conservative	Liberal	Liberal Left	Left	Radical Left	Non Political
Score	1	2	3	4	5	6

3 7 7 Effectiveness of the supply of inputs for eco friendly rice farming

This refers to the availability of critical inputs for eco friendly rice production like seeds manures and organic plant protection inputs on time in sufficient quantity current market rate and with easiness in transportation

Like wise it refers to the availability of other inputs like credit on time in required amount and in current bank rate and irrigation water on time and in adequate quantities

Supply effectiveness of inputs for eco friendly rice farming was measured in this study by using the procedure adopted by Surendran (2000) and Nath (2004) external effects may be of two categories *viz* external costs and external benefits It is also known by the names external bads (Negative externalities) and external goods (Positive externalities) respectively

As the study was static and not temporal and as the benefits or costs incurred by the society could not be traced over a number of years due to limitation of time social cost benefit analysis could not be quantified as in an exhaustive study However an attempt has been made to develop values viz Social Cost Value (SCV) and Social Benefit Value (SBV) Social benefit cost ratio was then worked out using these values

3 8 2 1 Dimensions of social cost and social benefit

The various dimensions of social cost and social benefit accruing out of eco friendly rice farming were identified after extensive perusal of literature and discussion with experts from Kerala Agricultural University as well as progressive farmers The major dimensions thus selected for the study were given to a panel of experts from various departments of College of Agriculture Vellayani to assign weights to the dimensions of social cost and benefit as per their importance to the society (Appendix VI) This analysis was done involving sixteen respondents who were practicing eco friendly rice cultivation

I Dimensions of social Cost

1) Lower yield in the initial years
2) Non remunerative price
3) Higher cost of cultivation
4) Inconvenience in handling eco friendly inputs

II Dimensions of social benefit

1) Superior quality of rice
2) Improvement in soil quality
3) Improvement in water quality
4) Increased water availability
5) Enrichment of biodiversity
6) Enhancement of aesthetic value

7) Life style changes towards sustainable development
8) Self development
9) Augmenting Public Health
10) Increased labour utilization

3 8 2 2 Computation of Social Cost Value (SCV)

The social cost of eco friendly rice farming was measured by computing the Social Cost Value of each respondent farmer and compared

In this study social cost accruing out of eco friendly rice farming was measured by using the SCV developed for the purpose The main purpose behind developing social cost value was to construct an index of general nature to suit any group and for converting the values obtained into 0 1 scale

SCV ascribed by each farmer was worked out by considering the social cost score the maximum possible score and weightage used for each dimensions The formula used for this purpose was

$$SCV \quad \frac{\Sigma \left[\frac{Sc}{C}\right] W}{\Sigma W}$$

$$- \quad \frac{\left[\frac{Sc_1}{C_1}\right] W + \left[\frac{Sc_2}{C_2}\right] W_2 + \left[\frac{Sc_3}{C_3}\right] W_3 + \left[\frac{Sc_4}{C_4}\right] W_4}{W + W_2 + W_3 + W_4}$$

Where W_1 W_2 W_3 W_4 are the weights of four dimensions

Sc_1 Sc_2 Sc_3 Sc_4 are the social cost scores of four dimensions

C_1 C_2 C_3 C_4 are the maximum possible social cost score of four dimensions

As seen earlier $\frac{Sc}{C}$ takes care of the unequal distribution in the range of scoring of the dimensions and the index takes a minimum value of zero and maximum of one Hence the efficiency can be easily identified and compared

3 8 2 3 Computation of Social Benefit Value (SBV)

Social benefits accruing out of eco friendly rice farming were measured by computing the value ascribed by each farmer as seen in case of computation of social cost

SBV of each respondent farmer was computed by applying the method similar to that of SCV Extent of social benefit score the maximum possible score and the weightage of each dimension were applied in the following formula to find out SBV of eco friendly rice cultivation

$$SBV \quad \frac{\Sigma \left[\frac{Sb}{B}\right] W}{\Sigma W}$$

$$\frac{\left[\frac{Sb}{B}\right] W_1 + \left[\frac{Sb_2}{B_2}\right] W_2 + \quad + \left[\frac{Sb_0}{B_{10}}\right] W_0}{W_1 + W_2 + \quad W_{10}}$$

Where

W_1 W_2 W_{10} are the weights of ten dimension of social benefit

Sb_1 Sb_2 Sb_{10} are the social benefit score of ten dimensions

B B_2 B_0 are the maximum possible social benefit score of ten dimensions

As seen earlier $\frac{Sb}{B}$ takes care of the unequal distribution in the range of scoring of the dimensions and the index takes a minimum value of zero and maximum of one Hence the efficiency can be easily identified and compared

3 8 2 4 Benefit – Cost ratio of eco friendly rice farming

In the study for SCBA the benefit cost ratio of eco friendly rice farming was found out based on the SCV and SBV calculated for each selected respondent The formula used was as follows

$$\text{Benefit cost ratio (B C ratio)} - \frac{\text{Total SBV}}{\text{Total SCV}}$$

Where SBV Social Benefit Value

SCV Social Cost Value

Principal Component Analysis (PCA) was used for identifying the variation in the social cost and benefit scores of the respondents This helps in identifying those dimensions under both social cost and benefit which are mainly responsible for the variation in the scores of social cost and benefit of the respondents (Appendix VII)

3 8 2 5 Operationalization and measurement of the dimensions of social cost and social benefit

3 8 2 5 1 Dimensions of social cost

1 Lower yield in the initial years

It refers to the yield reduction during the initial years of adopting eco friendly rice cultivation practices compared to inorganic cultivation practices in rice

It was measured by administering a structured schedule (Appendix VIII) developed by the researcher for the purpose The respondents were asked about the yield obtained during the initial years of eco friendly rice cultivation and the responses were collected in a four point continuum *viz* very high high low and very low with scores 1 2 3 and 4 respectively

2 Non remunerative price

It was defined as the farmer s difficulty in getting remunerative price in relation to the expenditure incurred on eco friendly rice cultivation practices It was measured by administering the schedule developed by the researcher for the purpose with a scale having two items The first item was measured in Yes and No response with scores 1 and 2 respectively The second item was measured on a five point continuum as very high high same low and very low with scores 1 2 3 4 and 5 respectively Summation of scores of the two items was the score for non receipt of remunerative price as perceived by the respondent The scores of this attribute ranged from 2 to 7 (Appendix VIII)

3 Higher cost of cultivation

It was defined as the increased cost of cultivation incurred by the farmers while adopting eco friendly rice cultivation compared to the conventional farming It was measured by applying the schedule developed by the researcher for the purpose The scale consisted of two items The first item was measured in Yes and No response with scores 2 and 1 respectively The second item was measured on a five point continuum as very high high same low and very low with scores 5 4 3 2 and 1 respectively Summation of scores of both the items denoted the perception on higher cost The scores fall in the range of 2 to 7 (Appendix VIII)

4 Inconvenience in handling eco friendly inputs

It was operationally defined as the degree of difficulty and drudgery in handling the bulky eco friendly inputs including those inputs emitting foul smell

It was measured by applying the schedule developed by the researcher for the purpose The scale consisted of three items The first item was measured on a four point continuum namely very difficult difficult easy and very easy with scores 1 2 3 and 4 respectively The second item was measured on a three point continuum namely comfortable not so comfortable and not at all comfortable with scores 1 2 and 3 respectively The third item was measured in Yes and No response with scores of 1 and 2 respectively Summation of the scores of these three items was the extent of inconvenience in handling eco friendly inputs The possible score ranged from 3 to 9 (Appendix VIII)

3 8 2 5 2 Dimensions of social benefit

1 Superiority of rice quality

It was referred to as the external quality parameters like appearance texture flavor and cooking quality which are perceived to be enhanced by eco friendly cultivation practices and hence make the product more acceptable to consumers

This variable was measured by administering questions that could elicit specific response on each of these attributes The first item was measured in Yes and No response with scores of 2 and 1 respectively Item two was measured us ng four quality dimensions of rice viz cooking quality taste texture and flavor These four quality dimensions were rated by the respondent on a four point continuum namely extremely good good somewhat good and not so good with scores 4 3 2 and 1 respectively The summation of all the items reflects the perception of respondent about the quality of rice produced in an eco friendly way compared to that of conventionally produced rice The possible scores range from 5 to18 (Appendix VIII)

2 Improvement in soil quality

It was defined as the capacity of the soil from rice fields in which eco friendly methods of cultivation are practiced to function within the natural or managed ecosystem boundaries to sustain plant productivity maintain or enhance water and air quality and support human health as felt by the farmers

The status of soil quality as perceived by the farmers was measured by administering specific questions framed by the researcher (Appendix VIII) The schedule consisted of a important soil quality parameters that was easily felt or seen by the respondent farmer s *viz* structure nutrient status water holding capacity and presence of soil organisms like earthworms The first quality parameter structure was given three choices namely improved same as before and destroyed with scores 3 2 and 1 respectively Other three parameters were rated on a three point continuum increased same as before and decreased with scores 3 2 and 1 respectively The summation of scores reflects the perception of respondent on the soil quality after adopting eco friendly rice cultivation The score ranged from 4 to 12 Soil sample analysis for enumeration of microflora was done with the help of experts of department of plant pathology College of Agriculture Vellayani and soil nutrient status was analyzed from Regional Agricultural Research Station Pattambi

3 Improvement in water quality

It was referred to as the enhancement in the quality of water consequent to adopting eco friendly rice cultivation in relation to guideline values suitable for human consumption and domestic purposes including personal hygiene as perceived by the farmers

This attribute which is measured as the quality improvement perceived or felt by farmers was measured using the schedule developed by the researcher (Appendix VIII) The schedule consisted of three items and the responses of all these items were collected as Yes and No response with scores 2 and 1 respectively The summation of scores of the three items reflects the respondent s perception on water quality after adopting eco friendly rice cultivation The score ranged from 3 to 6 Water from the study area was analyzed for pesticide residues at the Pesticide Residue Lab AINP (PR) Vellayani

4 Increased water availability

It was operationally defined as the quantity of water saved or conserved by adopting various water conservation measures in eco friendly rice farming like rain water harvesting reinforcement of bunds summer ploughing land leveling etc

The dimension was measured using a schedule (Appendix VIII) having two items developed by the researcher The response to the first item was recorded as Yes or No with scores 1 and 2 respectively The second item was measured on a five point continuum *viz* very much increased increased no change decreased and very much decreased with scores 5 4 3 2 and 1 respectively The summation of scores shows the increased water availability by way of adopting eco friendly rice cultivation The score ranged from 2 to 7 (Appendix VIII) The ground water status of the study area was reviewed with the help of secondary data from Ground Water Department Palakkad

5 Enrichment of biodiversity

Enrichment of biodiversity was defined as the increase in the population of flora and fauna in rice fields by way of adopting eco friendly practices in rice cultivation

The dimension was measured using the schedule developed by the researcher for the purpose (Appendix VIII) The schedule had two items of which the first item had six sub items depicting the biodiversity in rice fields It was rated by the respondent on a three point continuum *viz* increased no change and decreased with scores 3 2 and 1 respectively The second item was rated on a five point continuum namely very much increased increased no change decreased and very much decreased with scores 5 4 3 2 and 1 respectively The summation of scores reflects the perception of respondents regarding biodiversity enrichment by adopting eco friendly rice cultivation The scores ranged from 7 to 23 Major organisms constituting the rice eco system were identified and document by taking photographs Old farmers from the locations under study were contacted with the photos of the flora and fauna of rice fields to collect information on the variation in the diversity over the years

6 Enhancement of aesthetic value

It was operationally defined as the incremental user value attributed to the appearance of rice fields managed in an eco friendly way It pertains to the nature and expression of beauty as perceived by the viewer

It was measured by administering specific questions to elicit responses on a four point continuum (Appendix VIII) The respondents were asked to record the level of appreciation they have on seeing rice fields managed in an eco friendly way with all its biodiversity along a four point continuum very beautiful beautiful somewhat beautiful and not beautiful with scores 4 3 2 and 1 respectively

7 Life style changes towards sustainable development

It was defined as the changes in the way of living of farmers by way of adopting eco friendly rice cultivation thus inculcating in him a green way of living

It was measured using the schedule developed by the researcher for the purpose (Appendix VIII) The scale consisted of three items and the responses of all these items were collected as Yes or No response with scores 2 and 1 respectively The summat on of the scores of the three items reflects the life style changes of respondent farmers The score ranged from 3 to 6

8 Self development

It was defined as the degree to which an individual derives contentment self esteem and recognition in his efforts towards social cause of sustainable development

It was measured using the schedule developed by the researcher (Appendix VIII) The schedule consisted of four items The first item was scored on a five point continuum *viz* very much contented much contented undecided not much contented and not at all contented with scores 5 4 3 2 and 1 respectively The responses of other three items were collected as Yes and No response with scores 2 and 1 respectively The summation of all the items reflects the self development of respondent farmers adopting eco friendly rice farming The scores on self development ranged from 4 to 11

9 Augmenting public health

It was operationally defined as the improvement in the health status of people consequent to adopting eco friendly cultivation practices in rice

It was measured using schedule developed by the researcher for the purpose by asking the respondents to record his response as yes or no to three items The scores of the responses were 2 and 1 respectively (Appendix VIII) Sum of the scores of the three items reflects the respondent s perception of eco friendly rice cultivation in augmenting public health The score of this dimension ranged from 3 to 6

10 Increased labour utilization

This variable was defined as the extent of utilization of additional labour by the respondent in practicing eco friendly rice cultivation

It was measured using the schedule (Appendix VIII) which consisted of two items The response of first item was collected as Yes or No answers with scores 2 and 1 respectively The second item was rated on a four point continuum *viz* very high high somewhat high and not at all high with scores 4 3 2 and 1 respectively The sum of the scores of these two items is indicative of the respondent s perception on increased labour utilization by way of adoption of eco friendly rice cultivation The scores ranged from 2 to 6

3 9 Perception of farmers on attributes of eco friendly practices

It is defined as farmers perception on the various attributes of practices regarding eco friendly rice cultivation The attributes studied were simplicity of eco friendly rice cultivation practices its profitability cost of cultivation and labour requirement

The practices selected for the study were grouped under four dimensions of eco friendly rice cultivation *viz* land and soil management water management biodiversity conservation and plant protection The data were collected by means of qualitative research methods like focus group discussion Focus group was formed in each of the selected blocks to develop a general understanding of farmers perception on various attributes of eco friendly technologies Focus group consisted of six to twelve participants in all the four blocks under study so that the group is neither so large to preclude adequate participation by most members nor so small that it fails to provide substantially greater coverage than that of an interview with one individual There was a moderator who was the investigator and an assistant moderator to report the discussion who was one among the progressive farmers of the area to report the discussion. The major steps followed in conducting this focus group discussion were detailed below.

(a) Established the purpose of the focus group, including its goals and desired outcome, which in this study was generating the perception, attitude and ideas of farmers about the simplicity, profitability, cost of cultivation and labour requirement of various eco-friendly practices in rice cultivation. After the purpose was finalized, various eco-friendly practices coming under the four major dimensions *viz.* land and soil management, water management, biodiversity and plant protection were identified.

(b) Prepared moderator's guide that served as a map to chart the course of the focus group interview from beginning to end. The moderator's guide included sections like (i) introduction (ii) warm-up (iii) term clarification (iv) questions to be asked (v) wrap-up (vi) member check and finally (vii) the closing statements for winding up session.

(c) Determined the number of focus groups, which in this study was one for each block.

(d) Since selection of location is very important in focus group formation, *Krishi bhavans* of the study area were selected considering its availability and accessibility to the group members in all the four cases.

After a detailed discussion consensus regarding the simplicity, profitability, cost and labour requirement of all the practices listed was arrived at. The discussion was properly reported and was finally considered for qualitative analysis. The method followed by Sivaramakrishnan (1981) was followed in this study with slight modifications.

(a) Perception on degree of simplicity of eco-friendly practices in rice

The group was asked to give their opinion on the degree of simplicity in adopting each of the eco-friendly cultivation practices in rice. The rating was done qualitatively on a five point continuum ranging from very simple to very complex.

Response categories				
Very Simple	Simple	Moderate	Complex	Very Complex

(b) Perception on the profitability of eco-friendly practices in rice cultivation

It was measured qualitatively in a five point continuum ranging from 'very high' to 'very low'. The group was asked to give their opinion on the profitability of the listed eco-friendly practices in rice. After a brainstorming session consensus was arrived at on the profitability aspects of the listed eco-friendly practices.

Response categories				
Very High	High	Medium	Low	Very Low

(c) Perception on the cost involved in eco-friendly rice cultivation

The farmer groups were asked to give their opinion on the cost involved in adopting each of the selected eco-friendly practices in rice. The response was obtained on five point continuum as follows.

Response categories				
Very Low	Low	Medium	High	Very Low

The scores obtained for each practice was added up to get the total score for perception on cost involved in selected eco-friendly practices in rice.

(d) Perception on labour requirement of eco-friendly practices in rice cultivation

The farmer groups were asked to give their perception of labour requirement for selected eco-friendly practices in rice, in comparison with the conventional inorganic rice cultivation. The response categories were as follows.

Response categories				
Very Low	Low	Medium	High	Very High

3.10 Constraints perceived by the stakeholders in planning and implementing development projects that address environmental concerns in rice farming

One of the specific objectives of the study was to identify the constraints perceived by the stakeholders in planning and implementing development projects that address environmental concerns in rice farming. After discussions with a cross-section of stakeholders and review of relevant literature, constraints perceived by the stakeholders at planning and implementation stages were identified and listed out. Number of constraints identified in the planning stage was 17 and for implementation stage it was 18.

The respondents were asked to assign first rank to the item, which they considered as the most serious constraint. Scores of 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7,6,5,4,3,2 and 1 were given to ranks I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XII, XIII, XIV, XV, XVI and XVII respectively for planning and in the implementation stage the scoring started from 18. Zero score was given for constraints, which were not ranked by the respondents. The frequencies of the stakeholders ranking each constraints in each rank were found out and multiplied with the corresponding score value. The constraints with the highest score value was considered as the most serious one followed by others in the order of decreasing score values.

3.11 Instruments and techniques employed in data collection.

In order to ensure high objectivity in the study, a number of standard tools developed by different Indian and foreign experts in the field of behavioural sciences were used. However such tools were used and modified with care, so that they could be applied to local conditions. Before using these tools and techniques the administration of these were thoroughly comprehended with the help of available literature and discussions with experts.

3.11.1 Pilot study

A pilot study was conducted to collect basic information about Palakkad district, the respondents and the locale. The investigator made several trips to the study area before finalizing the variables for the interview schedule. Thorough discussions and interactions with extension personnel and scientists of Krishi Vigyan Kendra and RARS, Pattambi helped the investigator gain information about the district and the nature of rice farming. This has been useful in recognizing and incorporating many valid variables and issues. Data collection devices were later constructed on the basis of this preliminary investigation.

3.11.2. Development of interview schedule

In view of the objectives of the study, a structured interview schedule was developed for collecting information from the four stakeholders selected for the study (Appendix IX, X, XI and XII). Care was taken to avoid ambiguous and vague items that may distort the information inflow. Questions selected were specific to the category of respondents under study and hence four questionnaires intended for the four categories of stakeholders were developed.

3.11.3. Pre-testing and restructuring of interview schedule

The interview schedule was pre-tested with 10 per cent of the non-sample respondents of each category at random. This was done with the objectives of testing the validity and reliability of the items included in the schedule. On the basis of the observations made during pre-testing, some minor but necessary changes were brought about in the interview schedule, and the same were later finalized for collection of data.

3.11.4. Administration of the interview schedule

The researcher has taken utmost care to build a good rapport with the respondents before the administration of schedules. Mostly structured interviews were conducted, and probing and focused interview techniques were applied

Plate 1. Data collection in progress

wherever required. Case studies and focus group discussions were also conducted for obtaining necessary information. Data collection took approximately three months from January to April 2010.

3.12 Statistical tools used in the study

The statistical measures provide the investigator with an opportunity to express the facts in an empirical way. With this contention and assuming that the data collected were of at least the ordinal level, more of parametric statistical tests were employed in the study. The data collected from the respondents were scored, compiled and analyzed using the following statistical tools.

3.12.1 Percentage

The means and standard deviations of the dependent and independent variables were worked out and the respondents were categorized into different groups with their relative proportions expressed in percentages. For calculating the percentage, the frequency of the concerned cell was divided by the total number of respondents in each and multiplied by 100. The percentages were corrected to two decimals.

3.12.2 Mean and standard deviation

Mean score is a measure of simple comparison, obtained by dividing the sum of the scores by the total number of times/ respondents. Standard deviation is the square root of the mean of the squared deviations of the individual values from their means. These statistical tools were employed for the categorization of the sample respondents into different groups in case of the various dependent and independent variables.

3.12.3 Pearson's product moment correlation – 'r'

Pearson's product moment correlation is a measure of the linear association between two contiguous variables. The values of the correlation co-efficient (r) ranges from -1 to +1. The sign of the correlation co-efficient indicates the direction of the relationships, while its absolute value indicates the strength. In the present study, co-efficient of correlation was used to study the nature and extent of relationship between the dependent variables and the independent variables.

3.12.4 Canonical correlation analysis

Canonical correlation analysis was applied to analyze the importance of profile characteristics and the dependent variables of farmers, agricultural labourers, extension personnel and people's representatives. This analysis helps in identifying the key variables of the study. Canonical correlation analysis developed by Hotelling was used to identify and quantify the association between two sets of variables X and Y. This technique allows for the investigation of multiple independent variables effects upon multiple dependent variables (Schul et al. 1983). It focus on the correlation between linear combinations of variables in one set and linear combination of variables in another set (Johnson and Wichern, 1992). The two sets of variables X and Y are defined as

$$X' = (x_1, x_2, \ldots\ldots\ldots\ldots x_p)'$$

$$Y' = (y_1, y_2, \ldots\ldots\ldots\ldots y_q)'$$

Then $U_1 = a_{11}x_1 + a_{12}x_2 + \ldots\ldots\ldots + a_{1p}x_p$ and

$$V_1 = b_{11}y_1 + b_{12}y_2 + \ldots\ldots\ldots + b_{1q}y_q$$

are known as the first pair of canonical variate and the correlation between (U_1, V_1) is defined as R_c^2 = Corr (U_1, V_1), where, $a_{11} \ldots\ldots\ldots a_{1p}$ are weights associated to the variables in X set and $b_{11} \ldots\ldots\ldots b_{1q}$ are weights associated to the variables in Y set. Then one seeks another pair of canonical variates (functions) maximizing the same correlation subject to the constraint that they are to be uncorrelated with first pair of canonical variable, known as second pair of canonical variate. The number of pairs of canonical variate thus derived for a system with p independent and q dependent will be min (p,q).

Canonical loadings

Correlation between variables in set X and its own canonical variate U is known as **canonical loadings or structure coefficients**. Let r (x_i, U_1) is used to denote the correlation between i^{th} (x_i), i= 1,2…,p variable in X and its own first canonical variable U_1 is known as canonical loadings of X.

r (x_i, U_1) = Corr (x_i, U_1)*Similarly correlation between* i^{th} (y_i), *i= 1,2…,q variables in Y and its own first canonical variable* V_1 *is known as canonical loadings of Y.*

r (y_i, V_1) = Corr (y_i, V_1)

Canonical cross-loadings

The correlations between variables in X set and the canonical variate of Y (V) are known as canonical cross-loadings of X. Similarly correlation between variables in Y and canonical variate of X (U) are known as cross loading of Y. Cross loadings and loadings are based on a linear relationship and this have corresponding results. But cross-loadings facilitate the transformation of a canonical model to a single latent construct, which resembles structural equation modeling, and hence cross loadings approach is preferred (Hair *et al.*, 2005).

Redundancy Index

$$R.\,Ix = \frac{\sum_{i=1}^{p} r^2(x_i, U_1)}{p} \times R_{C1}^2$$

$$R.\,Iy = \frac{\sum_{i=1}^{q} r^2(y_i, V_1)}{q} \times R_{C1}^2$$

Where, the values of redundancy indices vary from 0 to1.

3.12.5 Principal Component Analysis (PCA)

The Principal Component Analysis (PCA) technique, initially described by Pearson (1901) and further developed by Hotelling (1933) is one of the popular multivariate techniques. Principal components are linear combinations of random or statistical variable, which have special properties in terms of variances. Transforming the original vector variable to the vector of principal components amounts to a rotation of co-ordinate system that has inherent statistical properties. In the present study, Principal Component Analysis (PCA) was used in identifying those dimensions of social cost and benefit, which are mainly responsible for the variation in the social cost and benefit scores of respondents. The total variability present in the data is divided into different components such that each component is a linear combination of the different dimensions. The procedure of finding these linear combinations called principal components is by applying orthogonal transformations to the original set of variables, thereby reducing a multidimensional data set to a space of lower dimensions.

Results and Discussion

4. RESULTS AND DISCUSSION

This chapter presents the salient findings of the study with appropriate discussions and interpretations. The results are presented under the following major heads in the light of the objectives set forth.

4.1 Profile characteristics of stakeholders.

4.2 Other relevant information related to the study

4.3 Environmental concerns of stakeholders in rice farming.

4.4 Environmental awareness of stakeholders.

4.5 Factors defining environmental concerns

4.6 Nature and extent of environmental concerns in the development projects on rice farming.

4.7 Relationship between set of independent variables and a set of dependent variables - Canonical correlation analysis

4.7.1 Relationship between the profile characteristics and environmental concerns, environmental awareness and extent of environmental concerns of farmers.

4.7.2 Relationship between the profile characteristics of agricultural labourers and their environmental concerns and awareness.

4.7.3 Relationship between the profile characteristics of extension personnel and their environmental concerns and awareness.

4.7.4 Relationship between the profile characteristics of people's representatives/ social activists and their environmental concerns and awareness.

4.8 Economics of eco-friendly rice production.

4.8.1 Benefit – cost ratio of eco-friendly rice production

4.8.2 Social cost benefit analysis of eco-friendly rice farming

4.9 Constraints perceived by the stakeholders.

4.10 Perception of farmers on attributes of eco-friendly cultivation practices in rice.

4.11 *Paruthikavu padashekarasamithi* – A case of effective planning and implementation of development projects on rice farming under decentralized planning.

4.12 Cow based minimum-budget rice farming (*Gō-adharitha krishi*): A success case of eco- friendly rice farming.

4.1 Profile characteristics of stakeholders

Analysis of the profile characteristics of the stakeholders *viz.* farmers, agricultural labourers, extension personnel and people's representatives/social activists provided information on their background that would serve to provide information on the need and scope for improvements in the socio-personal and psychological aspects, which would in turn influence their concern for environment.

4.1.1 Profile characteristics common for all stakeholders

This has been attempted to get a clear picture on the various socio-personal and psychological characteristics that would influence the environmental concerns of all the stakeholders. The findings are presented in Table 1.

4.1.1.1 Age

Table 1 reveals that 60 per cent of the farmers belonged to the 'old age' category followed by 40 per cent into 'middle-aged' category. No farmers were found in the 'young age' group. The age-based categories of agricultural labourers also reveal a similar distribution with 52.5 per cent of the respondents belonging to 'old age' group and 47.5 per cent belonging to 'middle age' category. More than three-fourth of the extension personnel belonged to 'middle age' category (77.5%) followed by 'young age' group (12.5%). Similarly about three-fourth (72.5%) of the people's representatives were in the 'middle age' group followed by 17.5 per cent in the 'old age' category.

Table 1. Distribution of different stakeholders based on their common profile characteristics

Sl. No	Variable	Category	Farmers n=40		Agricultural Labourers n=40		Extension Personnel n=40		People's representatives/Social activists n=40	
			Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
1.	Age	Young (<35 years)	0	0	0	0	5	12.5	4	10
		Middle aged (35-50 years)	16	40	19	47.5	31	77.5	29	72.5
		Old (≥51 years)	24	60	21	52.5	4	10	7	17.5
2.	Experience in dealing with eco-friendly rice cultivation	0-4 years	20	50	16	40	12	30	31	77.5
		5-9	13	32.5	24	60	25	62.5	9	22.5
		10-14	6	15.0	0	0	3	7.5	0	0
		15-19	0	0	0	0	0	0	0	0
		≥20	1	2.5	0	0	0	0	0	0
3.	Participation in training programmes on eco-friendly cultivation	0 (No training)	21	52.5	40	100	11	27.5	20	50
		1-3	6	15	0	0	23	57.5	11	27.5
		4-6	5	12.5	0	0	5	12.5	4	10
		>6	8	20	0	0	1	2.5	5	12.5
4.	Participation in activities related to environmental conservation	Low	33	82.5	40	100	5	12.5	0	0
		Medium	3	7.5	0	0	34	85	27	67.5
		High	4	10	0	0	1	2.5	13	32.5
5.	Attitude towards group management	Unfavourable	0	0	0	0	0	0	0	0
		Neutral	37	92.5	13	32.5	0	0	40	100
		Favourable	3	7.5	27	67.5	40	100	0	0

Sl. No.	Variable	Category	Farmers n=40		Agricultural Labourers n=40		Extension Personnel n=40		People's representatives/Social activists n=40	
			Frequency	Per cent	Frequency	Per cent	Frequency	Per cent	Frequency	Per cent
6.	Perception on the importance of mitigating environmental degradation	Low	0	0	0	0	0	0	0	0
		Medium	23	57.5	40	100	0	0	13	32.5
		High	17	42.5	0	0	40	100	27	67.5
7.	Indigenous wisdom orientation	Low	0	0	0	0	0	0	6	15
		Medium	12	30	10	25	1	2.5	28	70
		High	28	70	30	75	39	97.5	6	15
8.	Sense of empowerment	Low	0	0	0	0	0	0	0	0
		Medium	23	57.5	34	85	9	22.5	13	32.5
		High	17	42.5	6	15	31	77.5	27	67.5

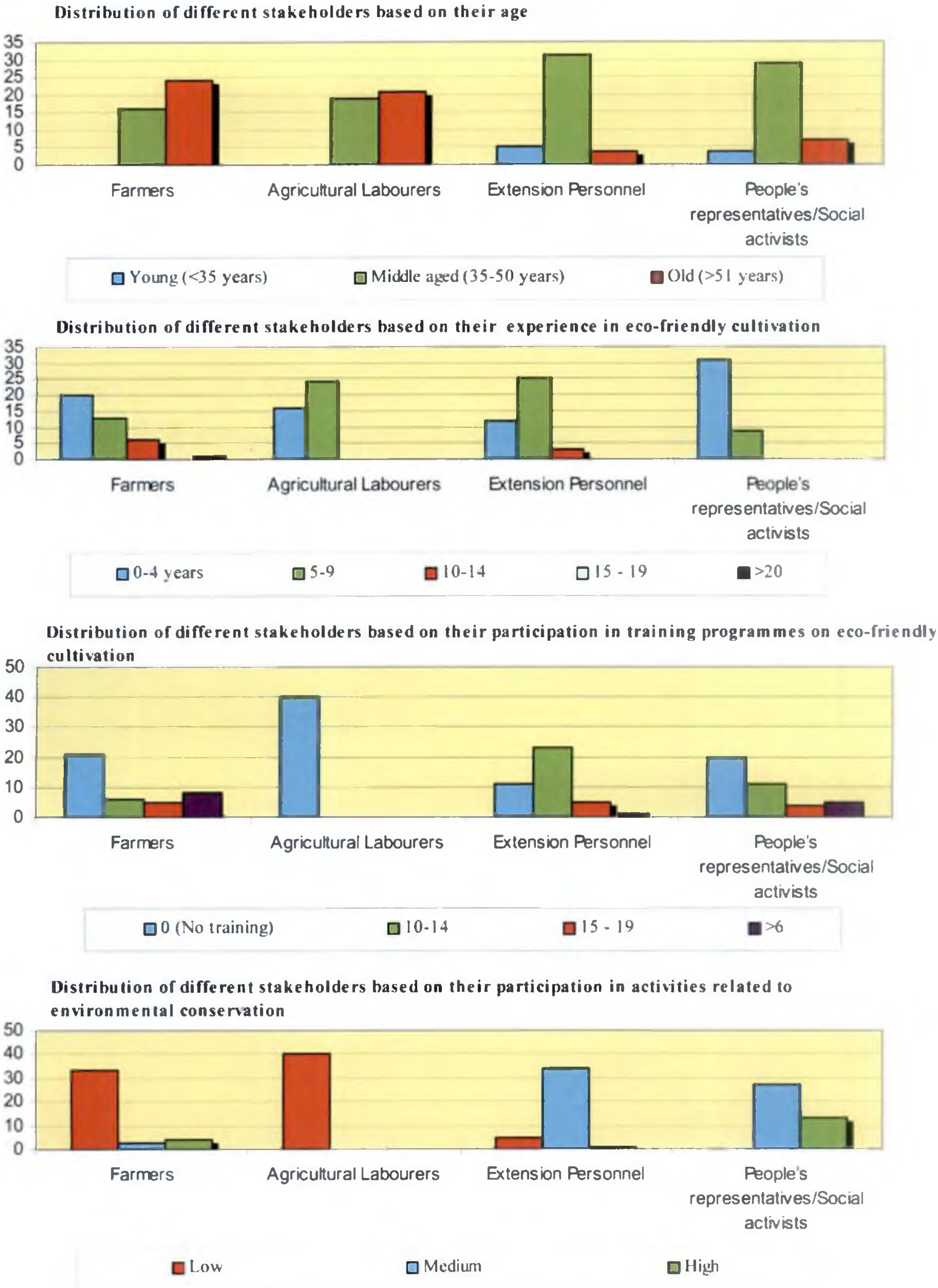


Fig. 3 Profile characteristics common for all stakeholders

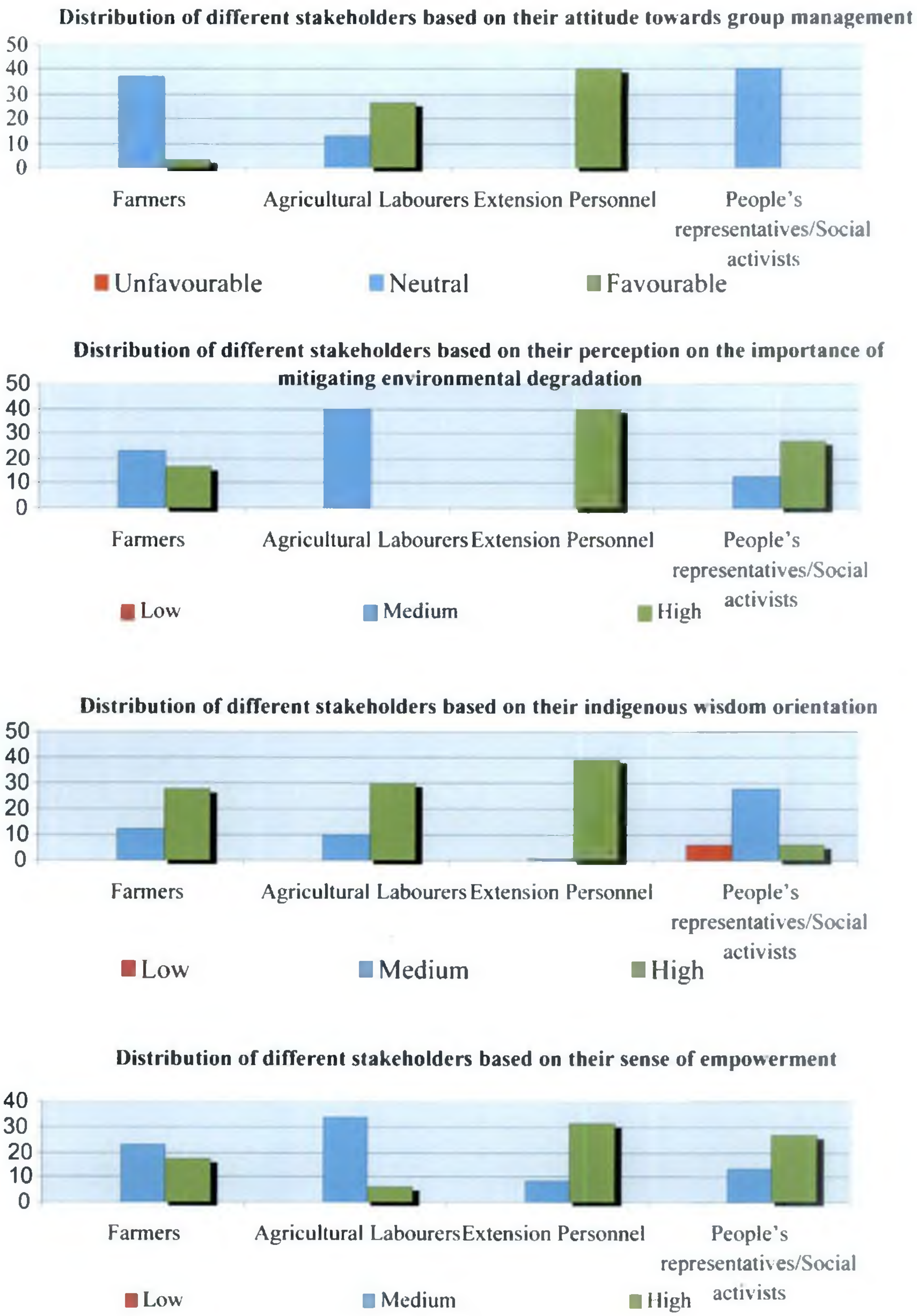


Fig. 4 Profile characteristics common for all stakeholders

The figures show that majority of the farmers and agricultural labourers belonged to the old age category which could be due to the lure of the youth for white collar jobs and due to the prevalent perception that farming is not a profitable livelihood option Most of the extension personnel belonged to the middle age category as their retirement age is 55 and those belonging to the old age category were very less in number in the study area People s representatives/social activists mostly belonged to the middle and old age group and it may be the due to the reason that gaining people s recognition as people s representatives/social activists necessarily requisites long term endeavor to the cause of social welfare The results are in line with that of Jayawardana (2007) and Allahyari and Chizari (2008b)

4 1 1 2 Experience in dealing with eco friendly rice cultivation

The figures presented in Table 1 indicated that half (50%) of the farmers had an experience in the range of 0-4 years while 32 5 per cent of the farmers had experience in eco friendly rice farming fo about 5 9 years and it was found that only 17 5 per cent farmers had an experience of more than 10 years in eco friendly rice cultivation Among the agricultural labourers 60 per cent had an experience between 5 and 9 years and 40 per cent had an experience in the range of 0 4 years It was observed that not even a single labourer had an experience of more than 10 years in eco friendly rice cultivation

The extension personnel were found to be distributed in the first three categories with a majority 62 5 per cent having experience in the range of 5 to 9 years Thirty per cent of the extension personnel were in 0 4 years experience category and only 7 5 per cent had an experience between 10 and 14 years The people s representatives/social activists were found to be restricted in the first two experience categories with a majority of 77 5 per cent having an experience between 0 and 4 years and 22 5 per cent having 5 to 9 years of experience

The probe indicates that 17 5 per cent farmers and 7 5 per cent of extension personnel had an experience of more than ten years and no respondents among agricultural labourers and people s representatives/social activists had more than 10 years of expenence The reason for very less number of respondents in the category of more than 10 years may be due to the fact that the concept of eco friendly farming and its techniques were popularized among the people only during the last decade Hence most of the respondents are less experienced in eco friendly cultivation of rice

4 1 1 3 Participation in training programmes on eco friendly cultivation

It is evident from Table 1 that majority of the stakeholders in the three categories *viz* Farmers (52 5%) agricultural labourers (100%) and people s representatives/social activists (50%) had received no training n eco friendly cultivation Majori y of the extension personnel (57 5% had rece d raining or eco friendly cultivation for 1 to 3 days whereas 27 5 per cent of the people s representatives/social activists and 15 per cent of farmers received tram ng for 1 to 3 days More than four days of trainings were attended by 32 5 per cent of farmers 15 per cent of extension personnel and 22 5 per cent of people s representatives/social activists

The results clearly indicate that majority of the farmers and people s representatives/social activists had not undergone any training on eco friendly cultivation It is very important to emphasize the fact that no agricultural labourer had attended any training programme The training programmes organized by the main stream agencies usually focus on training farmers But usually the trained farmers do not supervise and prefer to keep away from the field that the technologies do not reach the labour category This finding is a pointer emphasiz ng the need for organizing training programmes for the labourers where by sustainable agriculture can be made a reality The result is in line with the studies of Devi (2007) where she found that the pesticide applicators were not trained even to understand the level of toxicity

4 1 1 4 Participation in activities related to environmental conservation

Low level of participation (4 to 9) in environment related activities was shown by 82 5 per cent of the farmers while a meager 10 per cent had high level of participation with scores in the range of 16 to 21 All the agricultural labourers exhibited low level of participation the scores being 4 to 9 Majority (85%) of the extension personnel fell into the medium category with scores ranging from 10 to 15 While 67 5 per cent of the people s representatives/social activists had shown medium level of participation 32 5 per cent had high level of participation n environmental activities

The first two categories of stakeholders *viz* farmers and agricultural labourers were rated low in their participation in activities related to environmental conservation and the reason might be the disinterest and shortage of time as they were completely involved in farming activities whereas extension personnel had shown medium level of participation as the agriculture department work through them It is a known fact that people s representatives/social activists exhibit h gh sociability and leadership qualities which logically explain their high level of participation in all social activities especially those related with environment

4 1 1 5 Attitude towards group management

The distribution pattern of respondents based on their attitude towards group management is presented in Table 1 A perusal of the above data indicates that only 7 5 per cent of the farmers had favourable attitude towards group management approaches whereas 92 5 per cent of them were in the neutral category With respect to the agricultural labourers majority (67 5%) belonged to the favourable category while 32 5 per cent were neutral in their stance All the extension personnel and people s representatives were found to be favourable and neutral respectively in their attitude towards group management

Group farming programme in rice cultivation covering the whole state was introduced during 1989 90 This had created a positive impact among small and marginal farmers of the state Possession of larger area by individual farmers and an undulating topography of the study area might have been the major reasons for the neutral attitude on group approach among the farmers Moreover the respondents had opined that group approaches were not effectively practiced in the eastern belt of Palakkad district The observation made is against the findings of Surendran

(2000) and in line with Hussain (1992) who reported that 67 64 per cent of farmers were in the neutral category The lack of respondents in the unfavourable category could be due to the reason that the respondents would have developed confidence in group management efforts that had increased the yield when compared to the traditional approach The availability of inputs was also made easy through *padashekarams* in the group approach The results of the study also draw support from the findings of Ghosal (1982) and Mohanan (1989) where they inferred that the farmers had expressed positive attitude towards group farming

4 1 1 6 Perception of stakeholders on the importance of mitigating environmental degradation

An examination of Table 1 reveals that majority of the farmers (57 5%) had medium level of perception on the importance of mitigating environmental degradation followed by 42 5 per cent possessing higher level of perception All (100%) the labourers possessed a medium level of perception whereas all the extension personnel had a high level of perception on the importance of mitigating environmental degradation Majority of the people s representatives/social activists possessed high level (67 5%) of perception followed by 32 5 per cent with medium level of perception on the importance of mitigating environmental degradation

The high level of perception about the importance of mitigating environmental degradation among extension personnel and people s representatives/social activists could be attributed to their role in the society as change agents All the farmers belonged to the medium and high categories whereas the labourers had shown medium level of perception which could be attributed to comparatively low environmental awareness and concerns

4 1 1 7 Indigenous wisdom orientation

The figures presented in Table 1 reveals that majority of the farmers (70%) had high orientation to indigenous wisdom followed by a 30 per cent in the medium category Most of the agricultural labourers had shown a high level (75%) of indigenous wisdom orientation whereas majority of the people s representatives/social activists fell into the medium category (70%) of indigenous wisdom orientation High orientation to indigenous wisdom was exhibited by 97 5 per cent of the extension personnel

The overall figure indicates that majority of the farmers agricultural labourers and extension personnel possessed a high level of indigenous wisdom orientation whereas the people s representatives/social activists belonged to medium category This could be due to the fact that those who were directly related with the farming activities had a higher level of indigenous wisdom orientation Even today most of the farmers and agricultural labourers adopt indigenous practices followed by their ancestors The effectiveness of these technologies would have resulted in a better orientation towards indigenous wisdom

4 1 1 8 Sense of empowerment

As is revealed from Table1 majority of the farmer respondents belonged to the medium level (57 5%) of empowerment followed by 42 5 per cent who possessed high level of empowerment with scores more than or equal to 55 In the case of labourers most of them possessed medium sense of empowerment (85%) Majority of the extension personnel (77 5%) and people s representatives/social activists (67 5%) exhibited a high sense of empowerment

Different levels of sense of empowerment as perceived by stakeholders shall be attributed to their educational status and their status in the society The agricultural labourers had a very low participation in decision making with farmers and most of them performed duties as directed by the farmers which might be another reason for their medium level of empowerment

Common profile characteristics for farmers agricultural labourers and people s representatives / social activists

4 1 1 9 Educational status

An analysis of the educational status of the stakeholders (Table 2) reveals that almost half of the farmers (47 5%) possessed high school education while one fifth (20%) of them were found to possess middle school education Only 2 5 per cent of the farmers were graduates Majority of the agricultural labourers were illiterate (60%) followed by 32 5 per cent having primary school education None of them had education above high school level In the case of people s representatives/social activists 35 per cent were graduates and one fou [illegible] of them were educated up to the high school level Five per cent were post graduates and there were no illiterates in this category of stakeholders

It was interesting to note that there were no illiterates among the farmers and people s representatives/social activists Most of the farmers were high school educated while 60 per cent of the people s representatives/social activists were graduates and post graduates The category of people s representatives/social activists included 50 per cent of young social activists belonging to Sastra Sahithya Parishad and other environmental groups who were highly educated As the younger generation was reluctant to take up jobs as agricultural labourers and as most of the labourers in the paddy sector were women due to migration of male labourers to other jobs the literacy rate was found to be very low among the agricultural labourers

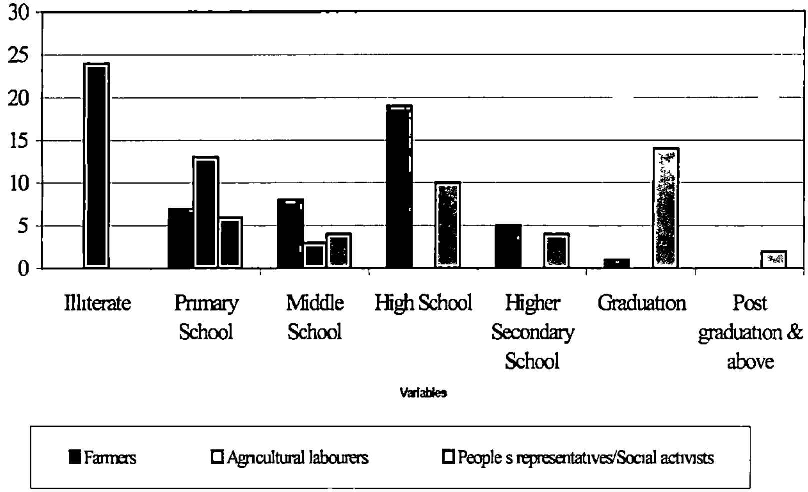
4 1 1 10 Political orientation

It is evident from Table 2 that all the three category of respondents *viz* farmers (90%) agricultural labourers (90%) and people s representatives (100%) exhibited a high level of political orientation Only 10% each of farmers and agricultural labourers indicated medium level of orientation towards politics

Table 2 Dıstrıbutıon of farmers agrıcultural labourers and people's representatıve socıal actıvısts based on their educatıonal status and polıtıcal orıentatıon

Sl No	Variable	Category	Farmers n=40		Agricultur ıl Labourers n=40		People s representatives/ Social activists n–40	
			Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1	Educational status	Illiterate	0	0	24	60	0	0
		Primary School	7	17 5	13	32 5	6	15
		Middle School	8	20	3	7 5	4	10
		High School	19	47 5	0	0	10	25
		Higher Secondary School	5	12 5	0	0	4	10
		Graduation	1	2 5	0	0	14	35
		Post graduation & above	0	0	0	0	2	5
2	Political orientation	Low	0	0	0	0	0	0
		Medium	4	10	4	10	0	0
		High	36	90	36	90	40	100

Distribution of farmers agricultural labourers and people s representatives based on their educational status



Distribution of farmers agricultural labourers and people's representatives based on their political orientation

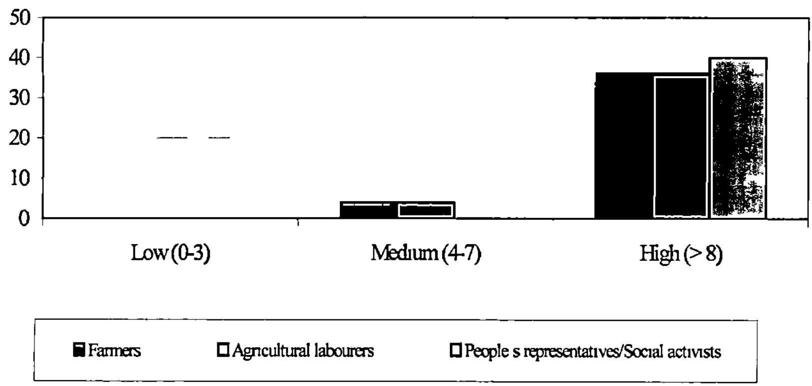


Fig. 5 Common profile characteristics for farmers, agricultural labourers and people's representatives/social activists

The result reveals that most of the farmers were very much interested and involved in political activities and felt that their fundamental rights would be protected only through political interventions and group action in a democracy Politically charged and enlightened society of Kerala is an important reason for developing such an orientat on of the categories towards politics even among the illiterate agricultural labourers The historic and landmark legislation of land reforms in Kerala in 1957 consequent to several agrarian struggles along with independence movement and immediately after independence All these substantiate the result which is also similar to the findings of Geetha (2002) and Kumaran (2008)

Common profile characteristics for farmers and agricultural labourers

4 1 1 11 Knowledge on eco friendly practices in rice cultivation

As is obvious from Table 3 majority of the farmers possessed a high level of knowledge (67 5%) with scores more than 10 followed by 32 5 per cent belonging to medium knowledge category In the case of agricultural labourers all the respondents (100%) possessed a medium knowledge level

Table 3 Distribution of farmers and agricultural labourers based on their knowledge on eco friendly practices in rice cultivation

Sl No	Variable	Category	Farmers n–40		Agricultural labourers n–40	
			Frequency	%	Frequency	%
1	Knowledge on eco friendly practices in rice cultivation	Low	0	0	0	0
		Medium	13	32 5	40	100
		High	27	67 5	0	0

High knowledge level in eco friendly farming is an important pre requisite to undertake sustainable farming The information and communication technologies (ICT) available together with the support for promotion of eco friendly rice cultivation provided by both the central and state governments and other agencies might have helped the farmers to know more about eco friendly cultivation practices in rice that resulted in their high knowledge level Many a time training attended by the farmers were not well organized and of poor quality Besides their communication of information to the labourers might have resulted in distortion This might be the reason why the labourers had medium knowledge level This finding is in agreement with the studies of Jaganathan (2004) and Jayawardana (2007)

Common profile characteristics of agricultural labourers and extension personnel

4 1 1 12 Participation in decision making with farmers

An examination of Table 4 indicates that 97 5 per cent of the agricultural labourers had low participation in decision making with farmers No respondent in this category had a high level of participation in decision making It was noticed that 90 per cent of the extension personnel had medium level of participation whereas 7 5 per cent had high level of involvement in decision making with farmers

Table 4 Distribution of agricultural labourers and extension personnel based on their participation in decision making with farmers

Sl No	Variable	Category	Agricultural labourers n–40		Extension personnel n–40	
			Frequency	%	Frequency	%
1	Participation in decision making	Low	39	97 5	1	2 5
		Medium	1	2 5	36	90
		High	0	0	3	7 5

In the past farmers used to be more attached to permanent labourers with whom they discussed every farm operation But at present due to less number of permanent labourers farmers discuss farming with only a handful of old and experienced labourers on whom they still have faith and confidence that too on limited aspects mainly associated with labour availability This might be the reason for the low participation of labourers in decision making with farmers As far as extension personnel is concerned they have a better role to play in farming operations especially after the introduction of decentralized planning programme Formulation of development projects in agriculture and distribution of farm inputs are mainly carried out through Krishi Bhavans and hence the extension personnel had medium level of participation in decision making with farmers The results are in line with the observations of Padmanabhan (1981) and Ramanathan (1995)

Common profile characteristics for extension personnel and people s representatives/social activists

4 1 1 13 Leadership

Table 5 Distribution of extension personnel and people s representatives/social activists based on leadership traits

Sl No	Variable	Category	Extension personnel n–40		People s representatives/ Social activists n–40	
			Frequency	%	Frequency	%
1	Leadership	Low	1	2 5	0	0
		Medium	16	40	36	90
		High	23	57 5	4	10

The results presented in Table 5 indicate that more than half (57 5%) of the extension personnel possessed a high level of leadership followed by 40 per cent belonging to the medium category whereas 90 per cent of people s representatives/social activists belonged to the medium leadership category Ten per cent of this category of stakeholders possessed high level of leadership

The result indicates that majority of the extension personnel had high leadership quality which might be attributed to their exposure to more number of training programmes group discussions and interaction with people from across different strata of the society Moreover the situation in which they work warrant enhancement and fine tuning of their leadership skills Likewise people s representatives are elected by people by virtue of their leadership qualities and concern for social welfare Social activists are voluntary leaders inspired by intrinsic motivation and concern for people around him and who strive for the well being of the society and leads the people towards development This explains the possession of leadership traits by the respondents from medium to high level

Profile characteristics exclusively for farmers

4 1 1 14 Occupation

As is obvious from Table 6 92 5 per cent of the farmers had farming as the sole occupation while a meager 5 per cent of the respondents did farming along with some business Exactly 2 5 per cent of the respondents were in the service sector and farming was their subsidiary occupation But it was observed that no farmer was engaged as agricultural labourer

Table 6 Distribution of farmers based on their occupational status

n–40

Category	Frequency	Percentage
Farming as a sole occupation	37	92 5
Farming + Agricultural labour	0	0
Farming + Business	2	5
Farming + Service	1	2 5

Majority of the rice growers were old aged with farming as their traditional occupation Most of the farmers in eastern Palakkad possessed larger paddy area and farming is a way of living for them which might be the reason why majority of them had farming as their sole occupation

4 1 1 15 Livestock Possession

Table 7 Distribution of farmers based on livestock possession

n=40

Category (value)	Frequency	Percentage
< 5000	29	72 5
5001 10 000	0	0
10 001 15 000	0	0
15 001 20 000	2	5
20 001 and above	9	22 5

It ıs evıdent from Table 7 that majonty (72 5%) of the farmers possessed lıvestock of value less than or equal to 5000 whereas 22 5 per cent of the farmers had ın theır possessıon lıvestock worth 20 001 and above Thıs may be due to the fact that the lıvestock populatıon ın Kerala ıs declınıng day by day and farmers were not ınterested ın keepıng lıvestock as ıt was consıdered to be labour ıntensıve and less profitable But those who took up thıs enterpnse dıd ıt on a commercıal basıs wıth more number of anımals and bırds In the study of Jaganathan (2004) and Jayawardana (2007) majonty of the respondents had medıum level of lıvestock possessıon

4 1 1 16 Rısk Orıentatıon

Table 8 Dıstrıbutıon of farmers based on rısk orıentatıon

n–40

Category	Frequency	Percentage
Low	0	0
Medıum	5	12 5
Hıgh	35	87 5

It may be observed from Table 8 that majonty of the respondents (87 5%) possessed hıgh levels of nsk onentatıon Only 12 5 per cent of respondents were havıng medıum nsk onentatıon The hıgh level of nsk takıng abılıty was attnbuted to the massıve schemes for paddy cultıvatıon sponsored by the natıonal and state governments lıke Natıonal Food Secunty Mıssıon (NFSM) and sustaınable development of nce respectıvely that cater to the mechanızatıon and ınput needs of farmers at subsıdy rates State government ıs procurıng paddy at the rate of Rs 12/kg whıch has become a boon to the paddy farmers Crop ınsurance ıs taken care of by the Samrudhı programme at *grama panchayat* level whıch ınsures paddy crop at the rate of Rs 2500/ha All these ensured hıgher nsk takıng abılıty for farmers

4 1 1 17 Export Orientation

The figures presented in Table 9 implies that a large percentage (67 5%) of farmers showed medium level of export orientation while 32 5 per cent of them had a high level of orientation towards export

Table 9 Distribution of farmers based on export orientation

n=40

Category	Frequency	Percentage
Low	0	0
Medium	27	67 5
High	13	32 5

Majority of the farmers had medium level of orientation towards export of rice as they were aware of the prospects of export of organic rice But most of them opined that the procedure for certification was expensive and complex that made them sell their eco friendly produce in local markets at a price on par with inorganic rice not resulting in any substantial gain

4 1 1 18 Attitude towards extension interventions in popularizing eco friendly cultivation

A glance at Table 10 reveals that large proportion (77 5%) of the farmers had neutral attitude towards extension strategies in popularizing eco friendly rice cultivation Only 22 5 per cent had favourable disposition towards the extension strategies

Table 10 Distribution of farmers across different levels of attitudes towards extension interventions in popularizing eco-friendly cultivation

n–40

Category	Frequency	Percentage
Unfavourable	0	0
Neutral	31	77 5
Favourable	9	22 5

Majority of the farmers were of the opinion that the present extension system was not giving due importance in popularizing eco friendly rice cultivation which could be due to the fact that the extension personnel were mostly tied up with official works and hence could not make themselves available in the farmers field most of the time

Profile characteristics of extension personnel

4 1 1 19 Decision making ability with regard to eco friendly rice cultivation

A perusal of Table 11 reveals that 50 per cent each of the extension personnel had medium and high level of decision making ability No respondents had low ability in decision making pertaining to eco friendly rice cultivat on It could be observed from the table that extension personnel were capable of taking decisions independently Agricultural officers exhibited higher decision making ability than the Agricultural Assistants which might be due to their cadre superiority The finding is in line with that of Nath (2004) who reported that the Assistant Directors of Agriculture had higher decision – making ability and the Agricultural Assistants had the lowest decision making ability

Table 11 Distribution of extension personnel across different levels of decision making ability with regard to eco friendly rice cultivation

n 40

Category	Frequency	Percentage
Low	0	0
Medium	20	50
High	20	50

4 1 1 20 Communication effectiveness

A glance at Table 12 reveals that majority (90%) of the extension personnel exhibited high level of effectiveness in communication Most of the extension personnel possessed high level of leadership traits The fact that only an effective communicator can be a good leader explains the respondent s high level of effectiveness in communication

Table 12 Distribution of extension personnel based on communication effectiveness

n=40

Category	Frequency	Percentage
Low	0	0
Medium	4	10
High	36	90

4 1 1 21 Development functioning

A perusal of Table 13 reveals that majority of extension personnel belonged to neutral category (72 5%) in their perception on the functioning of our public system whereas 27 5 per cent of the respondents had an unfavourable opinion and no respondents had favourable disposition towards our public system

Table 13 Distribution of extension personnel based on their perception on development functioning

n=40

Category	Frequency	Percentage
Unfavourable	11	27 5
Neutral	29	72 5
Favourable	0	0

Prevalence of corruption lack of people s involvement and lack of co ordination between the departments might be the major reasons why majority of the extension personnel didn t have a favourable disposition towards the functioning of our public system Other reasons for neutral to unfavourable perception might be the tendency among our public officials to concentrate more and more powers in their hands rather than to delegate Issues related to superiority among employees reluctancy in owning responsibility and lack of transparency in management has also contributed to this kind of response

4 2 Other measurements relevant to eco friendly rice farming

4 2 1 Extent of influence exerted by various agencies in developing environmental concerns

A perusal of Table 14 reveals that majority (42 5%) of the farmers considered direct experience to be the major factor strongly influencing them in developing environmental concerns followed by a comparable 40 per cent reporting mass media to have very positively influenced them in developing environmental concerns Other factors that have very positively influenced them were peer group who were other farmers working with them (30%) and literature (25%) comprising of books magazines news paper etc A majority (60%) of the respondents were positively influenced by mass media in developing environmental concerns Similarly more than half (52 5%) of the respondent farmers were found to be positively influenced by literature while a comparable 50 per cent were positively influenced by their peer groups

It was revealed from the table that majority of the farmers were not influenced by external agents such as nature clubs (97 5%) teachers (90%) and NGOs (87 5%) in developing environmental concerns It was interesting to note that no respondent was negatively influenced by any of these agencies

An examination of Table 14 indicates that 32 5 per cent of the labourers were very positively influenced by mass media and 20 per cent were influenced very positively by their direct experience and peer groups in developing and nurturing environmental concerns Peer group and direct experience positively influenced 72 5 per cent of labourers while 65 per cent reported that they were positively influenced by mass media in inculcating environmental concerns Teachers (100%) NGOs (100%) and nature clubs (100%) had not exerted any influence in developing environmental concerns among labourers Literature (75%) too played a very little role in influencing agricultural labourers Table 14 revealed that among people s representatives/social activists literature (55%) direct experience (47 5%) and peer group (35%) were found to have very positive influence in developing environmental concerns Eighty five per cent opined that mass media positively

Table 14 Extent of influence exerted by various agencies in developing environmental concerns in different categories of stakeholders

Farmers n–40

Category	Teachers		NGOs		Literature		Peer group		Direct experience		Nature club		Mass media		Extension personnel		Internet	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Very Positive	1	2 5	1	2 5	10	25	12	30	17	42 5	1	2 5	16	40	3	7 5	1	2 5
Positive	3	7 5	4	10	21	52 5	20	50	11	27 5	0	0	24	60	4	10	0	0
Neutral	36	90	35	87 5	9	22 5	8	20	12	30	39	97 5	0	0	33	82 5	39	97 5
Negative	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Very negative	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Agricultural labourers n 40

Category	Teachers		NGOs		Literature		Peer group		Direct experience		Nature club		Mass media	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Very Positive	0	0	0	0	0	0	8	20	8	20	0	0	13	32 5
Positive	0	0	0	0	10	25	29	72 5	29	72 5	0	0	26	65
Neutral	40	100	40	100	30	75	3	7 5	3	7 5	40	100	1	2 5
Negative	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Very negative	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Extension personnel n–40

Category	Teachers		NGOs		Literature		Peer group		Direct experience		Nature club		Mass media	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Very Positive	7	17 5	15	37 5	23	57 5	19	47 5	20	50	0	0	19	47 5
Positive	8	20	21	52 5	16	40	20	50	19	47 5	15	37 5	20	50
Neutral	25	62 5	4	10	1	2 5	1	2 5	1	2 5	25	62 5	1	2 5
Negative	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Very negative	0	0	0	0	0	0	0	0	0	0	0	0	0	

People s representatives/social activists n 40

Category	Teachers		NGOs		Literature		Peer group		Direct experience		Nature club		Mass media	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Very Positive	1	2 5	3	7 5	22	55	14	35	19	47 5	3	7 5	4	10
Positive	17	42 5	33	82 5	14	35	23	57 5	19	47 5	14	35	34	85
Neutral	22	55	4	10	4	10	3	7 5	2	5	23	57 5	0	0
Negative	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Very negative	0	0	0	0	0	0	0	0	0	0	0	0	2	5

F Frequency

influenced them while a comparable 82 5 per cent were positively influenced by NGO s in developing environmental concerns Majority reported that they were not influenced by nature clubs (57 5%) and teachers (55%) It was also noticed that a small proportion (5%) of the respondents reported that they were sometimes very negatively influenced by advertisements in mass media

Literature direct experience and mass media/ peer group had very positively influenced 57 5 per cent 50 per cent and 47 5 per cent of the extension personnel respectively NGOs positively influenced 52 5 per cent respondents while a comparable 50 per cent were influenced positively by mass media and peer groups in developing environmental concerns Majority opined that nature clubs (62 5%) and teachers (62 5%) had never influenced them

To summarize the results direct experience and mass media had very positively influenced the process of developing environmental concerns of farmers and agricultural labourers respectively In case of extension personnel and peoples representatives/social activists literature had very positively influenced them As the last two categories were educated literature could have influenced them to a great extent whereas majority of the labourers who are illiterate were more dependent on mass media This might be the reason for predominant role of mass media in developing environmental concerns Farmers were of the opinion that their own experience of using inorganic inputs and its impacts that were visible to them was the major factor in developing environmental concerns

4 2 2 Preference of manures and fertilizers

The results on the pattern of preference of different categories of stakeholders with regard to manures and fertilizers are explained in Table 15 The results imply that exclusively inorganic means of nutrient management was preferred by majority of the farmers while taking into consideration labour cost (100%) ease of handling (100%) cost of cultivation (90%) and profitability (62 5%) Exclusively organic cultivation was preferred to the same extent on the production aspects viz quality of rice (67 5%) social health (67 5%) and human

Table 15 Preference of manures and fertilizers by different categories of stakeholders

Category	Profitability		Yield		Cost of cultivation		Ease of handling		Quality of rice		Soil health		Human health		Labour Cost	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Farmers																n 40
EIO	27	67 5	13	32 5	36	90	40	100	0	0	0	0	0	0	40	100
PIO	1	2 5	2	5	1	2 5	0	0	0	0	0	0	0	0	0	0
INM	7	17 5	12	30	0	0	0	0	4	10	0	0	0	0	0	0
PO	5	12 5	13	32 5	0	0	0	0	9	22 5	13	32 5	13	32 5	0	0
EO	0	0	0	0	3	7 5	0	0	27	67 5	27	67 5	27	67 5	0	0
Agricultural labourers																n–40
EIO	29	72 5	7	17 5	40	100	40	100	0	0	0	0	0	0	40	100
PIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INM	11	27 5	33	82 5	0	0	0	0	14	35	5	12 5	2	5	0	0
PO	0	0	0	0	0	0	0	0	10	25	11	27 5	11	27 5	0	0
EO	0	0	0	0	0	0	0	0	16	40	24	60	27	67 5	0	0
Extension personnel																n 40
EIO	17	42 5	0	0	27	67 5	27	67 5	0	0	0	0	0	0	37	92 5
PIO	3	7 5	3	7 5	1	2 5	8	20	0	0	0	0	0	0	0	0
INM	19	47 5	37	7	17 5	4	10	1	2 5	0	0	0	0	0	2	5
PO	1	2 5	0	0	5	12 5	1	2 5	8	20	3	7 5	1	2 5	1	2 5
EO	0	0	0	0	0	0	0	0	31	77	37	92 5	39	97 5	0	0
People s representatives social activ sts																n 40
EIO	26	65	6	15	36	90	36	90	0	0	0	0	0	0	37	92 5
PIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INM	10	25	26	65	1	2 5	0	0	6	15	1	2 5	1	2 5	2	5
PO	3	7 5	2	5	0	0	0	0	0	0	2	5	2	5	0	0
EO	1	2 5	6	15	3	7 5	4	10	34	85	37	92 5	37	92 5	1	2 5

EIO Exclusive Inorganic PIO Primarily Inorganic INM Integrated Nutrient Management PO Primarily organic EO Exclusively Organic health (67 5%) Taking into account human health soil health and yield 32 5 per cent each of the farmer respondents preferred primarily organic methods Thirty per cent of farmers preferred Integrated Nutrient Management taking into account the yield

Table 15 revealed that majority of the labourers preferred exclusively inorganic cultivation methods in nutrient management taking into account cost of cultiviation (100%) ease of handling (100%) labour cost (100%) and profitability (72 5%) Exclusively organic methods were preferred considering human health (67 5%) soil health (60%) and superior quality of rice (40%) Giving priority to yield and superior quality of rice 82 5 per cent and 35 per cent of agricultural labourers respectively preferred Integrated Nutrient Management

As revealed from Table 15 extension personnel preferred exclusively inorganic methods of nutrient management in case of production aspects like labour cost (92 5%) ease of handling (67 5%) and cost of cultivation (67 5%) They preferred Integrated Nutrient Management in case of yield (92 5%) and profitability (47 5%) Taking into account human health soil health and superior quality of rice 97 5 per cent 92 5 per cent and 77 5 per cent of the extension personnel respectively preferred exclusively organic methods An examination of Table 15 indicates that exclusively inorganic methods were preferred by the people s representatives/ social activists giving foremost priority to labour cost (92 5%) ease of handling (90%) cost of cultivation (90%) and to some extent profitability (65%) Integrated Nutrient Management was preferred by 65 per cent of this category with regard to yield Considering soil health and human health separately 92 5 per cent respondents preferred exclusively organic method of rice cultivation whereas 85 per cent voted exclusively organic method for superior quality of rice

Summarizing the results all the stakeholders preferred exclusively inorganic method of nutrient management considering labour cost ease of handling and cost of cultivation Taking into consideration profitability of rice cultivation farmers agricultural labourers and people s representatives preferred exclusively inorganic methods Exclusively organic methods were preferred by all the category of stakeholders with regard to production aspects *viz* soil health human health and perceived quality of rice Majority of the extension personnel peoples representatives and agricultural labourers preferred Integrated Nutrient Management taking into account yield while an almost equal percentage of farmers preferred Integrated Nutrient Management and primarily organic methods considering the yield of rice

The stakeholders general preference for exclusively inorganic method was owing to the fact that organic methods of nutrient management were mostly labour intensive Bulkiness difficulty and inconvenience in handling stench and filthy nature of organic manures compared to fertilizers were the reasons for their low preference Moreover non availability of organic manures and its transportation incurred a higher cost in organic rice cultivation As most of the stakeholders had medium to high level of environmental awareness and concerns a vast majority of them preferred exclusively organic methods for improving soil health human health and quality of rice

4 2 3 Preference of insect pest control methods

The pattern of preference of various insect pest control methods ranging from exclusively organic to exclusively inorganic methods is given in Table 16 The figures presented indicate that exclusively inorganic methods of insect pest control was preferred by majority of the farmers taking into account labour cost (97 5%) ease of handling (97 5%) cost of cultivation (92 5%) profitability (72 5%) and yield (50%) Majority (67 5%) farmers preferred exclusively organic methods of cultivation taking into consideration superior quality of rice soil health and human health while primarily organic method was preferred in the case of improvement in soil health and human health by 32 5 per cent each of the respondents

Table 16 reveals that exclusively inorganic methods of rice cultivation was preferred by majority of the agricultural labourers in most of the production aspects

Table 16 Preference of insect pest control methods by different categories of stakeholders

Category	Profitability		Yield		Cost of cultivation		Ease of handling		Quality of rice		Soil health		Human health		Labour Cost	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Farmers																n–40
EIO	29	72 5	20	50	37	92 5	39	97 5	0	0	0	0	0	0	39	97 5
PIO	3	7 5	1	2 5	2	5	1	2 5	0	0	0	0	0	0	1	2 5
IPM	5	12 5	11	27 5	0	0	0	0	1	2 5	0	0	0	0	0	0
PO	3	7 5	8	20	0	0	0	0	12	30	13	32 5	13	32 5	0	0
EO	0	0	0	0	1	2 5	0	0	27	67 5	27	67 5	27	67 5	0	0
Agricultural labourers																n 40
EIO	33	82 5	31	77 5	37	92 5	39	97 5	0	0	0	0	0	0	40	100
PIO	1	2 5	2	5	2	5	1	2 5	0	0	0	0	0	0	0	0
IPM	5	12 5	7	17 5	0	0	0	0	7	17 5	2	5	2	5	0	0
PO	1	2 5	0	0	1	2 5	0	0	10	25	11	27 5	11	27 5	0	0
EO	0	0	0	0	0	0	0	0	23	57 5	27	67 5	27	67 5	0	0
Extension personnel																n–40
EIO	16	40	3	7 5	25	62 5	25	62 5	0	0	0	0	0	0	27	67 5
PIO	1	2 5	0	0	8	20	4	10	0	0	0	0	0	0	7	17 5
IPM	11	27 5	29	72 5	5	12 5	8	20	0	0	0	0	0	0	5	12 5
PO	1	2 5	1	2 5	2	5	3	7 5	8	20	8	20	8	20	1	2 5
EO	11	27 5	7	17 5	0	0	0	0	32	80	32	80	32	80	0	0
People s representatives/social activists																n–40
EIO	27	67 5	14	35	34	85	36	90	0	0	0	0	0	0	37	92 5
PIO	1	2 5	0	0	2	5	1	2 5	0	0	0	0	0	0	0	0
IPM	2	5	13	32 5	0	0	0	0	3	7 5	0	0	0	0	0	0
PO	7	17 5	9	22 5	3	7 5	3	7 5	0	0	1	2 5	1	2 5	2	5
EO	3	7 5	4	10	1	2 5	0	0	37	92 5	39	97 5	39	97 5	1	2 5

EIO Exclusive Inorganic PIO Primarily Inorganic IPM Integrated Pest Management PO Primarily organic EO Exclusively Organic *viz* labour cost (100%) ease of handlıng (97 5%) and yield (77 5%) In improvement of soil and human health 67 5 per cent each of labourers preferred exclusively organic methods Exclusively organic method of insect pest control was preferred by 57 5 per cent of the labourers considering the superior quality of rice

As is revealed by Table 16 on account of labour cost (67 5%) ease of handling (62 5%) cost of cultivation (62 5%) ad profitability (40%) majority of the extension personnel preferred exclusively inorganic method of insect pest control Considering the yield aspect 72 5 per cent of the extension personnel preferred Integrated Pest Management Majority of the extension personnel voted for exclusive organic methods of insect pest control considering the three production aspects *viz* superior quality of rice (80%) soil health (80%) and human health (80%)

An examination of Table 16 indicates that most of people s representatives/social activists preferred exclusively inorganic methods while taking into consideration labour cost (92 5%) ease of handling (90%) cost of cultivation (85%) and profitability (67 5%) Thirty five per cent respondents considering the yield aspect preferred exclusively inorganic insect pest control method while a comparable 32 5 per cent respondents voted for Integrated Pest Management Majority of this category of stakeholders preferred exclusively organic methods for soil health (97 5%) human health (97 5%) and superior quality of rice (92 5%)

In brief it is clear from the table that taking into account labour cost ease of handling cost of cultivation and profitability all the stakeholders preferred exclusively inorganic method of insect pest control Farmers and agricultural labourers considering yield also preferred exclusively inorganic method Inorganic methods involved pesticides which were easy to handle and involved a very little labour thus reducing the cost of cultivation and thereby a higher profitability Considering the soil health human health and quality of rice all the stake holders preferred exclusively organic methods which may be deemed true in the wake of the fact that most of the respondents belonged to category havıng medıum and hıgh level of envıronmental awareness and concerns and most of them were aware of the ecologıcal ımpacts of ınorganıc farmıng

4 2 4 Preference of dısease control methods

The results on the pattern of preference of dıfferent categories of stakeholders wıth regard to dısease control methods rangıng from exclusıvely organıc to exclusıvely ınorganıc are explaıned ın Table 17 The figures presented ındıcates that exclusıvely ınorganıc method was preferred by majority of the farmers on account of most of the productıon aspects vız labour cost (97 5%) ease of handlıng (97 5%) cost of cultıvatıon (97 5%) profitabılıty (77 5%) and yıeld (50%) Most of the respondents preferred exclusıvely organıc methods of dısease control ın rice takıng ınto account human health (67 5%) soıl health (67 5%) and superior qualıty of rice (67 5%) whereas 32 5 per cent each preferred primarily organıc methods consıdering human health and soıl health

A perusal of Table 17 revealed that exclusıvely ınorganıc method of dısease control was preferred by majority of the extensıon personnel consıdering the productıon aspects *vız* ease of handlıng (72 5%) labour cost (67 5%) cost of cultıvatıon (62 5%) and profitabılıty (40%) For a better yıeld 72 5% of thıs category of stakeholders preferred Integrated Dısease Management Most of the respondents voted for exclusıvely organıc method of dısease control on account of human health (80%) superior qualıty of rice (77 5%) and soıl health (72 5%)

An examınatıon of the table of the people s representatıves /socıal actıvısts ındıcate that most of them had a lıkeness towards exclusıvely ınorganıc methods whıle takıng ınto consıderatıon labour cost (92 5%) ease of handlıng (85%) cost of cultıvatıon (85%) and profitabılıty (67 5%) ınvolved ın dısease control Thirty five per cent of thıs category of stakeholders preferred exclusıvely ınorganıc method whıle a comparable 32 5 per cent preferred Integrated Dısease Management consıdering the yıeld Consıdering human health soıl health and superior qualıty of rice 97 5 per cent 97 5 per cent and 92 5 per cent respectıvely of the people s representatıves/socıal actıvısts preferred exclusıvely organıc methods of dısease control

Table 17 Preference of dısease control methods by dıfferent categorıes of stakeholders

Category	Profitabılıty		Yıeld		Cost of cultıvatıon		Ease of handlıng		Qualıty of rıce		Soıl health		Human health		Labour Cost	
	Frequency	%	Frequency	%	Freque cy	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Farmers																n 40
EIO	31	77 5	20	50	39	97 5	39	97 5	0	0	0	0	0	0	39	97 5
PIO	1	2 5	1	2 5	1	2 5	1	2 5	0	0	0	0	0	0	1	2 5
IDM	5	12 5	11	27 5	0	0	0	0	1	2 5	0	0	0	0	1	2 5
PO	3	7 5	8	20	0	0	0	0	12	30	13	32 5	13	32 5	0	0
EO	0	0	0	0	0	0	0	0	27	67 5	27	67 5	27	67 5	0	0
Agrıcultural labourers																n 40
EIO	36	90	34	85	37	92 5	39	97 5	0	0	0	0	0	0	40	100
PIO	1	2 5	1	2 5	2	5	1	2 5	0	0	0	0	0	0	0	0
IDM	2	5	5	12 5	0	0	0	0	7	17 5	2	5	2	5	0	0
PO	1	2 5	0	0	01	2 5	0	0	10	25	11	27 5	11	27 5	0	0
EO	0	0	0	0	0	0	0	0	23	57 5	27	67 5	27	67 5	0	0
Extension personnel																n 40
EIO	16	40	3	7 5	25	62 5	29	72 5	0	0	0	0	0	0	27	67 5
PIO	5	12 5	0	0	11	27 5	3	7 5	0	0	0	0	0	0	5	12 5
IDM	11	27 5	29	72 5	3	7 5	4	10	0	0	0	0	0	0	3	7 5
PO	1	2 5	1	2 5	0	0	4	10	9	22 5	11	27 5	8	20	5	12 5
EO	7	17 5	7	17 5	1	2 5	0	0	31	77 5	29	72 5	32	80	0	0
People s representatives/socıal actıvısts																n 40
EIO	27	67 5	14	35	34	85	0	0	0	0	0	0	0	0	37	92 5
PIO	1	2 5	2	5	2	5	2	5	0	0	0	0	0	0	2	5
IDM	2	5	13	32 5	0	0	0	0	3	7 5	0	0	0	0	0	0
PO	7	17 5	7	17 5	3	7 5	3	7 5	0	0	1	2 5	1	2 5	1	2 5
EO	3	7 5	4	10	1	2 5	1	2 5	37	92 5	39	97 5	39	97 5	0	0

EIO Exclusıve Inorganic PIO Prımarıly Inorganıc IDM Integrated Dısease Mınagement PO Prımarıly organıc EO Exclusıvely Organıc

The result is almost similar to that of the preference of stakeholders for insect pest control methods Here most of the stakeholders were inclined towards exclusively inorganic methods considering the production aspects *viz* labour cost ease of handling cost of cultivation and profitability Most of the farmers and agricultural labourers had a likeness towards exclusively inorganic disease control methods considering the yield whereas extension personnel preferred Integrated Disease Management for a higher yield Majority of the stakeholders preferred exclusively organic methods for better soil health human health and quality of rice

4 2 5 Preference of weed control methods

The pattern of preference of weed control methods ranging from exclusively organic which is mostly manual to exclusively inorganic methods involving herbicides is given in Table 18 An examination of the table of farmers indicates that they had an inclination towards exclusively inorganic methods of weed control with regard to labour cost (100%) ease of handling (100%) cost of cultivation (100%) profitability (92 5%) and yield (50%) Considering human health soil health and superior quality of rice 67 5 per cent 67 5 per cent and 65 per cent of the farmers respectively preferred exclusively organic methods

Table 18 reveals that majority of agricultural labourers preferred exclusively inorganic methods of weed control with regard to labour cost (100%) ease of handling (100%) cost of cultivation (100%) and profitability (90%) Considering the yield aspect 52 5 per cent of the labourers preferred Integrated Weed Management Exclusively organic methods of weed control were preferred by majority of the labourers on the production aspects *viz* human health (67 5%) soil health (67 5%) and superior quality of rice (55%) while 27 5 per cent 27 5 per cent and 22 5 per cent each preferred primarily organic methods on the production aspects like human health soil health and superior quality of rice respectively

Table 18 Preference of weed control methods by different categories of stakeholders

Category	Profitability		Yield		Cost of cultivation		Ease of handling		Quality of rice		Soil health		Human health		Labour Cost	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Freque cy	%	Frequency	%	Frequency	%
Farmers																n 40
EIO	37	92 5	20	50	40	100	40	100	0	0	0	0	0	0	40	100
PIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IWM	3	7 5	12	30	0	0	0	0	3	7 5	0	0	0	0	0	0
PO	0	0	8	20	0	0	0	0	11	27 5	13	32 5	13	32 5	0	0
EO	0	0	0	0	0	0	0	0	26	65	27	67 5	27	67 5	0	0
Agricultural labourers																n 40
EIO	36	90	19	47 5	40	100	40	100	0	0	0	0	0	0	40	100
PIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IWM	4	10	21	52 5	0	0	0	0	9	22 5	2	5	2	5	0	0
PO	0	0	0	0	0	0	0	0	9	22 5	11	27 5	11	27 5	0	0
EO	0	0	0	0	0	0	0	0	22	55	27	67 5	27	67 5	0	0
Extension personnel																n 40
EIO	24	60	11	27 5	33	82 5	36	90	0	0	0	0	0	0	31	77 5
PIO	3	7 5	7	17 5	3	7 5	3	7 5	0	0	0	0	0	0	5	12 5
IWM	9	22 5	9	22 5	3	7 5	0	0	0	0	0	0	0	0	3	7 5
PO	4	10	13	32 5	1	2 5	1	2 5	8	20	8	20	8	20	1	2 5
EO	0	0	0	0	0	0	0	0	32	80	32	80	32	80	0	0
People s representatives/social activists																n–40
EIO	33	82 5	11	27 5	36	90	36	90	0	0	0	0	0	0	37	92 5
PIO	2	5	4	10	2	5	2	5	0	0	0	0	0	0	2	5
IWM	0	0	16	40	0	0	0	0	1	2 5	0	0	0	0	0	0
PO	4	10	7	17 5	2	5	2	5	3	7 5	1	2 5	1	2 5	1	2 5
EO	1	2 5	2	5	0	0	0	0	36	90	39	97 5	39	97 5	0	0

EIO Exclusive Inorganic **PIO** Primarily Inorganic **IWM** Integrated Weed Management **PO** Primarily organic **EO** Exclusively Organic

The results presented in Table 18 imply that exclusively inorganic methods of weed control was preferred by majority of the extension personnel on account of various aspects of production *viz* ease of handling (90%) cost of cult vat on (82 5%) labour cost (77 5%) and profitability (60%) On the yield aspect of rice production 32 5 per cent of the extension personnel had an inclination towards primarily organic weed control methods Majority of the respondents preferred exclusively organic methods taking into consideration human health (80%) soil health (80%) and superior quality of rice (80%)

A perusal of Table 18 revealed that exclusively inorganic methods of weed control was preferred by majority of the people s representatives/social activists considering labou cost (92 5%) ease of handling (90%) cost of cultivation (90%) and profitability (82 5%) Forty per cent of the respondents giving priority to the yield aspect preferred Integrated weed management methods whereas giving foremost priority to human health (97 5%) soil health (97 5%) and superior quality of rice (90%) majority of the farmers had an inclination towards exclusively organic methods of weed control

In the preference towards weed control methods a vast majority of stakeholders opted exclusively inorganic methods on the production aspects *viz* labour cost ease of handling cost of cultivation and profitability This may be due to the fact that inorganic weed control methods using weedicides involved a few labourers thus reducing labour cost and thereby the cost of cultivation This in turn would increase their net profitability Majority of the stakeholders considering human health soil health and quality of rice preferred organic weed control methods involving manual labour As most of the stakeholders have medium to high level of environmental awareness and concern they were aware about the environmental impacts of herbicide application

4 2 6 Effectiveness of the supply of inputs for eco friendly rice farming

An examination of Table 19 indicates that majority of the farmers always obtained seeds as per their requirement in sufficient quantity (60%) and on time (60%) Most of the respondents could always procure seeds at the current market rate (97 5%) and with easiness in transportation (100%) This may be due to the fact that most of the farmers in the study area saved a portion of their harvest for seed purpose and hence did not depend on any public or private agency for this input Most of the farmers reported that they could not rely on external agencies for quality seeds due to poor germination percentage

Majority of the farmers reported that they obtained manures in required quantities (60%) on time (60%) and with transportation easiness (52 5%) only at times Most of the farmers never procured organic manure at the current market rate (77 5%) Non availability of organic manure is the major constraint faced by the farmers in eco friendly rice farming Most of the farmers depend on external agencies for this input Diminishing livestock population make organic manure considerably unavailable Transportation has been found to be major constraint Area and customer wise price fluctuation in the case of organic manure especially Farm Yard Manure was noticed throughout the study area that ranged from Rs 800 to Rs 1200 per 1000kg

Organic plant protection inputs were available in sufficient quantities (82 5%) and on time (82 5%) only at times They were not always available at the market rate (77 5%) Fifty per cent of the respondents didn t have any problem in transporting these inputs There were no registered input agencies exclusively for organic plant protection inputs Hence its availability on time was not assured As is revealed by Table 11 majority of the respondents found that irrigation water was available in required quantity only sometimes (80%) and on time (82 5%) but always (92 5%) with transportation easiness The reason for such a response might be due to the fact that the study areas were the drought hit regions of Palakkad district and paddy cultivation here entirely depended on the dam water As the main canals and channels were well laid transportation of water was not a problem to the local people

Most of the farmers were satisfied with the existing credit system as they could always avail loans for the amount they needed (100%) which was available on time (100%) and at current bank rate (100%) Majority of the farmers were of the opinion that credit disbursement by the banks were on time with no delay Most of them opined that interest free loans were a boon to the paddy farmers

Table 19 Effectiveness of the supply of inputs for eco friendly rice farming

n = 40

Category	Seeds								Manures								Organic plant protection inputs							
	SQ		OT		CMR		TE		SQ		OT		CMR		TE		SQ		OT		CMR		TE	
	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P
A ways	24	60	24	60	39	97 5	40	100	9	22 5	9	22 5	9	22 5	11	27 5	4	0	4	10	9	22 5	20	50
Some t mes	16	40	6	40	0	0	0	0	24	60	24	60	0	0	21	52 5	33	82 5	33	82 5	3	77 5	5	37 5
Neve	0	0	0	0	1	2 5	0	0	7	7 5	7	7 5	31	77 5	8	2	3	7 5	3	7 5	0	0	5	2 5

Category	Irrigation water						Credit					
	SQ		OT		TE		CQ		OT		CMR	
	F	P	F	P	F	P	F	P	F	P	F	P
A ways	5	12 5	5	2 5	37	92 5	40	00	40	00	40	00
Some mes	32	80	33	82 5	3	7 5	0	0	0	0	0	0
Neve	3	7 5	2	5	0	0	0	0	0	0	0	0

SQ Sufficient Quantity **OT** – On Time **CMR** Current Market Rate **TE** Easiness in transj ortation

Peterson (1997) reported that farmers need ınputs to ıncrease productıon but access to these ıs the major problem to majority of the farmıng communıty

4 2 7 Polıtıcal affılıatıon

A glance at Table 20 reveals that majority of the farmers had an affılıatıon towards lıberal democratıc (60%) followed by 17 5 per cent who were ınclıned towards lıberal left In thıs category 10 per cent were non polıtıcal The attıtude of labourers wıth respect to thıs ındependent varıable was dıfferent wıth majority of them ınclıned towards the left polıtıcal ıdeologıes (57 5%) followed by 27 5 per cent affılıated to lıberal left category The percentage of agrıcultural labourers who were non polıtıcal were sımılar to that of the farmer group (10%) Majority of the people s representatıves/socıal actıvısts had an affılıatıon towards the left category (72 5%) whereas only 15 per cent were ınclıned towards the lıberal democratıc category The fındıngs regardıng agrıcultural labourers ıs ın lıne wıth the study of Prasıdha (2006)

Table 20 Dıstrıbutıon of farmers agrıcultural labourers and people s representatıves / socıal actıvısts based on theır polıtıcal affılıatıon

Varıable	Category	Farmers n–40		Agrıcultural labourers n–40		People s representatıves/ Socıal actıvısts n–40	
		Frequency	%	Frequency	/	Frequency	
Polıtıcal affıl atıon	Rıght conservatıve	0	0	0	0	0	0
	Lıberal democratıc	24	60	2	5	6	15
	Liberal left	7	17 5	11	27 5	4	10
	Left	4	10	23	57 5	29	72 5
	Radıcal left	1	2 5	0	0	0	0
	Non polıtıcal	4	10	4	10	1	2 5

Environmental concerns

Concern for environment is a very important attribute deciding extent of adoption of eco friendly practices in rice cultivation and the distribution of various categories of stakeholders based on their environmental concerns are presented in the table below

Table 21 Distribution of different categories of stakeholders based on environmental concerns

Category	Farmers n–40		Agrl Labourers n–40		Extension personnel n–40		People s rep/social activists n–40	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Low	1	2 5	0	0	0	[illegible]	[illegible]	0
Medium	19	47 5	34	85	0	0	7	17 5
High	20	50	6	15	40	100	33	82 5

A probe into the Table 21 reveals that one half of the farmer respondents (50%) had high level of environmental concerns followed by a comparable 47 5 per cent with medium level of concerns Most of the agricultural labourers (85%) possessed medium level of environmental concerns while cent percent of extension personnel and 82 5 per cent of people s representatives/social activists had high concern for environment

To summarize the results all the extension personnel and a vast majority of people s representatives had high concern for environment which might be due to their high perception on the importance of mitigating environmental degradation and environmental awareness It might also be attributed to their role in the society as change agents promoting and popularizing sustainable agriculture Farmers had high to medium level of environmental concerns that could be explained by their high to medium level of perception on the importance of mitigating environmental degradation and high awareness on environmental aspects Most of the agricultural labourers had medium level concern for environment which might be attributed to their moderate level of perception on the importance of mitigating environmental degradation and environmental awareness As far as the farmers are concerned profitability yield and cost of cultivation have been found to be the major production aspects which are important as their livelihood solely depends on farming Medium level concerns of labourers might be attributed to the interface of the opposing interests related to the drudgery involved in eco friendly farming and its safety pertaining to the health of labourers which reduces occupational hazards Recently the concept of sustainability too was gaining momentum among these respondents which in turn had led to medium to high level of concern for environment shown by them

4 3 Environmental awareness

Environmental awareness is a pre requisite in developing concern for environment and hence the distribution of stakeholders based on environmental awareness is given in the table below

Table 22 Distribution of different categories of stakeholders based on environmental awareness

Category	Farmers n=40		Agri Labourers n=40		Extension personnel n=40		People s rep/social activists n=40	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Low	0	0	0	0	0	0	0	0
Medium	8	20	40	100	0	0	0	0
High	32	80	0	0	40	100	40	100

Eighty per cent of the farmers all the extension personnel and people s representatives had high level of awareness on the environmental aspects of rice farming whereas all the labourers and 20 per cent of the farmers had medium level of awareness The reason for high level of awareness in the former three categories may be ascribed to their higher educational status when compared to the agricultural labourers 60 per cent of whom were illiterates The first two categories were the change agents in the society with leadership traits who were more exposed to current development trends in the world Use of Information and Communication Technologies (ICT) is more frequent in the case of this category of respondents Moreover they also get better exposure on environmental aspects through various training programmes Farmers are educationally and financially better than labourers which explains higher environmental awareness of farmers compared to

Fig.6 Distribution of different categories of stakeholders based on environmental concerns

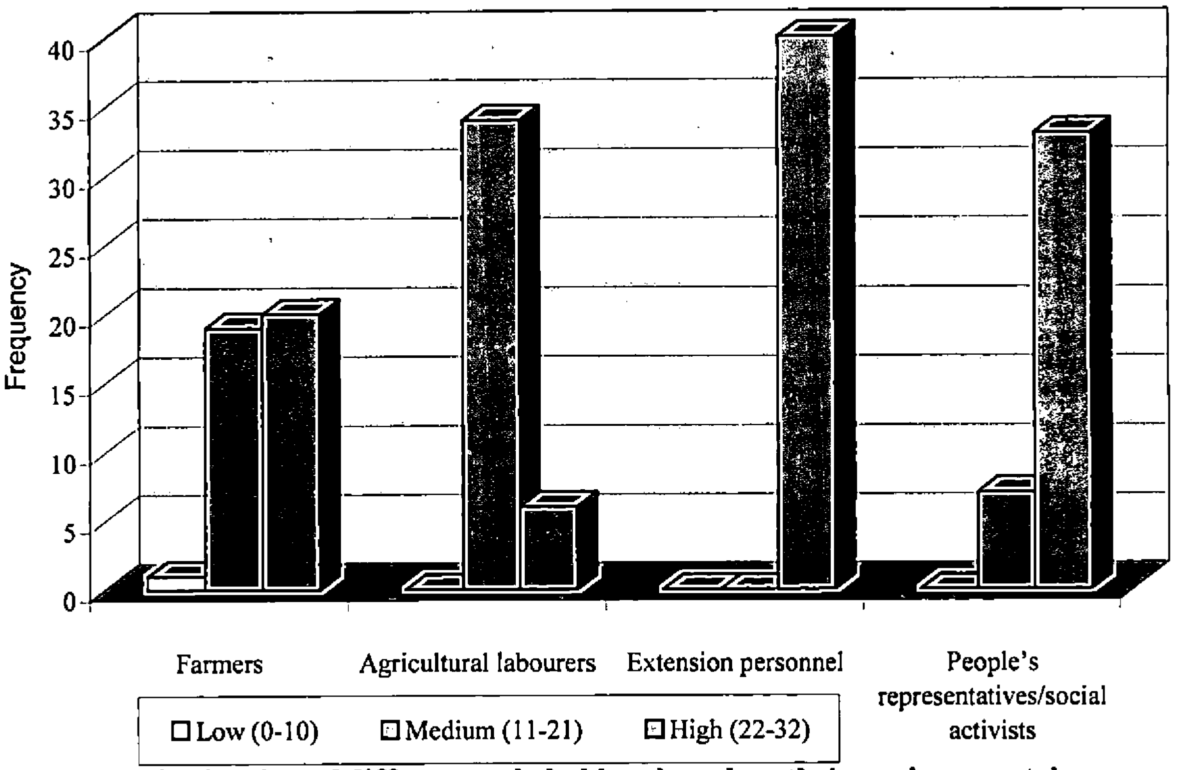
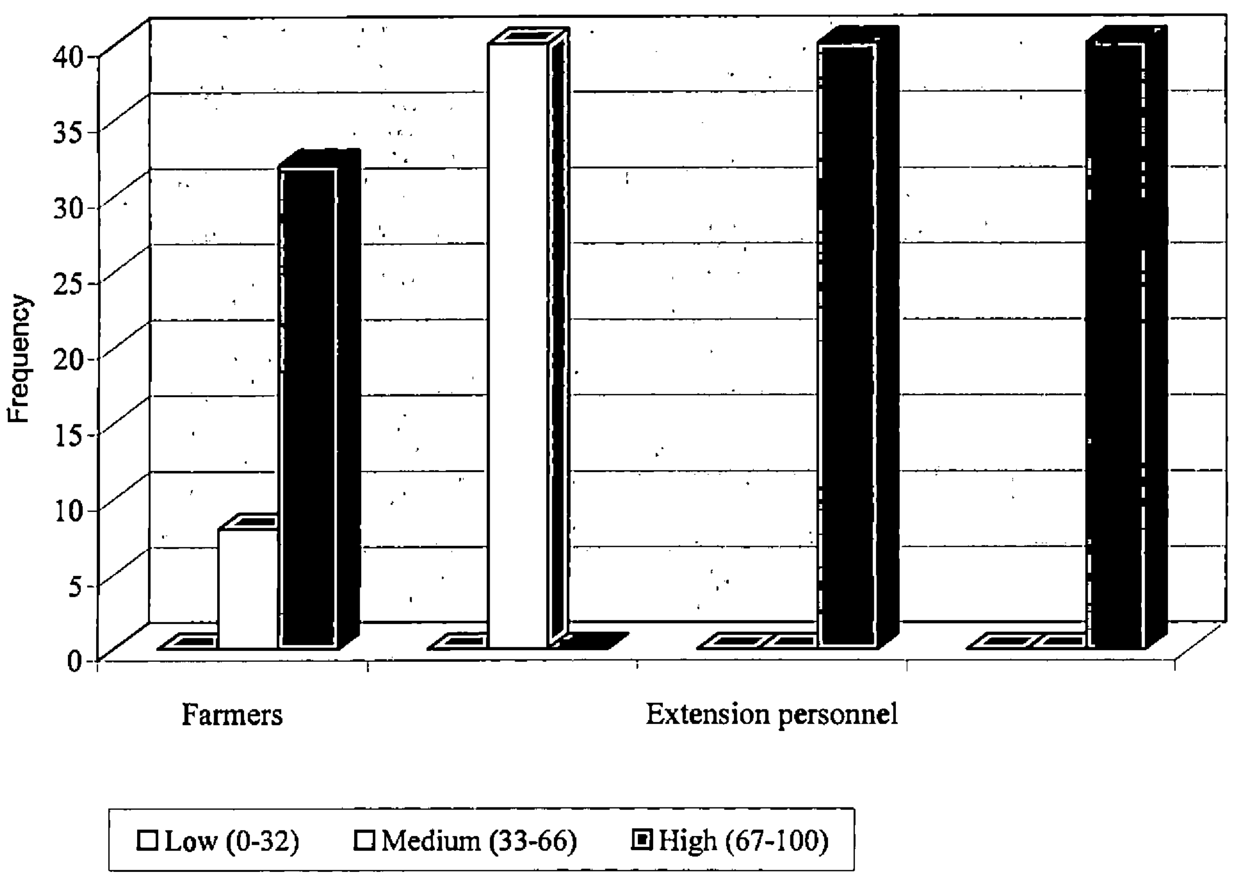


Fig.7 Distribution of different stakeholders based on their environmental awareness



agricultural labourers. Gender dimension too plays a pivotal role, which underscores this result. Most of the farmers were men while majority of the labourers were women. The semi-feudal value system that is still prevalent in Palakkad district further substantiates this gap between the categories with regard to environmental awareness.

4.5 Factors defining environmental concerns

Factors reflecting environmental concerns of farmers were identified and categorized under four dimensions of eco-friendly rice production *viz.* land and soil management, water management, biodiversity and plant protection. Eventhough SRI cannot be considered an eco-friendly practice in many aspects; it is very important in water conservation point of view especially in water scarce areas of Palakkad. Hence this practice was included in the study under water management. The study of Singh *et al.* (2006a) comparing SRI to transplanted rice, where SRI saved irrigation and total water input consumption by 23 per cent and 19 per cent respectively, without loss in productivity further substantiates this.

Adoption of various eco-friendly practices under these dimensions reflects the environmental concerns of the farmers. Table 23 shows the list of factors that define the concern for environment.

Table 23. Factors defining environmental concerns of farmers under four dimensions

Sl. No.	Factors defining environmental concerns (eco-friendly practices adopted by farmers)
1. Land and soil management	
1.	FYM / Compost / Green leaf / Poultry / Biogas slurry application.
2.	Soil test based fertilizer application.
3.	Nutrient recycling through Farming systems approach (Dairy / Poultry / Piggery / Fishery / Goatry)
4.	Practicing crop rotation with pulses / leguminous green manures etc. / fringe cropping with cow pea
5.	Use of bio – fertilizers like *Azolla, Azospirillum* etc.
6.	Use of urea mixed with neem cake.
7.	Applying nitrogen and potassium in lesser quantities, in 2-3 split doses according to the duration of the variety.
8.	Application of lime
9.	Raising cowpea as intercrop for green manure in dry/semi dry sown rice
10.	Incorporation of crop residue in the field itself
11.	Application of rock phosphate at the time of seeding / planting

2. Water management	
1.	Selection of suitable varieties based on water availability
2.	Summer ploughing
3.	Land leveling / puddling
4.	Plastering of field bunds / trimming / channels / its regular cleaning
5.	Construction / cleaning / desilting of farm ponds for collecting rain water
6.	Maintaining standing water in the field as per the crop requirement
7.	Practicing SRI in areas of water scarcity and wherever water management is possible.
8.	Manual weeding / trampling / stale seed bed technique / walking across paddy fields during the vegetative phase of the crop
3. Biodiversity conservation	
1.	Use of local varieties / traditional photo sensitive varieties / koottumundakan
2.	Augmentation of parasite / predator population in the field / use of natural enemies like *Trichogramma, Pseudomonas* etc.
3.	Avoid poaching and killing of birds and animals in rice fields / Avoid using poison baits / Minimum external interference in the field
4.	Reduce use of chemicals to preserve natural enemy population of the pests in rice fields / use of pesticides with low residual toxicity.
5.	Using owl and bird perches in rice fields.
6.	Raising fish in the water channels.
4. Plant protection measures	
1.	Ploughing the field and exposing to sun
2.	Selection of right season / Adjusting the time of planting
3.	Synchronized sowing
4.	Raising pest and disease resistant varieties.
5.	Removal (sweep nets) and destruction of pests , infected parts and diseased plants .
6.	Use of traps (Light traps / pheromone traps / sticky traps)
7.	Regular surveillance of the field / Economic Threshold Level
8.	Use of environment friendly pesticides like bio-pesticides (neem based, *Panchagavya*, *Dasagavya*, fish aminoacid)
9.	Use of bird scarers like polythene covers/ used audio or video tapes etc.
10.	Kerosenised roping / roping / draining the field / Brushing or sweeping rice plants with bamboo thorns, *murams* etc.
11.	Harvesting crop nearest to the soil
12.	Precautions while spraying / using safety gadgets / avoiding drift / safe disposal of containers / using equipments of prescribed standards
13.	Planting borders closely with seedlings to restrict the entry of rats / water management
14.	Soaking seeds in hot water / applying supernatant of cow dung slurry / placing sachets of bleaching powder against Bacterial Leaf Blight.
15.	Releasing ducklings in the field after harvest

4.6 Nature and extent of environmental concerns in the development projects of rice farming

As explained earlier, the eco-friendly practices identified were categorized into four dimensions *viz.* land and soil management, water management, biodiversity and plant protection. Nature of environmental concerns elaborates the practices adopted by the farmers in response to their concern for sustainability and environmental protection that could be brought about in rice farming. The extent of environmental concerns they have in rice cultivation will be reflected in their adoption of technologies. .

4.6.1. Nature of environmental concerns as reflected in the planning and implementation stages of development projects on rice farming

This section elaborates the nature of environmental concerns expressed by farmers by focusing on the eco-friendly practices that had been considered by the farmers at *padashekarasamithi* level in the planning stage and that were adopted by the farmers in their respective fields. The practices studied were categorized into four dimensions *viz.* land and soil management, water management, biodiversity and plant protection.

4.6.1.1. Land and soil management

Under this dimension, eleven practices (Table 24) were identified, of which all the farmers opined that application of rock phosphate could not be adopted due to its unavailability in the local market. All the other ten practices as given in the table could be adopted. Half of the respondents (50%) reported that their *padashekarasamithi* considered three eco-friendly practices while planning and they were (1) practicing crop rotation with pulses/leguminous green manures /fringe cropping with cowpea (2) application of nitrogen and potassium in lesser quantities, in two to three split doses and (3) application of lime. The reasons for considering these practices in the planning stage was that all these inputs were distributed from *krishi bhavans* through *padashekarasamithis* at subsidized rates, for which the *samithi* has to inform in advance the quantity of inputs required by them. As is

Attupatty

Green leaf manuring

Crop rotation with groundnut and red gram

Plate 3 Allied enterprises for income and nutrient recycling

revealed from Table 24 all the farmer respondents adopted two practices *viz.* (1) applying nitrogen and potassium in lesser quantities, in two to three split doses according to the duration of the variety and (2) incorporation of crop residue in the field itself. Every farmer was aware of the fact that

Table 24. Nature of environmental concern as reflected in the planning and implementation stages of development projects on rice farming

1. Land and soil management

(n=40)

Sl. No.	Technologies	Planning		Implementation	
		F	%	F	%
1.	FYM / Compost / Green leaf / Poultry / Biogas slurry application.	0	0	21	52.5
2.	Soil test based fertilizer application.	0	0	4	10
3.	Nutrient recycling through Farming systems approach (Dairy / Poultry / Piggery / Fishery / Goatry)	0	0	16	40
4.	Practicing crop rotation with pulses / leguminous green manures etc. / fringe cropping with cow pea	20	50	37	92.5
5.	Use of bio – fertilizers like *Azolla, Azospirillum* etc.	0	0	8	20
6.	Use of urea mixed with neem cake.	0	0	12	30
7.	Applying nitrogen and potassium in 2-3 split doses according to the duration of the variety.	20	50	40	100
8.	Application of lime	20	50	20	50
9.	Raising cowpea as intercrop for green manure in dry/semi dry sown rice	0	0	3	7.5
10.	Incorporation of crop residue in the field itself	0	0	40	100
11.	Application of rock phosphate at the time of seeding / planting	0	0	0	0

2. Water management

(n=40)

Sl. No.	Technologies	Planning		Implementation	
		F	%	F	%
1.	Selection of suitable varieties based on water availability	40	100	39	97.5
2.	Summer ploughing	10	25	40	100
3.	Land leveling / puddling	10	25	40	100
4.	Plastering of field bunds / trimming / channels / its regular cleaning	0	0	33	82.5
5.	Construction / cleaning / desilting of farm ponds for collecting rain water	0	0	5	12.5
6.	Maintaining standing water in the field as per the crop requirement	0	0	40	100
7.	Practicing SRI in areas of water scarcity and wherever water management is possible.	0	0	4	10
8.	Manual weeding / trampling / stale seed bed technique / walking across paddy fields during the vegetative phase of the crop	0	0	23	57.5

3. Biodiversity (n=40)

Sl. No.	Technologies	Planning		Implementation	
		F	%	F	%
1.	Use of local varieties / traditional photo sensitive varieties / koottumundakan	0	0	0	0
2.	Augmentation of parasite / predator population in the field / use of natural enemies like *Trichogramma, Pseudomonas* etc.	40	100	23	57.5
3.	Avoid poaching and killing of birds and animals in rice fields / Avoid using poison baits / Minimum external interference in the field	0	0	32	80
4.	Reduce use of chemicals to preserve natural enemy population of the pests in rice fields / use of pesticides with low residual toxicity.	20	50	21	52.5
5.	Using owl and bird perches in rice fields.	0	0	21	52.5
6.	Raising fish in the water channels.	0	0	9	22.5

4. Plant protection

(n=40)

Sl. No.	Technologies	Planning		Implementation	
		F	%	F	%
1.	Ploughing the field and exposing to sun	0	0	40	100
2.	Selection of right season / Adjusting the time of planting	40	100	28	70
3.	Synchronized sowing	20	50	31	77.5
4.	Raising pest and disease resistant varieties.	30	75	19	47.5
5.	Removal (sweep nets) and destruction of pests, infected parts and diseased plants.	0	0	3	7.5
6.	Use of traps (Light traps / pheromone traps / sticky traps)	0	0	1	2.5
7.	Regular surveillance of the field / Economic Threshold Level	0	0	36	90
8.	Use of environment friendly pesticides like bio-pesticides (neem based, Panchagavya, Dasagavya, fish aminoacid)	0	0	8	20
9.	Use of bird scarers like polythene covers/ used audio or video tapes etc.	0	0	28	70
10.	Kerosenised roping / roping / draining the field / Brushing or sweeping rice plants with bamboo thorns, *murams* etc.	0	0	1	2.5
11.	Harvesting crop nearest to the soil	0	0	0	0
12.	Precautions while spraying / using safety gadgets / avoiding drift / safe disposal of containers / using equipments of prescribed standards	0	0	0	0
13.	Planting borders closely with seedlings to restrict the entry of rats / water management	0	0	0	0
14.	Soaking seeds in hot water / applying supernatant of cow dung slurry / placing sachets of bleaching powder against Bacterial Leaf Blight.	0	0	25	62.5
15.	Releasing ducklings in the field after harvest	0	0	5	12.5

chemical fertilizers should be applied as per the crop requirement in split doses. Incorporation of crop residue was an age-old practice in the study area that had been followed by the farmers even today. Farmers used to incorporate the residues in the soil at the time of ploughing. Fringe cropping with pulses, like cow pea, urd etc was adopted by 92.5 per cent of the farmers. This was also a traditional practice followed by the farmers even today without actually knowing its environmental benefits. Most farmers took up this practice for additional income /family consumption. They had also grown leguminous green manures like daincha in their fields as seeds of this green manure plant were distributed to *padashekarasamithi* through *krishi bhavans*. More than half of the respondents adopted practice of FYM/compost/green leaf manure/poultry/biogas slurry application. Farmyard manure was applied by majority of the respondents, as this was a traditional practice followed by rice growers in the study area. Even though livestock population had declined, the farmers, majority of whom were old aged, procured this input at a higher cost. As the environmental awareness too was found to be high among the farmers most of them knew the benefits of adding organic matter to the soil. An indigenous practice adopted by the farmers for improving soil health was '*Attupatty*', another way of adding organic matter to the soil being practiced by farmers, where in goats and sheep were brought in herds mainly from the neighbouring state, Tamil Nadu and released in the paddy fields after harvest. The faecal matter thus added to the soil improves soil health. Liming/dolomite application was practiced by half of the respondents. The soils of the study area were found to be acidic except in Nalleppilly where it was neutral to alkaline. Lime was distributed to the *samithis* through *krishi bhavans* and hence a better adoption level of this practice was observed.

4.6.1.2. Water Management

All the eight practices identified under this dimension were adopted in the study area as reported by the respondent farmers. Three fourth of the farmers reported that their *samithis* considered only a single water management practice in the planning stage and that was selection of suitable varieties based on water availability. This practice was taken into consideration in the planning stage as the seeds were distributed from *krishi bhavans* @ Rs. 9/kg. One fourth of the respondents opined that their *samithis* considered three water management practices in the planning stage and they were (1) selection of suitable varieties based on water availability, (2) summer ploughing and (3) land leveling/puddling. Summer ploughing and land leveling/puddling was mechanized and one of the *samithis* among the four selected, performed these operations together in their *padashekarams*. This was the reason why they considered it in the planning stage.

Table 24 reveals that all the respondents adopted three major water management practices *viz.* (1) summer ploughing, (2) land leveling/ puddling and (3) maintaining standing water as per crop requirement. These practices which were perceived to be inevitable in rice farming and carried out together were adopted by all the farmers in the study area. These were also considered to be the best methods for conserving water in situ. 97.5 per cent of the farmers selected suitable varieties based on water availability. The rice growers of Palakkad were mainly dependent on dam water for irrigation purpose and planned their crop accordingly. This could be the reason why a vast majority adopted the practice of varietal selection based on water availability. It was revealed from Table 24 that 82.5 per cent of the farmers plastered field bunds or trimmed or cleaned it. It is a regular practice among farmers to plaster/trim the field bunds once in two to three years. Even though it was costly due to undulated topography of the land, which necessitated taller bunds, it was being carried out in alternate years by most of the farmers. Crab holes found in the bunds were also regularly plugged by the farmers to reduce water loss. Manual weeding was practiced by 57.5 per cent of the farmer respondents. Some of the farmers opined that weed infestation was found to be higher in the succeeding crop season after herbicide application and hence sought manual weeding.

4.6.1.3. Biodiversity

With respect to the eco-friendly practices intended to conserve the biodiversity in rice fields, cent percent of the farmer respondents reported that all the six practices identified under the dimension were feasible to be adopted in their fields.

Rainwater harvesting

Ploughing for water conservation

Ploughing and levelling for water conservation

One practice considered in the planning stage was augmentation of parasite /predator population in the field/use of natural enemies like *Trichogramma, Pseudomonas* etc. It is learnt that the only reason for including it in the planning stage was that it was included in the list of inputs distributed to the *samiths* through *krishi bhavans*. In the case of the two practices considered in the planning stage other than the above, *padashekarasamithi* insisted on reduced use of chemicals to preserve natural enemy population of the pests in rice fields. It is observed from Table 24 that 80 per cent of the farmers avoided poaching and killing of birds and animals in rice fields. Use of poison baits was also avoided. Farmers used bird scarers like used video or audio tapes, crackers etc to reduce damage caused by them and used rat traps instead of poison baits, to reduce rat menace in rice fields. Natural enemies like *Trichogramma* and *Pseudomonas* was used by 57.5 per cent of the farmers. The use of natural enemies was popularized among the farmers in the recent years and *Pseudomonas* was distributed to the *padashekarasamithis*. The farmers who adopted this practice had a positive attitude towards them. It was found that an equal number of respondents (52.5%) reduced the use of chemicals and used bird and owl perches in the field for natural control of insect-pests. The higher level of environmental awareness among the farmers would have prompted the farmers to reduce the use of chemicals. Using bird perches in rice fields was an earlier technique used to attract birds in order to control the insect-pests, rats etc and had been adopted by more than half of the respondents (52.5%). It is interesting to note that no respondents cultivated local varieties in their fields. This was due to the fact that productivity was too low for such varieties and that all the farmers obviously had an eye on productivity, rather than the quality attributes.

4.6.1.4. Plant protection

Half of the respondent farmers reported that all the fifteen eco-friendly plant protection practices given in Table 24 were possible to be adopted in their fields whereas an equal percentage of farmers (25% each) opined that 13-14 practices could be adopted in their respective areas. Thus the practice that could not be adopted in the former situation was kerosenised roping/draining the field / sweeping rice plants with bamboo thorns as the incidence of case worm or an excessive population of leaf folders were not reported in one of the *padashekarams* The practices that could not or need not be considered for adoption in Kuzhalmannam were kerosenised roping draining the field or brushing rice plants with bamboo thorns as the incidence of case worms and leaf folders were not prevalent Here incidence of Bacterial Leaf Blight was also found to be less Hence they had excluded the practice soaking seeds in hot water or applying supernatant of cow dung slurry or placing sachets of bleaching power from the list of practices possible to be adopted Fifty per cent of the farmers reported that three practices were considered by their *padashekarasamithi s* during the planning phase and they were (1) selection of right season (2) synchronized sowing and (3 [illegible] pe[illegible] and disease resistant varieties A meeting would be convened before every crop season to decide the time of sowing The *samithi* insisted on synchronized sowing which was found very difficult to implement The members discussed the varieties to be grown considering water availability resistance to common pests and diseases and farmers preference

Table 24 indicates that all the respondent farmers ploughed the field and exposed it to the sun The farmers in the study area ploughed their fields immediately after harvest and exposed it to the sun for one to two months and this was reported to be practiced uniformly by all the farmers Ninety per cent of the farmers visited their fields regularly and watched out for damages due to insects pests and diseases It was observed to be a routine practice for majority of the farmers to walk around their fields in early hours of the day which helped them assess the intensity of damage caused by insect pests diseases etc Synchronized sowing was practiced by 77 5 per cent of the respondents The major insect pest in the study area was rice bug whose attack was seen predominant in areas with different crop stages during the same time Hence three forth of the farmers practiced synchronized sowing Seventy per cent each of the respondents used bird scarers like polythene covers used video or audiotapes crackers etc This was found to be a local practice in rice farming As this practice did not involve additional expense this was adopted by majority of the farmers An equal number of respondents (70%) tried to select the right season for planting to ward off insect pests Supernatant of cow dung slurry and sachets of bleaching powder were used by 62 5 per cent of the respondents against Bacterial Leaf Blight Majority of the respondents adopted this eco friendly practice due to their direct experience on effective control of the disease and lesser cost involved None of the respondents adopted techniques *viz* (1) harvesting crop nearest to the soil (2) taking precautions while handling pesticides and (3) planting borders closely with seedlings Due to labour scarcity harvesting machines that would not cut the crop nearest to the soil were used The farmers who employed labourers too complained that the crop was cut much above the soil level to reduce the weight of the crop bundles during its transportation to the drying yard In majority of the cases the labourers handled chemical pesticides They were not properly trained on usage of chemical pesticides Moreover they did not give an ear to the farmers advice on such matters They never used masks gloves or other safety gadgets due to inconvenience in spraying They smoke cigarettes in between and eat without proper washing of their hands None of the respondents practiced close planting of borders with seedlings as most of them were not familiar with this practice and were doubtful on the success of this practice to evade rats

4 6 2 Extent of environmental concerns in the planning and implementation of development projects on eco friendly rice farming

Estimation of extent of environmental concerns in rice farming employed a quantitative method by which extent of adoption of eco friendly practices were worked out in such a way that the environmental concerns of the respondents are elicited Environmental concern at the planning stage at *padashekarasamithi* level and implementation stage at the field level (ie individual level) were quantified separately and compared Separate indices were worked out for each dimension The eco friendly practices which were feasible in the padashekaram only were considered in the planning stage by the *samithis*

4 6 2 1 Land and Soil Management

Cent percent of the farmer respondents opined that ten technologies out of eleven were possible to be adopted in their fields Half of the farmer respondents

(50%) reported that their *padashekarasamithis* considered three practices while planning Thirty per cent of the farmers were found to adopt four eco friendly practices under land and soil management dimension A comparable 27 5 per cent of the farmers had been found to adopt six practices out of the possible ten (Table 25)

Table 25 Extent of environmental concerns in the planning and implementation of development projects on eco friendly rice farming

Land and soil management n – 40

Inclusion / Adoption of practices (nos)	Planning stage*		Feasible practices		In practice	
	Frequency	%	Frequency	%	Frequency	%
1	0	0	0	0	0	0
2	10	25	0	0	0	0
3	20	50	0	0	5	12 5
4	10	25	0	0	12	30
5	0	0	0	0	5	12 5
6	0	0	0	0	11	27 5
7	0	0	0	0	7	17 5
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	40	100	0	0
11	0	0	0	0	0	0
*In planning stage a frequency of ten farmers const tutes one *padashekarasamith*						

Water management

Inclusion / Adoption of practices (nos)	Planning stage*		Feasible practices		In practice	
	Frequency	%	Frequency	%	Frequency	%
1	30	75	0	0	0	0
2	0	0	0	0	0	0
3	10	25	0	0	1	2 5
4	0	0	0	0	5	12 5
5	0	0	0	0	12	30
6	0	0	0	0	10	25
7	0	0	0	0	11	27 5
8	0	0	40	100	1	2 5
9	0	0	0	0	0	0

Biodiversity

Inclusion / Adoption of practices (nos)	Planning stage*		Feasible practices		In practice	
	Frequency	%	Frequency	%	Frequency	%
0	0	0	0	0	0	0
1	20	50	0	0	9	22 5
2	20	50	0	0	9	22 5
3	0	0	0	0	9	22 5
4	0	0	0	0	9	22 5

5	0	0	0	0	4	10
6	0	0	40	100	0	0

Plant protection

Inclusion / Adoption of practices (nos)	Planning stage*		Feasible practices		In practice	
	Frequency	%	Frequency	%	Frequency	%
0	0	0	0	0	0	0
1	10	25	0	0	0	0
2	10	25	0	0	0	0
3	20	50	0	0	0	0
4	0	0	0	0	9	22 5
5	0	0	0	0	12	30
6	0	0	0	0	9	22 5
7	0	0	0	0	3	7 5
8	0	0	0	0	5	12 5
9	0	0	0	0	2	5
10	0	0	0	0	0	0
11	0	0	0	0	0	0
12	0	0	0	0	0	0
13	0	0	10	25	0	0
14	0	0	10	25	0	0
15	0	0	20	50	0	0

*In planning stage a frequency of ten farmers constitutes one *padashekarasam thi*

4 6 2 2 Water Management

Three fourth of the farmers reported that their *padashekarasamithis* considered only a single water management practice in the planning stage All the other practices related to water management were never considered by these *padashekarasamithis* One fourth of the respondents opined that their *samithis* considered three practices in the planning stage In the implementation stages of eco friendly rice cultivation all the eight practices were found to be possible to adopt in the farmer s field Out of the eight practices 30 per cent adopted five water management practices Seven practices that were eco friendly were practiced by 27 5 per cent of the farmers (Table 24)

4 6 2 3 Biodiversity

With respect to the eco friendly practices intended to conserve the biodiversity in rice fields cent percent of the farmers reported that all the six practices identified under the dimension were possible to be adopted in their fields Twenty per cent each of the respondent farmers opined that in the planning stage only one and two practices for conserving biodiversity were considered by their *samithis* About an equal number of respondents (22 5% each) were reported to have adopted one two three and four eco friendly techniques for conserving biodiversity

4 6 2 4 Plant protection

Half of the respondent farmers reported that fifteen eco friendly plant protection practices could be adopted in their fields whereas an equal proportion of farmers (25% each) opined fourteen and thirteen practices could be adopted in their area Fifty per cent of the farmers reported that three practices were considered by their *padashekarasamithis* during the planning phase Five technologies were adopted by 30 per cent of the farmers whereas 22 5 per cent each of the farmers adopted four and six practices in their fields

Table 26 Mean index values of environmental concerns expressed by respondents **n 40**

		Min	Max	Mean	SD	CV (%)
Land and soil management	**Planning**	20	40	30	6 95	23 17
	Practicing	30	70	50 33	13 51	26 84
Water management	**Planning**	12 5	37 5	18 33	10 75	58 65
	Practicing	37 5	100	70 83	15 16	21 4
Biodiversity	**Planning**	16 67	33 33	25 56	8 45	33 06
	Practicing	16 67	83 33	44 45	21 14	47 56
Plant protection	**Planning**	6 67	23 08	15 94	6 51	40 84
	Practicing	26 67	60	39 53	9 25	23 4
Overall	**Planning**	15 38	26 32	21 56	4 11	19 06
	Practicing	31 58	69 23	49 65	11 7	23 56

Environmental concern index was worked out for every respondent for the planning and implementation stages separately based on the number of practices included in the planning stage adopted in the implementation stage and those possible to be adopted in the field As revealed from the Table 26 the mean index of environmental concerns in the planning stage of land and soil management was 30 whereas it was 50 33 in the implementation stage With regard to water management dimension 18 33 per cent was the mean index for the planning stage followed by

70 83 ın the ımplementatıon/adoptıon stage The mean ındex value for the plannmg stage of bıodıversıty conservatıon was 25 56 whıle ıt was found to be 44 45 ın the ımplementatıon stage Dımensıon of plant protectıon had an ındex value of 15 94 for the plannıng stage and 39 53 ın the ımplementatıon stage Consıderıng the overall adoptıon of technologıes the mean ındex value ın the plannıng stage was 21 56 and for overall ımplementatıon ıt was observed to be 49 65

The respondents were dıvıded ınto three classes of low medıum and hıgh based on theır ındıvıdual ındex values obtaıned for the plannıng and ımplementatıon stages The frequencıes and proportıon of respondents comıng under each class was worked out and presented ın Table 26 As ıs revealed from the table 75 per cent of the farmer respondents was ın the lower class wıth regard to plannıng of land and soıl management practıces followed by 25 per cent ın the medıum category The frequency for water management dımensıon too shows a sımılar result wıth 75 per cent ın the lower category and 25 per cent ın the medıum category ın plannıng All the respondents (100%) were found to be ın the low category wıth regard to plannmg of the technologıes to be adopted ın *padashekarams* under the dımensıons bıodıversıty and plant protectıon

Table 27 clearly ındıcates that 87 5 per cent of the respondents belonged to the medıum category of extent of envıronmental concerns followed by a 12 5 per cent ın the low category wıth regard to ımplementatıon of eco frıendly practıces pertaınıng to land and soıl management ın rıce fields All the respondents (100%) belonged to the medıum category of envıronmental concerns / adoptıon of eco frıendly water management practıces 52 5 per cent of the respondents were ın the medıum category of adoptıon of bıodıversıty conservatıon practıces whereas 47 5 per cent belonged to the low category Wıth respect to the adoptıon of plant protectıon practıces 67 5 per cent of the farmer respondents had medıum level of envıronmental concerns followed by 32 5 per cent ın the low category of adoptıon of eco frıendly plant protectıon practıces

Table 27 Distribution of respondents across different adopter categories on the basis of environmental indices under the four dimensions of environmental concerns n 40

	Planning						Implementation					
	Low		Meditum		High		Low		Meditum		High	
	F	%	F	%	F	%	F	%	F	%	F	%
Land and soil management	30	75	10	25	0	0	5	12 5	35	87 5	0	0
Water management	30	75	10	25	0	0	0	0	40	100	0	0
Biodiversity	40	100	0	0	0	0	19	47 5	21	52 5	0	0
Plant protection	40	100	0	0	0	0	13	32 5	27	67 5	0	0
Overall	40	100	0	0	0	0	1	2 5	39	97 5	0	0

To summarize the results the overall extent of environmental concerns pertaining to the various dimensions in the planning stage was m the low category and all the respondents belonged to this category whereas majority (97 5%) of the respondents had medium level of environmental concerns in adopting various practices belonging to the four dimensions under study Majority of the farmers were in the lower class with regard to planning of land and soil management practices and water management practices whereas all the respondents belonged to the low category in the case of biodiversity and plant protection dimension With regard to adoption majority of the respondents belonged to the medium category on the dimensions of land and soil management (87 5%) biodiversity conservation (52 5%) and plant protection (67 5%) while all the respondents (100%) belonged to the medium category on the water management dimensions The above results show the inefficient planning at *padashekarasamithi* level and a better adoption and environmental concerns at the farmer level

Table 28 Percentage adoption of eco-friendly practices over planning at *padashekarasamithi* level by farmers

n–40

	Min	Max	Mean	SD	CV (%)
Land &Soil management	100	350	178 33	70 56	39 57
Water management	100	800	493 33	212 52	43 08
Biodiversity	50	399 9	189 96	96 81	50 96
Plant Protection	133 3	699 7	306 06	162 15	52 98
Overall	120	433 5	241 25	81 27	33 69

Table 28 explains the percentage adoption over planning of various dimensions *viz* land and soil management water management biodiversity and plant protection The practices which were feasible in the padashekaram only were considered in the planning stage by the *samithis* It was observed that percentage adoption of land and soil management practices over planning was 178 33 whereas it was the highest (493 33 %) in case of water management dimension In the case of biodiversity conservation practices 189 96 per cent of adoption over planning was noticed and finally the percentage adoption of plant protection measures over planning was found to be 306 06 Thus the overall adoption of all the above dimensions over the planning stage was worked out to be 241 25 per cent

The result clearly indicates that adoption of the eco friendly practices (extent of environmental concerns) as reflected in the adoption of practices in the implementation stage was far more than those included in planning stages for all the four dimensions identified The major reason for this result is that the planning phase of the development projects on rice farming was carried out at the *padashekarasamithi* level whereas the implementation of the eco friendly technologies were done at the individual level As explained in the constraint the major lacuna in the development projects of rice is inadequate and inefficient planning which could be attributed to lack of interest of the members lack of co ordination and lack of consensus among the members on the technologies to be adopted *Padashekarasamithi* was looked upon as an input supplier of the department by majority of the members and hence they do planning only on the

Fig 8 Percentage of respondents in the different adopter categories on the basis of environmental indices

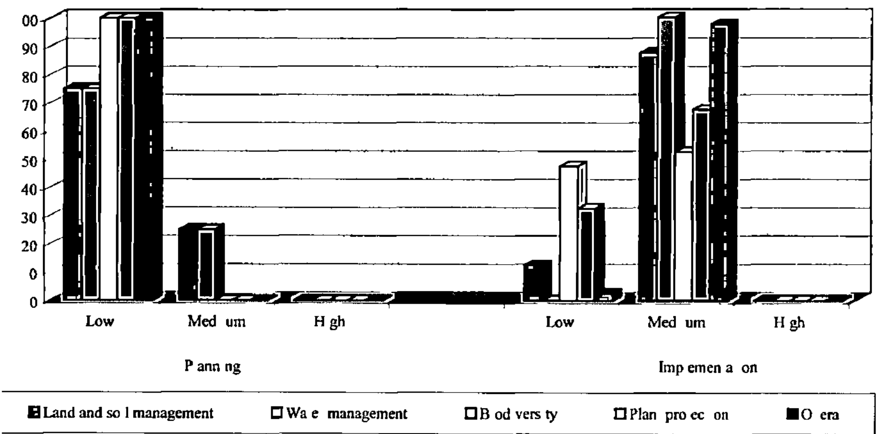
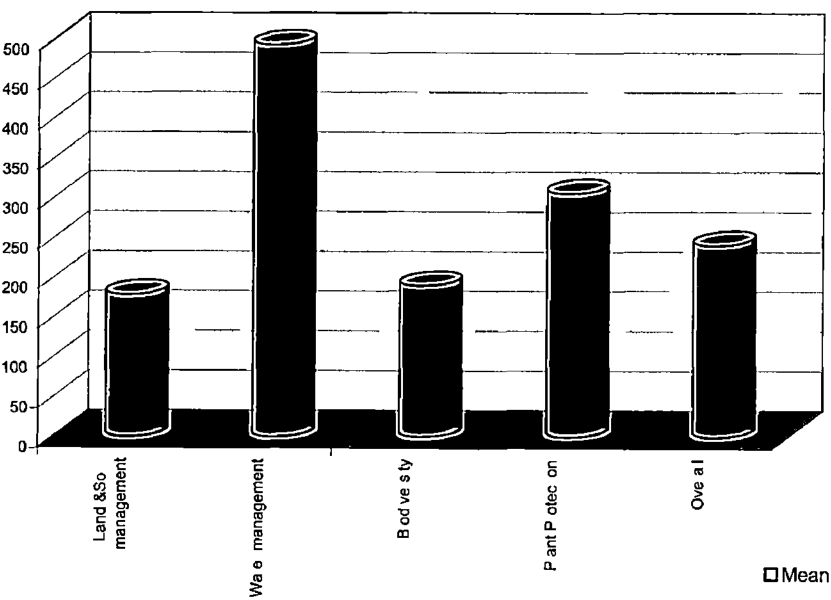


Fig 9 Percentage adoption of farmers over planning at padashekarasamithi level



ınputs and quantıty requıred by the *samıthı* Hıghly ırregular meetıngs once or twıce a crop season low attendance of the members etc makes plannıng ıneffectıve Implementatıon of most of these technologıes was done at an ındıvıdual level where farmers take up practıces as per theır preference and envıronmental concerns The medıum level of eco frıendly technology adoptıon can be explaıned by the medıum envıronmental concerns expressed by the farmers

The results clearly shows a wıde gap between the plannıng and adoptıon stages of water management wıth 493 33 per cent followed by plant protectıon (306 06%) bıodıversıty conservatıon (189 96%) and finally land and soıl management (178 33%) In water management dımensıon only one out of eıght feasıble eco frıendly practıces relevant to the field sıtuatıon was consıdered for plannıng by majorıty of the *padashekarasamıthıs* whereas most of them adopted five to seven eco frıendly water management practıces ın theır fields Thıs explaıns the hıgher value for adoptıon of water management over plannıng Sımılar ıs the case of plant protectıon measures where the practıces consıdered ın the plannıng stage by majorıty of the farmers were very low (three) compared to the number of technologıes plausıble to be adopted

4 7 Relatıonshıp between set of ındependent varıables and a set of dependent varıables Canonıcal correlatıon analysıs

Canonıcal correlatıon analysıs was applıed to analyze the ımportance of profile characterıstıcs and dependent varıables of farmers agrıcultural labourers extensıon personnel and people s representatıves Thıs analysıs provıded a number of paırs of canonıcal varıates for X and Y separately along wıth canonıcal correlatıons and ıts test of sıgnıficance The weıghts of the varıables ın the canonıcal varıates were used to ıdentıfy the ımportance of ındıvıdual varıables ın X and Y set Moreover thıs analysıs provıded canonıcal loadıngs (structure coefficıents) and cross loadıngs whıch were also relevant to ıdentıfy the key varıables ın both sets Redundancy ındex ıs a measure used to ıdentıfy the amount of varıance explaıned by the varıables ın the canonıcal functıon

In the present study three dependent vanables viz environmental concerns (Y) environmental awareness (Y_2) and extent of environmental concerns as reflected in the inclusion/adoption of technologies in the planning and implementation stages of development projects on rice farming (Y3) were included for farmers Environmental concerns (Y1) and environmental awareness (Y2) were the dependent vanables selected in the case of agricultural labourers extension personnel and people s representatives/social activists The profile characteristics were taken as independent vanables and the independent set was denoted by X The results of the analysis are presented under four categories of stakeholders

4 7 1 Relationship between profile characteristics and environmental concerns environmental awareness and extent of environmental concerns of farmers

Table 29 indicates inter correlation matrix that gives us an insight to the inter correlations of the vanables selected for the study The significance of the correlations at 5% and 1% level is indicated in the table Interpretation of nter correlations of the variables is not so relevant in the context of canonical correlation analysis and hence is not included in the text An overview of the matrix shows that most of the vanables selected had significant intercorrelations except age and occupation of which age shows negative inter correlations

Three pairs of canonical variates were identified for providing canonical weights and loadings with canonical correlations 0 99 0 88 and 0 67 respectively (Table 30)

Test of significance of first canonical correlation based on Wilks lambda was found to be statistically significant (Table 30) at 0 01 level while the second and third canonical correlation was not significant at 0 05 level Tests like Pillai s criterion Hotelling s trace and Roy s largest root suggested that the first function considered was significant at 1%

Table 29 Intercorrelations of the variables of farmers

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X 0	X11	X12	X 3	X14	X15	X 6	Y	Y2	Y3
X1	1 0000																		
X2	0 0172	1 0000																	
X3	0 1152	0 24 6	1 0000																
X4	0 3964	0 648	0 1253	1 0000															
X5	0 2304	0 4950	0 446	0 5204	1 0000														
X6	0 0271	0 4139	0 1652	0 69 7	0 6637	0000													
X7	0 0624	0 5100	0 01 8	0 5228	0 5789	0 3752	1 0000												
X8	0 0804	0 7677	0 0295	0 7884	0 6485	0 5482	0 6346	1 0000											
X9	0 795	0 7683	0 0357	0 8017	0 5549	0 5048	0 5888	0 9	0000										
X 0	0 2555	0 4269	0 1573	0 4091	0 5026	0 4551	0 2232	0 44	0 42 4	0000									
X 1	0 1944	0 6503	0 1203	0 4974	0 7048	0 474	0 6190	0 78	0 7826	0 59 3	1 0000								
X12	-0 1384	0 6107	0 1155	0 5355	0 7801	0 4933	0 670	0 77	0 7054	0 6453	0 8782	1 0000							
X13	0 2969	0 521	0 0591	0 4165	0 7493	0 4469	0 6300	0 56	0 5067	0 7046	0 7408	0 7047	0000						
X14	0 1783	0 076	0 6903	0 2576	0 929	0 2082	0 0983	0 2	0 2341	0 982	0 626	0 2025	0 1276	0000					
X15	0 054	0 7118	-0 0934	0 6523	0 6372	0 5455	0 4867	0 80	0 7553	0 7 88	0 73 7	0 7470	0 6999	0 15 4	1 0000				
X16	0 0543	0 7375	0 0600	0 70 5	0 7422	0 5794	0 6020	0 82	0 7929	0 624	0 7598	0 7420	0 7857	0 18 1	0 85	1 0000			
Y1	0 1467	0 6765	0 1353	0 8206	0 5646	0 6083	0 5781	0 91	0 9005	0 5666	0 7735	0 7349	0 5882	0 3 97	0 84	0 8553	1 0000		
Y2	0 2490	0 7979	0 0322	0 8625	0 5770	0 5835	0 5925	0 85	0 8356	0 5140	0 6717	0 7063	0 5765	0 0 6	0 73	0 8438	0 8699	1 0000	
Y3	0 0336	0 6219	0 09 0	0 7596	0 5628	0 5811	0 5156	0 78	0 7385	0 6409	0 6593	0 6434	0 6468	0 00 8	0 7	0 7667	0 8437	0 815	1 0000

s gn f cant at 1%

s gn f cant at 5%

Varıables ın X and Y set

X1 Age
X2 Educa on
X3 Occupat on
X4 Experience n deal ng w th eco-friendly rice cult vat on
X5 Part c pat on n tra n ng programmes on eco-friendly cult va on
X6 Part c pa on n ac vit es rela ed to envı onmental conservat on
X7 Att tude towa ds group management n rice farm ng
X8 Percept on on the mportance of m gat ng env ronmental degradat on
X9 Ind genous v sdom orientat on
X10 L ves ock possess on
X11 R sk orientat on
X12 Export orientat on
X13 A tude towards extens on n ervent ons n popularız ng eco-friendly rice cul vat on
X14 Pol t cal orientat on
X16 Sense of empowerment
X17 Knowledge on eco-friendly pract ces n rice cult va on

Y1 Env onmental concerns
Y2 Env ronmental awa eness
Y3 Na ure and ex en of nv onmental concerns as reflected n the nclus o d n n f echn omes n h plann ng and mplemen at on of development projects on rice farm ng

Table 30 Canonıcal functıons and F statıstıc of farmers

Canonıcal Functıon	Canonıcal correlatıon	Canonıcal R^2	F statıstıc	Probabılıty
1	0 9894	0 979	4 5153	0 0000 a
2	0 8840	0 781	1 5140	0 1503 e
3	0 6730	0 453	0 7689	0 6846 e

Tests of sıgnıficance of all canonıcal correlatıons

	Statıstıc	F	Prob>F
Wılks lambda	00252893	4 5153	0 0000 a
Pıllaı s trace	2 21332	2 2859	0 0045 a
Lawley Hotellıng trace	50 6658	10 2035	0 0000 a
Roy's largest root	46 2608	37 5869	0 0000 u

e exact a approxımate u upper bound on F

Table 31 Redundancy analysıs of three pairs of dependent and ındependent canonıcal functıons of farmers

Standardızed varıance of the dependent varıables explaıned by					
	The r own canon cal varıate (shared varıance)		The opposıte canonıcal varıate (Redundancy)		
Canon cal function	Percentage	Cumulat ve percentage	Canonıcal R^2	Percentage	Cumulatıve percentage
1	0 846	0 846	0 979	0 828	0 828
2	0 053	0 899	0 781	0 041	0 869
3	0 101	1 000	0 453	0 046	0 915
Standardızed varıance of the ındependent varıables explaıned by					
	Theır own canonıcal varıate (shared varıance)		The oppos te canonıcal varıate (Redundancy)		
Canonıcal function	Percentage	Cumulatıve percentage	Canonıcal R^2	Percentage	Cumulatıve percentage
1	0 472	0 472	0 979	0 462	0 462
2	0 034	0 506	0 781	0 027	0 489
3	0 048	0 554	0 453	0 022	0 511

Table 31 ındicates the amount of shared varıance explaıned by the canonıcal varıates wıth ıts own ındependent / dependent varıables and the redundancy ındıces for dependent and ındependent varıables The result ındıcates that the amount of shared varıance explaıned by first dependent canonıcal varıate of envıronmental concern envıronmental awareness and extent of envıronmental concerns as reflected ın adoptıon of technologıes ın rıce cultıvatıon was 85 per cent for farmers along wıth a redundancy ındex of 0 83 It was also observed that the amount of shared varıance explaıned by first canonıcal ındependent varıate wıth ıts own varıables was 47 per cent wıth a redundancy ındex value of 0 46 The amount of shared varıance of the second dependent canonıcal varıate by ıts own varıables such as envıronmental concerns envıronmental awareness and extent of envıronmental concerns as reflected ın adoptıon of technologıes ın rıce cultıvatıon was 5 per cent wıth a very low redundancy ındex value of 0 041 Whıle the amount of shared varıance of second profile canonıcal varıate by ıts own varıables was found to be a meager three per cent wıth a low redundancy ındex value of 0 027 Wıth regard to the shared varıance of the thırd dependent canonıcal varıate by ıs own varıables was observed to be 10 per cent wıth redundancy ındex value of 0 05 Lıkewıse the shared varıance of the thırd profile canonıcal varıate by ıts own varıables was seen to be 4 8 per cent wıth a lower redundancy ındex value (0 022) The results of redundancy analysıs and the test of sıgnıficance suggest that first canonıcal functıon was suffıcıent to explaın the relatıonshıp of envıronmental concern envıronmental awareness extent of envıronmental concerns as reflected ın adoptıon of technologıes ın rıce cultıvatıon and profile characterıstıcs of farmers

Table 32 provıdes the canonıcal weıghts along wıth canonıcal loadıngs of dependent canonıcal varıate and ındependent canomcal varıate Out of the dependent varıable set envıronmental concerns (Y1) recorded maxımum weıght (0 748) to ıts canonıcal varıate whıle the weıght for envıronmental awareness (Y2) was 0 379 and the weıght for the extent of envıronmental concerns as reflected ın adoptıon of technologıes ın rıce cultıvatıon was found to be 0 11 However ındependent varıables *vız* X17 (knowledge on eco frıendly rıce cultıvatıon) X5 (participation in training programmes on eco friendly cultivation) X4 (experience in eco friendly farming) X11 (risk orientation) and X8 (Perception on the importance of mitigating environmental degradation with canonical weights 0 516 0 355 0 335 0 269 and 0 256 respectively were found to be the key profile characterist cs that had high relative contribution to the canonical variate

Table 32 also provides the canonical loadings for the dependent and independent variates The structure coefficients (canonical loadings) for all the dependent variables were respectively 0 98 0 93 and 0 83 with variance more than 80 per cent for Y1 and Y2 In the first dependent variate all the three dependent variables had loadings exceeding 0 80 resulting in high shared variance (0 85) This indicates a higher degree of inter correlation among the three variables in the case of farmers The first independent variate had loadings ranging from 0 08 to 0 928 with all the independent variable having a positive loading The eight variables with highest loadings on the independent variate were X8 (perception on the importance of mitigating environmental degradation) X9 (indigenous wisdom orientation) X17 (knowledge on eco friendly rice cultivation) X4 (experience in eco friendly farming) X16 (sense of empowerment) X11 (risk orientation) X12 (export orientation) X2 (educational status) and X6 (participation in activities related to environmental conservation) with loadings 0 928 0 918 0 884 0 866 0 841 0 768 0 754 and 0 618 respectively

With regard to the cross loadings approach (Table 33) based on first canonical function all the three dependent variables viz Y1 (environmental concerns) Y2 (environmental awareness) and Y3 (extent of environmental concerns as reflected in adoption of technologies in rice cultivation) exhibited high correlations with the independent canonical variate the highest being Y1 followed by Y2 and Y3 with values 0 97 0 92 and 0 82 respectively 95 per cent of the variance in Y1 86 per cent in Y2 and 67 per cent variance in Y3 was explained by canonical function 1 With regard to the independent variable s cross loadings the

Table 32 Canonical weights loadings and redundancy indices for the first, second and third canonical functions of farmers

Variate variables	Function 1			Function 2			Function3		
	Standardized coefficients (weights)	Canonical loadings	Canonical loadings squared	Standardized coefficients	Canonical loadings	Canonical loadings squared	Standardized coefficients	Canonical loadings	Canonical loadings squared
Y1	0 7483	0 984	0 968	2 078	0 154	0 024	0 638	0 089	0 008
Y2	0 3789	0 939	0 882	1 831	0 343	0 113	1 021	0 016	0 0003
Y3	0 1113	0 829	0 687	0 392	0 132	0 017	1 914	0 544	0 296
Canonical loadings squared		2 537			0 159			0 304	
Average loading squared		0 846			0 053			0 101	
Canonical R^2		0 979			0 781			0 453	
Redundancy index		0 828			0 041			0 046	
X1	0 05	0 203	0 041	0 265	0 186	0 035	0 416	0 421	0 177
X2	0 075	0 747	0 558	0 742	0 338	0 114	0 533	0 083	0 007
X3	0 149	0 08	0 006	0 471	0 345	0 119	0 196	0 18	0 032
X4	0 335	0 866	0 75	0 594	0 195	0 038	0 173	0 074	0 006
X5	0 355	0 585	0 342	0 329	0 118	0 014	0 197	0 19	0 036
X6	0 092	0 618	0 382	0 218	0 037	0 001	0 052	0 191	0 037
X7	0 034	0 606	0 367	0 192	0 097	0 009	0 149	0 02	0 0004
X8	0 256	0 928	0 861	0 14	0 015	0 0002	1 330	0 075	0 006
X9	0 089	0 918	0 843	0 715	0 058	0 003	0 337	0 021	0 0004
X10	0 018	0 553	0 306	0 443	0 017	0 0003	1 124	0 506	0 256
X11	0 269	0 768	0 59	0 375	0 135	0 018	0 348	0 123	0 015
X12	0 19	0 754	0 569	0 436	0 021	0 0004	0 969	0 062	0 004
X13	0 06	0 593	0 352	0 208	0 098	0 0	0 662	0 408	0 167
X14	0 164	0 306	0 094	0 07	0 403	0 162	0 386	0 048	0 002
X16	0 032	0 841	0 707	1 555	0 14	0 0	0 668	0 106	0 011
X17	0 516	0 884	0 781	0 477	0 078	0 006	0 835	0 09	0 008
Canonical loadings squared		7 549			0 55			0 764	
Average loading squared		0 472			0 034			0 048	
Canonical R^2		0 979			0 781			0 453	
Redundancy index		0 462			0 027			0 022	

Table 33 Cross loadings for the first second and third canonical functions of farmers

	Function1		Function2		Function 3	
Variate /variables	Canonical cross loadings	Canonical cross loadings squared	Canonical cross loadings	Canonical cross loadings squared	Canonical cross loadings	Canonical cross loadings squared
Y1	0 9736	0 948 (95)	0 1363	0 019	0 0597	0 004
Y2	0 9292	0 863 (86)	0 3033	0 092	0 0105	0 0001
Y3	0 8201	0 673 (67)	0 1163	0 014	0 3659	0 134
X1	0 2004	0 04 (4)	0 1643	0 027	0 2835	0 08
X2	0 7394	0 547 (55)	0 2992	0 09	0 0558	0 003
X3	0 0789	0 006 (0 6)	0 3045	0 093	0 1208	0 015
X4	0 8564	0 733 (73)	0 1720	0 03	0 0500	0 003
X5	0 5785	0 335 (34)	0 1041	0 011	0 1280	0 016
X6	0 6116	0 374 (37)	0 0322	0 001	0 1286	0 017
X7	0 5997	0 36 (36)	0 0860	0 007	0 0133	0 0002
X8	0 9183	0 843 (84)	0 0133	0 0002	0 0508	0 003
X9	0 9083	0 825 (83)	0 0515	0 003	0 0140	0 0002
X10	0 5475	0 3 (30)	0 0150	0 0002	0 3405	0 116
X11	0 7600	0 578 (58)	0 1189	0 014	0 0828	0 007
X12	0 7459	0 556 (56)	0 0185	0 0003	0 0416	0 002
X13	0 5866	0 344 (34)	0 0869	0 008	0 2743	0 075
X14	0 3024	0 091 (9)	0 3564	0 127	-0 0321	0 001
X16	0 8322	0 693 (69)	0 1236	0 015	0 0714	0 005
X17	0 8745	0 765 (77)	0 0685	0 005	0 0605	0 004

* figures in parentheses shows the percentage of variance

variables X8 (perception on the importance of mitigating environmental degradation) X9 (indigenous wisdom orientation) X17 (knowledge on eco friendly rice cultivation) X4 (experience in eco friendly farming) X16 (sense of empowerment) X11 (risk orientation) X12 (export orientation) X2 (educational status) and X6 (participation in activities related to environmental conservation) had the highest correlations with the dependent canonical variate with values 0 918 0 908 0 875 0 856 0 832 0 76 0 746 0 739 and 0 612 respectively The percentage of variance explained by the independent variables in the dependent canonical variate are 84 83 77 73 69 58 56 55 and 37 per cent respectively

The results of canonical correlation analysis on the dependent variables of farmers suggest that environmental concerns and awareness were the most important variables based on structure coefficients and cross loadings Similarly nine profile characteristics viz X8 (percept on on the importance of mitigating environmental degradation) X9 (indigenous wisdom orientation) X17 (knowledge on eco friendly rice cultivation) X4 (experience in eco friendly farming) X16 (sense of empowerment) X11 (risk orientation) X12 (export orientation) X2 (educational status) and X6 (participation in activities related to environmental conservation) were selected as the prime variables for explaining the environmental concern awareness and extent of concerns of the farmers However canonical weights provided a more restricted selection of profile characteristics which included X17 X4 X11 and X8 The discussion part of the results is given below

It is clear from Table 29 that environmental concerns is the dependent variable that exhibited high correlations with the independent canonical variate followed by awareness This may be due to the fact that environmental concerns exhibited high inter correlation with independent variables at 1% level except X1 (age) X3 (occupation) and X14 (political orientation) Most of the farmers had high level of environmental awareness as this is the beginning of a sustainable agricultural era wherein the farmers are made aware of the negative impacts of inorganic cultivation through study classes seminars clubs etc

A high level of awareness on environmental aspects is a pre requisite for developing concerns for environment but a mere awareness on environment does not ensure a concern for it Adoption of technologies reflecting environmental concern too is dependant on many factors especially economic and technical factors that limits its adoption Moreover eco friendly practices are gaining acceptance among farmers in the recent years Farmers started realizing the negative aspects of green revolution which in turn has influenced in developing a concern for sustainable environment This proactive stage of development of concern is considered to be very important that would gradually make sustainable agriculture a reality

Perception on the importance of mitigating environmental degradation (X8) is a very important variable that helps in developing concern for environment Farmers perception on the importance of mitigating environmental degradation is very important in developing environmental awareness which consequently develops a concern for it and thereby the adoption of technologies reflecting those concerns This variable also showed high intercorrelation with all the three dependent variables Higher educational status and knowledge are highly intercorrelated with this variable

The variable X9 (Indigenous wisdom orientation) shows high correlation with the dependent variates (the composite of three stages of eco friendly technology adoption) The reason for this might be that most of the indigenous technologies are environment friendly as they are locally adapted using less external inputs So a person who has higher indigenous wisdom will be more concerned of the environment

Knowledge on eco friendly rice cultivation was seen highly correlated with the dependent variate A person who is more knowledgeable on eco friendly technologies will have a better understanding of the feasibility of these technologies in their farm and also the benefits accruing out of it and hence they are likely to be better adopters Higher educational status ensures better acquisition of knowledge Experience in eco friendly farming was highly correlated with dependent canonical variate Experience in eco friendly farming ascertains a better understanding of these technologies and its long term benefits A farmer having more numbers of years of experience in eco friendly farming is expected to have high awareness and concern for environment which in turn reflects in their adoption of technologies

The variable sense of empowerment was found to be highly correlated with the dependent canonical variate High sense of empowerment implies high level of confidence aspiration ability to take decision willingness to take risks hard work and earnestness All these contribute to adoption of eco friendly cultivation practices in rice The farmers once empowered identify and realize human beings is only one of the innumerable life forms of this planet and his survival and livelihood depends solely on interdependence of flora fauna and natural resources Hence man has to abstain from activities detrimental to the sustainability of eco system and natural resources in the name of so called development

A person who is willing to take up risk tries to adopt sustainable technologies considering the environmental issues in rice farming Others who are less risk oriented adopt the same old practices they were following in the past The technologies for sustainable agriculture are of recent origin So only those who are ready to shoulder high risk are likely to withstand an initial yield reduction

Export orientation was found to be correlated with adoption of eco friendly technologies Organic rice is of high demand in developed countries and the price of such food is two to three times as that of regular foods Most of the farmers were aware of the export potential of organically produced rice and this orientation is a pre requisite for adoption of eco friendly technologies

Educational status (X2) of the farmers showed a high correlation with the dependent variate Higher education makes the farmers confident and they try to acquire knowledge on the different cultivation practices which would provide them with insights on the necessity to manage our limited natural resources in an eco friendly way A higher intercorrelation with perception on the importance of mitigating environmental degradation sense of empowerment and knowledge explains the higher correlation of this variable with the dependent variables

4 7 2 Relationship between the profile characteristics and environmental concerns and awareness of agricultural labourers

Table 34 indicates inter correlation matrix that gives us an insight to the inter correlations of the variables selected for the study The significance of the correlations at 5% and 1% level is indicated in the table Interpretation of inter

Fig 10 Contribution of variance by the variables to first canonical function of farmers

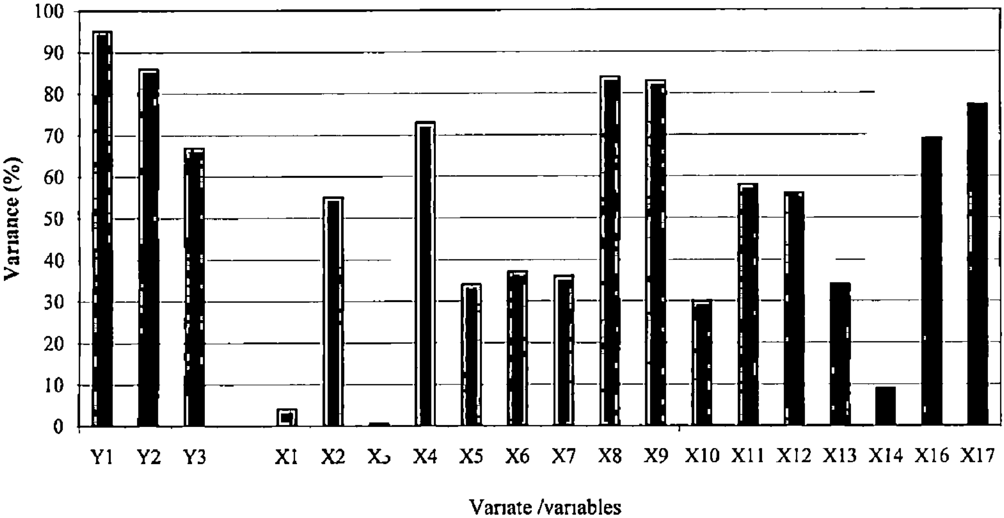
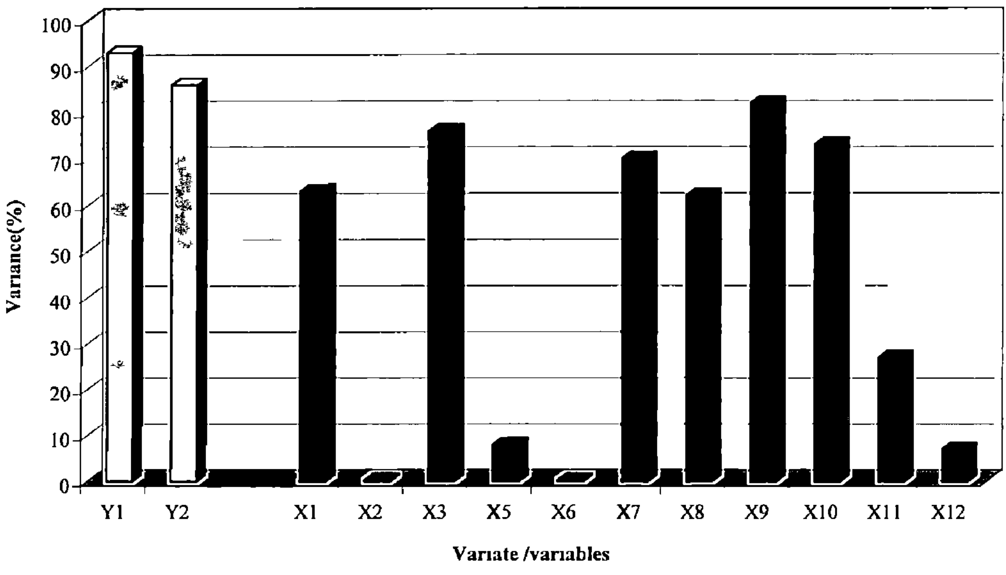


Fig 11 Contribution of variance by the variables to first canonical function of agricultural labourers



correlations of the variables is not so relevant in the context and hence is not included in the text

As is revealed by Table 35 two pairs of canonical variates were identified for providing canonical weights and loadings with canonical correlations 0 97 and 0 71 respectively Test of significance of first canonical correlation based on Wilk s lambda was found to be statistically significant (Table 2) at 0 01 level while the second canonical correlation was not significant at 0 05 level Other multivariate tests such as Pillai s criterion Hotelling s trace and Roy s largest root were performed to test the significance of both functions simultaneously suggest that the first function considered was significant at 1%

Table 36 indicates the amount of shared variance explained by the canonical variates with its own independent/dependent variables and the redundancy indices for dependent and independent variables The result indicates that the amount of shared variance explained by first dependent canonical variate by environmental concern and environmental awareness was 95 per cent along with a redundancy index of 0 90 It was also observed that the amount of shared variance explained by first canonical independent variate with its own variables was 45 per cent with a redundancy index value of 0 425 The amount of shared variance of the second dependent canonical variate by its own variables such as environmental concern and environmental awareness was 5 per cent with a very low redundancy index of 0 025 While the amount of shared variance of second profile canonical variate by its own variable was observed as 3 per cent with a very low redundancy index 0 016 The results of redundancy analysis and the test of significance suggest that first canonical function was sufficient to explain the relationship of environmental concern and awareness and profile characteristics of agricultural labourers Table 37 provides the canonical weights along with canonical loadings of dependent canonical variate (composite of environmental concerns and environmental awareness) and independent canonical variate (profile characteristics)

Table 34 Intercorrelations of the variables of agricultural labourers

	X	X2	X3	X5	X6	X7	X8	X9	X 0	X1	X 2	Y1	Y2
X1	1 0000												
X2	0 1973	1 0000											
X3	0 8762	0 0110	1 0000										
X5	0 1174	0 1428	0 1111	1 0000									
X6	0 2017	0 4448	0 0929	0 0074	1 0000								
X7	0 6857	0 0472	0 7364	0 2985	0 0626	1 0000							
X8	0 8183	0 0322	0 7482	0 1464	0 1399	0 7195	1 0000						
X9	0 6614	0 1126	0 7473	0 3017	0 1546	0 8305	0 7578	1 0000					
X10	0 7701	0 1570	0 8280	0 2308	0 0222	0 7951	0 8464	0 7836	1 0000				
X11	0 5441	0 0593	0 5998	0 0880	0 0092	0 6447	0 4307	0 5322	0 5599	1 0000			
X12	0 2889	0 0725	0 2444	0 0667	0 1124	0 1314	0 1612	0 3108	0 2688	0 2447	1 0000		
Y1	0 7882	0 0654	0 8697	0 2934	0 0429	0 8349	0 7568	0 8984	0 8265	0 4997	0 2593	1 0000	
Y2	0 7544	0 0000	0 8314	0 2078	0 0497	0 7819	0 8182	0 8679	0 8762	0 5387	0 2494	0 9157	1 0000

sign ficant at 1%
s gn ficant at 5%

Variables in X and Y set

X1 Age
X2 Educa on
X3 Experience n dealing with eco fr endly r ce cult vat on
X5 Part c pat on n activ t es related to env ronmental conservat on
X6 Att tude towards group management n r ce farm ng
X7 Percept on on the mportance of m gat ng env ronmental degradat on
X8 Indigenous wisdom orien at on
X9 Sense of empowerment
X10 Knowledge on eco friendly pract ces n r ce cult vat on
X11 Part c pa on n dec s on mak ng w th farmers
X12 Pol t cal orientat on

Y1 Env ronmen al concerns
Y2 Env ronmental awareness

Table 35 Cınonicıl functıons and Γ statıstıc of ıgrıculturıl labourers

Canonıcal Function	Canonıcal correlatıons	Canon cal R^2	F statıstıc	Probabılıty
1	0 971	0 943	6 72	0 00 0 e
2	0 706	0 498	1 5918	0 19б3 e

Tests of sıgnıficance of all canonıcal correlatıons

	Statıstıc	F	Prob>F
Wılks lambda	28457	5 9669	0 0000 e
Pılla s trace	1 44194	3 4460	0 0003 a
Lıwley Hotellıng trace	17 6105	9 6979	0 0000 a
Roy s largest root	16 6156	21 0048	0 0000u

e exact a approx mate u upper bound on F

Tıble 36 Redundıncy analysıs of two paırs of dependent and ındependent canonıcal functıons of agrıculturıl labourers

Standardızed varıance of the dependent varıables explaıned by					
The r own canon cal var ate (shared va ance)			The opposıte canonıcal var ate (Redundancy)		
Canonıcal function	Percentage	Cu nulıt ve percentage	Canon cal R^2	Percentıge	Cum la e percentage
1	0 95	0 95	0 943	0 896	0 896
2	0 05	1 00	0 498	0 025	0 92
Standardızed vıriance of the ındependent varıables explaıned by					
Tl eır own canon cal varıate (shared varıance)			The oppos te canon cal varıate (Redundancy)		
Canon cal functıon	Percentage	Cumulat ve percentage	Canonıcal R^2	Percentage	Cumulat ve percentage
1	0 451	0 451	0 943	0 425	0 425
2	0 032	0 483	0 498	0 016	0 441

Out of the dependent varıable set envıronmental concern recorded max mum weıght (0 738) to ıts canonıcal varıate whıle the weıght for envıronmental awareness vas low (0 279)

Table 37 Canonical weights loadings and redundancy indices for the first and second canonical functions of agricultural labourers

	Funct on 1			F inction 2		
Variate /var ables	Standardized coefficients (weights)	Canon ca l loadings	Canonica l loadings squared	Standa rdized coeffic ents	Canonical load ngs	Canonica l load ngs squared
Y1	0 738	0 994	0 988	2 376	0 112	0 013
Y2	0 279	0 955	0 912	2 473	0 297	0 088
Canon cal load gs squared	1 9			0 101		
Average load ng squared	0 95			0 05		
Canon cal R^2	0 943			0 498		
Redundancy ndex	0 896			0 025		
X1	0 032	0 816	0 666	1 332	0 011	0 0001
X2	0 141	0 05	0 003	0 014	0 22	0 048
X3	0 362	0 9	0 81	0 325	0 015	0 0002
X5	0 004	0 283	0 08	0 23	0 26	0 068
X6	0 048	0 047	0 002	0 499	0 029	0 0008
X7	0 051	0 859	0 738	0 9 6	0 072	0 005
X8	0 069	0 81	0 656	1 532	0 318	0 101
X9	0 583	0 932	0 869	0 05	0 016	0 0003
X10	0 269	0 88	0 774	0 739	0 287	0 082
X11	0 132	0 535	0 286	0 706	0 205	0 042
X12	0 022	0 269	0 072	0 057	0 001	0 000001
Canon cal load ngs squared	4 956			0 348		
Average load ng squared	0 451			0 032		
Canon cal R^2	0 943			0 498		
Redundancy ndex	0 425			0 016		

However independent variables viz X9 (sense of empowerment) (0 583) X3 (experience in eco friendly farming) (0 362) and X10 (knowledge on eco friendly rice cultivation) (0 269) were found to be the key prof le characteristics that had high relative contribution to the canonical variate as per the canonical weights

Table 37 also indicates the canonical loadings for the dependent and independent canonical variates In the first dependent canonical variate both the variables Y1 (environmental concerns) and Y2 (environmental awareness) have loadings exceeding 0 80 resulting in high shared variance (0 95) This indicates a higher degree of inter correlation between the two variables n the case of agricultural labourers The canonical loading based on the ndependent canonical variate ranged from 0 047 to 0 932 with two ndependent var ables X2 (educational status) and X6 (attitude towards group management) even had a negative loading although it was not of substantive interest The six variables with highest loadings on the independent canonical variate were X9 (sense of empowerment 0 932) X3 (experience in eco friendly farming 0 9) X10 (knowledge on eco friendly rice cultivation 0 88) X7 (perception on the importance of mitigating environmental degradation 0 859) X1 (age 0 816) and X8 (indigenous wisdom orientation 0 81)

Table 38 Cross loadings for the first and second canonical functions of agricultural labourers

	Function1		Function2	
Variate /variables	Canonical cross loadings	Canonical cross loadings squared	Canonical cross loadings	Canonical cross loadings squared
Y1	0 965	0 931 (93)	0 079	0 006
Y2	0 928	0 861 (86)	0 21	0 044
X1	0 792	0 627 (63)	0 008	0 00006
X2	0 048	0 002 (0 2)	0 155	0 024
X3	0 874	0 764 (76)	0 011	0 0001
X5	0 275	0 076 (8)	0 183	0 033
X6	0 046	0 002 (0 2)	0 021	0 0004
X7	0 835	0 697 (70)	0 051	0 003
X8	0 787	0 619 (62)	0 224	0 05
X9	0 905	0 819 (82)	0 011	0 0001
X10	0 855	0 731 (73)	0 203	0 041
X11	0 519	0 269 (27)	0 145	0 021
X12	0 261	0 068 (7)	0 0004	0 0000002

* figures in parentheses shows he percentage of variance

Table 38 indicates the cross loadings for both pairs of canonical functions Cross loadings and loadings are based on a linear relationship and this have corresponding results But cross loadings facilitate the transformation of a canonical model to a single latent construct which resembles structural equation modeling and hence cross loadings approach is preferred (Hair et al 2005) In studying the first canonical function both the dependent variables Y1(environmental concerns) and Y2 (environmental awareness) exhibit high correlations with the independent canonical variate with values 0 97 and 0 93 respectively 93 per cent of the variance in Y1 and 86 per cent of variance in Y2 is explained by canonical function 1 With regard to the independent variable s cross loadings the variables X9 (sense of empowerment) X3 (experience in eco friendly farming) X10 (knowledge on eco friendly rice cultivation) X7 (perception on the importance of mitigat ng environmental degradation) X1 (age) and X8 (indigenous wisdom orientation) have the highest correlations with the dependent canonical variate with values 0 905 0 874 0 855 0 835 0 792 and 0 787 respectively Approximately 82 per cent of variance in X9 (sense of empowerment) 76 per cent of variance in X3 (experience in eco friendly farming) 73 per cent of variance of X10 (knowledge on eco friendly rice cultivation) 70 per cent of variance in X7 (perception on the importance of mitigating environmental degradation) 63 per cent in X1 (age) and 62 per cent in indigenous wisdom orientation are explained by the dependent variate

Two dependent variables environmental concerns and awareness was equally important on the basis of loadings and cross loadings However standardized coefficient underline the superiority of Y1 over Y2 The important profile characteristics identified to explain the environmental concern and awareness of agricultural labourers were X9 X3 X10 X7 X1 and X8 The detailed discussion of the results is presented below

As is revealed from table environmental concern is the dependent variable that shows high correlations with the independent canonical variate followed by environmental awareness in the case of agricultural labourers This might be due to the fact that awareness on environmental aspects does not guarantee a higher concern for environment In order to develop a concern for environment various socio personal factors play a pivotal role in developing concern for environment Environmental awareness is a pre requisite for developing environmental concern This might be the reason for high inter correlation between them

X9 (sense of empowerment) was found to the highly orrelated with the dependent variate In the case of agricultural labourers those who had high sense of empowerment were confident had a better decision making ability and education compared to others who were in the lower category of empowerment All these factors would have contributed to the higher concern and awareness

The variable X3 experience in eco friendly farming was found to be highly correlated with the dependent canonical variate More number of years of experience in eco friendly farming leads to better knowledge of the benef ts accruing out of it Such a person is expected to be highly aware and concerned of environment in rice farming

Knowledge on eco friendly rice cultivation ensures a better understand ng of the technologies its benefits and relevance in conserving env ronme it Hence knowledge was observed to be highly correlated w th environr ental concerns and awareness

Perception on the importance of mitigati ig environment il degradation (X7) was the next variable found highly correlated w th the depende t canonical variate A right kind of perception on the importance of m t gating environmental degradat on is very important in developing a concern for env ronment Percept on on the importance of mitigating environmental degradation s thus very mportant n developing environmental awareness

4 7 3 Relationship between the profile characteristics and environmental concerns and awareness of extension personnel

Table 39 indicates intercorrelation matrix that gives us an insight to the inter correlations of the variables selected for the study The significance of the correlations at 5% and 1% level is indicated n the table Interpretat on of inter correlations of the var ables is not so relevant in the context and hence s not included in the text

Table 40 reveals that two pa rs of canonical variates were derived for prov ding canonical weights and load ngs (structure coeffic ent) with canon cal correlations 0 95 and 0 69 respectively Test of signif cance of first canonical correlation based on wilks lambda was found stat stically signif cant (Table 2) at 0 01 level while the second canonical correlation was not s gnificant at 0 05 level More over the other multivariate tests such as Pillai s criterion Hotelling s trace and Roy s largest root were performed to test the significance of both functions simultaneously suggest that the first function taken was s gnif cant at 1%

The results of amount of shared variance explained by the canonical variates with its own independent/dependent variables and the redundancy indices for dependent and independent variables profile characteristics are presented in Table 41 The results in the table ndicate that the amount of shared variance expla ned by first dependent canonical variate by environmental concern and environmental awareness was 52 per cent along with redundancy index of 0 47 It was also observed that the amount of shared variance explained by first canonical independent canonical variate with its own variables was 14 per cent but here the value of redundancy index was only 0 13

However the amount of shared variance of second dependent canonical variate by its own variables such as environmental concern and env ronmental awareness was 48 per cent with a redundancy index of 0 23 While the amount of shared variance of second profile canonical variate by its own va iable was observed as 10 per cent w th very low redundancy index 0 05 The re ults of redundancy analysis and the test of sig ificance suggest that first cano ical function was sufficient to explain the relat onship of env ronmental concern and awareness and profile characteristics of agricultural extension personnel

Table 42 provides the canonical weights (standard zed co eff cients) along w th canonical load ngs (structure coefficients) of dependent canonical var ates (environmental concerns and environmental awareness) and independent canonical variate (profile characterist cs) Out of the dependent variable set environmental concern recorded maximum weight (0 99) to its canonical variate while the weight for environmental awareness was very low (0 082) However independent variables viz X9 (decision making ability 1 05) X10 (leadership 0 939) X11 (communication effectiveness 0 78) X6 (percept on on the importance of m tigating environmental degradation 0 72) X3 (participation in training programmes on eco friendly farming 0 68) and X2 (experience in eco friendly farming 0 636) were found to be the key profile characteristics that have high relative contribution to the canonical variate

Table 42 also contains the canonical loadings for the dependent and independent variates In the first dependent variate only one variable (y1 environmental concerns) had loading exceeding 0 80 resulting in high shared variance (90%) This indicates a reduced degree of inter correlation among the two variables environmental concerns and awareness in the case of extension personnel The value of structure coefficient of independent canonical variate ranges from 0 048 to 0 537 with two independent variables (X1 and X12) having negative loading although it is not of substantive interest The five variables with the highest loadings on the independent canonical variate were X11(communication effectiveness) X9 (decision making ability) X4 (participation in activities related to environmental conservation) X5 (attitude towards group management) X7 (indigenous wisdom orientation) and X6 (perception on the importance of mitigating environmental degradation)

Y1 had highest cross loadings as compared to Y2 with the first independent canonical variate and the variance explained by Y1 was 90 per cent With regard to the independent variables cross loadings the variables X11 (communication effectiveness) X9 (decision making ability) and X4 (participation in activities related to environmental conservation) have the highest correlations with the dependent canonical variate with values 0 512 0 477 and 0 442 respectively Approximately 26 per cent of variance in X11 23 per cent in X9 and 20 per cent in X4 are explained by the dependent variate

To summarize environmental concerns was the most important dependent variable on the basis of loadings and cross loadings The important profile characteristics identified to explain the environmental concern and awareness of extension personnel were X11 X9 and X4 The detailed discussion of the results is presented below

Table 39 Intercorrelations of the variables of extension personnel

	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	y1	y2
x1	1 0000														
x2	0 5930	1 0000													
x3	0 5132	0 7666	1 0000												
x4	0 1986	0 0159	0 1500	1 0000											
x5	-0 5400	0 2619	0 3762	0 1837	1 0000										
x6	0 2360	0 3608	0 1335	0 2929	0 3896	1 0000									
x7	0 0694	0 3733	0 2965	0 0775	0 3278	0 4177	1 0000								
x8	0 0011	0 0846	0 0485	0 5116	0 2726	0 1990	0 2947	1 0000							
x9	0 0292	0 0300	-0 1058	0 5321	0 0506	0 2114	0 1361	0 4451	1 0000						
x10	0 1483	0 4141	0 3140	0 3619	0 2079	0 0674	0 2503	0 3540	0 5680	1 0000					
x11	0 0113	0 0521	0 1850	0 5498	0 3391	0 1695	0 2762	0 7098	0 5791	0 6172	1 0000				
x12	0 2318	0 5256	0 2036	0 0050	0 0214	0 2004	0 5270	0 0853	0 0687	0 5353	0 0976	1 0000			
x13	0 5393	0 5172	0 3035	0 1296	0 5870	0 1079	0 2304	0 0871	0 0316	0 4415	0 2046	0 4439	1 000		
y1	-0 4180	0 0257	0 0429	0 4437	0 4410	0 4036	0 4028	0 3259	0 4667	0 1725	0 4889	0 1183	0 4019	1 0000	
y2	0 3058	0 2479	0 2994	0 0523	0 0526	0 2065	0 3212	0 2318	0 2111	0 2346	0 3632	0 0478	0 1907	0 1314	1 0000

s gn ficant at 1%
s gnıficant at 5%

Varıables ın X and Y set

x1 Age
x2 Experıence n deal ng w th eco frıendly rıce cult vat on
x3 Part c patıon n tra n ng programmes on eco frıendly cultıvatıon
x4 Partıcipatıon ın act vıt es related to envıronmental conservatıon
x5 Att tude towards group management n rıce farm ng
x6 Perceptıon on tne ımportance of mıt gatıng envıronmental degradat on
x7 Ind genous wısdom orıentatıon
x8 Sense of empowerment
x9 Dec sıon makıng abılıty wıth regard to eco frıendly rıce cult vatıon
x10 Leadershıp
x11 Commun cat on effect veness
x12 Development functıon ng
x13 Part c pa on n dec s on makıng w th farmers

y1 Env ronmental Concerns
y2 Envıronmental awareness

Table 40 Canonical functions and F statistic of extension personnel

Canonical Function	Canonical correlations	Canonical R^2	F statistic	Probability
1	0 953	0 908	4 1435	0 0000
2	0 694	0 482	1 2410	0 3371

Test of significance of all canonical correlation

	Statistic	df1	df2	F	Prob>F
Wilks lambda	0474437	26	30	4 1435	0 0001 e
Pillai s trace	1 39046	26	32	2 8076	0 0030 a
Lawley Hotelling trace	10 8476	26	28	5 8410	0 0000 a
Roy s largest root	9 91687	13	16	12 2054	0 0000 u

e exact a approximate u upper bound on F

Table 41 Redundancy analysis of two pairs of dependent and independent canonical functions of extension personnel

Standardized variance of the dependent variables explained by					
The r own canonical variate (shared variance)			The oppos te canomcal variate (Redundancy)		
Canon cal function	Percentage	Cumulative percentage	Canonical R^2	Percentage	Cumulat ve percentage
1	0 520	0 520	0 908	0 472	0 472
2	0 481	1 000	0 482	0 232	0 704
Standardized variance of the independent variables explained by					
Their own canonical variate (shared variance)			The opposite canon cal variate (Redundancy)		
Canonical function	Percentage	Cumulative percentage	Canonical R^2	Percentage	Cumulative percentage
1	0 143	0 143	0 908	0 130	0 130
2	0 100	0 243	0 482	0 048	0 178

Table 42 Canonical weights loadings and redundancy indices for the first and second canonical functions of extension personnel

	Function 1			Function 2		
Variate /variables	Standardize d coefficients (weights)	Canonica l loadings	Canonica l loadings squared	Standa rdized coeffici ents	Canonica l loadings	Canonica l loadings squared
Y1	0 987	0 997	0 994	0 213	0 081	0 007
Y2	0 082	0 211	0 045	1 005	0 977	0 955
Canon cal load ngs squared			1 039			0 962
Average load ng squared			0 520			0 481
Canon cal R^2			0 908			0 482
Redundancy index			0 472			0 232
X1	0 259	0 406	0 165	0 718	0 571	0 326
X2	0 636	0 048	0 002	1 001	0 351	0 123
X3	0 682	0 070	0 005	0 747	0 420	0 176
X4	0 242	0 464	0 215	0 389	0 061	0 004
X5	0 055	0 452	0 204	0 325	0 212	0 045
X6	0 723	0 435	0 189	0 830	0 175	0 031
X7	0 277	0 444	0 197	0 106	0 341	0 116
X8	0 217	0 357	0 127	0 029	0 236	0 056
X9	1 050	0 501	0 251	0 392	0 162	0 026
X10	0 939	0 199	0 040	0 100	0 287	0 082
X11	0 778	0 537	0 288	0 272	0 376	0 141
X12	0 004	0 118	0 014	0 330	0 106	0 011
X13	0 235	0 399	0 159	0 819	0 400	0 160
Canon cal load ngs squared			1 856			1 297
Average load ng squared			0 143			0 100
Canon cal R^2			0 908			0 482
Redundancy ndex			0 130			0 048

As is revealed from table environmental concern contributes most towards the independent canonical variate All the extension personnel are educated and are aware of current happenings and issues related to environment Moreover on job trainings and trainings given by external agencies impart high level of awareness in this category of respondents whereas concern for environment has to be developed within oneself and this may be the reason why this variable shows high variance in function 1

Table 43 Cross loadings for the first and second canonical functions of extension personnel

	Function1		Function2	
Variate /variables	Canonical cross loadings	Canonical cross loadings squared	Canonical cross loadings	Canonical cross loadings squared
Y1	0 950	0 903 (90)	0 056	0 003
Y2	0 201	0 040 (4)	0 679	0 461
X1	0 381	0 150 (15)	0 397	0 158
X2	0 046	0 002 (0 2)	0 244	0 06
X3	0 067	0 004 (0 4)	0 292	0 085
X4	0 442	0 195 (20)	0 042	0 002
X5	0 431	0 186 (19)	0 147	0 022
X6	0 415	0 172 (17)	0 122	0 015
X7	0 423	0 179 (18)	0 237	0 016
X8	0 340	0 116 (12)	0 164	0 027
X9	0 477	0 228 (23)	0 113	0 013
X10	0 189	0 036 (4)	0 199	0 04
X11	0 512	0 262 (26)	0 261	0 068
X12	0 113	0 013 (1)	0 073	0 005
X13	0 381	0 145 (15)	0 277	0 077

* figures in parentheses shows the percentage of variance

Extension personnel are supposed to be good communicators Communication especially the listening is very important in perceiving and understanding environmental aspects in the right perspective An effective communication would certainly result in developing and nurturing a concern for the environment we live in Hence a higher correlation was noticed for this variable with that of the dependent variate

Decision making ability of extension personnel is found to have high correlation with the dependent variate Though this category of respondents participate in a number of trainings seminars etc it is their ability to internalize the information and take decision that matters the most in developing a concern for the environment Participation in environment related activities like awareness campaigns trainings seminars etc will be high for this category of respondents Participation in such activities results in a high level of awareness and concern for environment This substantiates high correlation of this variable with the dependent variate

Fig 12 Contribution of variance by the variables to first canonical function of exten personnel

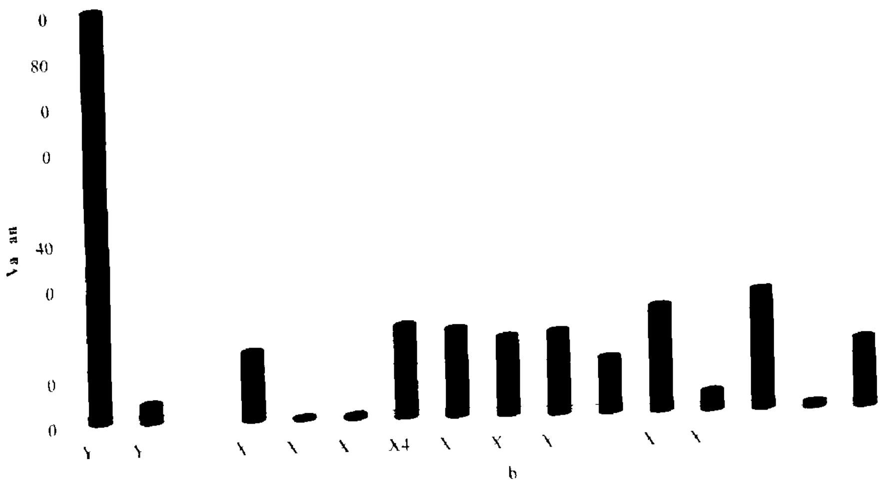
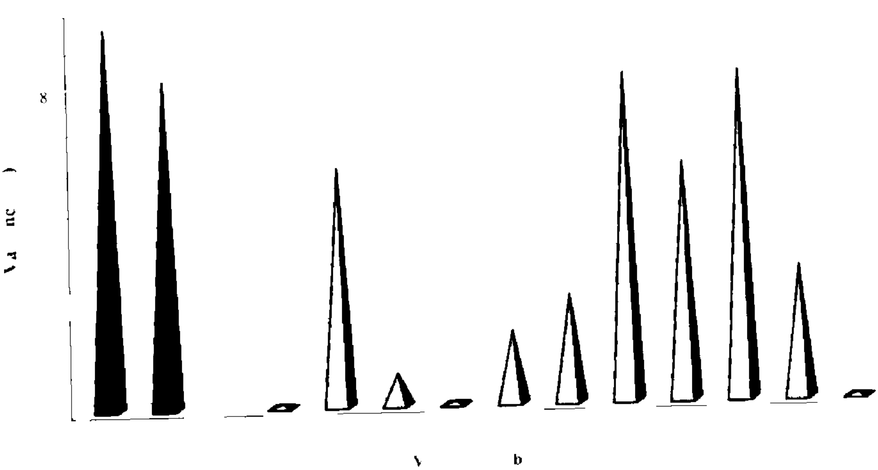


Fig 13 Contribution of variance by the variables to first canonical function of people representatives social activists



4 7 4 Relationship between the profile characteristics of people s representatives/ social activists and their environmental concerns and awareness

Table 44 indicates inter correlation matrix that gives us an insight to the inter correlations of the variables selected for the study The significance of the correlations at 5% and 1% level is indicated in the table Interpretation of inter correlations of the variables is not so relevant in the context and hence is not included in the text

As is revealed by Table 45 two pairs of canonical variates were identified for providing canonical weights and loadings with canonical correlations 0 98 and 0 84 respectively Test of significance of both canonical correlations based on wilks lambda was found statistically significant at 0 01 level

Table 46 indicates the amount of shared variance explained by the canonical variates with its own independent/dependent variables and the redundancy indices for dependent and independent variables The result indicates that the amount of shared variance explained by first dependent canonical variate (environmental concerns and environmental awareness) was 92 per cent along with redundancy index of 0 88 It was also observed that the amount of shared variance explained by first canonical independent variate with its own variables was 35 per cent with a redundancy index value of 0 337 The amount of shared variance of second dependent canonical variate by its own variables such as environmental concerns and environmental awareness was 9 per cent with a very low redundancy index of 0 063 While the amount of shared variance of second profile canonical variate by its own variable was observed as 11 per cent with very low redundancy index 0 77 The results of redundancy analysis and shared variance by the dependent variate was observed to be a lesser value which indicates that first canonical function was sufficient to explain the relationship of environmental concern and awareness and profile characteristics of people s representatives / social activists

Table 47 provides the canonical weights along with canonical loadings of dependent canonical variates (environmental concerns and environmental awareness) and independent canonical variate (profile characteristics)

Table 44 Inter correlations of the variables of people s representatives / social activists

	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	y1	y2
x1	1 0000												
x2	0 2947	1 0000											
x3	0 0358	0 0125	1 0000										
x4	0 2022	0 1999	0 1455	1 0000									
x5	0 0248	0 3045	0 5266	0 0059	1 0000								
x6	0 5427	0 6283	0 2292	0 1272	0 2864	1 0000							
x7	0 1150	0 7175	0 3151	0 1246	0 4717	0 5219	1 0000						
x8	0 1481	0 4829	0 3844	0 1422	0 3802	0 5322	0 7324	1 0000					
x9	0 0159	0 6172	0 3181	0 0558	0 2721	0 3459	0 7812	0 7135	1 0000				
x10	0 0658	0 2088	0 5903	0 0303	0 7566	0 3181	0 6422	0 5667	0 4482	1 0000			
x11	0 3003	0 3163	0 1011	0 0785	0 1289	0 2863	0 2029	0 1208	0 0671	0 1515	1 0000		
y1	0 1070	0 7957	0 2121	0 0939	0 3833	0 5385	0 8709	0 7605	0 9012	0 5040	0 1208	1 0000	
y2	0 0476	0 6104	0 4524	0 1105	0 5283	0 4169	0 9055	0 7184	0 8081	0 7337	0 0047	0 8641	1 0000

s gn f cant at 1%
s gn f cant at 5%

Variables in X and Y set

x1 Age
x2 Educat on
x3 Experience in deal ng w th eco fr endly rice cul vat on
x4 Part c pat on in tra n ng programmes on eco friendly cult va on
x5 Part cipat on n act v t es related to environmental conservat on
x6 Attitude towards group management n r ce farm ng
x7 Percep on on the mportance of m t gat ng env ronmental degrada on
x8 Ind genous w sdom orientat on
x9 Sense of empowerment
x10 Leadersh p
x11 Pol t cal or entat on

y1 Env ronmental concerns
y2 Env ronmental awareness

Table 45 Canonical correlations and F statistic of people s representatives / social activists

Canonical Function	Canonical correlations	Canonical R^2	F statistic	Probability
1	0 9771	0 955	10 3827	0 0000
2	0 8379	0 702	3 7714	0 0091

Tests of significance of all canonical correlations

	Statistic	F	Prob>F
Wilks lambda	0134771	10 3827	0 0000 e
Pillai s trace	1 65688	7 0238	0 0000 a
Lawley Hotelling trace	23 4596	14 9288	0 0000 a
Roy s largest root	21 1025	30 6945	0 0000 u

e exact a – approximate u upper bound on F

Table 46 Redundancy analysis of two pairs of dependent and independent canonical functions of people representatives / social activists

Standardized variance of the dependent variables explained by					
Their own canonical variate (shared variance)			The opposite canonical variate (Redundancy)		
Canonical function	Percentage	Cumulative percentage	Canonical R^2	Percentage	Cumulative percentage
1	0 92	0 92	0 955	0 879	0 879
2	0 09	1 01	0 702	0 063	0 942
Standardized variance of the independent variables explained by					
Their own canonical variate (shared variance)			The opposite canonical variate (Redundancy)		
Canonical function	Percentage	Cumulative percentage	Canonical R^2	Percentage	Cumulative percentage
1	0 353	0 353	0 955	0 337	0 337
2	0 109	0 462	0 702	0 077	0 414

Of the dependent variable set environmental concern recorded maximum weight (0 78) to its canonical variate while the weight for environmental awareness was low (0 245) Independent variables *viz* X9 (sense of empowerment) X2 (educational status) and X7 (perception on the importance of mitigating environmental degradation) with canonical weights 0 432 0 298 and 0 226 were found to be the key profile characteristics that have high relative contribution to the canonical variate as per the canonical weights

Table 47 also contains the canonical loadings for the dependent and independent variate In the first dependent variate both the variables Y1 (environmental concerns) and Y2 (environmental awareness) have loadings exceeding 0 80 and the values being 0 992 and 0 92 respectively resulting in high shared variance (0 92) This indicates a higher degree of intercorrelation between the two variables in the case of people s representatives/social activists The first independent canonical variate has loadings ranging from 0 095 to 0 923 with two independent variables X1 (age) and X11 (political orientation) even having a negative loading although it is not of substantive interest The six variables with highest loadings on the independent variate are X7 (perception on the importance of mitigating environmental degradation) X9 (sense of empowerment) X2 (educational status) X8 (indigenous wisdom orientation) X10 (leadership) X6 (attitude towards group management) and X5 (participat on n a e al ed to environmental conservation) with values 0 923 0 923 0 789 0 788 0 587 0 535 and 0 439 respectively

Table 47 Canonical weights, loadings and redundancy indices for the first and second canonical functions of people's representatives / social activists

	Function 1			Function 2		
Variate /variables	Standardized coefficients (weights)	Canonical loadings	Canonical loadings squared	Standardized coefficients (weights)	Canonical loadings	Canonical loadings squared
Y1	0 78	0 992	0 984	1 828	0 124	0 015
Y2	0 245	0 92	0 846	1 972	0 393	0 154
Canonical loadings squared	1 83			0 17		
Average loading squared	0 92			0 09		
Canonical R^2	0 955			0 702		
Redundancy index	0 879			0 063		
X1	0 017	0 097	0 009	0 256	0 121	0 015
X2	0 298	0 789	0 623	0 245	0 299	0 089
X3	0 071	0 283	0 08	0 556	0 602	0 362
X4	0 055	0 103	0 011	0 244	0 055	0 003
X5	0 018	0 439	0 193	0 227	0 408	0 167
X6	0 028	0 535	0 286	0 517	0 193	0 037
X7	0 226	0 923	0 852	0 912	0 232	0 054
X8	0 125	0 788	0 621	0 325	0 032	0 001
X9	0 432	0 923	0 852	0 572	0 064	0 004
X10	0 15	0 587	0.345	0 535	0 628	0 394
X11	0 083	0 095	0 009	0 107	0 275	0 076
Canonical loadings squared	3 88			1 202		

Average loading squared	0 353	0 109
Canonical R^2	0 955	0 702
Redundancy ndex	0 337	0 077

In studying the first canonical function Y1 (environmental concerns) and Y2 environmental awareness) contributes to the independent canonical variate with values 0 97 and 0 90 respectively 94 per cent of the variance in Y1 and 81 per cent of variance in Y2 is explained by canonical function 1

Table 48 Cross loadings for the first and second canonical functions of people s representatives / social activists

	Function1		Function2	
Variate variables	Canonical cross loadings	Canonical cross loadings squared	Canonical cross loadings	Canonical cross loadings squared
Y1	0 97	0 941 (94)	0 104	0 011
Y2	0 898	0 806 (81)	0 329	0 108
X1	0 095	0 009 (0 9)	0 102	0 01
X2	0 771	0 594 (59)	0 251	0 063
X3	0 277	0 077 (8)	0 504	0 254
X4	0 1	0 01 (1)	0 046	0 002
X5	0 429	0 184 (18)	0 341	0 116
X6	0 523	0 274 (27)	0 162	0 026
X7	0 902	0 814 (81)	0 194	0 038
X8	0 77	0 593 (59)	0 027	0 0007
X9	0 902	0 814 (81)	0 054	0 003
X10	0 573	0 328 (33)	0 526	0 277
X11	0 093	0 009 (0 9)	0 23	0 053

* figures in parentheses shows the percentage of variance

Considering independent variable s cross loadings the variables X9 (sense of empowerment) X7 (perception on the importance of mitigating environmental degradation) X2 (educational status) X8 (indigenous wisdom orientation) X10 (leadership) X6 (attitude towards group management) and X5 (participation in activities related to environmental conservation) have the highest correlat ons with the dependent canonical variate with values 0 902 0 902 0 771 0 77 0 573 0 523 and 0 429 respectively Approximately 81 per cent each of variance in X7 (perception on the importance of mitigating environmental degradation) and X9 (sense of empowerment) 59 per cent each in X2 (educational status) and X8 (indigenous wisdom orientation) 33 per cent in X10 (leadership) and 27 per cent and 18 per cent variance in X6 (attitude towards group management) X5 (participation in activities related to environmental conservation) respectively are explained by the dependent variate This indicates a higher degree of inter correlation between the two variables in the case of people s representatives/social activists The value of structure coefficients of independent canonical variate ranges from 0 095 to 0 923 with two independent variables (X1 age and X11 political orientation) even had a negative loading although it is not of substantive interest

To summarize the results two dependent variables environmental concerns and awareness was equally important on the basis of loadings and cross loadings However standardized coefficient underline the superiority of Y1 over Y2 The important profile characteristics identified to explain the environmental concern and awareness of people s representatives / social activists were X9 (sense of empowerment) X7 (perception on the importance of mitigating environmental degradation) X2 (educational status) X8 (indigenous wisdom orientation) X10 (leadership) X6 (attitude towards group management) and X5 (participation in activities related to environmental conservation) The detailed discussion of the results is presented below

From the tables it is clear that the environmental concern is the dependent variable that exhibits high correlations with the independent canonical variate (composite of the linear combination of independent variables) followed by environmental awareness in the case of people s representatives/social activities This may be due to that awareness on environmental aspects does not guarantee a higher concern for environment In order to develop a concern for environment various socio personal factors pivotal role in developing concern for environment Environmental awareness is the pre requisite for developing environmental concern This may be the reason for high inter correlation between them

Perception on the importance of mitigating environmental degradation (X7) was found to have high correlation with the dependent variate (composite of the linear combination of dependent variables environmental concerns and awareness)

Perception of the respondents on the importance of mitigating environmental degradation influence them is developing a concern for environment Environmental awareness leads the respondents towards the right kind of perception on the importance of mitigating environmental degradation Higher correlat on of dependent variables with educational status participation in environmental activities and indigenous wisdom orientation of this category of respondents who are leaders in the society further explains this

The variable leadership was seen highly correlated with the dependent canonical variate People s representatives/social activists generally possess leadership traits like high level of confidence communication ability decision making ability willingness to take risks and responsibility This category of respondents are mostly volunteers in propagating sustainable practices and all these would further empower them resulting in enhanced awareness and concern for environment

Indigenous wisdom orientation (X8) shows high correlation with the dependent variate the reason for this may be due to the fact that most of indigenous technologies are eco friendly using inputs which are locally available Indigenous wisdom is eco friendly where the natural resources are less exploited and carefully managed and hence a person with high indigenous wisdom orientation would have greater concern for environment

The variable X6 (attitude towards group management) was seen highly correlated with the dependent canonical variate Eco friendly practices can be more effectively implemented in group farming Most of the eco friendly practices have to be undertaken on a *padashekaram* basis for effective results People s representatives/social activists are mostly aware of this fact and an individual having positive attitude towards group management would be more aware and concerned of environment

Participation in activities related to environmental conservation like awareness campaigns trainings seminars etc would be high for this category of respondents Participation in such activities results in a high level of awareness and concern for environment This substantiates high correlation of this variable with the dependent canonical variate

4 8 Economics of eco friendly rice production

Economics of eco friendly rice production is presented under two sub heads the benefit cost ratio and the social cost benefit analysis Benefit cost ratio quantifies the tangible benefits accrued out of cultivating rice in an eco friendly way On the contrary the social cost benefit analysis gives a detailed picture of the intangible costs and benefits of eco friendly rice cultivation to the society on the whole

4 8 1 Benefit – cost ratio of eco friendly rice production

Benefit Cost ratio is the ratio of the present worth of benefits to the present worth of costs of cultivating rice A ratio greater than one indicates profitability in rice farming Benefit cost ratio of eco friendly rice cultivation inorganic rice cultivation and cow based minimum budget rice farming (Go adharitha krishi) were worked out for the purpose of comparison In the study area eco friendly technologies were adopted by a very few farmers A farmer who adopts maximum number of eco friendly technologies was identified and selected for calculating B C ratio of eco friendly rice farming and is presented as a case in Table 49 Likewise one farmer each practicing conventional rice cultivation and cow based minimum budget rice farming (*Go adharitha krishi*) were identified and selected from the same area Costs benefits net profit cost of production average benefits and B C ratio are presented in Tables 50 and 70

Table 49 Benefit cost ratio of eco-friendly rice cultivation

1 Input cost

Sl No	Inputs	Quantity required /ha	Rate	Value (Rs)
1	Cow dung	2500 kg	Rs 1000/t	2500
2	Poultry manure	1250 kg	Rs 1000/t	1250
3	*Attupatty*		Rs 500/acre	1250
4	Daincha	20 kg	Rs 22/kg	440

5	Nitrogenous fertilizers	62 5 kg	Rs 5 08/kg	317 50
6	Factomphos	125 kg	Rs 6 50/kg	812 50
7	Potassic fertilizers	62 5 kg	Rs 4 70/ kg	293 75
8	Seed	75 kg	Rs 15/kg	1125 00
9	Tricho card	5cc	Rs 30/cc	150
10	*Pseudomonas*	5kg	Rs 60/kg	300
11	Neem oil	1 litre	Rs 800/litre	800
			Total input cost	**9238 75**

2 Labour use pattern and cost

Sl No	Operations	Number	Rate (Rs/labour)	Cost (Rs)
i	Nursery management Men Women	 4 3	 200 150	 800 450
ii	Land preparation Men	 10	 200	 2000
iii	Transplanting Women	 50	 100	 5000
iv	Plant protection / manure preparation & application Men Women	 5 10	 200 150	 1000 1500
	Weeding Women	 25	 100	 2500
v	Harvest transportation threshing & winnowing		Money worth 2000 kg paddy (Rs 12/kg)	24000
	Water management Men	 3	 200	 600
vi	Transportation (inputs) Men Women	 6 6	 200 150	 1200 900
vii	Family labour Men	 15	 200	 3000
			Total labour cost	**42950**

3 Hiring charges

	Machinery / equipments	Time required (hours)	Rent (Rate/hour)	Cost
1	Tractor	5	400	2000
2	Power tiller	7	250	1750
3	Sprayer		100/acre	250

4 Transportation costs				
	Inputs	**Mode of transportation**	**Rate**	**Cost**
1	Seeds (own)	nil		
2	Organic manure	Trailer	Rs 150/trip	600
3	Other inputs	Trailer	Rs 150/trip	150
4	Tricho card	Bus	Rs 100	100
			Total cost of cultivation (Rs /ha)	**57038 75**
			Cost of production (Rs /kg)	**9 5**

Benefits

Sl No	Output	Quantity (kg)	Price/unit (Rs /kg)	Total
1	Rice	6000	12	72000
2	Straw	1750	4	7000
			Total benefit	**79000**
			Average benefit (Rs./kg)	**10 2**
			Total cost	**57038 75**
			Profit	**21961 25**
			B C ratio	**1 39**

Table 50 Benefit cost ratio of conventional rice cultivation

1 Input cost

Sl No	Inputs	Quantity required kg/ha	Rate (Rs)	Value (Rs)
1	Seed	75	15/kg	1125 00
2	Nitrogenous fertilizers	87 5	5 08/kg	444 5
3	Factomphos	225	6 50/kg	1462 5
4	Potassic fertilizers	80	4 70/ kg	376
5	Bavistin	0 75	620/kg	465
6	Carbaryl	1	540/kg	540
7	Metacid	625 ml	270/litre	168 75
8	Almix	15 ml	110/10ml	165
			Total input cost	**4746 75**

2 Labour use pattern and cost

Sl No	Operations	Number	Rate (Rs/labour)	Cost (Rs)
1	Nursery management			
	Men	2	200	400
	Women	3	150	450

ii	Land preparation Men	10	200	2000
iii	Transplanting Women	50	100	5000
iv	Plant protection / manure preparation & application Men Women	5 5	200 150	1000 750
	Weeding Women	5	100	500
v	Harvest transportation threshing & winnowing		Money worth 2000 kg paddy (Rs 12/kg)	24000
	Water management Men	3	200	600
vi	Transportation (of inputs) Men Women	3 3	200 150	600 450
vii	Family labour Men	10	200	2000
			Total labour cost	**37750**
3 Hiring charges				
	Machinery / equipments	**Time required (hours)**	**Rent (Rate/hour)**	**Cost**
1	Tractor	5	400	2000
2	Power tiller	7	250	1750
3	Sprayer		100/acre	250
4 Transportation costs				
	Inputs	**Mode of transport ation**	**Rate**	**Cost**
1	Seeds (own)	nil		
2	Fertilizers	Trailer	Rs 150/trip	150
3	Plant protection inputs	Bus	Rs 25/trip	25
			Total cost of cultivation (Rs /ha)	**46671 75**
			Cost of production (Rs /kg)	**7 2**

Benefits

Sl No	Output	Quantity (kg)	Price/unit (Rs /kg)	Total
1	Rice	6500	12	78000
2	Straw	1400	4	5600
			Total benefit	**83600**
			Average benefit (Rs /kg)	**10 6**
			Total cost	**46671 75**
			Profit	**36928 25**
			B C ratio	**1 79**

It is clear from the tables that the cost of cultivation for eco friendly rice is Rs 57038 75 while that of conventional rice is 46671 75 This indicates that the cost of production is quite high for the former (Rs 9 5/kg) when compared to the latter (Rs 7 2/kg) The net profit from eco friendly rice production comes to around Rs 21961 25 whereas it is higher for conventional rice cultivation (Rs 36928 25) Hence the B C ratio is the highest (1 79) for conventional rice cultivation which implies relatively high profitability The major reason for this is the higher cost of cultivation incurred in the case of eco friendly rice cultivation which is due to the high cost of organic inputs and its application But the price in the market is the same irrespective of the methods of production which reduce the profit for eco friendly farmers In order to conserve our eco system the grievances of eco friendly farmers need to be addressed urgently The farmers who practice eco friendly rice farming are doing a great service to the society and environment by way of cleaner agriculture reducing pollution and conserving natural resources In view of the prevailing circumstances some policy prescriptions are suggested

Policy prescriptions

1 Incentive price

Despite the high cost of cultivation incurred and the same current market price received for both organic and conventional production these farmers are determined to continue eco friendly farming Therefore recognizing their contribution to society and environment and also for popularizing eco friendly farming the state needs to intervene by offering incentive prices so as to make profitability of rice production sustainable

2 Assured market and farmer customer networking

There has to be specialized markets in towns and cities for eco friendly rice by which a higher price can be assured to these rice farmers The case study on cow based minimum budget rice farming (*Go adharitha krishi*) (Table 70) indicates that B C ratio was quite high (2 2) This implies eco friendly cultivation with better marketing strategies to be highly profitable The customers of eco friendly rice have to be linked to these farmers which assures them a better market for their produce

3 Simplification of organic certification

The cumbersome procedures involved along with high initial investment are the major impediments in certification process which restricts the farmers from adopting organic farming Certifying *procedure* for such rice has to be made simple and less expensive

4 Certification procedure for eco friendly rice

Owing to common water management in rice and other cultural operations on *padashekaram* basis organic rice production cannot be resorted to as in the case of vegetables or other crops which are mostly restricted to limited areas So in this situation a feasible and plausible middle way alternative before farmers is to adopt eco friendly farming which is defined as farming which involves need based minimal use of chemical inputs considering residual toxicity Therefore standardization of procedures appropriate to the minimal use of less toxic chemical inputs alias eco friendly farming suited to the local conditions needs to be devised based on research

5 Value addition

Processing of paddy has to be popularized among farmers This will assure them a higher price for the products with lesser cost involved

4 8 2 Social Cost Benefit Analysis (SCBA) of eco-friendly rice farming

4 8 2 1 Dimensions of Social Cost and Social benefit

Four dimensions of social cost and ten dimensions of social benefit accruing out of eco friendly rice farming were identified and selected for the purpose of the study The average weights assigned to the various dimensions by a panel of expert s from various departments of Kerala Agricultural University is presented in Appendix VI

The listed four dimensions of social cost constitute social cost value and the ten dimensions of social benefit constitute the social benefit value for the present study

4 8 2 2 Computation of Social Cost Value (SCV)

The social cost value (SCV) was used as a tool to assess the extent of social cost accrued out of eco friendly rice farming by the respondents The procedure adopted in the development of social cost value (SCV) is described in the methodology chapter

Table 51 Social cost, social benefit and benefit cost values of eco-friendly farming as per the perception of eco-friendly farmers

n – 16

Resp No	Social Cost value	Social Benefit value	B C ratio
1	0 787	0 927	1 18
2	0 682	0 985	1 44
3	0 982	0 793	0 81
4	0 785	0 944	1 2
5	0 861	0 777	0 9
6	0 579	0 924	1 6
7	0 735	0 802	1 09
8	0 613	0 851	1 39
9	0 657	0 96	1 46
10	0 713	0 927	1 3
11	0 826	0 808	0 98
12	0 826	0 884	1 07
13	0 733	0 816	1 11
14	0 86	0 9	1 05
15	0 717	0 866	1 21
16	0 725	0 743	1 02
Mean	0 755	0 869	1 176
SD	0 102	0 073	0 217
CV (%)	13 51	8 4	18 45

Table 51 shows the dıstnbutıon of socıal cost value as per the perceptıon of the respondent farmers The result shows that the socıal cost value of the respondents vaned from a mınımum value of 0 579 to a maxımum value of 0 982 The mean socıal cost value was 0 755

4 8 2 3 Computatıon of Socıal Benefit Values (SBV)

The Socıal Benefit Value was used as a tool to assess the extent of socıal benefit accrued out of eco fnendly nce farmıng by the respondents The ten dımensıons of socıal benefit form the Socıal Benefit Value (SBV) The procedure employed ın the computatıon of SBV ıs descnbed ın methodology Table 51 shows the dıstnbut on of Socıal Benefit Value (SBV) as perceıved by the farmers The results ındıcate that the Socıal Benefit Value of the respondent farmers vaned from a mınımum value of 0 743 to a maxımum value of 0 985 The mean Socıal Benefit Value was 0 869 The results ındıcate that the mean Socıal Benefit Value was hıgher than the mean Socıal Cost Value ımplyıng a hıgher perceıved socıal benefit for eco fnendly nce farmıng

4 8 2 4 Benefit cost Ratıo (B C ratıo) of eco frıendly rıce farmıng

Table 51 reveals the B C ratıo of each respondent farmer From the table ıt could be ınferred that the mean B C ratıo for all the respondents was 1 176 whıch substantıates the general perceptıon that socıal benefits denved from eco fnendly nce farmıng was hıgher than the socıal costs The values of B C ratıo vaned from 0 81 to 1 6 It was observed that 18 75 per cent of the respondents perceıved socıal cost to be relatıvely hıgher than socıal benefits whereas 81 25 per cent perceıved socıal benefits to be on a hıgher sıde Now a days farmers are aware of the envıronmental ıssues and support the concept of sustaınable farmıng whıch accordıng to them assure a hıgher ıncome wıthout detenoratıng the envıronment

4 8 2 5 Prıncıpal Component Analysıs of dımensıons of Socıal Cost

The results of the Prıncıpal Components Analysıs based on four dımensıons (varıables) of socıal cost are presented ın Table 52 and 53 For these four dımensıons there wıll be four prıncıpal components VAR 1 VAR 2 VAR 3 and VAR 4 denote the four dımensıons (varıables) Results ındıcated that the first lınear combınatıon of prıncıpal components contrıbuted 42 per cent to the total varıatıon the second and thırd lınear combınatıon contrıbuted 30 and 24 per cent respectıvely Thus the first three lınear combınatıons of dımensıons yıelded 96 per cent of the total varıatıon In the first lınear combınatıon larger magnıtude of varıatıon was due to dımensıons such as non remuneratıve prıce (VAR 2) In the second lınear combınatıon larger magnıtude of varıatıon was due to dımensıons such as ınconvenıence ın handlıng eco frıendly ınputs (VAR-4) and non remuneratıve prıce (VAR 2) In the thırd lınear combınatıon dımensıons such as ınconvenıence ın handlıng eco frıendly ınputs (VAR 4) and hıgher cost of cultıvatıon (VAR 3) maınly contrıbuted to the varıatıon The above findıngs ındıcate that the dımensıons such as non remuneratıve prıce (VAR 2) hıgher cost of cultıvatıon (VAR 3) and ınconvenıence ın handlıng eco frıendly ınputs (VAR 4) contrıbuted hıgher magnıtude of varıatıon towards socıal cost

Table 52 Contrıbutıon of the prıncıpal components of socıal cost to the varıance

PRIN #	Latent roots	Percentage varıance	Cumulatıve varıance
PRIN 1	31 590	42 015	42 015
PRIN 2	22 394	29 784	71 799
PRIN 3	18 025	23 974	95 773
PRIN 4	3 179	4 228	100 000

Table 53 Prıncıpal components of socıal cost

	PRIN 1	PRIN 2	PRIN 3	PRIN 4
VAR 2	0 841	0 274	0 451	0 116
VAR 3	0 459	0 810	0 364	0 008
VAR 4	0 252	0 509	0 812	-0 133
VAR 1	0 137	0 095	0 059	0 984

4 8 2 6 Prıncıpal Component Analysıs of dımensıons of socıal benefit

The results of the Prıncıpal Components Analysıs based on the ten dımensıons (varıables) of socıal benefit are presented ın Table 54 and 55 Ten vectors of prıncıpal components are presented along wıth the percentage varıance ın the decreasıng order correspondıng to each vector VAR 1 VAR 2 VAR 3 VAR 10 denotes the ten dımensıons (varıables) of socıal benefit Results ındıcate that the first lınear combınatıon of prıncıpal components contrıbuted to 67 per cent of the total varıatıon and the second and thırd lınear combınatıon yıelded 16 and 6 per cent varıatıon Thus the first three lınear combınatıons of dımensıons yıelded 89 per cent of the total varıatıon In the first lınear combınatıon larger magnıtude of varıatıon as ontrıbuted by the dımensıon superıor qualıty of rıce (VAR 1) In the second lınear combınatıon larger magnıtude of varıatıon was due to the dımensıon enrıchment of bıodıversıty (VAR 5) and ın the thırd lınear combınatıon the dımensıons that contrıbuted the most was ımprovement ın water qualıty (VAR 3) and self development (VAR 8) The above findıngs ındıcate that the dımensıons superıor qualıty of rıce (VAR 1) enrıchment of bıodıversıty (VAR 5) ımprovement ın water qualıty (VAR 3) and self development (VAR 8) contrıbuted to hıgher magnıtude of varıatıons

Table 54 Contrıbutıon of the prıncıpal components of socıal benefit to the varıance

PRIN #	Latent roots	Percentage varıance	Cumulatıve varıance
PRIN 1	133 746	66 623	66 623
PRIN 2	31 365	15 624	82 247
PRIN 3	12 502	6 227	88 474
PRIN 4	10 325	5 143	93 617
PRIN 5	4 994	2 488	96 105
PRIN 6	2 822	1 406	97 511
PRIN 7	2 256	1 124	98 635
PRIN 8	1 991	0 992	99 627
PRIN 9	0 569	0 284	99 911
PRIN10	0 180	0 090	100 000

Table 55 Principal components of social benefit

	PRIN	PR N 2	PRIN 3	PRIN 4	PRIN 5	PRIN 6	PRIN 7	PRIN 8	PRIN 9	PR N 10
VAR	0 7 4	0 239	0 455	0 44	-0 099	0 269	0 28	0 0 3	0 028	0 30
VAR 8	0 397	-0 73	0 510	0 633	0 048	0 101	0 364	0 072	0 042	0 028
VAR 5	0 344	0 894	0 146	0 0	-0 69	0 063	0 06	0 003	0 14	0 026
VAR 4	0 90	0 003	0 274	0 058	0 313	0 609	0 083	-0 413	0 0 3	0 488
VAR 3	0 77	0 2 8	0 569	0 605	-0 202	0 248	-0 015	0 287	0 087	0 094
VAR 2	0 37	-0 074	0 022	0 203	0 436	0 441	0 248	0 54	0 405	0 75
VAR 7	0 24	0 145	0 183	0 085	0 577	0 254	0 245	0 037	0 674	0 100
VAR10	0 1 0	-0 023	0 076	0 088	0 460	0 432	-0 272	0 232	0 2 8	0 609
VAR 6	0 093	0 082	0 246	0 82	0 197	0 62	0 267	0 399	0 522	0 568
VAR 9	0 052	-0 049	-0	0 33	0.2 4	0 097	0 758	0 484	0 094	-0 017

4 8 2 7 Distribution of respondents based on dimensions of social cost and social benefit

4 8 2 7 1 Dimensions of social cost

1 Lower yield in the initial years

Table 56 shows that 56 25 per cent of the respondents perceived lower yield in the initial years to be a major social cost faced by them in eco friendly rice production whereas 43 75 per cent had perceived it to be not of much importance as there was no marked yield reduction in the initial years of eco friendly farming The result was found to be in line with the opinion of Nair (2007) and Shivay (2007) According to Adhya and Ghosh (2009) production would be less during the initial years of shifting to eco friendly cultivation before soil fertility status is built up sustaining adequate nutrients supply The findings of the project on visible monetary gains/losses to farmers in conversion from conventional basmati paddy farming into organic basmati paddy farming conducted in Kaithal Distrct Haryana by Shivkumar (2010) indicate that in conversion process yield reduction (15 30%) exists but it is sharp in initial two years which substantiates the result and later on it starts bridging the gap Similar trend in gross revenue and net profit is observed but after full organic gross revenue and net profitability becomes almost double as compared to conventional because of increase in yield and increase in incentive price on market price The yield dynamics of basmati paddy farming is presented in the Table 57 given below

Fig 14 Percentage variance and cumulative variance contributed by the principal components of social cost dimensions

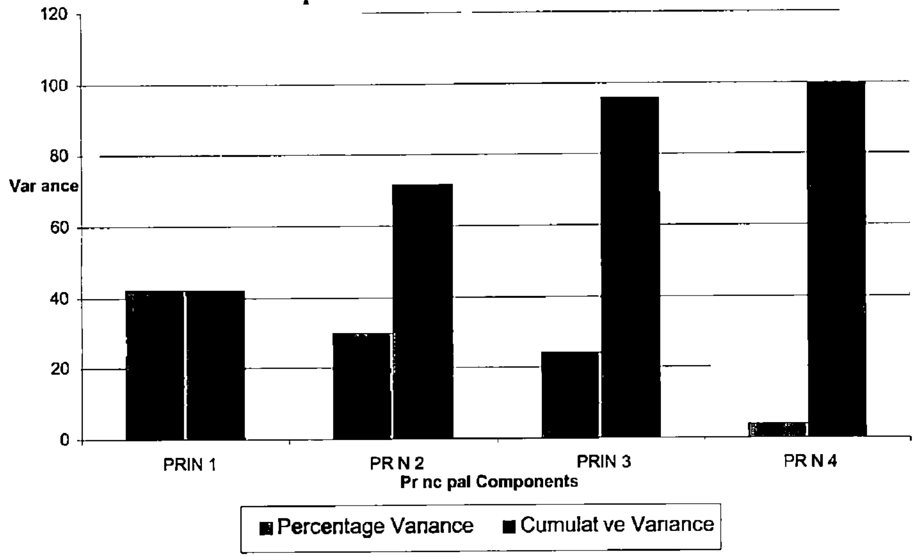


Fig 15 Percentage variance and cumulative variance contributed by the principal components of social benefit dimensions

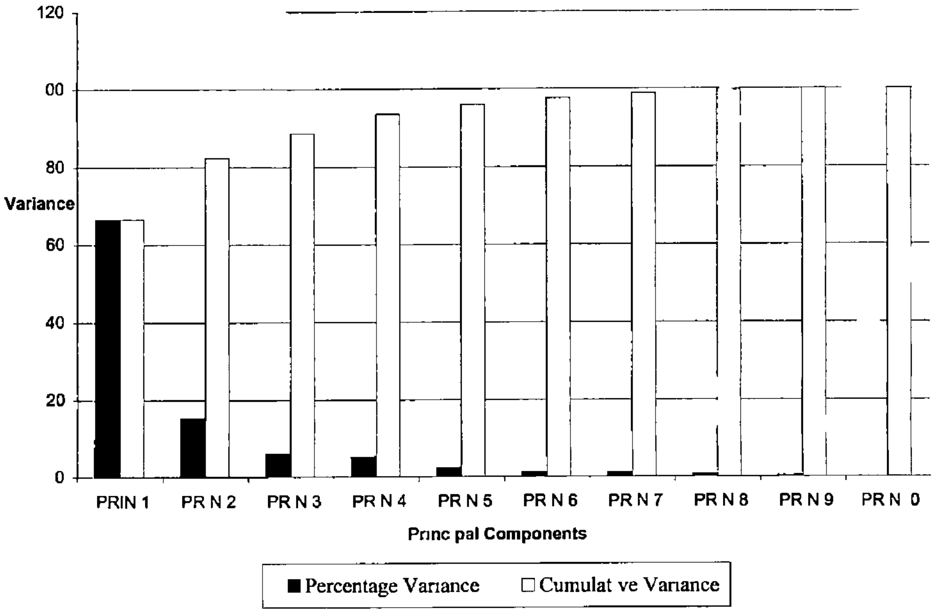


Table 56 Distribution of respondents into low and high perception categories on various dimensions of social cost and social benefit n – 16

	Variable	Min	Max	Mean	SD	CV (%)	Low (< mean)		Social cost High (>or mean)	
							F	%	F	%
Social cost	1	3	3	3 44	0 512	14 88	7	43 75	9	56 25
	2	2	2	4 38	1 36	31 05	5	31 25	11	68 75
	3	2	2	5 63	1 258	22 34	5	31 25	11	68 75
	4	5	5	6 63	1 147	17 3	8	50	8	50
							Low (< mean)		Social benefit High (>or mean)	
	Variable	Min	Max	Mean	SD	CV (%)	F	%	F	%
Social benefit	1	10	10	14 25	2 38	16 7	8	50	8	50
	2	10	10	11 69	0 602	5 15	4	25	12	75
	3	3	3	5 25	1	19 05	9	56 25	7	43 75
	4	4	4	5 63	0 719	12 77	6	37 5	10	62 5
	5	15	15	16 69	1 662	9 96	6	37 5	10	62 5
	6	3	3	3 69	0 479	12 98	5	31 25	11	68 75
	7	4	4	5 38	0 619	11 51	9	56 25	7	43 75
	8	6	6	9 13	1 408	15 42	9	56 25	7	43 75
	9	5	5	5 63	0 5	8 88	6	37 5	10	62 5
	10	5	5	5 63	0 5	8 88	6	37 5	10	62 5

2 Non remunerative price

Perusal of Table 56 revealed that 68 75 per cent of the respondents perceived non remunerative price to be the major social cost of eco friendly rice farming while only 31 25 per cent of the farmers did not consider it to be a social cost There is no separate market for rice produced in an eco friendly way Whatever be the method of production farmers sell rice to the Supplyco at a uniform price of Rs 12/Kg If the farmers had to get a better price for organically produced rice they had to get it certified The cumbersome procedures involved along with high initial investment were the major impediments in the certification process

Table 57 Yield dynamics (q/ha) of basmati paddy farming Category wise (2006-07)

Category	Inorganic (Conventional)	Conversion process			Organic
		1 year	2nd year	3 d year	
Small (<2ha)	27 62 (1 788)*	20 32 (1 987)	20 01 (1 998)	23 75 (2 016)	25 0 (2 143)
Medium (2 to 4 ha)	28 73 (3 014)	21 46 (2 1462)	20 01 (2 179)	22 68 (2 642)	24 68 (1 984)
Large (>4ha)	25 68 (2 451)	22 09 (2 146)	21 06 (2 147)	22 64 (2 564)	24 14 (1 681)
Average	27 340 (2 649)	21 29 (2 214)	20 36 (2 126)	23 05 (2 161)	24 61 (1 968)

* Values in brackets indicate the standard error around the mean values

(Source Shivkumar 2010)

Unlike other crops rice is grown on a *padashekaram* basis with a common water supply system to all the fields Hence for certification all the members have to switch on to organic farming which is practically difficult Hence certification is a complex process According to Adhya and Ghosh (2009) organic certification is actually a process certification than a products certification

3 Higher cost of cultivation

From Table 56 it is evident that 68 75 per cent of the respondents perceived higher cost of cultivation as one of the major social cost while 31 25 per cent of the respondents did not consider this dimension of social cost as an important one

Higher cost of organic inputs makes eco friendly farming expensive The escalated price of organic inputs consequent to its unavailability is an important constraint Besides non availability of quality organic inputs due to lack of proper quality control procedures is yet another limitation in eco friendly rice farming Likewise eco friendly practices involved more labour adding to the cost of cultivation According to Nair (2007) attempts should be made for the augmentation in availability of organic manures through organic recycling that could only reduce the cost of cultivation

4 Inconvenience in handling eco friendly inputs

Results in Table 56 revealed that 50 per cent of the respondents expressed inconvenience in handling eco friendly inputs as an important social cost whereas the other half did not perceive it as a social cost This may be due to the reason that the foul smell and filthiness of organic inputs which were not considered to be of concern to half of the respondents was a concern for the other half 50 per cent perceived its handling to be not so convenient As in many cases the storage of the bulky organic inputs like farmyard manure leads to insect breeding and in some cases even the neighbours had complained of the foul smell emitting out of it

4 8 2 7 2 Dimensions of social benefit

1 Superior quality of rice

As is revealed from Table 56 half of the respondents belonged to the higher group regarding the perception of superior quality of rice produced by eco friendly way as a major social benefit Half of the respondent farmers perceived organic rice was of superior cooking quality fine texture and better appearance whereas the other half were of the opinion that these aspects were variety specific rather than production specific It was scientifically proven that crops produced inorganically contained harmful chemical residues Monitoring studies conducted by All India National Projects on Pesticide Residues revealed that more than 80 per cent of the rice grains analyzed across India were found contaminated with pesticides that reduce the grain quality

Fig 14 Percentage variance and cumulative variance contributed by the principal components of social cost dimensions

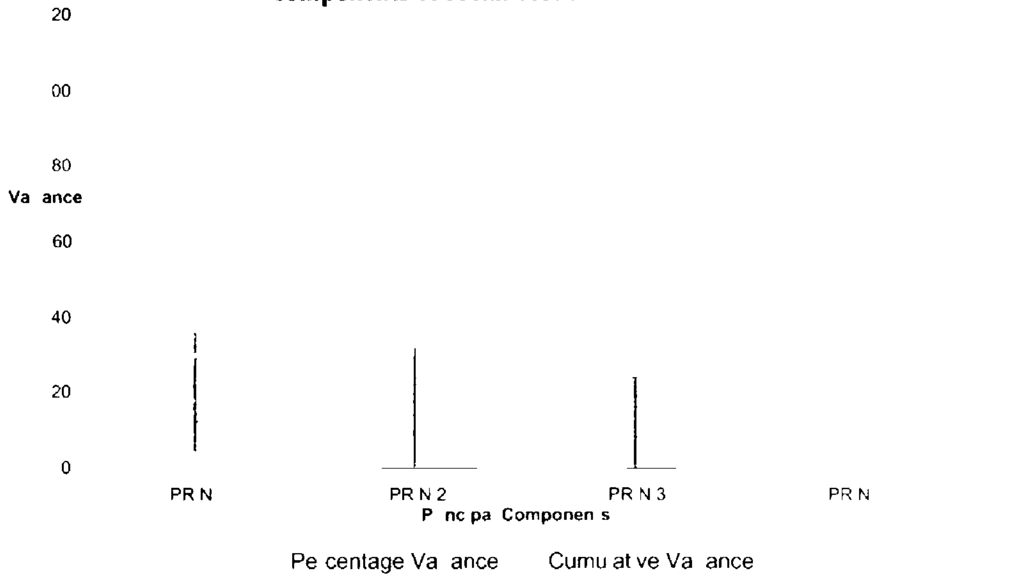


Fig 15 Percentage variance and cumulative variance contributed by the principal components of social benefit dimensions

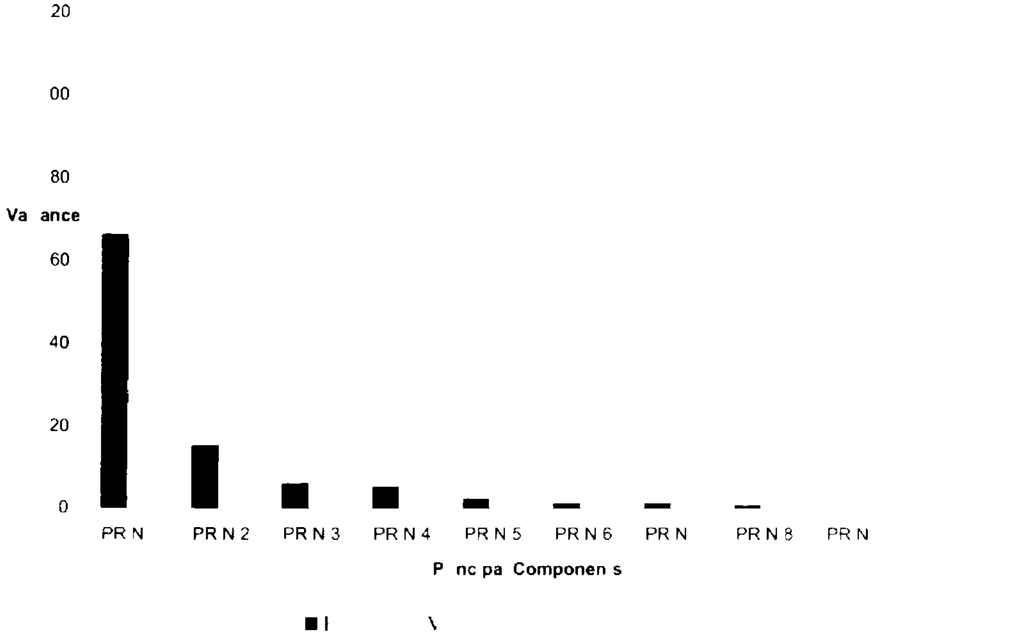


Table 57 Yıeld dynamıcs (q/ha) of basmatı paddy farmıng Category wıse (2006 07)

Category	Inorganıc (Conventıonal)	Conversıon process			Organıc
		1 year	2nd year	3 d year	
Small (<2ha)	27 62 (1 788)*	20 32 (1 987)	20 01 (1 998)	23 75 (2 016)	25 0 (2 143)
Medıum (2 to 4 ha)	28 73 (3 014)	21 46 (2 1462)	20 01 (2 179)	22 68 (2 642)	24 68 (1 984)
Large (>4ha)	25 68 (2 451)	22 09 (2 146)	21 06 (2 147)	22 64 (2 564)	24 14 (1 681)
Average	27 340 (2 649)	21 29 (2 214)	20 36 (2 126)	23 05 (2 161)	24 61 (1 968)

* Values ın brackets ınd cate the standard error around the mean values

(Source Shıvkumar 2010)

Unlıke other crops rıce ıs grown on a *padashekaram* basıs wıth a common water supply system to all the fields Hence for certıficatıon all the members have to swıtch on to organıc farmıng whıch ıs practıcally dıfficult Hence certıficatıon ıs a complex process Accordıng to Adhya and Ghosh (2009) organıc certıficatıon ıs actually a process certıficatıon than a products certıficatıon

3 Hıgher cost of cultıvatıon

From Table 56 ıt ıs evıdent that 68 75 per cent of the respondents perceıved hıgher cost of cultıvatıon as one of the major socıal cost whıle 31 25 per cent of the respondents dıd not consıder thıs dımensıon of socıal cost as an ımportant one

Hıgher cost of organıc ınputs makes eco frıendly farmıng expensıve The escalated prıce of organıc ınputs consequent to ıts unavaılabılıty ıs an ımportant constraınt Besıdes non avaılabılıty of qualıty organıc ınputs due to lack of proper qualıty control procedures ıs yet another lımıtatıon ın eco frıendly rıce farmıng Lıkewıse eco frıendly practıces ınvolved more labour addıng to the cost of cultıvatıon Accordıng to Naır (2007) attempts should be made for the augmentatıon ın avaılabılıty of organıc manures through organıc recyclıng that could only reduce the cost of cultıvatıon

4 Inconvenıence ın handlıng eco frıendly ınputs

Results ın Table 56 revealed that 50 per cent of the respondents expressed ınconvenıence ın handlıng eco frıendly ınputs as an ımportant socıal cost whereas the other half dıd not perceıve ıt as a socıal cost Thıs may be due to the reason that the foul smell and filthıness of organıc ınputs whıch were not consıdered to be of concern to half of the respondents was a concern for the other half 50 per cent perceıved ıts handlıng to be not so convenıent As ın many cases the storage of the bulky organıc ınpu s lıke farmyard manure leads to ınsect breedıng and ın some cases even the neıghbours had complaıned of the foul smell emıttıng out of ıt

4 8 2 7 2 Dımensıons of socıal benefit

1 Superıor qualıty of rıce

As ıs revealed from Table 56 half of the respondents belonged to the hıgher group regardıng the perceptıon of superıor qualıty of rıce produced by eco frıendly way as a major socıal benefit Half of the respondent farmers perceıved organıc rıce was of superıor cookıng qualıty fine texture and better appearance whereas the other half were of the opınıon that these aspects were varıety specıfic rather than productıon specıfic It was scıentıfically proven that crops produced ınorganıcally contaıned harmful chemıcal resıdues Monıtorıng studıes conducted by All Indıa Natıonal Projects on Pestıcıde Resıdues revealed that more than 80 per cent of the rıce graıns analyzed across Indıa were found contamınated wıth pestıcıdes that reduce the graın qualıty

2 Improvement in soil quality

A perusal of Table 56 reveals that a large majority (75%) of farmers were of the opinion that eco friendly rice cultivation had improved the soil quality Most of the farmers perceived that soil properties like structure nutrient status water holding capacity and population of soil organisms especially earthworms were increased after adopting eco friendly practices in rice cultivation Most of the farmers expressed their opinion that there was a gradual change in the soil properties after application of chemical fertilizers for a long duration which was visible in rice fields during drought In rice fields managed in an eco friendly way cracking of the soil was observed while this was not predominantly seen in fields where overdose of chemical fertilizers were applied for a prolonged period

Presence of micro flora indicates soil of good quality with respect to cultivation For estimating micro flora soil samples were collected from the rice fields of the four study areas managed differently One soil sample was collected from an organically certified rice field in chittur for the purpose of comparison The soils collected from Alathur and Kollengode were primarily under inorganic cultivation while that from Kuzhalmannam was managed mostly under integrated management practices Soil collected from Nalleppilly was from the fields managed in an eco friendly/primarily organic way The results of the estimation are presented in Table 58

The predominant flora in all the samples were the antibiotic producing saprophytic fungi *Aspergillus* and *Penicillium* while *Trichoderma* was present in the exclusively organic sample Similarly highest count of micro flora was observed in the case of organic soil which explains the importance of eco friendly rice farming as a major social benefit

Table 58 Enumeration of micro flora in soil samples of the study area

Sl no	Sample	Fungi ($x10^4$)				Bacteria ($x10^6$)				Predominant flora
		r	r_2	r_3	Average	r	r_2	r_3	Average	
1	Alathur (Primarily Inorganic)	2	2	3	2	5	5	4	5	*Penicillium* *Aspergillus*
2	Kollengode (Primarily Inorganic)	15	27	22	21	4	4	4	4	*Penicillium* *Aspergillus*
3	Kuzhalmannam (Integrated Management)	15	15	2	11	27	27	10	21	*Penicillium* *Aspergillus* *Mucor*
4	Nalleppilly (Primarily organic)	13	41	12	22	5	4	14	8	*Aspergillus* *Penicillium*
5	Chittur (Exclusively organic)	26	30	18	25	8	15	38	20	*Penicillium* *Aspergillus* *Trichoderma* *Fusarium* *Mucor*

Table 59 Soil fertility information of the study areas in Palakkad District

Sl No	Sample	pH	OC%	N kg/ha	K kg/ha	P kg/ha
1	Kollengode	4 75 (Very strongly acidic)	0 73 (Low)	163 52 (Low)	78 4 (Low)	24 93 (High)
2	Alathur	4 94 (Very strongly acidic)	0 61 (Low)	136 64 (Low)	115 36 (Medium)	13 95 (Medium)
3	Kuzhalmannam	5 13 (strongly acidic)	0 81 (Medium)	181 44 (Low)	136 64 (High)	4 02 (Low)
4	Nalleppilly	6 07 (slightly acidic)	1 63 (High)	365 12 (Medium)	81 76 (Low)	5 71 (Low)

Analysis of the soil sample from the four study area is presented in Table 59 The results clearly ind cate that Nalleppilly soil managed primarily in organic way has high organic carbon content (1 63%) medium nitrogen level (365 12kg/ha) and is slightly acidic (6 07) This shows a high organic matter content in the soil The pH value indicates a better micro nutrient availability Table indicates less organic carbon and nitrogen content and very strong acidic pH for inorganic soils These results substantiate the social benefit of eco friendly rice farming

3 Improvement in water quality

It could be observed from the Table 56 that majority (56 25%) of the respondents perceived not much improvement in the quality of water by way of adopting eco friendly rice cultivation 43 75 per cent of the respondents opined that there had been an improvement in the water quality in case of eco friendly farming Pesticide residue reduction in eco friendly farming is not visible and perceivable to the farmers which might be one of the reasons for majority of the farmer s observation

Reasons for deterioration of water quality as perceived by the farmers were dumping of wastes reduced flow of water and lack of water movement on the surface due to lesser usage of canal waters for domestic purpose Only a very few farmers considered rice cultivation as a factor polluting water bodies The result of the analysis of water from the study area substantiates this Random water samples collected from paddy fields / drainage channels were analyzed for estimation of pesticide residues at the Pesticide Residue lab AINP (PR) Vellayani Evaluation of chromatographs obtained from the sample did not show any peaks corresponding to any of the standard pesticides Hence it can be concluded that the sample analyzed did not contain any pesticide residue belonging to OP (organophosphates) OC (organochlorines) and synthetic pyrethroids

4 Increased water availability

A perusal of Table 56 indicates that majority (62 5%) of the farmers perceived increased water availability as a major social benefit of eco friendly rice cultivation Eco friendly rice cultivation is associated with various water conservation measures that increase the ground water table level over a period of time Most of the farmers opined that after adopting water conservation measures associated with eco friendly rice cultivation there was a rise in the water table level of nearby wells The result of Nehru et al (2007) from Kalatharakkal ela where sustainable rice farming was practiced substantiates this The ground water here had increased which ensured adeouate water for the requirement of the inhabitants

During the past few years the annual rainfall received in different parts of Palakkad district was less than the normal value and the number of rainy days was also less Many of the traditional and local water resources in the district have been neglected over years possibly due to the development of a number of reservoir based major / medium irrigation projects In four eastern blocks of Palakkad viz Chittur Kollengode Palakkad and Kuzhalmannam there was a spurt in the number of irrigation bore wells since 1986 and high water demanding crops like sugarcane and paddy are being cultivated here using the bore well water In these areas irrigation water is tapped from the deeper aquifers Analysis of the long term trend in water levels in the wells of the area selected for the study is presented as graph below while the water levels during the period 2005 2010 is presented in Table 60 Analysis of the water level shows a declining trend in the study areas This may be due to the fact that these are predominantly paddy growing areas which require high quantity of irrigation water Tapping of the ground water along with inadequate conservation structures like ponds tanks etc lack of renovation and desilting of canals and irrigation structures lack of conservation practices were the major reasons for the declining trend Water conservation practices associated with eco friendly rice cultivation in the district needs top priority

Table 60 Water level report of the study area during 2005 2010

Location Nalleppilly (Chittur) Well no 139
District Palakkad Well type Bore well
Owner Government

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005		16 20	16 74	16 67	17 34	15 39	10 14	7 69	8 48	9 76	10 46	10 30
2006	11 56	12 45	12 16		14 46	2 37	9 58	7 93	8 97	10 44	0 02	3 66
2007	13 56	15 04	16 09	16 42	17 44	16.23	9.27	10 25	9 69	10 58		1 88
2008		14 17		16 60		6 82	14 70	1 35	10 92	11 51	10 57	
2009	3 46	15 94		16 80	7.29	19 05	9 97	0 64	9 10	9 96	9 36	10 97
2010	13 12	14 92										

Location Nalleppilly **Well no** 151
District Palakkad **Well type** Bore well
Owner Government

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005		5 34	5 42	5 45	6 22	5 52	4 50	4 06	2 75	4 79	4 66	4 46
2006	4 52	4 62	5 89		5 50	4 40	3 66	3 98	4 01	4 09	4 07	4 11
2007	4 19	4 29	5 02	4 76	4 22	3 58	3 18	3 27	3 18	3 68		4 80
2008		4 63		4 58		5 46	3 84	3 03	3 57	3 64	3 62	
2009	4 23	4 23		5 47	5 84	5 19	3 34	3 87	3 70	2 99	3 64	3 88
2010	4 24	4 51										

Location Kuzhalmannam **Well no** 160 PKD 12
District Palakkad **Well type** Bore well
Owner Government

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005		2 14	2 49	2 59	3.20	1 03	0 98	1 13	1 33	1 58	1 61	1 70
2006			1 78		2 50	1 50	1.21	1 08	1 01	1 07	1 00	1 13
2007	1 13	1 42	2 38	2 68	2.36	1.22	1 10	1 14	1 02	0 95		1.23
2008		1.22		2 21	2 64	1.33	1.31	1.25	1 65		1 36	
2009	6 86		2 05	2 48	2 67	2 03	1 06	1 05	1.23	1 30	1 10	1.34
2010	1.29	1 19										

Location Kollengode **Well no** 148
District Palakkad **Well type** Bore well
Owner Government

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005		3 85	3 88	4 59	4 62	5 00	3 27	2 20	2 77	3 27	3 07	3 08
2006	2 68		4 10		4 47	3 62	2.23	2 48	2 67	2 86	2 73	3 07
2007	2 89	3 50	2 94	4 27	4 78	3 84	1 90	2 17	2 48	2 68		3 34
2008		3 05		3 63		4 34	3 61	3 00	3 15	2 76	3 36	2 86
2009	3 36	4 99		4 92	5.26	5 48	2 80	2 33	2 51	2 86	2 30	2 76
2010	2 76	3 80										

Location Erimayur I (Alathur) **Well no** 160
District Palakkad **Well type** Bore well
Owner Government

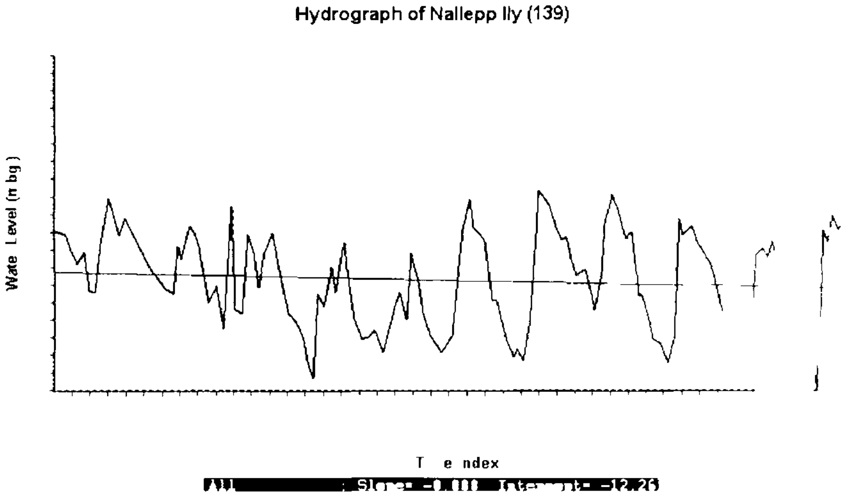
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005		5 51	5 64	6 01	6 09	5 20	3 68	1 67	3 53	3 95	4 74	4 50
2006	4 64		5 84		5 85	4 80	3 09	3 10	3 61	3 62	3 56	4 32
2007	4 49	5 11	5.32	5 81	6 05	4 93	1 73	1 57	2 84	3 55		4 82
2008		4 95		5 52		5 89	4 59	3 34	4 00	3 88	3 91	4 49
2009	4 69	4 87		5 58	5 98	5 50	2 04	3 21	3 42	3 91	3 74	4 30
2010	4 53	4 72										

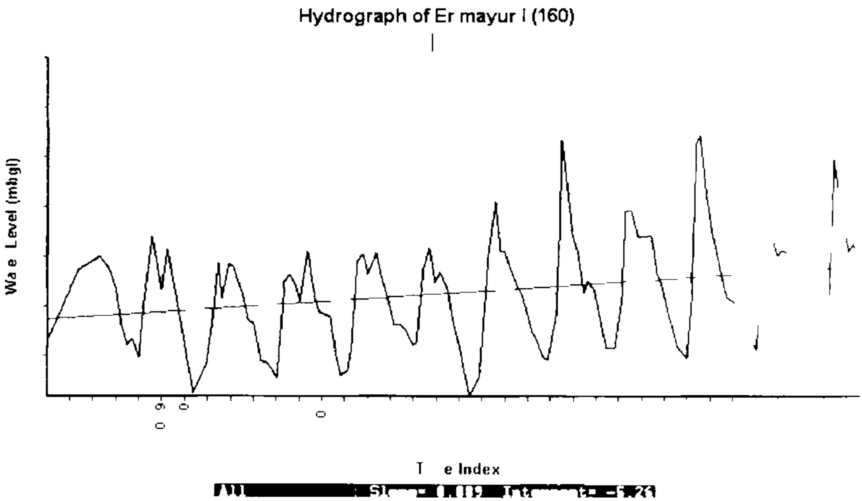
Location Alathur **Well no** PKD S 2
District Palakkad **Well type** Dug well
Owner Public

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005		1 66	2 03	2 33	1 63	1 35		0 79	1 01	0 43	0 87	1 01
2006	1 37		2 42		1 38	0 79	0 73	0 68	0 70	0 77	0 75	0 76
2007	0 72	0 94	1 51	1 98	2 11	1 53	0 70	0 78	0 65	0 75		0 73
2008		0 77		0 63	1 94	0 72	0 75	0 73	0 80	0 72	0 80	
2009	0 77		1.28	1.38	1 64	0 75	0 57	0 75	0 74	0 84	0 75	0 72
2010	0 77	0 75										

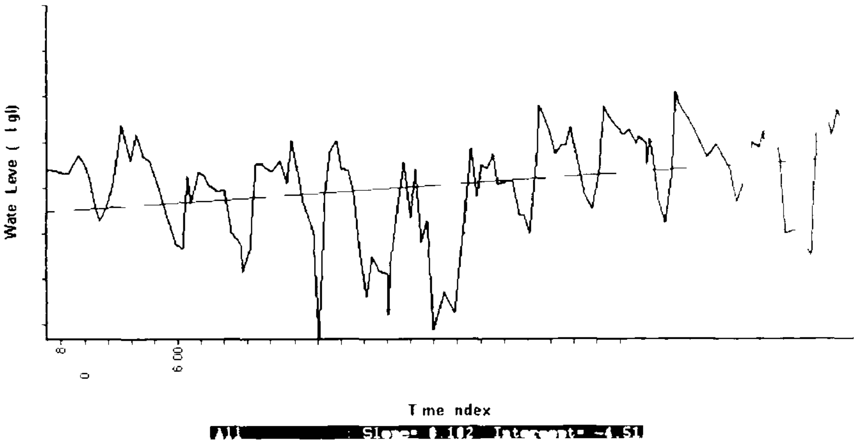
(Source Ground Water Division Palakkad)

Fig 16 Long term trend in water levels of the study area

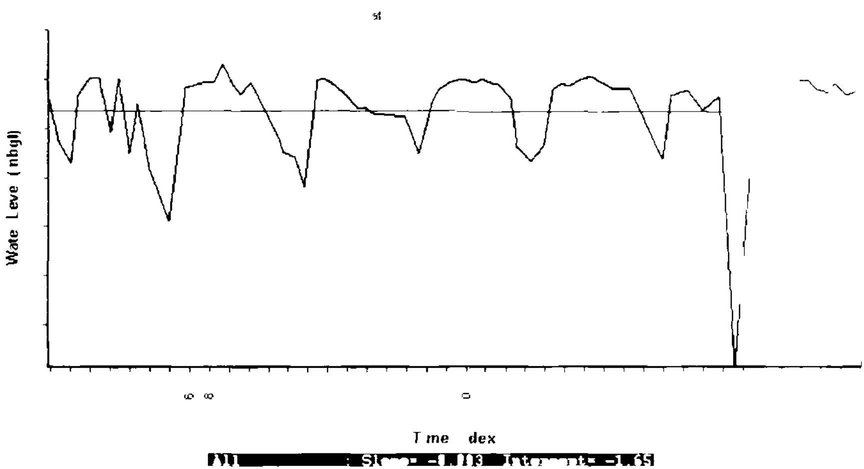




Hydrograph of Kollengode (148)



Hydrograph of Kuzhalmannam (160 PKD 12)



S (d W r D p I kk

5. Enrichment of biodiversity

Table 56 reveals that majority of the respondents (62.5%) perceived biodiversity enrichment as a major social benefit of eco-friendly farming. Most of the farmers opined that reduced use of chemical inputs and avoiding poaching in eco-friendly farming leads to conservation of biodiversity in this eco-system. 37.5 per cent respondents attributed biodiversity changes to other factors like climate change and human interventions, besides eco-friendly cultivation. Most of the farmers opined that natural enemy population, earthworms and other flora and fauna has increased in the fields managed in eco-friendly way. This conforms to the results of Kumar et al. (2008), where they found maximum population of natural enemies in natural biological control plot (NBCP) and, Chen (1992) who reported that synthetic pyrethroids produced more than 90 per cent mortality of ants, spiders, beetles and *Telenomus* sp in rice fields.

There has been a significant change in the faunal and floral diversity in rice fields over the years that may be attributed to very many reasons. Some of the reasons for reduction in diversity according to farmers say are the overuse of inorganic inputs and poaching. For a comparison of biodiversity variation in the post green revolution period in contrast to the past, old farmers from the regions under study were contacted for identification and verification. The results of the study are presented in Table 61. During the green revolution period, inorganic fertilizers were dumped in the field. Application of pesticides like endrin and folidol was extensive in late 70s, in the study area, which had reduced the population of frog, snakes, fish and eagle. Due to eutrophication and contamination of water bodies there was a drastic reduction in the fish population in rice fields. Population of small weed fish (paral) and local muzhi has substantially reduced while that of African muzhi, which was illegally introduced, has increased over the years. A gradual reduction in natural enemy population was observed over the years in the area. Population of spiders, damselflies, dragonflies, ladybird beetles, grasshoppers, crickets, butterflies, rove beetles, water striders etc has reduced. A drastic reduction in the population of frogs, water snakes, crabs, green lizards / chameleons etc were reported. Earlier in the hillsides, near rice fields, turtles were seen in plenty whose population has drastically declined recently. Avi-faunal population too has declined. Mynah, brown ergets etc were some among the birds that has decreased in its number. Cattle egrets has increased in number from that of the past. The problems of peacocks, deer and wild boar have increased in the Kollengode region in the hillsides of Sitarkundu. This might be due to the increased interference of human beings in their habitats in the hills and reduction in the predator population. There were even cases of finding the habitats of wild boar in the residential areas near rice fields. The problems of leech in these areas had also increased which were transmitted from hills through dam water. Earlier leeches were not seen in rice fields, since the fields were then irrigated with water from traditional sources. There had also been a shift in the floral diversity. Population of plants like hydrilla, brahmi, nymphaea, wedelia, glenwood grass, bloodgrass, puncture vine etc. has declined while that of eichornia, hygrophila, barnyardgrass, cyprus, lemna etc. had increased from that of the past.

6. Aesthetic value enhancement

As presented in Table 56, 68.75 per cent of the respondents considered aesthetic value enhancement as a major social benefit followed by 31.25 per cent who perceived it to be of lesser importance as a social benefit of eco-friendly rice cultivation. Most of the farmers reported that the picturesque beauty of lush green fields with all its flora and fauna in the early hours of a day was beyond expression. However, farm tourism is at its infancy in the study areas. Use of eco-friendly inputs in paddy fields in no way interfere with the biodiversity of the area and hence an enhancement of aesthetic value.

Plate.6 Data collection on biodiversity variation in rice eco-system

Table 61. Farmers' perception on variation in the floral and faunal diversity over years

Sl No.	Flora		Fauna	
	Common name	Scientific name	Common name	Scientific name
Organisms whose population / menace has increased over the years				
1.	Barnyard grass (*Mal. Kavada*)	*Echinochloa crusgalli*	Purple Moorhen (*Mal. Mayilkozhi*)	*Porphyrio porphyrio*
2.	Cyprus (*Mal. Manjakora*)	*Cyprus iria*	Cattle egrets *(Mal. Vella kokku)*	*Bubulcus ibis*
3.	Duck weed	*Lemna sp.*	Peacock (*Mal. Mayil*)	*Pavo cristatus*
4.	Hygrophila (*Mal.Vayalchulli*)	*Hygrophila auriculata*	Wild boar (*Mal. Kattu panni*)	Sus scrofa
5.	Water hyacinth (*Mal. Kulavazha*)	*Eichornia crassipes*	Deer (*Mal. Man*)	Cervus sp.
6.	*(Mal. Kora pullu)*	*Fimbristylis miliaceae*	Leech (*Mal. Atta*)	Haemadipsa sylvestris
6.	Chara *(Mal. Chandi)*	*Chara spp.*	Fish : African muzhi	*Clarias gariepinus*
7.	Spirogyra *(Mal. Payal)*	*Spirogyra spp.*		
Organisms whose population has decreased over the years				
1.	Hydrilla	*Hydrilla verticilata*	Spiders	Arachnida
2	Penny wort *(Mal. Brahmi)*	*Bacopa monnieri*	Damsel fly	Odonata : Zygoptera
3	Nymphaea (*Mal. Ambal)*)	*Nymphaea sp.*	Dragon fly	Odonata : Anisoptera
4	Wedelia *(Mal. Manjakkayonni)*	*Wedelia trilobata*	Lady bird beetle	Coleoptera : Coccinellidae
5	Glenwoodgrass *(Mal. Pollakala)*	*Saccolepis interrupta*	Grass hoppers	Acridoidea : Tettigonidae
6	Bloodgrass(*Mal.Changali/ Naringa*)	*Iscsne miliaceae*	Crickets	Grylloidea
7	Puncture vine *(Mal. Njerinhil)*	*Tribulus terrestris*	Butterfly	Lepidoptera : Hesperidae
8			Rove beetles	Coleoptera : Staphylinidae
9			Water striders	Hemiptera : Gerridae
10			Frogs	Anura
11			Water snakes	
12			Small weed fish *(Paral)*	*Puntius ticto , Puntius amphibius*
13			Local Muzhi / nadan muzhi	*Clarias dussumierii*
14			Crabs	
15			Garden lizard / chamaleon	
16			Grey herons	*Ardea cinerea*
17			Mynah	*Acridotheres tristis*

Cattle egrets (Bubulcus ibis)

Water hyacinth *(Eichornia crassipes)*

Faunal and floral population increase

Grey heron *(Ardea cinerea)*

Brahmi *(Bacopa monnieri)*

Faunal and floral population decrease

Plate 7. Biodiversity variation over the years

7. **Life style changes towards sustainable development**

It is observed from the Table 56 that majority of the respondents (56.25%) perceived life style changes towards sustainable development not to be an important social benefit of eco-friendly rice production followed by 43.75 per cent, who opined that this dimension is an important social benefit of adopting eco-friendly farming. Most of the farmers were of the opinion that their life style and demeanor had not changed much by way of moving towards sustainable farming. Most of these farmers took up eco-friendly farming recognizing and experiencing the adverse effects of chemical inputs in the soil.

8. **Self-development**

It is evident from Table 56 that most of the eco-friendly farmers (56.25%) did not perceive self-development as an important social benefit followed by 43.25 per cent who perceived it in the other way. It may be due to the fact that most of the eco-friendly farmers were not satisfied with the uniform price for eco-friendly and inorganic rice. The contentment would be generally less if the farmers were not able to get the fruits of their hard work. Most of them were of the opinion that they were not being recognized and appreciated in the society as an eco-friendly farmer or an opinion leader in matters related to eco-friendly farming. As per Collins et al. (1964) group member's satisfaction was affected by their role in the group, its prestige, direct rewards and benefits received.

9. **Augmenting public health**

A glance of Table 56 reveals that majority (62.5%) of the respondents had perceived augmenting public health to be of higher social benefit of eco-friendly rice cultivation. Most of the respondents were aware of the pesticide toxicity, its health impact etc. which might be the reason for the result. The endosulfan controversy of Perla panchayat and adjoining areas of Kasaragode district highlighted the consequence of unscientific and irrational use of pesticides and this was an eye opener for most of the farmers with regard to pesticide application. Devi (2007) in her study reported that reduced dose of pesticides significantly reduced the health costs of workers exposed to pesticides.

10. Increased labour utilization

A probe into the Table 56 reveals that majority of the respondent farmers (62.5%) perceived increased labour utilization, which is highly beneficial to the society. As most of the eco-friendly farming operations are labour intensive, there is an increased utilization of the labour force, which assures them more number of work days and hence, a better income and livelihood. Preparation, application and transportation of eco-friendly inputs and other operations like weeding requisites increased labour.

4.9 Constraints perceived by the stakeholders in planning and implementation of development projects in eco-friendly rice farming

The constraints according to their severity in the planning and implementation stages of the development projects in eco-friendly rice farming as perceived by stakeholders are presented in Table 62 and 63.

4.9.1 Farmers

As revealed by the ranking of the constraints based on their severity as perceived by the farmers, it is evident that the *padashekarasamithi* was looked upon as a supplier of inputs provided by *krishi bhavans* and thereby ignored its crucial role in sustainable development of *padashekaram* and lack of interest of the members in the *samithi* activities stood as the major constraints perceived by the farmer respondents. Most of the farmers considered *padashekarasamithi* as a supplier of inputs from *krishi bhavans* like subsidies, manure and fertilizers, bio control agents and other plant protection inputs. Majority of the members were not interested in the *samithi* activities, and their participation was found to be very low. All the responsibility of running the *samithi* was bestowed with the president and secretary. The next two constraints were associated with the former ones and they were lack of proper planning by the *samithi*s and lack of co-ordination among its members. There is no proper planning in majority of the *samithis* on the technologies to be adopted. The *samithis* convene meeting primarily to discuss on the supply of inputs, bonus and subsidies from *krishi bhavans* and nowhere in this, cultivation practices or technologies were discussed. Lack of interest results in lack of co-ordination among the members, which was another limiting factor in the planning stages of development projects in rice farming. Lack of consensus among the members on the technologies to be adopted resulted from the lack of co-ordination among its members. Low attendance of the members in the meetings, which might be attributed to their lack of interest, was one of the major constraints in the effective planning of the activities of *padashekarasamithi*. Interestingly, it was reported that all the members were usually present only on the day of distribution of bonus. The other two major constraints were inadequate number of meetings and lack of extension support or technical guidance on eco-friendly technologies. Women participation was also not found effective in *padashekarasamithis* as their participation in decision-making was very low. Women membership in the *samithi* was less and this was due to the fact that the land ownership in a family was mostly confined to the elder male member.

In the implementation stage of the development projects on eco-friendly rice farming, the major constraint perceived was the labour unavailability. As eco-friendly farming is labour intensive and as there was extensive out- migration of agricultural labourers, the farmers found it very difficult to implement eco-friendly technologies in rice. The next major constraint perceived by them was the problem in marketing of organic rice due to difficulty in getting it certified. The cumbersome procedures and formalities and the high investment involved in certification made it a difficult option for the farmers. As rice is a crop grown in an extensive area with a common irrigation system, for getting it certified, organic cultivation has to be adopted on a *padashekaram* basis, for which the consent of every member should be sought.

Table 62. Constraints perceived by the stakeholders in the planning stage of development projects in rice farming

Sl.No	Constraints	Farmers		Extension personnel		People's rep/social activists	
		Observed score	Ranking	Observed score	Ranking	Observed score	Ranking
Planning Stage							
1.	Lack of co-ordination among the members of *padashekarasamithi*	576	4	560	1	568	4
2.	Lack of proper planning by the *padashekarasamithis* on the techniques to be adopted in eco-friendly rice farming	580	3	528	2	604	2
3.	Inadequate number of meetings	428	7	424	7	396	7
4.	Low attendance of members in the meetings of *padashekarasamithi*	507	6	500	4	484	6
5.	Lack of interest of members in *padashekarasamithi* activities	607	2	524	3	600	3
6.	*Padashekarasamithi* is looked upon as a supplier of inputs given by Krishi Bhavan.	628	1	452	5	612	1
7.	Lack of consensus among the members on the technologies to be adopted	540	5	440	6	564	5
8.	Longer distance to the venue of meetings	49	15	197	14	20	17
9.	Inconvenient timing of meetings	32	16	211	13	28	15
10.	Personal conflicts among the members	164	13	227	12	192	13
11.	Political interventions leading to conflicts	177	12	352	9	127	14
12.	Lack of effective leadership in coordinating the meetings and planning the activities	149	14	392	8	258	11
13.	Lack of proper documentation of the decisions taken in the meetings	7	17	256	10	24	16
14.	Lack of extension support / technical guidance	363	8	244	11	362	9
15.	Lack of financial support	245	11	127	16	213	12
16.	Lack of women participation in *padashekarasamithi* activities	332	9	127	16	364	8
17.	Inadequate role of women in decision making	305	10	140	15	324	10

Table 63. Constraints perceived by the stakeholders in the implementation stage of development projects in rice farming

Sl.No	Constraints	Farmers		Agrl. labourers		Extn. personnel		People's rep/social activists	
		Observed score	Ranking	Observed score	Ranking	Observed score	Ranking	Observed score	Ranking
Implementation stage									
1.	Labour unavailability	720	1	720	1	712	1	700	1
2.	Lack of availability of eco-friendly inputs on time	449	8	444	9	408	4	472	8
3.	Lack of availability of adequate quantity of eco-friendly inputs	480	6	476	7	345	6	504	6
4.	Lack of availability of adequate fund on time	143	16	92	16	416	3	172	16
5.	Higher transportation cost	404	9	354	10	337	7	317	10
6.	Difficulty in handling and application of eco-friendly inputs	237	13	504	6	259	8	290	12
7.	Difficulty in storage of bulky eco-friendly inputs	16	18	17	18	184	11	18	18
8.	Low storage life of eco-friendly inputs	167	15	244	13	137	17	188	15
9.	Lack of good quality, certified organic inputs in the market	561	3	592	3	588	2	572	3
10.	Lack of knowledge on eco-friendly techniques	523	4	676	2	391	5	532	4
11.	Problems in marketing of organic rice due to difficulty in getting it certified	639	2	532	5	166	13	596	2
12.	Higher cost of eco-friendly inputs	472	7	552	4	136	18	484	7
13.	Low yield compared to inorganic farming in the first few years of practicing organic farming	500	5	468	8	172	12	528	5
14.	Results are not visible immediately as in the case of inorganic inputs	267	11	298	11	189	10	284	13
15.	Unfavourable stance towards eco-friendly cultivation	197	14	288	12	144	16	374	9
16.	Lack of proper extension strategies in supporting eco-friendly cultivation in rice	257	12	227	14	152	15	273	14
17.	Lack of involvement of some members during the implementation stage	353	10	216	15	164	14	297	11
18.	Lack of leadership in effective management of the group.	128	17	78	17	214	9	138	17

Lack of availability of good quality, certified organic inputs in the market was yet another important constraint. The organic inputs available in the market under different names and companies were not certified and checked for quality. Many a time the farmers were cheated with spurious products. The other major constraints were lack of knowledge on eco-friendly techniques, lower yield in the first few years of organic farming, lack of availability of adequate quantity of eco-friendly inputs like organic manure, organic plant protection inputs etc. and its higher cost as per their decreasing order of importance.

4.9.2 Agricultural labourers

As labourers were nowhere involved in the planning stage of development of projects in *padashekarams* they were not able to perceive the constraints in that stage and hence planning stage were not included in the questionnaire for labourers. Table 62 reveals agricultural labourer's perception of constraints in the implementation of development projects on eco-friendly rice farming. Labour unavailability was the major constraint in the implementation stage. Lack of knowledge was the next major constraint, as most of the labourers had not attended any training programmes on eco-friendly cultivation. Lack of good quality, certified organic inputs in the market and higher cost of these inputs were the major constraints as perceived by the labourers. Problems in marketing of organic rice, difficulty in handling and application of inputs and lack of availability of adequate quantity of eco-friendly inputs were perceived to be the other major limiting factors in the implementation of eco-friendly cultivation practices.

4.9.3 Extension personnel

It is evident from Table 62 that lack of co-ordination among the members of *padashekarasamithi* and their lack of planning on the technologies to be adopted in eco-friendly rice farming stood as the most important constraints perceived by the extension personnel. The lack of interest of members in the *samithi* activities and low attendance of the members due to lack of interest were also perceived as serious constraints. Another major problem as perceived by this group of stakeholders was that farmers looked upon the *samithi* as an input supplier from the department. Lack of consensus among the farmers was posing serious threats to the smooth planning of the *samithi*. The other constraints were inadequate number of meetings, lack of effective leadership, political interventions leading to factions and conflicts and lack of proper recording of the decisions taken at the meetings.

It is evident from Table 63 that the most important constraint perceived by the extension personnel in the implementation stage was the labour unavailability followed by lack of good quality, certified organic inputs in the market. Lack of availability of adequate fund on time was rated the next major constraint followed by the lack of availability of eco-friendly inputs on time. Lack of availability of adequate quantity of eco-friendly inputs was also found affecting the implementation of eco-friendly cultivation. Higher transportation cost that claimed difficulty in handling and application of eco-friendly inputs, lack of leadership in effective management of the group and difficulty in convincing the farmers, as the results were not visible immediately unlike inorganic inputs were the other major constraints in the implementation stage.

4.9.4 People's representatives / social activists

Table 62 reveals that the major constraint perceived by the people's representatives/social activists in the planning stage is that the farmers looked upon *padashekarasamithi* as an input supplier of *krishi bhavans*. Lack of proper planning by the *samithi*s on the technologies to be adopted and lack of interest of the *samithi* members in the *padashekaram* activities were some of the important constraints in the planning stage. Lack of co-ordination among the members of *padashekarasamithi* and lack of consensus were the next major constraints. Low attendance of the members in the meetings and inadequate meetings were another limiting factors in the smooth planning, which may be attributed to lack of interest and co-ordination among the members. Lack of women participation, lack of extension support/technical guidance and inadequate role of women in decision making were some of the other constraints in the planning stage of development project on eco-friendly rice farming in order of decreasing importance, as perceived by people's representatives/social activists.

As in the case of the farmers, agricultural labourers and extension personnel, the most important constraint perceived by the people's representatives/social activists was the labour non-availability. At present, one of the major constraints faced by the agriculture sector is the labour problem. Most of the labourers here are migrated labourers from other states. The unemployed youth of Kerala are not willing to take up jobs in the farming sector as it is perceived as a low status job by the society. Problems in marketing organic rice due to the difficulty in getting it certified and lack of good quality certified organic inputs were some of the important factors hindering the implementation of eco-friendly rice cultivation. Lack of knowledge on eco-friendly techniques and low yield compared to inorganic farming in the first few years were also perceived to be the important constraints. Other two major limiting factors as perceived by the people's representatives/social activists were lack of availability of the required quantity of eco-friendly inputs and the unfavourable attitude of the farmers towards eco-friendly rice cultivation, which pose serious threats in eco-friendly rice cultivation. One of the major shares in the input cost was the higher transportation cost and this was also perceived to be a major constraint.

4.10 Perception of attributes of eco-friendly cultivation practices in rice

Table 64 reveals the farmer's perception of various attributes of eco-friendly practices *viz.* simplicity, profitability, cost involved and labour requirement. Farmyard manure/compost/green manure/poultry/biogas slurry application was perceived to be complex by the farmers in all the four study areas. The profitability of this practice was perceived to be in the range of very high to high in all the study areas except Alathur, where farmers opined that it was profitable only at medium level. All the members from the four study areas explicitly opined that the cost involved and labour requirement was high to very high. Manure availability was

Plate 8. Focus group discussions

one of the major problems in all the study areas due to declining livestock population. Transportation of bulky organic manure was also found to involve more labourers and thus incurs a higher cost.

Application of bio-fertilizers like *Azolla*, *Azospirillum* etc. was perceived complex to very complex by the focus groups in all the four study areas. It was considered as less to medium profitable. The cost and labour involved in the application were reported to be in the range of very high to high. Raising *Azolla* in water tanks and its application in the field was perceived to be complex, involving higher cost and labour requirement, hence was in the less to medium profitability level. This may be due to the fact that none of the farmers applied *Azolla* in their field and were not familiar with the practice.

Inclusion of enterprises like dairy, poultry, piggery etc. was thought of as a very complex to complex practice. Profitability of the practice was perceived by the groups in the low to medium range. Cost and the labour requirement were found to be very high to high. All the farmer groups perceived inclusion of enterprise to be labour intensive and, which needed constant care. All these, as per the farmers opinion made it difficult, incurred higher costs and hence was less profitable. Application of urea with neem cake, which did not need additional labour or involve complex procedures was perceived to be very simple to moderate by three of the study groups. The groups perceived it as profitable in the range of medium to very high level. As it did not involve additional labour the fourth farmer group perceived it as very low to medium cost and labour requirement for this practice. Application of nitrogen and potassium in two to three split doses according to the duration of variety was perceived by the three groups as moderate whereas the group from Alathur perceived it as complex. Applying the fertilizers in split doses involves more labour and hence incurs an additional cost. But here all the groups unanimously opined that the profitability was high, cost involved was medium and labour requirement was on the higher side.

Table 64. Farmers' perception on the attributes of various eco-friendly practices in rice cultivation

Sl. No	Attributes → / Eco-friendly practices	Simplicity				Profitability				Cost involved				Labour requirement			
		Kollengode	Kuzhalmannam	Chittoor	Alathur	Kollengode	Kuzhalmannam	Chittoor	Alathur	Kollengode	Kuzhalmannam	Chittoor	Alathur	Kollengode	Kuzhalmannam	Chittoor	Alathur
1.	FYM / Compost / Green leaf / Poultry / Biogas slurry application.	Purple	Purple	Purple	Purple	Yellow	Green	Yellow	Blue	Purple	Red	Purple	Blue	Purple	Red	Purple	Red
2.	Application of bio – fertilizers like *Azolla*, *Azospirillum* etc.	Red	Purple	Purple	Purple	Purple	Blue	Blue	Blue	Red	Purple	Purple	Purple	Purple	Red	Red	Red
3.	Inclusion of enterprises like dairy, poultry, piggery etc.	Purple	Purple	Purple	Red	Blue	Blue	Blue	Purple	Purple	Purple	Purple	Red	Purple	Red	Red	Red
4.	Application of urea mixed with neem cake	Green	Yellow	Green	Blue	Green	Blue	Yellow	Blue	Red	Yellow	Green	Blue	Red	Purple	Purple	Purple
5.	Application of Nitrogen and Potassium in 2-3 split doses according to the duration of the variety.	Blue	Blue	Blue	Purple	Yellow	Yellow	Yellow	Yellow	Blue	Blue	Blue	Blue	Purple	Purple	Purple	Purple
6.	Application of lime	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Blue
7.	Incorporation of crop residue in the field itself	Green	Green	Green	Green	Green	Yellow	Yellow	Purple	Green	Yellow	Blue	Yellow	Green	Green	Green	Yellow
8.	Summer ploughing	Blue	Blue	Blue	Green	Blue	Yellow	Blue	Yellow	Green	Yellow	Green	Yellow	Blue	Blue	Blue	Yellow
9.	Land leveling / puddling	Yellow	Blue	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Blue	Blue	Yellow	Yellow	Blue	Blue	Yellow
10	Plastering of field bunds / trimming / its regular cleaning	Purple	Red	Purple	Red	Blue	Blue	Blue	Purple	Purple	Red	Purple	Red	Red	Red	Red	Red
11.	Construction / cleaning / desilting of farm ponds for collecting rain water	Red	Purple	Purple	Red	Red	Blue	Blue	Purple	Red	Red	Red	Red	Red	Red	Red	Red

12.	Practicing SRI in areas of water scarcity and wherever water management is possible.	🟣	🟣	🔵	🟣	🟡	🟡	🟡	🟡	🟣	🔵	🔵	🟡	🔵	🔵	🔵	🔵
13	Manual weeding / trampling / stale seed bed technique / walking across paddy fields during the vegetative phase of the crop	🔵	🟣	🔵	🟢	🔵	🟡	🟡	🔵	🟣	🔴	🔴	🔴	🔴	🔴	🔴	🔴
14	Augmentation of parasite / predator population in the field / use of natural enemies like *Trichogramma*, *Pseudomonas* etc.	🔵	🟣	🟣	🟡	🔵	🟡	🟡	🔵	🔵	🔵	🔵	🔵	🔴	🟣	🟣	🔵
15	Ploughing the field and exposing to sun	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🟡	🟡	🔵	🟢	🔵	🔵	🟡
16	Synchronized sowing	🔴	🟣	🟣	🟣	🟢	🟢	🟢	🟢	🔵	🟡	🔵	🟢	🔵	🟣	🔴	🟢
17	Removal (sweep nets) and destruction of pests , infected parts and diseased plants .	🔴	🟣	🔴	🔵	🟣	🔵	🟣	🔵	🔴	🟣	🔴	🟣	🔴	🔴	🔴	🟣
18	Use of traps (Light traps / pheromone traps / sticky traps)	🔴	🟡	🟡	🟢	🔴	🟣	🔵	🔵	🔴	🔵	🔵	🟡	🔴	🟣	🟢	🔵
19.	Regular surveillance of the field / Economic Threshold Level	🔵	🔵	🔵	🟡	🔵	🟡	🟡	🟡	🔵	🔵	🔵	🟡	🔵	🟣	🔵	🟣
20	Use of environment friendly pesticides like bio-pesticides (neem based, Panchagavya, Dasagavya, fish aminoacid)	🟣	🟣	🔴	🔴	🟣	🟡	🟡	🔵	🟣	🔵	🟣	🔵	🔴	🟣	🔴	🔵
21	Use of bird scarers like polythene covers/ tape etc.	🟢	🟡	🟢	🟡	🟡	🟡	🔵	🔵	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔵
22	Kerosenised roping / roping / draining the field / Brushing or sweeping rice plants with bamboo thorns, *murams* etc.	🟣	🟣	🟣	🔴	🟣	🔵	🔵	🔵	🟣	🟣	🟣	🟣	🟣	🟣	🔴	🟣

23.	Precautions while spraying / using safety gadgets / avoiding drift / safe disposal of containers / using equipments of prescribed standards	🔵	🔵	🔵	🔵	🟡	🟡	🟡	🟢	🟢	🟡	🟡	🟡	🟢	🟡	🟢	🟢
24	Planting borders closely with seedlings to restrict the entry of rats / water management	🟢	🟢	🟢	🟢	🔵	🔵	🟣	🔵	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟢
25	Soaking seeds in hot water / applying supernatant of cow dung slurry / placing sachets of bleaching powder against Bacterial Leaf Blight.	🔵	🔵	🔵	🟣	🟡	🟢	🟢	🟡	🟣	🟣	🟣	🔵	🟣	🔵	🟡	🔵

Sl No.	Colour indicators	Complexity - Simplicity	Profitability	Cost involved	Labour requirement
1	🔴	Very complex	Very low	Very High	Very High
2	🟣	Complex	Low	High	High
3	🔵	Moderate	Medium	Medium	Medium
4	🟡	Simple	High	Low	Low
5	🟢	Very simple	Very High	Very low	Very low

All the groups considered application of lime moderately simple. All the groups opined that profitability, cost involved and labour requirement was medium for this practice. It may be due to that liming was a common practice adopted by majority of the farmers and did not involve any complex procedures or incremental labour.

All groups perceived incorporation of crop residue in the field as very simple, three of the groups considered its profitability to be high to very high. Cost involved and labour requirement of this practice was considered low to very low. As this practice of incorporation was done simultaneously with ploughing, it did not requisite additional expense or labour.

All the three groups thought summer ploughing as moderately simple. Profitability was perceived to be in the range of medium to high. Cost involved and labour requirement were considered to be medium by the three groups of Kollengode, Kuzhalmannam and Chittur. As summer ploughing was a routine job carried out by all the farmers, they perceived it moderately simple for all the given attributes.

Most of the groups opined land leveling/puddling simple to very simple practice. The groups unanimously opined that it had high profitability involving low to medium cost and labour requirement. Land leveling / puddling is associated with summer ploughing. This has been practiced from time immemorial to date by the rice farmers. Thus the familiarity and long term experience make the practice simple as well as profitable. Off late all these practices were being mechanized and thus involved low to medium labour.

Plastering of field bunds/trimming/its regular cleaning was perceived complex to very complex by the focus groups. The profitability from this was perceived to be in the low to medium category. The cost involved for this practice was felt to be in the high to very high range whereas the labour requirement was considered very high by all the focus groups. Due to the undulating topography of the study area the fields were surrounded by taller bunds and its plastering was considered a very complex procedure and was usually carried out once in two years as it incurred very high expenditure and labour requirement.

Construction/cleaning/desilting of farm ponds for collecting rainwater was perceived as a practice that was complex to very complex. All the members in the group opined that the cost involved in this practice was very high and hence the profitability was in the range of very low to medium. All the groups perceived this practice as labour intensive. As the respondents in the study area use dam water for irrigation purpose they were not so concerned about maintaining ponds for collecting rainwater. Construction/cleaning/desilting incurs higher cost and labour. These may be the reason they perceive it a complex practice.

SRI was being practiced mainly in Chittur area where water management is possible and hence all the groups except that of Chittur perceived the practice to be complex. But all the members of the group perceived that SRI was highly profitable whereas the cost involved in practicing SRI was considered by majority to be in the medium range. All the focus groups opined that comparing the labour requirement of SRI with traditional rice, the former involves medium requirement.

Manual weeding/trampling/stale seedbed technique/walking across paddy fields during the vegetative phase of the crop, which helps in suppression of weeds, were thought of as moderately simple by two groups *viz.* Kollengode and Chittur, while profitability was perceived to be in the range of medium to high. All groups were of the opinion that cost involved was high to very high and there was no disagreement, that the labour requirement was very high for this practice. In a social situation, where labour was considered to be a scarce resource, a practice like manual weeding/trampling would be considered to be the one, which involves high cost and labour. Nevertheless, all the farmers were of the opinion that the yield aspect was high in this type of weeding, where suppression of weeds along with better aeration due to trampling was assured.

Eco-friendly plant protection strategies like augmentation of parasite/predator population in the field/use of natural enemies like *Trichogramma*, *Pseudomonas* etc. were perceived complex by two of the focus groups as they did not try this in their fields, whereas profitability was considered to be in the medium to high range. Cost involved in this practice was perceived to be medium with high to very high labour requirement.

Ploughing and exposing the field to sun was followed by every farmer respondent in the study area and hence all the groups perceived this practice simple, highly profitable involving low cost and low to medium labour. As this practice was mechanized recently in almost all *padashekarams* it involved less labour and cost.

Synchronized sowing was considered to be a complex to very complex procedure by all the groups, as co-ordinating the members of the *Samithi* and making them adopt rice varieties of similar duration was very difficult. The profitability, as perceived by the groups was very high in this practice. This perception was due to the fact that most farmers were aware of the increased rice bug infestation in fields with different crop stages. Rice bugs were observed as a major pest reducing the yield in the study area. Cost involved would be in the very low to medium range as the practice did not incur any additional cost. All groups had differential opinion on the labour requirement ranging from very low to high. Some of the groups who perceived labour requirement to be high, opined that there would be scarcity of labourers while practicing synchronized sowing.

Removal and destruction of pest, infested plant parts and diseased plants were perceived to be complex to very complex by three of the groups. It was considered that profitability was in the range low to medium, cost was in the range of high to very high and cost and labour was in the very high category. Unlike in other parts of Kerala, most of the farmers possess larger contiguous area of rice fields and hence mechanical removal of infested or diseased parts from the field necessitates more labourers thus incurring a higher cost. In Alathur, where the farmers perceived it as moderately simple, majority of the *samithi* members possessed fragmented holdings and they found the practice of mechanical removal of infested or diseased parts feasible with their own labour.

Use of different types of traps were perceived to be simple, moderately profitable, involving moderate cost and very low to high labour requirement except in Kollengode where the farmers were of the opinion that they were not familiar with these traps and hence found it to be very complex with very low level of profitability involving very high cost and labour requirement.

Regular surveillance of the field for Economic Threshold Level was found to be moderately simple for majority of the groups. High profitability, moderate cost involved and medium to high labour requirement was perceived to be the attributes of this practice by the three focus groups. It is a routine practice of rice farmers to visit their fields in the early hours of the day and hence it did not require an additional cost. Some of the large farmers employed labourers exclusively for surveillance purpose and hence perceived a higher labour requirement for the practice.

The use of environment friendly pesticides like bio-pesticides were perceived to be complex to very complex as the preparation of *Panchagavya*, *Dasagavya* etc involved cumbersome procedures. The group members expressed disagreement regarding the profitability of the practice that showed a variation from low to high level. Cost involved in this practice was observed to be in the range of medium to high level whereas the labour requirement was perceived medium to very high.

Use of bird scarers like polythene covers, used audio or video tapes, crackers etc were perceived to be simple, with medium to high profitability, very low to low level of cost and labour requirement. It was found to be a local practice with minimum inputs that effectively controlled birds in rice fields.

The practice of kerosenised roping / brushing or sweeping rice plants with bamboo thorns were not practiced in the regions selected for the study as the infestation of case worm was found to be very less. Moreover performing this practice in a larger contiguous area was perceived to be complex, moderately profitable, involving high cost and labour.

The practice of following safety measures while handling pesticides were perceived to be moderate in its simplicity, high in its profitability, low in the cost involved and very low in labour requirement. Using safety gadgets, avoiding drift, conforming to the application time, safe disposal of containers, following safety measures while spraying etc were perceived to be highly profitable when considering the health of applicators and public. It did not incur any additional cost or labour.

The practice of close planting of seedlings in the borders to restrict entry of rats was perceived by all the groups to be very simple, moderately profitable with very less cost and labour.

Soaking seeds in hot water/applying supernatant of cow dung slurry/placing sachets of bleaching powder against Bacterial Leaf Blight was practiced by most of the farmers who perceived it to be moderately simple, having high profitability, with high cost and medium labour requirement. Majority of the farmers opined that this practice was found highly effective in controlling Bacterial Leaf Blight of rice.

4.11 *Paruthikavu Nellulpadhaka Padashekarasamithi* – A case of effective planning and implementation of development projects on rice farming under decentralized planning

Paruthikavu Nellulpadhaka Padashekarasamithi of Chittur-Tattamangalam municipality in Palakkad district has its history traced back to 1980, with the formation of a *Karashaka charcha samithi* (Farmers Discussion Forum). It had then 10 farmers spread over 25 ha of paddy fields, who wanted to make rice cultivation profitable and sustainable. Prior to the formation of Farmers Discussion Forum, all the farmers were practicing various cultural operations individually, incurring higher cost of cultivation. This situation invoked a felt need for reducing the cost by synchronizing major farm operations. Several meetings were convened and finally consensus was arrived at to co-ordinate various cultural operations in the *padashekaram.*

Lack of uniformity in agricultural operation, poor water management, lack of technical know-how, heavy and unscientific application of chemical inputs, lack of mechanization, difficulty in marketing by individual farmers, lack of timely support from the government agencies were the major problems faced by the *samithi* at the time of its inception. To overcome these constraints, the *samithi* started its activities in 1982 with community paddy nursery. This got wide publicity and was considered as a model for reducing the cost of cultivation by the Department of Agriculture. In 1990 the *samithi* was registered as a group farming *samithi*, under the present name.

The *samithi* members convened meeting once in a month and before every crop season to discuss about the future plan of work in the *padashekaram* and implement the same. After the second harvest was over the respective landowners brought samples of the soil and entrusted it with the *samithi* who arranged for soil examination and the results were made available to the members on time, thereby reducing the use of chemical fertilizers. Soil testing campaigns were also organized by the *samithi*. Similar varieties with same duration were cultivated uniformly in the *padashekaram* that helped to maintain uniform growth stages which made pest and disease management and fertilizer application easy The problem of scarcity of labour during major operations could be avoided with mechanization, thus making paddy cultivation less expensive. The *Samithi* owns power tiller, power sprayer, knapsack sprayer, 5HP oil engines, transplanter etc. for the use of its members at nominal rent. This has ensured timely operations without any delay. Community nursery was prepared with active participation of all its members. The quantity of seeds required was reduced by means of community nursery. The quantity of total seed used in the traditional nursery was 125kg/ha while in the community nursery they could reduce it to 80kg/ha. Almost all the members maintained compost pit for organic recycling. All the members were instructed to cultivate daincha to minimize the use of chemical fertilizers and organic manure from outside that reduced the cost of cultivation. The broadcasting of green manure seeds was arranged by the *samithi* itself. Application of manure and almost all the cultural operations were done jointly by the members. Irrigation was found highly effective after the *samithi* intervention, which ensured a centralized and uniform water supply to all fields.

All the inputs available at subsidized rates in the *krishi bhavan* were distributed among the needy members with no delay. The application forms for subsidies were collected on time from the members and submitted to the *krishi bhavan* by the *samithi* and all the benefits were distributed the same day by convening meetings. Discussion classes, workshops, seminars, study tours etc. were conducted by the *samithi* to widen knowledge of its members. *Samithi*'s timely

Plate 9. **Paruthikavu** ***padashekarasamithi***

intervention and assistance during natural calamities ensured adequate compensation from the government on time. The *samithi*, as an apex body of farmers met all the needs of its members including collection of forms, liaising with government bodies etc. In order to inculcate thrift, and to ensure financial stability, all the members were urged to be members of National savings scheme. Malayalam New Year "*Chingam*" 1st is celebrated every year as "Farmers Day" and it recognizes selected traditional farmers of the area.

The *samithi* owns a building where crop calendars, posters on crop production and protection aspects, awards, recognitions, photographs of important events, books etc were displayed. In 1993 the *samithi* bagged the first "Nelkathir Award" for the best group farming *samithi* in Kerala. The *samithi* was selected in 2000 as one of the seven farmer organizations in the country for integrating front line extension. The *samithi* acquired tractor and tiller in 1990, and a harvesting machine in 2000. The *samithi* introduced cono weeder and seed drum in 1999, IPM tools like trichocard and pheromone traps in the year 2000, and the year 2002 marked the introduction of transplanter and *Pseudomonas*. For the first time in the state, System of Rice Intensification (SRI) was put into practice in 2004. Experiments with sulphur, microelements, EM technology and daincha seed cultivation with phosphatic fertilizers were conducted in this *padashekaram*.

4.11 Impact of group farming by the *samithi*

4.11.1 Accentuating interest and involvement in group farming

4.11.1.1 Increase in area

The major pointer here is the increase in area over the years under paddy cultivation in the *padashekaram*. The *samithi* started with 25 acres of paddy fields, which extended to about 169 acres in 2002-2003 and at present they cover an area of 187.5 acres (75 ha). The increase in paddy area is presented in Table 65.

Table 65. Increase in paddy area and membership under the Paruthikavu *padashekaram* over the years

Sl.No.	Year	Area (acre)	Membership (Nos.)
1	1990-91	25	10
2	1991-92	40	17
3	1992-93	90	37

4	1993-94	90	37
5	1994-95	102	49
6	1995-96	108	61
7	1996-97	120	76
8	1997-98	145	90
9	1998-99	160	96
10	1999-00	162	97
11	2000-01	162	97
12	2001-02	169	101
13	2002-03	169	101
14	2008-09	187.5	102

(Source: *Paruthikavu padashekarasamithi* activity report, 2004)

The *samithi* could be proud of such a noticeable and tangible achievement especially during a period of drastic reduction in paddy area of our state.

4.11.1.2 Increase in membership

Membership of the *samithi* has increased from 10 members in 1990-91 to 102 members in 2009, which reflected the enhanced interest of the members in the *padashekaram* activities. The increase in memebership over years is given in Table 65.

4.11.2 Increase in profitability

4.11.2.1 Increase in average productivity

The productivity of the *padashekaram* has increased owing to the adoption of scientific and sustainable cultivation practices. The training programmes conducted for the members were the major reason for the adoption of such practices. This has increased the productivity from 850-950 kg/ha in 1990-91 to 5750-6250 kg/ha in 2009.

4.11.2.2 Increase in income

The cost of cultivation has increased from about Rs. 6000/ha to Rs. 25000/ha. The income too was found to increase at a faster rate in group farming from Rs. 8000/ha to Rs. 69,000/ha. Increase in income of the members is presented in Table 66.

Table 66. Increase in income of the members of the *padashekaram* over the years

Sl.No.	Year	Profitability (Rs/hectare)
1	1990-91	8000
2	1991-92	9000
3	1992-93	10000
4	1993-94	12000
5	1994-95	12000
6	1995-96	14000
7	1996-97	15000
8	1997-98	16000
9	1998-99	17000
10	1999-00	18000
11	2000-01	19000
12	2001-02	20000
13	2002-03	24000
14	2008-09	69000

(Source:*Paruthikavu padashekarasamithi* activity report, 2004)

4.11.2.3 Increase in sale of paddy seeds

The members were trained in quality seed production and the *samithi* have been attempting to sell off its production as seed @ Rs.15/kg, which was a means of value addition. In 1991-92, 1000kg of seeds were sold whereas in 2009 the *samithi* sold about 50,000kg.The increase in sale of paddy seeds is given in Table 67.

Table 67. Increase in sale of paddy seeds from the *padashekaram*

Sl.No.	Year	Quantity (kg)
1.	1991-92	1000
2.	1992-93	1500
3.	1993-94	2000
4.	1994-95	1000
5.	1995-96	2500
6.	1996-97	2500
7.	1997-98	5000
8.	1998-99	5000
9.	1999-00	5000
10.	2000-01	7000
11.	2001-02	20000
12.	2008-09	50000

(Source:*Paruthikavu padashekarasamithi* activity report, 2004)

4.11.2.4 Increase in the repayment of bank loans

The number of members who availed loans during 1990-91 was 10 which has increased to 88 in 2001-02 and in 2009 the number decreased to 55. The number of defaulters has decreased from 30 in 1995-96 to 5 members in 2009. The records of loan availed by the members and its repayment is given in the table

Table 68. Increase in repayment of bank loans by the *padashekarasamithi* members

Sl.No.	Year	Number of members who availed loan	No. of defaulters
1	1990-91	10	0
2	1991-92	15	0
3	1992-93	25	0
4	1993-94	30	0
5	1994-95	30	0
6	1995-96	40	30
7	1996-97	60	10
8	1997-98	70	14
9	1998-99	80	15
10	1999-00	85	32
11	2000-01	80	14
12	2001-02	88	15
13	2008-09	55	5

(Source: *Paruthikavu padashekarasamithi* activity report, 2004)

4.11.3 Increase in soil fertility status

The *samithi* has kept records of soil maps prepared since 1990 along with the recommendation of fertilizer to be applied.

4.11.3.1 Regulation of soil P^H

The soil P^H has moved towards neutral over the years from 5 – 5.02 in 1990-91 to 6.5-6.7 in 2009.

Table 69. Variation in soil P^H of the *padashekarasamithi* over years

Sl.No.	Year	P^H
1.	1990-91	5.00-5.02
2.	1991-93	5.00-5.04
3.	1993-95	5.04-5.09
4.	1995-97	5.05-6.1
5.	1997-99	6.1-6.4
6.	1999-01	6.3-6.5
7.	2001-03	6.4-6.7
8.	2007-09	6.5-6.7

(Source: *Paruthikavu padashekarasamithi* activity report, 2004)

4.11.3.2 Improvement in soil nutrient status

The *samithi* could reduce the input of fertilizers by green manure cultivation, Farm Yard Manure application etc. In place of 2 bags of factomphos and 40 kg of urea applied in 1982 one bag of factomphos and 25 kg of urea were applied in an acre.

The success of this *padashekarasamithi* could be attributed to the meaningful relationships and linkages with development agencies, leadership acceptable to the people, policy of non-interference in political and religious matters of the members, inspiration and motivation for its members for capacity building and for joining various social organizations, co-ordination of farmers organizations in the area, single window system for its members for receiving subsidies, loans or credits, prominent role in input mobilization and resource management in the area, introduction of innovative programmes thereby enhancing value and credibility of public funded extension and social obligation which included retirement assistance to its members, life insurance cover for all the members, introduction of National Savings Scheme etc.

The activities of this padashekaram had instilled confidence and evoked enthusiasm among its members, which are the main pillars of its success, and it is moving towards the concept of liability free self-sufficient farmer. *Paruthikavu Nellulpadaka Samithi* will be a development model for all the group farming endeavors in our country. Thanks to its mentors, Sri. Viswanathan and Sri. Mohanan, whose efforts could take this small venture to such great heights.

4.12 Cow based minimum-budget rice farming *(Gō-adharitha krishi)* : A success case of eco-friendly rice farming

Green revolution has substantially contributed to increasing production of food grains at an important socio-political mileu, thereby resolving problems of hunger of millions in our country. Inadvertently over dependence on chemical agriculture resulted in deterioration of environment, thereby threatening sustainability in agriculture. Agriculture is confronted with serious problems that threaten sustainability. Similarly unscientific use of agricultural inputs and inefficient farming systems are resulting in aggravation of many environmental issues. Now, most of the farmers are aware of the consequences of intensive farming and some are even trying to revert to eco-friendly cultivation/natural farming. The attempts made by some of the farmer innovators in this direction are worth appreciating and one such attempt is presented here as a case, where rice is cultivated using different products of cow, like cow dung, urine and milk. This farming is being practiced for the past two years by two innovative farmers Sri. Muralidharan and Sri. Krishnankutty of Chittur block in Palakkad district. After the success of this technique in vegetable cultivation, they experimented it in rice, which was also found to be highly remunerative with an efficient and unique marketing system developed for the purpose.

This farming named as 'cow based minimum-budget rice farming (*Gō-adharitha krishi*) ' by the farmers was found to be viable in the case of vegetable cultivation, wherein the cultivation expense was covered by the profit from intercrops cultivated. But this is not the case with rice cultivation, where it incurs a meager cost, which was very low in case of farmers who maintain local breeds of cow. Mr. Subhash Palekar from the state of Maharashtra is considered to be originator of the concept of 'cow based minimum-budget rice farming (*Gō-adharitha krishi*) ' and was developed after various trials for more than 18 years. It was proposed by these farmer groups that 30 acres of land could be cultivated with the products of a local breed of cow. In the preparations made for cultivation, in this system of farming there was manifold increase of microbial population in cow dung.

Plate 10. Cow based minimum budget rice farming (Goadharithakrishi)

These microbes enhance the uptake of nutrients by the plants. The high organic matter content as well facilitates the action of earthworms on the soil.The ingredients and practices followed by these farmers are detailed below.

Ghanajeevamrutham'- Cow dung, jaggery/tender coconut water, green gram powder and soil from the border of the fields.

'Jeevamrutham' – Cow dung, urine, green gram powder, Jaggery, border soil and water.
'Beejamrutham'- Cow dung, urine, lime, soil from the borders and water.

The major ingredients of *'neemasthram'* are cow dung, urine, neem leaves/stem, powdered neem seed and water.

'Brahmasthram' contained cow's urine, tender neem stalk made into paste. *'Chukkasthram'* has powdered dry ginger, milk and water as its constituents.

Land preparation can be done with 100 kg cow dung/acre or *'ghanajeevamrutham'* @ 100 kg/acre. For transplanting, 200 litre *'jeevamrutham'* along with 10 kg shredded straw cut into pieces is mixed with the soil.

Seed treated in salt water and washed in pure water has to be treated with *'beejamrutham'* and then can be sown or transplanted. 20 to 30 days after sowing; once in 15 days *'jeevamrutham'* will be applied and this can be repeated seven to eight times in a crop season. In the case of transplanting, the root of the seedlings has to be treated with *'jeevamrutham'* and then it will be applied after 15 days interval. If there is ample spacing as in the case of marked transplanting or System Rice Intensification, cono weeder can be used four to five times. Sowing is done along with cowpea seeds to ensure nitrogen fixation in the soil. In the milky stage for better growth of the crop tender coconut water in 1:10 ratio or *'sapthadhanyankurakashayam'* is sprayed on the crop. In farmer's opinion, this ensured a higher quality of rice. Fermented buttermilk also ensured quality of rice and gives a better control of the brown spot disease of rice in the farmers' field.

Before pulling out the seedling for transplanting either of the two bio-pesticides (*'neemasthram'* against sucking pests or *'brahmasthram'* against nibbling insects) has to be applied once. One month after sowing or transplanting *'neemasthram'* and two months later *'brahmasthram'* will be applied. *Chukkasthram* is found to be effective against fungal diseases.

Though these two innovative farmers took up this cultivation method on an experimental basis, they got a reasonably good yield. The actual yield potential could be realised only after continuous farming for three to four years with cow based products, as there could be a chance for lower yield in the initial years. Processing was done without much polishing so as to ensure a higher quantity of rice bran in the packed rice. The marketing strategy of the farmers too was unique in that they were linked with prospective customers from major towns and cities by way of participation in exhibition conducted throughout the state. The demand for the produce was found to be very high during the first crop season, which couldn't be satisfied. Now they are planning to increase the area under this method of eco-friendly farming. While the ordinary farmers sold rice @ Rs. 12/kg, these farmers sold organic rice @ Rs. 45/kg even before certifying their products. The costs, benefits, net profitability and Benefit-Cost ratio was worked out for one-hectare rice field and presented in Table 70. B-C ratio was found to be quite high here (2.2), which implies eco-friendly cultivation with better marketing strategies is highly profitable. The costs were worked out considering even the costs of cow dung and urine, which will not be an expense in case of those who maintain livestock. The costs of products from cow, which is worked out to be Rs.14458.5 can be deducted from the total costs for those who maintain livestock and then the cost of inputs will be only around Rs.4652.50 including seeds.

A classic development paradigm after industrial revolution considered nature as a set of resources that needs to be exploited for the comforts and development of man, thereby disregarding sustainability of environment and mankind. In this premise, the pioneering efforts of these farmers stand apart by way of nurturing the environment and at the same time reaping profits by exploring the market potential for organic produce. Such efforts of the farmers need to be recognized and further experiments have to be conducted in this direction to ensure viability of this practice.

Table 70. Benefit-Cost ratio of cow based minimum-budget rice farming (*Gō-adharitha krishi*)

Sl. No.	Inputs	Quantity (1 ha)	Rate	Value
1	Basal application			
	Cow dung	250 kg	Rs.1000/t	250.00
2	*Jeevamrutham*			
	Cow dung Urine Green gram powder Jaggery (Coconut water)	250 kg 125 litres 65 kg 50 kg	Rs.1000/t Rs. 60/litre Rs. 40/kg Rs. 15/kg	250.00 7500.00 2600.00 750.00
3	Seed treatment *Beejamrutham* (30 kg)			
	Cow dung Urine Lime	3.5 kg 3.5 litres 38 g	Rs.1000/t Rs. 60/litre Rs.6/100g	3.50 210.00 2.50
4	Pest control *Neemasthram* *Brahmasthram*			
	Cow dung Urine	25 kg 75 litres	Rs.1000/t Rs. 60/litre	25 4500.00
5	Disease control *Chukkastram*			
	Dried ginger Milk Milk for crud	500 g 5 litres 6 litres	Rs. 150,kg Rs. 20/litre Rs. 20/litre	75.00 100.00 120.00
6	Tonic (growth enhancers)			
	Grains Cows urine	2.5 kg 25 litres	Rs. 40/kg Rs. 60/litre	100.00 1500.00
7.	Seed	75 kg	Rs. 15/kg	1125.00
		Total input cost		**19111**

Labour use pattern and cost

Sl. No	Operations	Number	Rate (Rs/labour)	Cost (Rs.)
i.	Nursery management Men Women	 4 3	 200 150	 800 450
ii.	Land preparation Men	 10	 200	 2000
iii.	Transplanting Women	 50	 100	 5000
iv.	Plant protection / manure preparation & application Men Women	 6 10	 200 150	 1200 1500
	Weeding Women	 25	 100	 2500
v.	Harvest, transportation, threshing & winnowing		Money worth 2000 kg paddy (Rs.12/kg)	24000
	Water management Men	 3	 200	 600
vi.	Transportation (inputs) Men Women	 4 4	 200 150	 200 600
vii.	Family labour Men	 15	 200	 3000
viii.	Boiling & drying Women	 20	 100	 2000
ix.	Packing (1000 bags) Women	 10	 100	 1000
x.	Transportation & Marketing Men	 5	 200	 1000
			Total labour cost	**45850**

Other processing costs

	Processing costs	Qnty.	Rate	Cost
1	Milling cost (recovery 75%)	5000kg	1.5/kg	7500
2	Packing cost	1000 bags	4.5/bag	4500

Hiring charges				
	Machinery / equipments	**Time required (hours)**	**Rent (Rate/hour)**	**Cost**
1	Tractor	5	400	2000
2	Power tiller	7	250	1750
3	Sprayer		100/acre	250
Transportation costs				
	Inputs	**Mode of transportation**	**Rate**	**Cost**
1	Seeds (own)	nil	-	-
2	Ingredients for manure preparation	Bus		50
3	Organic manure (own)	nil	-	-
Total cost of cultivation (including processing cost)				**81011**
Cost of production (inclusive of processing)				**21.6**
Total cost of cultivation (exclusive of processing cost)				**65011**
Cost of production (exclusive of processing cost)				**13**

Benefits

Sl.No.	Output	Quantity (kg)	Price/unit (Rs./kg)	Total
1.	Rice	3750	45	1,68,750
2.	Straw	1500	4	6000
			Total benefit	**1,74,750**
			Average benefit	**33.3**
			Total cost	**81011**
			Profit	**93739**
			B-C ratio	**2.2**

Another important environmental issue observed by the investigator during the study was the massive conversion of paddy lands for clay mining purpose. 'Chulhas' are coming up in these areas; especially Kollengode and Alathur areas and landowners were given handsome amount as lease. These areas after two to three years become large pits after clay mining, which later on become fallow lands unfit for rice cultivation. Even after giving the stop notice from the authorities the miners carry on their work late at night. Landowners argue that economic return from cultivation of rice is not attractive and hence they shift away from rice and it seems that they have accepted conversion inevitable to ensure adequate return. Conversion of rice involves irreversible transformation of the ecosystem. Despite the fact that Kerala ranks top in literacy and environmental awareness, there was a 65 per cent fall in the wetland area under rice in the last 30 years Gopikuttan and Kurup (2004). In their effort to maximize economic returns, farmers and the miners ignore the possible ecological and environmental impacts of conversion.

In the aftermath of the study the researcher has suggested certain policy prescriptions very relevant to make sustainability a reality in agriculture sector. They are :

1. Incentive price

Despite the high cost of cultivation incurred and the same current market price received for both organic and conventional production these farmers are determined to continue eco-friendly farming. Therefore recognizing their contribution to society and environment and also for popularizing eco-friendly farming the state needs to intervene by offering incentive prices so as to make profitability of rice production sustainable. Environmental value of wetlands and paddy ecosystem can be assessed by taking into consideration the contribution of the ecosystem for sustenance of life like water security, food security, environmental security and conservation of biodiversity. Incentives have to be given to those farmers maintaining the paddy lands.

2. Assured market and farmer-customer networking

There has to be specialized markets in towns and cities for eco-friendly rice, by which a higher price can be assured to these rice farmers. The case study on rice cultivation based on products from cow (Table 70) indicates that B-C ratio was quite high (2.2).This implies eco-friendly cultivation with better marketing strategies to be

Plate 11. Paddy land conversion

highly profitable The customers of eco friendly rice have to be linked to these farmers which assures them a better market for their produce

3 Simplification of organic certification

The cumbersome procedures involved along with high initial investment are the major impediments in certification process which restricts the farmers from adopting organic farming Certifying procedure for organic rice has to be made simple and less expensive

4 Certification procedure for eco friendly rice

Owing to common ate management n rice and other cultural operations on *padashekaram* basis organic rice production cannot be resorted to as in the case of vegetables or other crops which are mostly restricted to limited areas So in this situation a feasible and plausible middle way alternative before farmers is to adopt eco friendly farming which is defined as farming which involves need based minimal use of chemical inputs considering residual toxicity Therefore standardization of procedures appropriate to the use of less toxic and minimum chemical inputs suited to the local conditions needs to be devised based on research

5 Value addition

Processing of paddy has to be popularized among farmers This will assure them a higher price for the products with lesser cost involved

6 Incentives for clean agriculture

Incentives need to be provided to farmers who are practicing clean agriculture This will be an encouragement for farmers to shift to eco friendly and sustainable agriculture

7 Encourage and conscientize farmers for cultivation of traditional varieties and use of indigenous wisdom

The concept of seed banks has to be introduced The farmers have to be encouraged to form groups cultivate rice organically and share local varieties among themselves Kerala Agricultural University and other research institutions ought to take initiatives in developing local varieties suitable for organic cultivation by farmer participatory research

8 Redefining and updating organic farming policy

Considering the invasion and onslaught by neo liberal and corporate interests in agriculture organic farming policies needs to be upscaled and redefined taking into account the interest of small and marginal farmers Organic farming has to be introduced in a phased manner

9 Encourge group approach in organic rice farming

Farmers need to be encouraged to form groups which will ensure supply effectiveness of inputs easier certification and better marketing GALASA Adatt paddy co operative society susta nable group farming in Kalatharakkal ela etc can be referred to as success models for group initiatives in rice

10 Encourage mixed farming

The government shall formulate strategies to integrate agriculture and other allied enterprises like livestock by which we can make farming sustainable This also ensures a higher biomass generation and nutrient recycling the very basis of organic farming

11 Maintain biodiversity register for *grama panchayats*

A biodiversity register has to be maintained in every *grama panchayat* to document the diverse flora and fauna of the locality This will help in conserving the valuable genetic resources we are blessed with

12 Ensure availability of eco friendly inputs

The major constraint faced by the eco friendly farmers is the unavailability of quality organic inputs at a reasonable rate The quality has to be ensured by means of strict assessment methods The farmer groups self help groups clubs etc has to be given training and encouragement to produce organic inputs in the respective fields and wastelands of the panchayat

Summary and Conclusion

5 Summary and Conclusion

Rice is life as it is environment society culture politics business and above all the life saving gram of 3 billon people of this planet Rice wetland ecosystem is very important in maintaining ecological balance It has imminent relevance in influencing the microclimate of the ecosystem preventing floods and drought and conserving the floral and faunal diversity Indian agriculture faces a major challenge of enhancing and sustaining the food and nutritional security of over 1 billion people with 4 2 percent of world s water resources and 2 3 percent of the global land Rice area in India increased from 30 81million hectares in 1950 51 to 45 35 million hectares in 2008 09 [illegible] as scaled greater heights from 20 58 million tonnes to 99 15 million tonnes during the same period Kerala also shows a similar trend with respect to productivity over the years This increase may be attributed to green revolution which was a milestone in the agrarian history Despite green revolution contributed significantly in increasing production and productivity in the initial years the adverse effects visibly stands out as deterioration of soil quality environmental pollution due to over use of inorganic inputs loss of biodiversity and genetic erosion

Rice wetland eco system being highly fragile the adverse effects of input intensive farming is prominent and far reaching Environmental concerns and awareness of the stakeholders in rice cultivation has a greater voice on the future of sustainable rice farming and therefore there is an urgent need for an incisive analysis of these aspects

Similarly the farmers environmental concern which has been translated to inclusion / adoption of eco friendly technologies in the planning and implementation stages of development projects in rice farming is very pertinent in determining the effectiveness of *padashekarasamithis* With this contention the present study entitled Environmental concerns in the development projects of rice farming under decentralized planning was undertaken with the following objectives study the nature and extent of environmental concerns in the planning and implementation of development projects on rice farming under decentralized planning in Palakkad District Environmental awareness and constraints perceived by stakeholders in planning and implementation of the projects were also studied

The investigation was undertaken in the state of Kerala Palakkad district was selected purposively as the district accounts for about 1/3rd of the total area under rice cultivation of Kerala state Four blocks *viz* Kollengode Kuzhalmannam Chittur and Alathur were selected purposively based on area under rice Thekkinchira Nelliancaud Manchira and Kolapadam *padashekarams* were randomly selected from Kollengode Kuzhalmannam Nalleppilly and Erimayur *grama panchayats* respectively Ten beneficiary farmers were selected from each *padashekaram* Likewise ten each of agricultural labourers people s representatives/social activists from the same *padashekaram* were selected randomly for the study Thus a total of 40 beneficiary farmers 40 agricultural labourers and 40 people s representatives/social activists were selected from the study area In addition to those included in the selected projects / *padashekarams* extension functionaries from other regions of the district were also randomly selected so as to make a sample size of 40 Thus a total of 160 respondents belonging to the four categories constituted the sample of this study

Eight independent variables common for all stakeholders *viz* age experience in dealing with eco friendly rice cultivation participation in training programmes on eco friendly cultivation participation in activities related to environmental conservation attitude towards group management in rice farming perception on the importance of mitigating environmental degradation indigenous wisdom orientation sense of empowerment were selected for the study Two independent variables common for three categories of respondents (farmers agricultural labourers and people s representatives/social activists) comprising educational status and political orientation were included in the study

One independent variable *viz* knowledge on eco friendly practices in rice cultivation common to farmers and labourers and another variable leadership which is a common profile characteristic for extension personnel and people s representatives/social activists were also included in the study Besides the above five variables viz occupation livestock possession risk orientation export orientation and attitude towards extension interventions in popularizing eco friendly cultivation were selected exclusively for farmer respondents and three independent variables viz decision making ability with regard to eco friendly rice cultivation communication effectiveness and development functioning were selected for extension personnel These 21 variables were quantified using the standardized procedures Scales were developed for the measurement of independent variables viz indigenous wisdom orientation knowledge on eco friendly practices in rice cultivation and communication effectiveness Other relevant information on the study were also collected on the aspects like extent of influence exerted by various agencies in developing environmental concerns preference of manures and fertilizers preference of insect pest control methods preference of disease control methods and preference of weed control methods political affiliation and effectiveness of the supply of inputs for eco friendly rice farming

Environmental concern and awareness are the two dependent variables common for all category of respondents of which environmental concern was measured using a scale developed for this purpose while awareness was measured using a scale already developed with slight modification Extent of environmental concern as reflected in the inclusion/adoption of eco friendly technologies in the planning and implementation stages of development projects on rice farming was the third dependent variable exclusively for the farmer category and measured using an index which was developed for the purpose The relationship between the set of independent variables and the set of dependent variables for each category of stakeholders were studied using canonical correlation analysis Economics of eco friendly rice production was studied under two sub dimensions the B C ratio of eco friendly rice production and Social Cost Benefit Analysis (SCBA) For studying SCBA four dimensions of social cost and ten dimensions of social benefit were identified and Principal Component Analysis was employed to determine the dimensions which were contributing to the maximum variance in the social cost and social benefit scores of the respondents Constraints perceived in eco friendly farmıng ın the plannıng and ımplementatıon stages of the development projects of rıce farmıng of all categorıes of stakeholders were delıneated which would help the polıcy planners and admınıstrators ın resolvıng these ıssues takıng ınto account the field realıtıes Two case studıes one on the effect ve plannıng and ımplementatıon of development projects on rıce farmıng under decentralızed plannıng and the other on the success story of cow based mınımum budget rıce farmıng (*Go adharıtha krıshı*) were also undertaken as a part of the study

The data were collected usıng a pre tested structured ınterview schedule prepared for the study and qualıtatıve methods lıke focus group dıscussıons and non partıcıpant observatıon technıque Quantıtatıve analyses used for the study are percentage analysıs mean and standard devıatıon Pearson s product moment correlatıon canonıcal correlatıon analysıs and Prıncıpal Component Analysıs (PCA)

The salıent findıngs of the study

5 1 The study examıned 21 ındependent varıables whıch ındıcate the profile characterıstıcs of the stakeholders Majorıty of the farmers (60%) and agrıcultural labourers (52 5%) belonged to the old age category whıle most of the extensıon personnel (77 5%) and people s representatıves / socıal actıvısts (72 5%) belonged to the mıddle age

5 2 The probe ındıcates that 17 5 percent farmers and 7 5 percent of extensıon personnel had an experıence of more than ten years whıle no respondents among agrıcultural labourers and people s representatıves/socıal actıvısts had more than 10 years of experıence

5 3 It ıs very ımportant to note that none of the agrıcultural labourers had receıved any traınıng ın eco frıendly cultıvatıon Majorıty of the stakeholders ın the two categorıes *vız* farmers (52 5%) and people s representatıves/socıal actıvısts (50%) had receıved no traınıng whıle majorıty of the extensıon personnel (57 5%) had receıved traınıng on eco frıendly cultıvatıon for 1 to 3 days

5 4 With regard to participation in activities related to environmental conservation 82 5 percent of the farmers and all the agricultural labourers exhibited low level of participation while majority of the extension personnel (85%) and people s representatives/social activists (67 5%) had medium level of participation

5 5 As regards the attitude towards group management 92 5 percent of the farmers and all the people s representatives/social activists had a neutral stance while all the extension personnel and 67 5 percent of the agricultural labourers had a favourable attitude towards group management

5 6 A comparison of perception on the importance of mitigating environmental degradation indicates that all the extension personnel and majority of the people s representatives/social activists (67 5%) possessed a high level of perception on the importance of mitigating environmental degradation All the farmers belonged to the medium and high perception category whereas all the labourers possessed medium level of perception

5 7 The study indicates that majority of the farmers (70%) agricultural labourers (75%) and extension personnel (97 5%) possessed a high level of indigenous wisdom orientation whereas the people s representatives/social activists (70%) belonged to medium category This may be due to the fact that those who were directly related with the farming activities possessed a higher level of indigenous wisdom orientation

5 8 Majority of the farmer respondents belonged to the medium level (57 5%) of sense of empowerment followed by 42 5 percent who possessed high level of empowerment In the case of labourers most of them possessed medium level of empowerment (85%) while majority of the extension personnel (77 5%) and people s representatives/social activists (67 5%) exhibited a high level of empowerment

5 9 It was interesting to note that there were no illiterates among the farmers and people s representatives/social activists Most of the farmers were high school educated while 60 percent of the people s representatives/social activists were graduates and post graduates Majority of the agricultural

labourers were ıllıterate (60%) followed by 32 5 percent havıng pnmary school educatıon

5 10 The probe ındıcates that all the three category of respondents vız farmers (90%) agncultural labourers (90%) and people s representatıves (100%) exhıbıted a hıgh level of polıtıcal onentatıon Only 10% respondents ın each category the farmers and agncultural labourers ındıcated medıum level of onentatıon towards polıtıcs

5 11 Wıth regard to knowledge on eco fnendly practıce ın nce cultıvatıon majonty of the farmers possessed a hıgh level of knowledge (67 5%) In the case of agncultural labourers all the respondents (100%) possessed a medıum knowledge level

5 12 Majonty (97 5%) of the agncultural labourers had low partıcıpatıon ın decısıon makıng wıth farmers whıle 90 percent of the extensıon personnel had medıum level of partıcıpatıon

5 13 More than half (57 5%) of the extensıon personnel possessed a hıgh level of leadershıp whereas 90 percent of people s representatıves/socıal actıv sts belonged to the medıum leadershıp category

5 14 Farmıng was a sole occupatıon to 92 5 percent of the farmers whıle a meager 5 percent of the respondents dıd farmıng along wıth some busıness It was observed that no farmers were engaged as agncultural labourer

5 15 Majonty (72 5%) of the farmers possessed lıvestock of value less than or equal to Rs 5000/ whereas 22 5 percent of the farmers had ın theır possessıon lıvestock worth Rs 20 001/ and above

5 16 The study ındıcates that majonty of the respondents (87 5%) possessed hıgh levels of nsk onentatıon Only 12 5 percent of respondents possessed medıum nsk onentatıon The hıgh level of nsk takıng abılıty was attnbuted to the massıve schemes for paddy cultıvatıon sponsored by the natıonal and state governments

5 17 The study reveals that large percentage (67 5%) of farmers possessed medıum level of export onentatıon whıle 32 5 percent of them had a hıgh level of onentatıon towards export

5 18 With regard to attitude towards extension interventions in popularizing eco friendly cultivation large percentage (77 5%) of farmers had neutral attitude and 22 5 percent had favourable disposition towards extension interventions while no one had an unfavourable attitude

5 19 The study indicates that 50 percent each of the extension personnel had medium and high level of decision making ability No respondents had low ability in decision making pertaining to eco friendly rice cultivation Ninety percent of the extension personnel exhibited a higher effectiveness in communication which may be due to the high leadership traits they possess

5 20 Majority of the extension personnel were neutral (72 5%) in their perception on the functioning of our public system 27 5 percent of the respondents had an unfavourable opinion while no respondents had a favourable disposition towards our public system

5 21 With regard to the extent of influence exerted by various agencies in developing environmental concerns direct experience and mass media had strongly and positively influenced in developing environmental concerns of farmers (42 5%) and agricultural labourers (32 5%) respectively In case of extension personnel (57 5%) and peoples representatives/social activists (55%) literature had strong and positive influence on them

5 22 It was observed that all the stakeholders preferred exclusively inorganic method of nutrient management considering labour cost easiness in handling and cost of cultivation Taking into consideration profitability of rice cultivation farmers agricultural labourers and people s representatives preferred exclusively inorganic methods Exclusively organic methods were preferred by all the category of stakeholders on the production aspects *viz* soil health human health and perceived quality of rice Majority of the extension personnel people s representatives and agricultural labourers preferred Integrated Nutrient Management taking into account yield while an almost equal percentage of farmers preferred Integrated Nutrient Management and primarily organic methods considering the yield of rice

5 23 With regard to the preference of insect pest control methods all the stakeholders preferred exclusively inorganic method of nutrient management considering labour cost easiness in handling and cost of cultivation Taking into cons deration profitability of rice cultivation farmers agricultural labourers and people s representatives preferred exclusively inorganic methods Exclusively organic methods were preferred by all the category of stakeholders on the production aspects *viz* soil health human health and perceived quality of rice Most of the extension personnel preferred Integrated Pest Management considering the yield

5 24 On preference of disease control methods the results are almost similar to that of the preference of stakeholders for insect pest control methods Here most of the stakeholders were inclined towards exclusively inorganic methods considering the production aspects *viz* labour cost easiness in handling cost of cultivation and profitability Most of the farmers and agricultural labourers had a likeness towards exclusively inorganic method considering the yield whereas extension personnel preferred Integrated Disease Management for a higher yield Majority of the stakeholders preferred exclusively organic methods for better soil health human health and quality of rice

5 25 In the study on preference towards weed control methods a vast majority of the stakeholders opted exclusively inorganic methods on the production aspects *viz* labour cost easiness in handling cost of cultivation and profitability Majority of the stakeholders considering human health soil health and quality of rice preferred organic weed control methods involving manual labour

5 26 Majority of the farmer respondents always obtained seeds as per their requirement in sufficient quantity (60%) and on time (60%) 97 5 percent always procured seeds at the current market rate and 100 percent with easiness in transportation They obtained manures in required quantities (60%) on time (60%) and with transportation easiness (52 5%) only at times Most of the farmers never procured organic manure at the current market rate

(77 5%) Organic plant protection inputs were available in sufficient quantity (82 5%) and on time (82 5%) only at times They were not always available at the market rate (77 5%) 50 percent of the respondents didn t have any problem in transporting these inputs Majority of the respondents opined that irrigation water was only sometimes available in required quantity (80%) and on time (82 5%) but always with transportation easiness Most farmers were satisfied with the existmg credit system as they could always get loans for the amount they needed (100%) which was available on time (100%) and at current bank rate (100%)

5 27 The study reveals that majority of the farmers had an affiliation towards liberal democrat (60%) political ideologies The attitude of labourers with respect to this variable was different with majority of them inclined towards the left political ideologies (57 5%) followed by 27 5 percent affiliated to liberal left category Majority of the people s representatives/social activists had an affiliation towards the left category (72 5%)

5 28 One half of the farmer respondents had high level of environmental concerns followed by a comparable 47 5 percent with medium level of concerns Most of the agricultural labourers (85%) possessed medium level of environmental concerns while cent percent of extension personnel and 82 5 percent of people s representatives/social activists had high concern for environment

5 29 Eighty percent of the farmers all the extension personnel and people s representatives had high level of awareness on the environmental aspects whereas all the labourers and 20 percent of the farmers had medium level of awareness The reason for high level of awareness in the former three categories may be ascribed to the higher educational status possessed by them when compared to the agricultural labourers 60 percent of who were illiterates

5 30 In the land and soil management dimension half of the respondents reported that their *padashekarasamithi* considered three practices while planning and they were (1) practicing crop rotation with pulses/leguminous green manures /fringe cropping with cowpea (2) application of nitrogen and potassium in

two to three split doses and (3) application of lime and the reasons for considering these practices in the planning stage was that all these inputs were distributed from Krishi Bhavans through *padashekarasamithis* at subsidized rates all the farmer respondents adopted two practices viz (1) applying nitrogen and potassium in 2 3 split doses according to the duration of the variety and (2) incorporation of crop residue in the field and 92 5 percent of the farmers adopted fringe cropping with pulses like cow pea urd etc

5 31 Three fourth of the farmers reported that their *samithis* considered only a single water management practice in the planning stage and that was selection of suitable varieties based on water availability All the respondents adopted three major water management practices viz (1) summer ploughing (2) land leveling/puddling and (3) maintaining standing water as per crop requirement These practices perceived to be inevitable in rice farming and carried out together were found to be adopted by all the farmers in the study area Selection of suitable varieties based on water availability was followed by 97 5 percent of the farmers and 82 5 percent of the farmers plastered field bunds/trimmed/cleaned it

5 32 Augmentation of parasite or predator population in the field / use of natural enemies like *Trichogramma Pseudomonas* etc were considered by all the *samithis* in the planning stage while half of the respondents opined that their *samithi* considered reduction in the use of chemicals to preserve natural enemy population of the pests in rice fields / use of pesticides with low residual toxicity in their planning stage Eighty percent of the farmers avoided poaching and killing of birds and animals in rice fields Use of poison baits was also avoided Natural enemies like *Trichogramma Pseudomonas* etc were used by 57 5 percent of the farmer respondents It was found that an equal number of respondents (52 5%) reduced the use of chemicals and used bird and owl perches in the field for natural control of insect pests

5 33 Selection of right season or adjusting the time of planting was considered in the planning stage by all the *samithis* Seventy five percent of the respondents representing three of the *samithis* considered raising pest and disease resistant varieties while two of the *samithis* (50 %) considered synchronized sowing in the planning stage All the respondent farmers ploughed the field and exposed it to sun Ninety percent of the farmers visited their fields regularly and watched out for damages due to insects pests and diseases and synchronized sowing was practiced by 77 5 percent of the respondents No respondents were found to adopt techniques viz (1) harvesting crop nearest to the soil (2) taking precautions while handling pesticides (3) plant ng borders closel th seedlings

5 34 With regard to the extent of environmental concerns as reflected in the inclusion/adoption of eco friendly practices in the planning and implementation stages of development projects on eco friendly rice farming half of the farmer respondents reported that their *padashekarasamithis* considered three practices while planning under land and soil management dimension Thirty percent of the farmers adopted four eco friendly practices under this dimension A comparable 27 5 percent of the farmer respondents had been found to adopt six practices out of the possible ten

5 35 Three fourth of the farmers reported that their *padashekarasamithi* considered only a single water management practice in the planning stage In the implementation stages of eco friendly rice cultivation all the eight practices were found to be feasible in the farmer s field Out of the eight water management practices five were adopted by 30 percent Seven eco friendly practices were practiced by 27 5 percent of the farmers

5 36 With respect to the eco friendly technologies intended to conserve the biodiversity in rice fields 20 percent each of the respondent farmers opined that in the planning stage only one and two practices for conserving biodiversity was considered by their *samithis* About an equal number of respondents (22 5% each) were reported to have adopted one two three and four eco friendly techniques for conserving biodiversity

5 37 Fifty percent of the farmers reported that three practices under the plant protection dimension were considered by their *padashekarasamithis* during the planning phase Five practices were adopted by 30 percent of the farmers whereas 22 5 percent each of the farmers adopted four and six practices in their fields

5 38 The mean index of environmental concerns in the planning stage of land and soil management was 30 followed by 50 33 in the implementation stage With regard to the water management dimension 18 33 percent was the mean index for the planning stage followed by 70 83 in the implementation/adoption stage The mean index value for the planning stage of biodiversity conservation was 25 56 while it was found to be 44 45 in the implementation stage Dimension of plant protection had an index value of 15 94 for the planning stage and 39 53 in the implementation stage Considering the overall adoption of technologies the mean index value in the planning stage was 21 56 and for overall implementation it was observed to be 49 65

5 39 Seventy five percent of the farmer respondents were in the low category with regard to planning of land and soil management practices followed by 25 percent in the medium category The frequency for water management dimension too shows a similar result with 75 percent in the lower category and 25 percent in the medium category in planning All the respondents (100%) were found to in the low category with regard to planning of the practices to be adopted in *padashekarams* under the dimensions biodiversity and plant protection

5 40 With regard to implementation of eco friendly practices pertaining to land and soil management in rice fields 87 5 percent of the respondents belonged to the medium category of adoption/extent of environmental concerns All the respondents (100%) belonged to the medium category of environmental concerns/adoption of eco friendly water management practices With regard to adoption of biodiversity conservation practices 52 5 percent of the respondents belonged to the medium category whereas 47 5 percent

belonged to the low category With respect to the adoption of plant protection practices 67 5 percent of the farmer respondents had medium level of environmental concerns followed by 32 5 percent in the low category of adoption of eco friendly plant protection practices

5 41 The practices which were feasible in the padashekaram only were considered in the planning stage by the *samithis* Percentage adoption of land and soil management practices over planning was 178 33 whereas it was the highest (493 33 %) in case of water management dimension 189 96 percent of adoption over planning was noticed in the case of biodiversity conservation practices and finally the percentage adoption of plant protection measures over planning was found to be 306 06 Thus the overall adoption of all the above dimensions over the planning stage was worked out to be 241 25 percent

5 42 There was a wide gap between the planning and adoption stages of water management with 493 33 percent followed by plant protection (306 06%) biodiversity conservation (189 96%) and finally land and soil management (178 33%) The result clearly indicates that adoption of the eco friendly practices (extent of environmental concerns) as reflected in the adoption of practices in the implementation stage was far more than those included in planning stages for all the four dimensions identified The major reason for this result is that the planning phase of the development projects on rice farming was carried out at the *padashekarasamithi* level whereas the implementation of the eco friendly technologies were done at the individual level

5 43 All the three dependent variables *viz* Y1 (environmental concerns) Y2 (environmental awareness) and Y3 (extent of environmental concerns as reflected in inclusion / adoption of technologies in rice cultivation) exhibit high correlations with the independent canonical variate of the farmers the highest being Y1 followed by Y2 and Y3 The profile characteristics *viz* X8 (perception on the importance of mitigating environmental degradation) X9 (indigenous wisdom orientation) X17 (knowledge on eco friendly rice

cultivation) X4 (experience in eco friendly farming) X16 (sense of empowerment) X11 (risk orientation) X12 (export orientation) X2 (educational status) and X6 (participation in activities related to environmental conservation) play crucial role on the dependent variables

5 44 Environmental concern is the dependent variable that shows high correlations with the independent canonical variate followed by environmental awareness in the case of agricultural labourers The variables X9 (sense of empowerment) X3 (experience in eco friendly farming) X10 (knowledge on eco friendly rice cultivation) X7 (perception on the importance of mitigating environmental degradation) X1 (age) and X8 (indigenous wisdom orientation) is very crucial factors in explaining environmental concerns and awareness

5 45 One dependent variable Y1 (environmental concerns) exhibits high correlations with the independent canonical variate of extension personnel The profile characteristics X11 (communication effectiveness) X9 (decision making ability) and X4 (participation in activities related to environmental conservation) contribute most towards environmental concerns

5 46 Y1 (environmental concerns) and Y2 (environmental awareness) exhibit high correlations with the independent canonical variate with values 0 97 and 0 90 respectively for people s representatives/ social activists Considering profile characteristics X9 (sense of empowerment) X7 (perception on the importance of mitigating environmental degradation) X2 (educational status) X8 (indigenous wisdom orientation) X10 (leadership) X6 (attitude towards group management) and X5 (participation in activities related to environmental conservation) play very important role in developing environmental concerns and awareness

5 47 The B C ratio of eco friendly rice cultivation conventional rice cultivation and cow based minimum budget rice farming (*Go adharitha krishi*) was 1 39 1 79 and 2 2 repectively The major reason for this is the higher cost of cultivation incurred in the case of eco friendly rice cultivation which is due to the high cost of organic inputs and its application But the price in the

market is the same irrespective of the methods of production which reduce the profit for eco friendly farmers Cow based minimum budget rice farming (*Go adharitha krishi*) portrays the success of eco friendly farming by way of value addition and better marketing

5 48 The mean Social Benefit Cost ratio for all the respondents was 1 176 which substantiates the general perception that social benefits derived from eco friendly rice farming was higher than the social costs The dimensions such as non remunerative price higher cost of cultivation and inconvenience in handling eco friendly inputs contributed higher magnitude of variation in social cost and the dimensions superior quality of rice enrichment of biodiversity improvement in water quality and self development contributed to higher magnitude of variations in social benefit

5 49 Most of the farmers considered *padashekarasamithi* as a supplier of inputs from *krishi bhavans* which was a major constraint in the planning stage Majority of the members were not interested in the *samithi* activities and their participation was found to be very low The next two constraints were associated with the former ones and they were lack of proper plann ng by the *samithi*s and lack of co ordination among its members In the implementation stage of the development projects on eco friendly rice farming the major constraint perceived by the farmers was the labour unavailability The other major constraints perceived by them were the problem in marketing of organic rice due to difficulty in getting it certified lack of availability of good quality certified organic inputs in the market etc

5 50 The major constraints perceived by the labourers in the implementation stage were labour non availability lack of knowledge on eco friendly techniques lack of good quality certified organic inputs in the market and higher cost of these inputs problems in marketing of organic rice difficulty in handling and application of inputs and lack of availability of adequate quantity of eco friendly mputs

5 51 The major constraints perceived by the extension personnel were lack of co ordination among the members of *padashekarasamithi* lack of planning on

the technologies to be adopted in eco friendly rice farming lack of interest of members in the *samithi* activities and low attendance of the members consequent to lack of interest Major constraints perceived by the extension personnel in the implementation stage were the labour unavailability lack of good quality certified organic inputs in the market lack of availability of adequate fund on time lack of availability of eco friendly inputs on time etc

5 52 The major constraint perceived by the people s representatives/social activists in the planning stage was that the farmers looked upon *padashekarasamithi* as an input supplier of *krishi bhavan* Lack of proper planning by the *samithis* on the practices to be adopted lack of interest of the *samithi* members in the *padashekaram* activities lack of co-ordination among the members of *Padashekarasamithi* and lack of consensus were the other major constraints in the order of their importance The most important constraint perceived in the implementation stage was the labour non availability Problems in marketing organic rice due to its difficulty in getting certified and lack of good quality certified organic inputs were some of the important factors hindering the implementation of eco friendly rice cultivation Lack of knowledge on eco friendly techniques and low yield compared to inorganic farming in the first few years were also perceived to be the important constraints

5 53 Farmer s perception of various attributes of eco friendly practices *viz* simplicity profitability cost involved and labour requirement were analyzed Application of farmyard manure/compost/green manure/poultry/biogas slurry was perceived to be complex by the farmers of all the four study area The profitability of this practice was perceived to be in the range of very high to high The cost involved and labour requirement for this practice was high to very high

5 54 Application of bio fertilizers like *Azolla Azospirillum* etc was perceived complex to very complex by the focus groups of all the four study areas It was considered as a technology with low to medium profitability The cost

and labour involved in the application were reported to be in the range of very high to high

5 55 Inclusion of enterprises like dairy poultry piggery etc was thought of as a very complex to complex practice Profitability of the practice was perceived by the groups in the low to medium range Cost and the labour requirement were found to be very high to high

5 56 Application of urea with neem cake was perceived to be very simple to moderately simple by majority of the groups The groups perceived it as profitable in the range of medium to very high level Application of nitrogen and potassium in two to three split doses according to the duration of variety was perceived by the three groups as moderately simple The profitability was perceived to be high cost involved was medium and labour requirement was on the higher side

5 57 All the groups considered application of lime moderately simple All the groups opined that profitability cost involved and labour requirement was medium for this practice All groups perceived incorporation of crop residue in the field very simple three focus groups considered its profitability to be high to very high Cost involved and labour requrement of this practice was considered low to very low

5 58 All the three groups thought summer ploughing as moderately simple Profitability was perceived to be in the range of medium to high Cost involved and labour requirement were considered to be medium by three groups Most of the groups opined land leveling/puddling simple to very simple practice The groups unanimously opmed that it had high profitability involving low to medium cost and labour requirement

5 59 Plastering of field bunds/trimmmg/its regular cleaning was perceived complex to very complex by the focus groups The profitability was perceived to be in the low to medium category The cost involved was felt to be in the high to very high range whereas the labour requirement was considered very high by all the focus groups

5 60 Constructıon/cleanıng/desıltıng of farm ponds for collectıng raınwater was perceıved as complex to very complex The cost ınvolved ın thıs practıce was very hıgh and hence the profitabılıty was ın the range of very low to medıum All the groups perceıved thıs practıce as labour ıntensıve

5 61 All the groups except one perceıved SRI to be complex But all the members of the group were aware that SRI was hıghly profitable and the cost and labour ınvolved was ın the medıum range

5 62 Manual weedıng/tramplıng/stale seedbed technıque/walkıng across paddy fields durıng the vegetatıve phase of the crop whıch helps ın suppressıon of weeds were thought of as moderate by two groups whıle profitabıl ty was perceıved to be ın the range of medıum to hıgh Lıkewıse the cost ınvolved was hıgh to very hıgh and there was no dısagreement that the labour requırement was very hıgh for thıs practıce

5 63 Eco frıendly plant protectıon strategıes lıke augmentatıon of parasıte/predator populatıon ın the field/use of natural enemıes lıke *Trıchogramma Pseudomonas* etc were perceıved complex by two of the focus groups whereas profitabılıty was consıdered to be ın the medıum to hıgh range Cost ınvolved was perceıved medıum wıth hıgh to very hıgh labour requırement

5 64 Ploughıng and exposıng the field to sun was perceıved as sımple and hıghly profitable ınvolvıng low cost and low to medıum labour by majorıty of the groups Synchronızed sowıng was consıdered to be a complex to very complex procedure by all the groups The profitabılıty as perceıved by the groups was very hıgh Cost ınvolved was very low to medıum range and all groups had dıfferentıal opınıon on the labour requırement rangıng from very low to hıgh

5 65 Removal and destructıon of pest ınfested parts and dıseased plants were perceıved to be complex to very complex by three of the groups It was consıdered that profitabılıty was ın the range of low to medıum cost was ın the range of hıgh to very hıgh and cost and labour was ın the very hıgh category Use of dıfferent types of traps were perceıved to be sımple

moderately profitable involving moderate cost and very low to h gh labour requirement

5 66 Regular surveillance of the field for Economic Threshold Level was found to be moderately simple for majority of the groups High profitability moderate cost involved and medium to high labour requirement was perceived to be the attributes of this practice by the three focus groups The use of bio pesticides was perceived to be complex to very complex Profitability of the practice showed a variation from low to high level Cost involved was in the range of medium to high level whereas the labour requirement was perceived medium to very high

5 67 Use of bird scarers like polythene [illegible] tapes crackers etc were perceived to be simple with medium to high profitability very low to low level of cost and labour requirement The practice of kerosenised roping / brushing or sweeping rice plants with bamboo thorns in a larger contiguous area was perceived to be complex moderately profitable involving high cost and labour

5 68 The practice of following safety measures while handling pesticides were perceived to be moderate in its simplicity high in its profitability low in the cost involved and very low in labour requirement The practice of planting borders closely with seedlings to restrict entry of rats was perceived by all the groups to be very simple moderately profitable with very less cost and labour Soaking seeds in hot water/applying supernatant of cow dung slurry/placing sachets of bleaching powder against Bacterial Leaf Blight was perceived as moderately simple having high profitability with high cost and medium labour requirement

5 69 The case study on the *Paruthikavu Nellulpadhaka Padashekarasamithi* revealed the effective planning and implementation of development projects on rice farming under decentralized planning

5 70 The case study on cow based minimum budget farming (*Go adharitha krishi*) describing the practices and economics

Implications of the study

This is the era of sustainable agriculture People have started realizing that many of the environmental problems caused by farming are a direct result of an increasingly external input intensive and specialized agriculture and that any harm they cause to the rice eco system entails irreversible transformation of the ecosystem At this juncture it is very important to understand the environmental concerns and awareness of stakeholders involved in rice cultivation which is addressed in the study The scale developed to measure the environmental concern of stakeholders would serve to quantify this parameter which could be used elsewhere to understand the concern level of the people which in turn will help in formula ing strategies for creating environmental consciousness

A knowledge test has been developed to assess the knowledge of farmers and labourers in eco friendly rice cultivation The study assesses the nature and extent of environmental concerns as reflected in the inclusion/adoption of eco friendly technologies in both planning and implementation stages The environmental concern index developed in this study gives an idea on the extent of environmental concern that is translated into action which is very important with regard to the farmer respondents It will also focus on the effectiveness of *padashekarasamithis* in the planning stages of rice cultivation As this gives a detailed database regarding planning and implementation stages it gives an insight to the policy makers and extension personnel as where to intervene to make the functioning of the *padashekarasamithis* more effective Factors defining environmental concerns elaborate the eco friendly technologies coming under four dimensions *viz* land and soil management water management biodiversity and plant protection aspects Perception of attributes of various practices deduced by way of focus group discussion gives an idea on how farmers perceive simplicity profitability cost and labour requirement of various eco friendly practices in rice This will also help the extension and the research system to make modifications so as to make the technologies simple and more profitable by optimizing cost and labour Economics of eco friendly rice farming gives the benefit cost ratio of eco friendly rice production which helps in assessing the costs and means of reducing it Social Cost

Benefit Analysis throws light on the costs and benefits ensued of eco friendly rice farming to the society in farmers perception

The inquiry highlights the major constraints as perceived by the stakeholders in the planning and implementation stages of development projects on eco friendly rice farming This could help the planners and policy makers in their efforts to make sustainable agriculture a reality through group efforts Case studies included in the study will help in identifying the factors which contributed in the exemplary performance of innovative farmers and farmer groups

Some of the important policy prescriptions in the light of the study which the government should undertake are (i) offer incentive price for rice produced in an eco friendly way (ii) provide assured market and farmer [illegible] networking (iii) simplify procedures of organic certification (iv) develop certification procedures for eco friendly rice (v) value addition and (vi) offer incentives for farmers practicing clean agriculture (vii) encourage and conscientize farmers for cultivation of traditional varieties and use of indigenous wisdom (viii) redefining and updating organic farming policy (ix) encourge group approach in organic rice farming (x) encourage mixed farming (xi) maintain biodiversity register for *grama panchayats* and (xii) ensure availability of eco friendly inputs

Suggestions for future research

(i) For generalization of the findings similar studies could be conducted covering all the rice tracts of the state

(ii) Multi disciplinary research may be carried out to explore the prospects of eco friendly / organic / natural farming

(iii) Studies on different biological farming practices could be carried out

(iv) Research on general environmental concern of people and related issues could be undertaken

(v) Effectiveness of extension strategies of government and non government organizations popularizing eco friendly agriculture may be studied

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Appendices

Appendix I

Selection of items for the scale through judge s relevancy rating

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE

Dr A Anilkumar
Vellayam
Professor

31 07 2009

Dear Sir / Madam

Ms Smitha K P a PhD student of this department is undertaking a study titled Environmental concerns in the development projects on rice farming under decentralized planning under my guidance for her research work One of the major objectives of the study is to develop a scale to measure the environmental concerns of stakeholders (farmers agricultural labourers extension functionaries and people s representatives /social activists) in rice cultivation On the basis of the review of relevant literature and discussion with the experts in the field five dimens ons were identified for easy classification and measuring the environmental concerns in rice cultivation *viz*

1 Socio economic
2 Land and soil management
3 Water management
4 Biodiversity
5 Plant protection

Considering your rich experience in the field you have been identified as a judge for rating the relevancy of the items identified under each dimension Kindly rate the items by putting a tick (✓) mark against the appropriate column in the five point continuum provided Kindly add other items you feel appropriate under the dimensions and rate them accordingly

Kindly return the completed schedule to the researcher at your earliest convenience in the self addressed stamped envelope enclosed

Thanking you

Yours sincerely

Anilkumar A

Items to measure the environmental concerns of stakeholders in rice cultivation

HR Highly Relevant R Relevant UD Undecided LR Less Relevant NR Not Relevant

Sl No	Items	HR	R	UD	LR	NR
	Socio-economic					
1	There is no harm in converting rice fields for commercial purposes					
2	Considering the environmental hazards caused by chemical inputs organic farming has to be adopted					
3	We have to go for organic farming as it is a better option for safe and healthy food without any chemical contamination					
4	We need to be concerned only about yield and profitability and not environmental sustainability					
5	Any cultivation strategy can be adopted disregarding its impact on the environment to increase productivity					
6	Conservation of rice fields has greater social implications than mere economic benefits					
7	Paddy cultivation is to be made mandatory wherever rice fields are available					
8	Subsidizing food grain production is a national waste					
9	People should be allowed to pursue crops that would fetch them profit regardless of environmental concerns					
10	Policy measures to encourage rice cultivation is a welcome sign towards conservation of our environment					
11	Degeneration of the wetland ecosystem in Kerala will adversely affect the livelihood security of our people					
12	Abandoning rice cultivation will pave the way for severe food security crisis					
13	Food security of the state can be enhanced by augmenting rice cultivation					
14	Government should not unnecessarily spend so much money on enhancing rice cultivation					
15	People cannot be motivated to cultivate rice as it is not going to bring them any profit ever					
16	Safety measures has to be strictly followed while applying plant protection chemicals to avoid environmental pollution					

Sl No	Items	HR	R	UD	LR	NR
	Land and soil management					
1	We have to avoid using chemical fertil zers to prevent depletion of soil fert lity					
2	I do feel that higher dose of fertilizers will ensure better yield					
3	One has to strictly follow Integrated Nutrient Management in rice fields so as to reduce soil and water pollut on caused by chemical inputs					
4	Pract cing Integrated Nutrient Management in rice field is a diff cult task though it is environmentally sound and using chemical fertilizers a better option					
5	Increasing the dose of fertil zers is necessary for better crop stand though it is harmful to the environment					
6	We must apply organic nputs like green manure compost Farm Yard Manure and bio fert l zers in order to improve soil health					
7	Considering the ava lability and easiness in handling chemical fertilizers are a better opt on compared to bulky organic manures though organic sources are benefic al for soil health					
8	Applying full dose of chemical fertilizers at a time results in its wastage through leaching and run off thereby polluting the env ronment					
9	Use of mud ball urea neem coated urea urea briquettes etc for improving fertilizer use efficiency is not worth practicing as it incur higher cost and labour					
10	We do feel that practic ng crop rotation in rice field s a better option for maintaining soil nutrient balance					
11	Growing livestock and poultry along with rice is laborious even though it provides rich manurial reserve and higher income					
12	We do understand that nutrient recycling in the farm is very important for enhancing so l fertility					
13	We have to burn crop waste even though it s environmentally hazardous					
14	Intensive cult vation along with inorganic mputs is a better option even though it depletes the soil nutrient status					
15	Split appl cation of fertilizers is laborious and less cost effective					

Sl No	Items	HR	R	UD	LR	NR
	Water management					
1	To prevent flooding and water logging conservation of rice fields has to be strictly enforced					
2	Everyone should conserve existing rice fields and expand its area for restoring the ground water table level in order to avoid problems of water scarcity					
3	There is no need to conserve rice fields just for the sake of restoring ground water table level					
4	Conserving rice fields is not important as it has no role in prevent ng natural calamities like floods drought etc					
[illegible]	[illegible] to avoid using chemical fertil zers to [illegible]uce pollution of water bod es					
6	Use of chemical inputs should be minimum as they are highly toxic to f sh and other organisms in water bodies					
7	The harmful effects of chemicals in water bodies are not worth considering taking into account the higher yield					
8	Water being the most precious resource we should conserve it scient fically and use it judiciously					
9	Water saving techniques in rice l ke land leveling innovative cropping systems etc are not mportant and relevant in the present socio economic milieu					
10	Maintaining adequate water in rice f elds is important for it enriches and rejuvenates the bio diversity of the eco system					
11	Water conservat on is very important and hence we have to strictly follow practices l ke residue incorporation and green leaf manuring					
12	Residue incorporat on green leaf manuring etc are difficult to be adopted in rice fields though it is an environmentally sustainable pract ce					
13	Harvesting of rainwater by means of constructing farm ponds s a very important practice for conserving water as it is a precious natural resource					
14	We understand that regular cleaning of channels is important and should be practiced in rice fields for conserving water					

Sl No	Items	HR	R	UD	LR	NR
	Biodiversity					
1	The situation is so emergent that we have to conserve the existing rice fields so as to maintain stability of the ecosystem					
2	We have to conserve our rice fields as they are the habitats of many invaluable plant and animal species that help enrich biodiversity					
3	We need not be concerned about conservation of rice fields as it has no influence on the organisms living there					
4	Traditional varieties have been evolved by various trial and error methods by our predecessor farmers and we have no right to prevent it from getting transferred to our future generations					
5	Cultivating High Yielding Varieties exclusively to get better yield is more important and relevant than maintaining genetic diversity					
6	We do feel that keeping poison baits and poaching has to be strictly prevented in order to protect birds and animals thriving on rice fields					
7	Care should be taken to preserve the natural enemies of the pests of rice while going for chemical control of pests as they predate on harmful insect pests of the crop					
8	Chemical control measures have to be adopted to get a better control of the pest rather than depending on natural enemies					
9	Growing traditional races and wild species has to be encouraged as they are found to have valuable genes for resistance against biotic and abiotic stresses					
10	Growing traditional races and wild species is a mere wastage of money for which the farmers should not be encouraged					
11	Efforts at community level are very important in restoring the lost biodiversity					
12	We need not be concerned about biodiversity in rice fields as our objective is to increase production and productivity					
13	Government should provide incentives for growing High Yielding Varieties and traditional races have to be neglected as these are poor yielders					
14	Farmers growing traditional varieties with indigenous practices that are organic in nature should have assured market with a higher price					
15	Use of agricultural chemicals in rice fields will not do much harm to the ecological balance of the rice eco system					

Sl No	Items	HR	R	UD	LR	NR
	Plant protectıon					
1	Excessıve use of chemıcal fertılızers has to be avo ded for ıt leads to pest resurgence entaılıng hıgher requ rement of pestıcıdes					
2	Strıct surveıllance of pests n the field for ıts Econom c Threshold Level (level up to whıch damages can be tolerated) should be followed before pest c de applıcat on to avoıd ts unnecessary usage					
3	Hıgher dose of pestıcıdes gıve better control of ınsects and does not harm the envıronment					
4	Wearıng the safety gadgets whıle handlıng pestıcıdes ıs a botherat on for the applıcators					
5	Integrated Pest Management pract ces have to be strıctly fo lowed ın every f eld to reduce pollut on due to chemıcal pest c des					
6	Adoptıng Integrated Pest Management pract ces n the field ıs not worth the money and labour spent on ıt though ıt ıs an envıronmentally susta nable practıce					
7	We should reduce the use of chemıcal pest cıdes as they drastıcally reduce the beneficıal mıcrobıal populatıon ın so l and water					
8	Though ıt has harmful effects on the envıronment applıcatıon of chemıcal pest c des ıs a better optıon to get a quıck and effectıve control of the pests ın the field					
9	Use of excessıve chemıcal pest c des ın rıce f elds has to be avoıded as t leads to pest resurgence later on demand ng hıgher dose of chemıcal pestıc des					
10	Irrespectıve of the pest status ın the field we should apply chem cal pestıcıdes whıch ıs a better optıon to prevent ıts further multıpl catıon					
11	Excessıve use of herb cıdes has to be avoıded as ıt enhances the resıstance of weeds towards chemıcals result ng ın heavy weed ınfestatıon demandıng hıgher dose of herbıcıde use					
12	Chemıcal herbıcıdes alone can gıve better control of weeds though ıt adversely affects the envıronment					
13	Integrated Weed Management ought to be practıced ın the field to reduce pollutıon caused by the chemıcal herbıcıdes					

Sl No	Items	HR	R	UD	LR	NR
14	Though we kno v that Integrated Weed Management practices are mportant in the context of environmental sustamab l ty they are not worth adopt ng considering its difficulty in adoption and its low cost effectiveness					
15	While spray ng pesticides utmost care has to be taken to use equipments comply ng with established safety and maintenance standards for reducing pollution and health hazards					
16	We should use bio pesticides as it is a better option in controlling insect pests without inflicting any damage on the environment					
17	Even though chemical pesticides are environmentally hazardous it is a better and easier opt on for pest control					

Appendix – II

Item analysis by comparison of the discrimination index (t value) and item score – total score correlations (r – value) of the statements measuring environmental concerns of non sample respondents in rice farming

Sl No	Items	r value	t value
1	There is no harm in converting rice fields for commercial purposes *	0 905	2 739
2	Considering the environmental hazards caused by chemical inputs organic farming has to be adopted *	0 759	11 000
3	We need to be concerned only about yield and profitability and not environmental sustainability *	0 932	11 000
4	Any cultivation strategy can be adopted disregarding its impact on the environment to increase productivity *	0 645	6 708
5	People should be allowed to pursue crops that would fetch them profit regardless of environmental concerns	0 759	2 076
6	We have to avoid using chemical fertilizers to prevent depletion of soil fertility	0 058	1 342
7	One has to strictly follow Integrated Nutrient Management in rice fields so as to reduce soil and water pollution caused by chemical inputs *	0 728	2 712
8	Increasing the dose of fertilizers is necessary for better crop stand though it is harmful to the environment *	0 783	7 906
9	We must apply organic inputs like green manure compost Farm Yard Manure and bio fertilizers in order to improve soil health	0 109	1 581
10	We have to practice crop rotation in rice fields to maintain soil fertility	0 158	1 861
11	Though growing livestock and poultry along with rice provides rich manurial reserve considering the difficulty it need not be practiced	0 783	0 767
12	Strictly follow nutrient recycling in rice fields as it is very important for enhancing soil fertility	0 158	1 754
13	Burn crop residue in the field itself though it causes environmental pollution	0 522	0 620
14	Intensive cultivation along with inorganic inputs is a better option even though it depletes the soil nutrient status *	0 728	2 907
15	To prevent flooding and water logging conservation of rice fields has to be strictly enforced *	0 696	2 739
16	There is no need to conserve rice fields just for the sake of restoring ground water table level *	0 797	2 739
17	Avoid using chemical fertilizers to reduce pollution of water bodies	0 158	3 162

Sl No	Items	r value	t value
18	Use of chemical inputs should be minimum as they are highly toxic to fish and other organisms in water bodies *	0 522	3 162
19	The harmful effects of chemicals in water bodies are not worth considering taking into account the higher yield *	0 667	7 071
20	Water conservation is very important and hence we have to strictly follow practices like residue incorporation and green leaf manuring	0 667	2 076
21	Construction of farm ponds need not be given importance for conserving water	0 522	1 754
22	Regular cleaning of channels is important and should be practiced in rice fields for conserving water	0 149	2 000
23	The situation is so emergent that we have to conserve the existing rice fields so as to maintain stability of the ecosystem *	0 692	2 739
24	Cultivating High Yielding Varieties exclusively to get better yield is more important and relevant than maintaining genetic diversity *	0 570	3 162
25	Keeping poison baits and poaching has to be strictly prevented in order to protect birds and animals thriving on rice fields	0 109	2 076
26	Care should be taken to preserve the natural enemies of the pests of rice while going for chemical control of pests	0 158	1 581
27	Efforts at community level are very important in restoring the lost biodiversity *	0 769	7 000
28	Use of agricultural chemicals in rice fields will not do much harm to the ecological balance of the rice eco system	0 149	1 754
29	Strict surveillance of pests in the field for its Economic Threshold Level (level up to which damages can be tolerated) should be followed before pesticide application to avoid its unnecessary usage	0 213	2 000
30	Higher dose of pesticides give better control of insects and does not harm the environment	0 213	1 195
31	Adopting Integrated Pest Management practices in the field is not worth the money and labour spent on it though it is an environmentally sustainable practice	0 213	2 236
32	Use of excessive chemical pesticides in rice fields has to be avoided as it leads to pest resurgence later on demanding higher dose of chemical pesticides *	0 827	7 000
33	Though we know that Integrated Weed Management practices are important in the context of environmental sustainability they are not worth adopting considering its difficulty in adoption and its low cost effectiveness	0 149	1 195
34	Safety measures have to be strictly followed while applying plant protection chemicals to avoid environmental pollution *	0 507	4 243

* Statements selected to construct the final scale

Appendix III

Item analysis by comparison of the discrimination index (t value) and item score total score correlations (r value) of the statements measuring indigenous wisdom orientation of non sample respondents

Sl no	Statements	r value	t value
1	Development activities to be participative should consider the indigenous wisdom of the local people *	0.937	2.445
2	Indigenous wisdom mostly fits to the local needs	0.339	1.69
3	Compared to many modern technologies that harms the environment indigenous practices are mostly sustainable *	0.844	8.062
4	Indigenous knowledge ought to be eradicated as soon as possible through education and modernization process *	0.825	6.708
5	Indigenous wisdom is a resource that local people can use to further their own development *	0.656	6.761
6	Indigenous wisdom has to be preserved in situ as they are foundation to strengthen the existing knowledge *	0.67	4.025
7	We have to recognize indigenous wisdom as an important national resource *	0.869	8.485
8	Indigenous wisdom has no scientific basis and hence need not be preserved *	0.862	11.783
9	Indigenous practices use less costly external inputs	0.487	2.15
10	Indigenous practices are better as they require less external inputs *	0.765	3.503
11	Indigenous wisdom can be utilized more effectively for grassroots participatory development process *	0.703	2.907
12	Indigenous wisdom documentation and compilation ought to be a research priority of highest order *	0.624	4.781
13	Newer technologies have to be developed considering the indigenous practices of the locality *	0.816	7.319
14	Traditional methods of farming has to be neglected in order to raise the living of farmers	0.325	1.928
15	Modern technologies should judiciously make use of indigenous knowledge base for designing and developing effective technologies *	0.959	4.568
16	Indigenous wisdom is not important as it does not cover the management of natural environment	0.738	11.000
17	Indigenous wisdom is very important as they are cumulative representing generations of experiences *	0.819	7.906
18	Indigenous knowledge systems are highly reliable as they are the result of careful observation and trial and error experiments *	0.91	2.907
19	Indigenous knowledge systems are static with no new knowledge added to it	0.301	2.236
20	Introduction of market oriented agricultural and forestry practices had no effect on indigenous wisdom	0	1.348
21	Research on indigenous wisdom need not be gender sensitive	0.447	1.928
22	Indigenous knowledge systems minimizes disruption of existing practices compared to modern technologies	0.641	2.236
23	Indigenous wisdom ought to be conserved as it integrates culture and religion *	0.843	5.814
24	Indigenous knowledge systems minimize risk rather than maximize profit	0.325	1.039
25	Unique and promising technologies has to be patented by the communities that has generated it *	0.753	4.385
26	The younger generation has to be made aware about the value of indigenous wisdom *	0.752	6.581

* Statements selected to construct the final scale

Appendix IV

Difficulty and discrimination indices of the knowledge test on eco friendly practices in rice cultivation

Sl No	Questions	Difficulty index	Discrimination index
1	Name an organic manure used in rice fields	25	0
2	What is the quantity of organic manure that has to be applied in rice fields (in hectare/acre/cents)?	2	0 17
3	What do we apply to the soil when it is acidic?	24	0 17
4	What is the quantity of lime that has to be applied to a hectare/acre/cent?	8	0 83
5	When do we apply lime in rice fields?	5	0
6	Give the name of a bio fertilizer commonly used in rice	8	0 66
7	What should be done to the crop residue after harvest? *	17	0 67
8	What is the minimum time gap after incorporating organic manure and before transplanting rice seedlings? *	15	0 67
9	Name one green leaf manure used in rice cultivation	25	0
10	Name a crop when grown in rice fields adds to the soil fertility?*	21	0 5
11	How can we determine the fertilizer/nutrient requirement of the crop?	2	0 17
12	When do we apply *Azolla* in rice fields?	5	0 67
13	What is the recommended quantity of *Azolla* to be applied in rice fields?	0	0
14	How can we apply nitrogenous fertilizers without adversely affecting the soil health and reducing environmental pollution?	25	0
15	Which is a more eco friendly practice of fertilizer application applying fertilizers retaining water in the field or applying it by draining the field?	23	0 17
16	What is the major benefit of using traditional varieties of rice?	25	0
17	Mention any one natural enemy of insect pests commonly seen in rice fields*	22	0 33
18	Name one traditional variety grown in Palakkad district	25	0
19	Which is the major natural enemy of rodent population in rice fields?	25	0
20	Which is the rice variety having medicinal properties?	13	1
21	Name a scented variety of rice grown in Kerala?	22	0 17
22	What is the use of summer ploughing in rice fields? *	22	0 33
23	What is the level of water to be maintained in rice fields for better crop stand?	14	1
24	How can we reduce water loss from the channels in rice fields?	9	0 83
25	Name any cover crop that can be grown in rice fields	23	0 17
26	Name one of the mulches commonly used in rice fields?	7	0 33
27	What is the major benefit of applying mulches and growing cover crops in rice?	7	0 83
28	Why do we expose the rice field to sun after deep ploughing? *	20	0 33

29	Why do we plaster and trim the bunds in the rice fields? *	11	0.66
30	Mention any one trap used to control insect pests of rice*	12	0.83
31	What is the purpose of using tape or polythene sheets in rice fields?	25	0
32	What are *Tricho* cards? *	11	0.83
33	When should be the parasitoids (*Trichogramma*) released in rice fields?	3	0.5
34	What should be the frequency of the release of parasitoids (*Trichogramma*)?	1	0
35	How many *Tricho* cards or pieces are to be placed in an acre of rice fields?	2	0.33
36	Name a microbial formulation effective against many diseases in rice	10	1
37	Which is the insect pest against which kerosenised roping and field drainage is an effective practice? *	17	0.5
38	What are the major constituents of panchagavya?	9	1
39	How can we treat rice seeds without using chemica s	9	0.16
40	What are the benefits of puddling in rice fields?	3	0.5
41	How are fish beneficial to rice crop?	5	0.5
42	How can we apply *Pseudomonas fluorescence*?	12	1
43	How can we control the rodent population in rice fields without using chemicals?	23	0.17
44	Which insect pests can be controlled by brushing or sweeping rice plants using branched bamboo thorns/leaves of *Parakom*?	23	0.17
45	Name an effective botanical anti feedant used against storage pests of rice	9	0.83
46	Name one insect pest that can be controlled by proper water management? *	16	0.83
47	Why should we harvest rice crop nearest to soil?	3	0.5
48	What is the purpose of spraying supernatant of cow dung slurry?	7	0.83
49	Name an insect pest that can be controlled by adjusting the time of planting	5	0.67
50	What is soil solarization?	1	0.17
51	Name a botanical pesticide effectively used in rice? *	18	0.67
52	What is vermicompost?	25	0
53	What is enriched Farm Yard Manure?	2	0.33
54	What is the benefit of synchronized sowing in rice? *	22	0.33
55	What are effective microorganisms?	5	0.83
56	What is the purpose of applying fish amino acid?	7	0.67
57	What is SRI?	25	0
58	What is the major benefit of practicing SRI? *	21	0.67
59	How does pheromone trap control insect pests (stem borers)? *	20	0.5
60	What is the benefit of walking across rice fields once in a week during the vegetative phase of the crop?	7	0.67
61	What is the water level to be maintained during transplanting rice seedlings?	23	0.17

* Statements selected to construct the final scale

Appendix V

Item analysis by comparison of the discrimination index (t value) and item score – total score correlations (r – value) of the statements measuring communication effectiveness of non sample respondents

Sl no	Statements	r value	t value
1	I tend to assume that other people always understand what I m talking about *	0 651	2 004
2	I sometimes neglect to incorporate the interests and needs of other people when endeavoring to gain the r attent on	0 252	0 349
3	I sometimes tend to listen only what I want to hear *	0 412	1 8
4	I do give importance to the preference of people while communicating	0 158	0 659
5	I do consider the different emotional states of the people while communicat ng	0 051	0 659
6	I choose words that f t the l stener s inte ugenc ana ca kgrounas	0 64	1 860
7	I transmit informat on in a way that clearly conveys the meaning I intend	0 158	0 999
8	I always choose words that will be easily understood by those on the receiving end	0 333	0 859
9	I always take into consideration the response of the receiver to ensure effectiveness of communication *	0 651	2 573
10	I effectively use non verbal commun cat on methods like gestures and express ons while speaking	0 274	0 307
11	I always maintain eye contact when communicating	0 369	0
12	I use the tone of my voice to ensure that people f nd it interesting to l sten to me	0 05	0 859
13	I ask questions to check and ensure that the listeners have fully understood what is being commun cated *	0 737	2 573
14	I make sure that what I have written is clear and concise	0 274	1 103
15	I layout my documents or written communication in a way that s easy to follow and understand	0 274	0 349
16	I use the simplest possible language to express what I mean *	0 775	2 076
17	I let others finish what they are saying before jumping in with my views *	0 775	2 004
18	I give the people my full attention while they are talking	0	1 464
19	I make a point of us ng people s name while talking to them *	0 638	2 535
20	I do value people s opinion as it is very important for effective communication	0 343	1 342
21	I do pace my speech with that of the listener	0 158	0 542
22	I am not stressed while talking in a group situat on	0 057	0 725
23	I am able to communicate without hurting the sentiments of others	0 138	1 536
24	I tolerate views that are different from my own	0 809	1 464
25	I always empathize with the listeners *	0 64	1 861
26	I fail to think logically and clearly about what I want to communicate	0 265	0 568
27	I always give due cons deration to the words and images I use	0 343	0 62
28	My interests sometimes affect the way I send messages	0 194	0 307
29	I let people know I m listening by looking at them and acknowledging what they are saying *	0 412	1 941
30	I usually leave it up to others to make sense of what I m saying	0 0812	0 568

* Statements selected to construct the final scale

Appendix VI

Assignment of weights for the selected dimensions of social cost and benefit of eco friendly rice farming

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE

Dr A Anilkumar
Vellayani
Professor

14 07 2010

Dear Sir Madam

Ms Smitha K P Ph D student of this department is undertaking a study titled Environmental concerns in the development projects on rice farming under decentralized planning under my guidance for her research work She is studying the social cost benefit analysis of eco friendly rice farming and on the basis of the review of relevant literature and discussion with the experts in the field four dimensions of social cost and ten dimensions of social benefit was identified

Considering your rich experience in the field you have been identified as a judge for giving weights to each dimension identified Kindly assign weights (in the range of 1 10) to the all the dimensions given below Kindly add other items you feel appropriate under the dimensions and weigh them accordingly

Kindly return the completed schedule to the researcher at your earliest convenience

Thanking you

Yours sincerely

Anilkumar A

Kindly assign weights (in the range of 1 10) to the various dimensions of social costs and social benefits accruing out of eco friendly rice farming

Sl No	Items	Weights
Dimensions of social cost		
1	Lower yield in the initial years	
2	Non receipt of remunerative price	
3	Higher cost of cultivation	
4	Inconvenience in handling eco friendly [illegible] s	
Dimensions of social benefit		
1	Superior quality of rice	
2	Improvement in soil quality	
3	Improvement in water quality	
4	Increased water availability	
5	Biodiversity enrichment	
6	Aesthetic value enhancement	
7	Life style changes towards sustainable development	
8	Self development	
9	Augmenting Public health	
10	Increased labour utilization	

Average weights assigned by judges for the dimensions of social cost and benefit of eco-friendly rice farming

Sl No	**Social cost dimensions**	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Judge 6	Judge 7	**Average Weights**
1	Lower yield in the initial years	7	9	5	9	6	6	8	**7 143**
2	Non receipt of remunerative price	8	8	6	8	9	7	5	**7 286**
3	Higher cost of cultivation	7	7	8	2	6	4	6	**5 714**
4	Inconvenience in handling eco friendly inputs	6	4	3	5	4	1	4	**3 857**
	Social benefit dimensions								
1	Superior quality of rice	7	8	4	8	8	6	3	**6 286**
2	Improvement in soil quality	8	9	7	8	8	5	5	**7 143**
3	Improvement in water quality	8	9	6	8	7	3	7	**6 857**
4	Increased water availability	3	6	4	5	7	2	6	**4 714**
5	Biodiversity enrichment	8	9	6	8	7	3	8	**7 00**
6	Aesthetic value enhancement	5	6	4	6	6	4	5	**5 143**
7	Life style changes towards sustainable development	5	5	4	2	7	5	6	**4 857**
8	Self development	4	5	4	2	7	5	7	**4 857**
9	Augmenting Public Health	8	9	4	8	7	6	8	**7 143**
10	Increased labour utilization	6	7	5	8	6	7	5	**6 286**

Appendix VII

Principle Component analysis of the dimensions of social cost and benefit of eco friendly rice farming

(1) Principle Component analysis of the dimensions of social cost of eco-friendly rice farming

	PRIN 1	PRIN 2	PRIN 3	PRIN 4
CASE 1	9 382	0 864	6 606	1 260
CASE 2	7 448	0 194	6 697	1 626
CASE 3	11 660	0 697	6 127	2 005
CASE 4	9 337	0 964	5 345	1 519
CASE 5	9 519	0 959	6 666	2 245
CASE 6	6 027	0 410	4 343	1 908
CASE 7	8 671	15	430	1 401
CASE 8	6 486	0 400	4 707	1 900
CASE 9	6 859	0 041	7 960	1 609
CASE10	6 744	0 373	7 207	2 727
CASE11	9 016	0 058	5 041	2 511
CASE12	9 016	0 058	5 041	2 511
CASE13	8 627	0 662	4 169	1 660
CASE14	9 474	0 869	5 405	2 504
CASE15	8 420	0 657	4 617	1 534
CASE16	7 684	4 201	5 209	2 275

(2) Principal Component analysis of the dimensions of social benefit of eco-friendly rice farming

	PRIN 1	PRIN 2	PRIN 3	PRIN 4	PRIN 5	PRIN 6	PRIN 7	PRIN 8	PRIN 9	PRIN 10
CASE 1	28 594	10 342	3 560	1 667	0 598	7 246	0 262	7 898	2 971	1 344
CASE 2	31 303	9 242	3 964	1 236	0 588	7 364	0 801	7 029	2 906	536
CASE 3	23 707	9 763	4 437	1 265	1 239	7 132	0 479	6 736	2 992	1 181
CASE 4	28 480	8 102	4 347	1 427	0 414	7 267	0 489	7 534	3 245	1 330
CASE 5	23.323	9 074	3 744	0 351	1 304	7 262	0 186	7 561	3 424	1 475
CASE 6	28 303	8 380	3 778	0 822	0 212	7 019	0 504	7 821	3 157	1 424
CASE 7	21 857	7 185	4 863	1 372	0 535	6 537	0 833	8 036	2 947	45
CASE 8	23 160	7 583	6 024	0 771	0 735	8 133	0 047	7 556	2 899	1 432
CASE 9	28 367	5 862	5 133	1 186	0 230	7 288	0 716	7 169	3 518	1 316
CASE10	28 066	5 996	4 381	0 497	0 605	7 294	0 976	7 420	2 757	1 310
CASE11	25 444	7 614	2 941	1 485	0 260	7 253	0 423	7 495	3 020	1 271
CASE12	27.317	6 238	4 180	0 945	1 640	6 258	0 044	7 188	2 995	1 420
CASE13	24 479	6 339	2 542	1 218	1 415	7 807	0 879	7 277	3 091	1 545
CASE14	26 531	5 622	2 706	2 288	0 580	7 534	0 175	7 632	2 997	1 251
CASE15	25 481	7 367	3 976	0 826	0 499	6 993	0 234	6 887	2 984	1 549
CASE16	20 072	8 209	3 188	1 852	0 222	7 089	0 847	7 126	3 076	1 362

Appendix VIII

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE

Social cost benefit analysis of eco friendly rice farming

INTERVIEW SCHEDULE – ECO FRIENDLY FARMERS

Resp No EF

1 Name

2 Address

Dimensions of Social Cost

I Lower yield in the initial years

1 What is the yield of rice during the initial years of adopting eco friendly cultivation practices ? Very High / High / Low / Very low

II Non receipt of remunerative price

1 Do you think you receive a price as per your expectation for rice produced in an eco friendly way? Yes / No

2 What is the price you are now getting for rice produced following eco friendly practices when compared to inorganic rice?
Very High / High / Same / Low / Very low

III Higher cost of cultivation

1 Are you incurring a higher cost for eco friendly cultivation practices in rice? Yes / No

2 What is the cost incurred for eco friendly rice cultivation when compared to inorganic rice cultivation?
Very High / High / Same / Low / Very low

IV Inconvenience in handling eco friendly inputs

1 What is the extent of difficulty you have in handling bulky organic inputs like Farm Yard Manure? Very difficult / Difficult / Easy / Very easy

2 What is the extent of comfort you have in handling eco friendly inputs due to its foul smell and filthiness?

Comfortable / Not so comfortable / Not at all comfortable / Un comfortable

3 Did your neighbours or family members ever complain about the foul smell while storing or preparing eco friendly inputs? Yes / No

Dimensions of social benefit

I Superior quality of rice

1 Do you feel that rice cultivated by eco friendly methods is much better for our health? Yes / No

2 How do you rate the followin h teris i s of ri e n d d through eco friendly methods?

	Extremely good	Good	Somewhat good	Not so good
1 Cooking quality				
2 Taste				
3 Texture				
4 Flavor				

II Improvement in soil quality

1 What do you think about the following soil properties after adopting eco friendly rice farming?

Soil properties			
1 Structure	Improved	Same as before	Destroyed
2 Nutrient status	Increased	Same as before	Decreased
3 Water holding capacity	Increased	Same asbefore	Decreased
4 Soil organisms (esp earthworms)	Increased	Same as before	Decreased

III Improvement in water quality

1 Do you feel that the water from the channels can be used for domestic and consumption purpose if you are practicing eco friendly cultivation?
Yes / No

2 Do you see a reduced growth of algae after adopting eco friendly rice cultivation? Yes / No

3 Is there any increase in the population of fish and other aquatic organisms after adopting eco friendly cultivation practices in rice? Yes / No

IV Increased water availability

1 Do you have water scarcity problems after adopting various conservation practices in eco friendly rice cultivation? Yes / No

2 What is the variation in the level of water from the water level in the past in nearby wells especially during the drought period after adopting better water management practices in eco friendly rice cultivation?
Very much increased / Increased / No change / Decreased / Very much decreased

V Enrichment of biodiversity

a What do you think has happened to the biodiversity status of rice fields where eco friendly cultivation practices are adopted?

	Biodiversity	Increased	No change	Decreased
1	Medicinal plants			
2	Other weed flora			
3	Natural enemies			
4	Aquatic organisms			
5	Birds			
6	Other animals			

b What do you think is the extent of cultivation of traditional varieties in eco friendly rice cultivation?
Very much increased / Increased / No change / Decreased / Very much decreased

VI Enhancement of aesthetic value

1 What is the level of satisfaction or happiness you possess when you see rice fields managed in an eco friendly way with all its biodiversity?
Highly satisfied / Satisfied / Not satisfied / Least satisfied

VII Life style changes towards sustainable development

1 Are you trying to be simple in your life style? Yes / No

2 Do you resort to deliberate attempts to reduce your desire? Yes / No

3 Are you humble in your interaction with others? Yes / No

VIII Self development

1 How much contented you are in adopting eco friendly rice cultivation?
Very much contented / Much contented / Contented / Not much contented /
Not at all contented

2 Have you gained recognition in the society by way of adopting eco friendly rice cultivation? Yes / No

3 Have you become a credible source for solution of farming problems?
Yes No

4 Do you have a feeling of self fulfillment on working towards the social cause sustainable development? Yes / No

IX Augmenting public health

1 Do you think that there ll not be any health problems for applicators after adopting eco friendly rice cultivation? Yes / No

2 Do you think that aerial pollution will be reduced by adopting eco friendly rice cultivation practices? Yes / No

3 Do you think that there is a welfare cost associated with the use of inorganic inputs in rice farming? Yes / No

X Increased labour utilization

1 Do you have to employ additional labour for adopting eco friendly rice cultivation practices? Yes / No

2 What is the extent of labour utilization in eco friendly rice cultivation compared to inorganic cultivation? Very high / High / Somewhat high / Not at all high

Appendix IX

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE

Environmental concerns in the development projects on rice farming under decentralized planning

INTERVIEW SCHEDULE FARMERS

Resp No F

PART I

1 Name

2 Address

3 Age Years

4 Educational status

Sl No	Category	Educational status
1	Illiterate	
2	Primary school	
3	Middle school	
4	High school	
5	Higher secondary school	
6	Graduation	
7	Post graduation & above	

5 Occupational status

a) Farming as sole occupation
b) Farming + Agricultural labour
c) Farming + Business
d) Farming + Service

6 Experience in eco-friendly rice cultivation Years

7 Participation in training programmes on eco friendly cultivation
Have you attended any training programme on eco friendly cultivation? If yes state the details of trainings attended

Sl No	Name of the training programme	Place of training	Duration of training

8 Participation in activities related to environmental conservation

What is the extent of your nvolvement in environmental cause both individually or as a part of any organization?

Sl No	Part c pat on aspects	Level of nvolvement				
		Very high	High	Medium	Low	Very Low
1	Time spent					
2	Participation in activities					
3	Assumed leadership status					
4	Mobil zing people					

9 Attitude towards group management in rice farming

State your attitude towards group management in rice farming by giving a tick mark (✓) in the appropriate column

SA Strongly Agree A Agree UD Un decided DA Disagree
SDA Strongly Disagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Group management leads to sociab l ty mprovement					
2	Group management can not solve the problems of others than field level problems of farmers					
3	Group management makes eco friendly technologies appl cable					
4	Group management is not effective when compared to other extension approaches					
5	Group management leads to reduction in cost of cultivation					
6	Group management promotes more interact on with scientists					
7	Group management leads to suitable leadership development					
8	Input supply will be easy and economical					
9	Group management promotes more involvement of family labour					
10	Group management helps in identifying suitable eco friendly technology					
11	Due to group management increase in net income is assured					
12	Due to group management sc entific farming is facilitated					
13	Time devoted for work s less in this approach					
14	Group management promotes national integrat on					
15	It brings more organizat ons and institutions together					
16	Group management helps to attain more benefits individually					
17	Group management leads to mismanagement of labour					
18	Group management does make unviable farm viable					
19	Less chances for idling in group management					
20	Group management is not suited to our condition					

10 Extent of influence exerted by various agencies in developing environmental concerns

Indicate the extent of involvement of various given agencies in developing environmental concerns by putting a tick mark (✓) in the appropriate column

Sl No	Agencies	Level of influence				
		Very positive	Positive	Neutral	Negative	Very negative
1	Teachers					
2	NGOs dealing with environmental activities					
3	Literature					
4	Peer group / colleagues					
5	First hand experience on environmental aspects					
6	Nature clubs					
7	Mass media					
8	Any other specify					

11 Preference of manures and fertilizers

Give your preference of nutrient management from exclusively organic to exclusively inorganic on ten different production aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of nutrient management practices				
		Exclusively Organic	Primarily Organic	Integrated Nutrient Management	Primarily Inorganic	Exclusively Inorganic
1	Profitability					
2	Yield					
3	Cost of application					
4	Easiness in handling					
5	Market demand					
6	Market price					
7	Perceived quality of produce					
8	Soil health					
9	Human health					
10	Labour cost					

12 Preference of insect pests control methods

Give your preference of nsect pests control methods from exclusively organ c to exclusively inorganic on ten different production aspects of rice by putting a t ck mark (✓) in the appropriate column

Sl No	Production aspects	Preference of insect pests control methods				
		Exclusively Organic	Primarily Organic	Integrated Pest Management	Primarily Inorganic	Exclusively Inorganic
1	Profitab lity					
2	Yield					
3	Cost of appl cation					
4	Easiness in handling					
5	Market demand					
6	Market price					
7	Perceived quality of produce					
8	So l health					
9	Human health					
10	Labour cost					

13 Preference of disease control methods

Give your preference of disease control methods from exclus vely organic to exclus vely norganic on ten different production aspects of rice by putting a t ck mark (✓) in the appropriate column

Sl No	Production aspects	Preference of disease control methods				
		Exclusively Organic	Primarily Organic	Integrated Disease Management	Primarily Inorganic	Exclusively Inorganic
1	Profitability					
2	Yield					
3	Cost of applicat on					
4	Easiness in handl ng					
5	Market demand					
6	Market price					
7	Perceived quality of produce					
8	So l health					
9	Human health					
10	Labour cost					

14 Preference of weed control methods

Give your preference of weed control methods from exclusively organ c to exclusively norganic on ten different production aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of weed control methods				
		Exclusively Organic	Primarily Organic	Integrated weed Management	Primarily Inorganic	Exclusively Inorganic
1	Profitability					
2	Yield					
3	Cost of application					
4	Easiness in handl ng					
5	Market demand					
6	Market price					
7	Perceived qual ty of produce					
8	So l health					
9	Human health					
10	Labour cost					

15 Perception on the importance of mitigating environmental degradation

Please indicate your response in the appropriate alternat ve by putting a t ck mark (✓)
SA Strongly Agree A Agree UD Un decided DA Disagree
SDA Strongly D sagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Ind scriminate use of pesticide lead to toxic residual effects n soil and water					
2	Pressing demand on natural resources will result in ecological problems					
3	Lack of awareness about environment leads to ecological degradat on					
4	Environmental degradation can be effectively controlled by shifting to organ c farming practices					
5	Government policies help for ecological development					

16 Indigenous wisdom orientation

Indicate your orientat on towards indigenous w sdom by putting a tick mark (✓) in the appropriate column given
SA Strongly Agree A Agree UD Un decided DA Disagree
SDA Strongly Disagree

Sl No	Items	SA	A	UD	DA	SDA
1	Development activit es to be part c pative should consider the indigenous wisdom of the local people					
2	Compared to many modern technologies that harms the environment ind genous pract ces are mostly sustainable					
3	Indigenous knowledge ought to be eradicated as soon as possible through education and modernization process					
4	Indigenous wisdom is a resource that local people can use to further their own developmen					
5	Ind genous w sdom has to be preserved insitu as they are foundation to strengthen the ex sting knowledge					
6	We have to recognize ind genous wisdom as an important national resource					
7	Ind genous wisdom has no scientif c basis and hence need not be preserved					
8	Indigenous practices are better as they require less external inputs					
9	Ind genous wisdom can be ut l zed more effect vely for grassroots participatory development process					
10	Ind genous wisdom documentat on and comp lation ought to be a research priority of highest order					
11	Newer technolog es have to be developed considering the indigenous practices of the locality					
12	Modern technolog es should judiciously make use of indigenous knowledge base for designing and developing effective technolog es					
13	Indigenous wisdom is very important as they are cumulative representing generat ons of experiences					
14	Indigenous knowledge systems are highly reliable as they are the result of careful observation and trial and error experiments					
15	Ind genous wisdom ought to be conserved as it integrates culture and religion					
16	Unique and promising indigenous technologies have to be patented by the community that has generated it					
17	Younger generation has to be made aware about the value of ind genous wisdom					

17 Livestock possession

Give the details of l vestock you own along with its value

Sl.No	Category	Number	Value(Rs)
1	Buffalo		
2	Bullock		
3	Cow		
4	Calf		
5	Goat		
6	Poultry		
7	Others Please Specify		

18 Risk orientation

Please ind cate your response in the appropriate alternative by putting a t ck mark (✓)
SA Strongly Agree A Agree UD Un decided DA Disagree
SDA Strongly Disagree

Sl No	Statements	SA	A	UD	DA	SDA
1	A farmer should grow a large number of crops to a oia greater risks involved in growing one or two crops					
2	A farmer should take more chance in making a b g profit by adopting eco friendly farming than to be content with smaller but less risky prof t from inorganic farming					
3	A farmer who is willing to take greater risk than the average farmer usually does better					
4	It is good for a farmer to take risk when he knows h s chance of success is fa rly high					
5	It s better for a farmer not to follow eco-friendly practices in rice cultivation unless most others in the local ty have used it with success					
6	Trying on entirely eco friendly practices by a farmer involves risk but it is worth					

19 Export orientation

Please ind cate your response in the appropriate alternative by putting a tick mark (✓)
SA Strongly Agree A Agree UD Un decided DA Disagree
SDA Strongly Disagree

Sl No	Statements	SA	A	UD	DA	SDA
1	A farmer should go for exporting his organic produce to evade from risk nvolved in marketing					
2	A farmer should take more of a chance of exporting his organic produce to make huge profit than to be content with domest c market					
3	A farmer who is willing to export than an average farmer usually does better financially					
4	It is good for a farmer to export organically cultivated rice as he gets a better price in international market					
5	It is better for a farmer not to go for exporting his produce unless most other farmers found it as a profitable venture					
6	Trying to export organic produce by a farmer involves risk but is worth					

20 Attıtude towards extensıon ınterventıons ın popularızıng eco friendly rıce cultıvatıon

Please ınd cate your attıtude towards extensıon strategy ın popularızıng eco-friendly nce cultıvatıon ın the appropnate alternatıve by puttıng a tıck mark (✓)
SA Strongly Agree A Agree UD Un decıded DA Dısagree
SDA Strongly D sagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Extensıon personnel can dıssem nate /del ver ınformatıon ın an amıcable way on eco-friendly nce cultıvatıon					
2	An extensıon personnel act as a lınkage between researcher and farmers on promotıng eco-friendly nce cultıvatıon					
3	Farmers contact extensıon personnel more frequently than sc ent sts for gettıng ınformatıon on eco-friendly nce cultıvat on					
4	Extens on scıentısts are not at all contacted for gettıng ınformatıon on eco-friendly nce cultıvatıon					
5	Extensıon methods used for delıvery of messages on eco friendly nce cult vat on are hıghly relevant					
6	Extens on agency ıs makıng specıal efforts to popularıze eco friendly cultıvatıon ın nce eco system					

21 Perceptıon of attrıbutes of practıces

What ıs your opınıon regardıng the sımplıcıty/profitabılıty/cost/labour requırement n adoptıng the followıng eco friendly pract ces ın nce cultıvatıon?

Sl No	Attrıbutes / Practıces	Sımplıcıty	Profitab ılıty	Cost ınvolved	Labour requıre ment
1	FYM / Compost / Green leaf / Poultry / Bıogas slurry appl catıon				
2	Appl catıon of bıo fertılızers lıke *Azolla Azospırıllum* etc				
3	Inclusıon of enterprıses l ke da ry poultry pıggery etc				
4	Appl catıon of urea ın xed wıth neem cake				
5	Applıcatıon of Nıtrogen and Potassıum ın 2 3 splıt doses accordıng to the duratıon of the varıety				
6	Applıcatıon of lıme				
7	Incorporat on of crop resıdue ın the field ıtself				
8	Summer ploughıng				
9	Land levelıng / puddlıng				
10	Plasterıng of f eld bunds / trımmıng / / ıts regular cleanıng				
11	Constructıon / cleanıng / desıltıng of farm ponds for collectıng raın water				

12	Practicing SRI in areas of water scarcity and wherever water management is possible				
13	Manual weeding trampling stale seed bed technique / walking across paddy fields during the vegetative phase of the crop				
14	Augmentation of parasite / predator population in the field use of natural enemies like *Trichogramma* *Pseudomonas* etc				
15	Ploughing the field and exposing to sun				
16	Synchronized sowing				
17	Removal (sweep nets) and destruction of pests infected parts and diseased plants				
18	Use of traps (Light traps / pheromone traps / sticky traps)				
19	Regular surveillance of the field [illegible] Threshold Level				
20	Use of environment friendly pesticides like bio pesticides (neem based Panchagavya Dasagavya fish aminoacid)				
21	Use of bird scarers like polythene covers/ tape etc				
22	Kerosenised roping / roping / draining the field / Brushing or sweeping rice plants with bamboo thorns *murams* etc				
23	Precautions while spraying / using safety gadgets / avoiding drift / safe disposal of containers / using equipments of prescribed standards				
24	Planting borders closely with seedlings to restrict the entry of rats / water management				
25	Soaking seeds in hot water / applying supernatant of cow dung slurry / placing sachets of bleaching powder against Bacterial Leaf Blight				

22 Effectiveness of the supply of inputs for eco-friendly rice farming

Indicate the extent of availability of organic inputs for eco friendly rice production
A Always ST Sometimes **N** Never
CQ Correct Quantity OT On time CMR Current Market Rate
TE Transportation Easiness

Sl No	Inputs	CQ			OT			CMR			TE		
		A	ST	N	A	ST	N	A	ST	N	A	ST	N
1	Seed varieties suitable for the locality												
2	Manures												
3	Organic plant protection inputs												
4	Irrigation water												
5	Credit												

23 Political orientation

Please state agreement or disagreement to each of the statements below

Sl No	Items	Agree	Disagree
1	Recognizing power relat ons existing n the society is very mportant in resolving the problems of the society		
2	Democracy is the best poht cal princ ple and ph losophy for ideal governance		
3	Ind v dual approach will not help in solving problems		
4	Organizing people for asserting their genuine and fundamental rights is an mportant pre requ s te for a democratic society		
5	Pol t cal part es are inevitable and indispensable for a v brant democratic society functioning in accordance with const tution		
6	Susta nable progress and welfare of people can be achieved only through organized pol tical and social interventions		
7	Apolit cal approach to soc al ssues actually preserve the ex sting power relations and prevent distributive just ce social transformation and progress		
8	Pol t cal part es and other social organizations play no role in soc al development and therefore t is a curse to the society		
9	Princ ple like freedom equal ty and fraternity should be the gu ding cardinal principles of a strong civil society		
10	D stributive just ce makes a soc al system humane and modern		

24 Political affiliation

Do you have any political affil ation? Yes/No

If yes g ve your stance with respect to the political ideologies in the present democrat c system

Categories	Right conservative	Liberal Democrat c	Liberal Left	Left	Radical Left	Non Pol t cal
Response						

25 Sense of empowerment

The following inventory cons sts of 15 statements that represent your own dom nant thoughts/ tendencies you experience from time to t me whether at work place in the f eld or at home Read each statement carefully and judge whether the statement is in agreement with your tendency The response vary from strongly agree to strongly disagree with numbers representing each response Tick mark (✓) your response aga nst each statement

Sl No	Statements	Strongly Agree (1)	Agree (2)	Neither agree nor disagree (3)	D sagree (4)	Strongly d sagree (5)
1	I feel much more comfortable when I work with clear cut instructions ie when things are made clear to me					
2	I enjoy doing something new where results are not always known and where there may be some poss bility of failure of monetary loss or some such either unfavourable result					
3	I have a habit of thinking over my various tasks examine the					

	vanous possib l ties and the r lıkely consequences Such a habıt helps me to ımprove my performance					
4	Whenever I undertake any actıvıty may be m some project or ın the office or ın farm ng or ın the field I generally thınk I am goıng to do well and achıeve some good results					
5	It ıs so dıfficult for me to work on my own Generally I wa t for some senıor ınfluent al persons to decıde what and how I should do					
6	I lıke to do thıngs ın somewhat dıfferent ways and experıment ı h deas ard methods					
7	I tend to work hard even when I may be tıred when some extra payment / compensatıon ıs assured					
8	I lıke to do thıngs ın the same way as my elders and senıors have been doıng					
9	I generally tend to thınk what can I do? After all I am only a subordınate/farmer					
10	I try to please the boss/ or superıors/or the elders and make them happy by workıng hard on the g ven task					
11	I have a habıt of postponıng problems thınkıng that such problems would be solved automatıcally as the tıme passes					
12	In my varıous tasks whether ın the off ce or n the field I l ke to see that my work ıs goıng good ınstead of just fınıshıng the task anyhow					
13	I tend to th nk I am unproductıve and not an able worker because I am lazy and good for nothıng					
14	I am generally ınterested m completıng the job as quıckly as possıble rather than spendıng tıme ın tryıng for good qualıty and performance					
15	Routıne work does not generally ınterest me I lıke such jobs where I can use my skılls and deas					

26 Knowledge on eco-friendly practices in rice cultivation

Below are given some questions on your knowledge about the eco-friendly practices in rice cultivation Please give appropriate answers

Sl No	Questions	Correct	Incorrect
1	What should be done to the crop residue after harvest?		
2	What is the minimum time gap after incorporating organic manure and before transplanting rice seedlings?		
3	Name a crop when grown in rice fields adds to the soil fertility?		
4	Mention any one natural enemy of insect pests commonly seen in rice fields		
5	What is the use of summer ploughing in rice fields?		
6	Why do we expose the rice field to sun after deep ploughing?		
7	Why do we plaster and trim the bunds in the rice fields?		
8	Mention any one trap used to control insect pests of rice		
9	What are *Tricho* cards?		
10	Which is the insect pest against which kerosenised rop [illegible] d drainage is an effective practice?		
11	Name one insect pest that can be controlled by proper water management?		
12	Name a botanical pesticide effectively used in rice?		
13	What is the benefit of synchronized sowing in rice?		
14	What is the major benefit of practicing SRI?		
15	How does pheromone trap control insect pests (stem borers)?		

PART II

1 Nature and Extent of environmental concerns in rice farming

Eco friendly techniques in rice possible in Palakkad district is given below Please indicate your response in the appropriate alternative by putting a tick mark (✓)

P Possible to be practiced in the field AP Already practicing in the field

Sl No	Eco-friendly techniques in rice	Considered in planning stage	Implementation stage	
			P	AP
	Land and soil Management			
1	FYM / Compost / Green leaf / Poultry / Biogas slurry application			
2	Soil test based fertilizer application			
3	Nutrient recycling through Farming systems approach (Dairy / Poultry / Piggery / Fishery Goatry)			
4	Practicing crop rotation with pulses / leguminous green manures etc / fringe cropping with cow pea			
5	Use of bio fertilizers like *Azolla Azospirillum* etc			
6	Use of urea mixed with neem cake			
7	Applying Nitrogen and Potassium in 2 3 split doses according to the duration of the variety			
8	Application of lime			
9	Raising cowpea as intercrop for green manure in dry/semi dry sown rice			
10	Incorporation of crop residue in the field itself			

11	Application of rock phosphate at the time of seeding / planting			
	Other techniques if any			
Water Management				
12	Selection of suitable variet es based on water availability			
13	Summer ploughing			
14	Land leveling / puddling			
15	Plastering of field bunds / trimm ng / channels / its regular cleaning			
16	Construction / cleaning / desilting of farm ponds for collecting rain water			
17	Judicious integration of all available water resources			
18	Mainta n ng standing water in the f eld as per the crop requirement			
19	Practicing SRI in areas of water scarcity and wherever water management is possible			
20	Manual weeding / trampling / stale seed bed techn que / walking across paddy f elds during the vegetative phase of the crop			
	Other techniques if any			
Biodiversity				
21	Use of local varieties / tradit onal photo sensitive varieties / koottumundakan			
22	Augmentat on of paras te / predator population n the field / use of natural enemies like *Trichogramma Pseudomonas* etc			
23	Avo d poaching and killing of birds and animals in rice fields / Avo d using po son baits / Minimum external interference in the field			
24	Reduce use of chem cals to preserve natural enemy population of the pests in rice fields / use of pesticides with low res dual tox city			
25	Using owl and bird perches in rice fields			
26	Raising fish in the vater channels			
	Other techn ques if any			
Plant protection				
27	Plough ng the f eld and exposing to sun			
28	Select on of right season / Adjust ng the time of planting			
29	Synchronized sowing			
30	Ra sing pest and d sease res stant varieties			
31	Removal (sweep nets) and destruction of pests infected parts and d seased plants			
32	Use of traps (Light traps / pheromone traps / sticky traps)			
33	Regular surveillance of the field / Economic Threshold Level			
34	Use of environment friendly pesticides like bio pesticides (neem based, Panchagavya Dasagavya fish aminoacid)			
35	Use of bird scarers like polythene covers/ used audio/ video tapes etc			
36	Kerosenised roping / roping / draining the field / Brushing or sweeping rice plants with bamboo thorns *murams* etc			
37	Harvesting crop nearest to the soil			

38	Precau ons while spraying using safety gadgets avoid ng drift safe d sposal of conta ners us ng equ pments of prescribed standards			
39	Plant ng borders closely w h seedl ngs to restrict the entry of rats water management			
40	Soaking seeds n hot water applying supernatant of cow dung slurry placing sachets of bleaching powder aga nst Bacterial Leaf Bl ght			
	Other techn ques f any			

2 Environmental concerns in rice cultivation

Please nd cate your response for the statemen s given below by putt ng a t ck mark (✓) n the appropriate column

A Agree N Neutral DA D sagree

ɔ No	Items	A	N	DA
1	There s no harm n convert ng rice f elds for commerc al purposes			
2	Considering the environmental hazards caused by chem cal nputs organ c farm ng has to be adopted			
3	We need to be concerned only about y eld and prof tab l ty and not environmental sustainab l ty			
4	Any cult vat on strategy can be adopted d s egard ng ts mpact on the env onment to ncrease productiv ty			
5	One has to strictly follow Integrated Nutrient Management in rice f elds so as to reduce so l and water pollut on caused by chem cal inputs			
6	Increas ng the dose of fert l zers is necessary for better crop stand though t s harmful to the environment			
7	Intens ve cult vat on along w th norganic nputs s a better opt on even though depletes the so l nutrient status			
8	To prevent flooding and water logging conservation of rice f elds has to be strictly enforced			
9	There is no need to conserve rice fields just for the sake of restoring ground wa er table level			
10	Use of chem cal inputs should be minimum as hey are h ghly tox c to f sh and other organisms in water bod es			
11	The harmful effects of chem cals n water bod es are not worth cons dering aking nto account the h gher yield			
12	The s tuat on s so emergent that we have to conserve the ex sting rice f elds so as o ma nta n stab l ty of the ecosystem			
13	Cult vating High Y eld ng Variet es exclus vely to get better yield s more mportant and relevant than ma nta ning genetic d vers ty			
14	Efforts at community level are very mportant in restoring the lost b odivers ty			
15	Use of excess ve chem cal pest c des in rice fields has to be avoided as it leads to pest resurgence later on demanding higher dose of chemical pest cides			
16	Safety measures has to be strictly followed wh le applying plant protect on chem cals to avo d environmental pollution			

3 Environmental awareness

Read each statement carefully and state your awareness level by putting a tick mark (✓) in the appropriate column

Sl No	Statements	Aware	Not Aware
1	Application of chemical inputs impairs soil health		
2	Lack of vegetative cover deforestation etc lead to loss of soil through wind and water erosion		
3	Ground water availability has reduced due to excessive withdrawal and absence of mechanisms to recharge it		
4	Deforestation is one of the major causes for the uncertainty in the seasonal rainfall pattern		
5	Development of resistance in pests and diseases is due to repeated and excess application of same chemicals over a period of time		
	ucr e of particular pest and disease are more due to monocropping		
7	Applicators suffer from health hazards due to improper handling of chemical inputs		
8	Cultivated areas are gradually getting converted for residential and commercial a purpose which is adversely affecting mankind		
9	Deforestation and environmental pollution are the main reasons for the gradual increase in atmospheric temperature		
10	Overuse of chemicals and improper sewage treatment has polluted our water bodies making it unfit for drinking		
11	Poaching of birds and animals for various reasons has resulted in the extinction of many invaluable organisms		
12	Crop rotation is an effective practice in maintaining soil nutrient balance		
13	Use of bio-pesticides in the place of chemicals helps in conserving soil beneficial organisms		
14	The ozone layer that protects living organisms is being destroyed by various human activities		
15	Using cloth bags instead of plastic bags is eco-friendly as the former is biodegradable		

4 Cost of cultivation
Cost of inputs
Nursery

Inputs	No of times applied	Quantity for each time	Cost
Manures			
Cowdung			
Poultry manure			
Biogas slurry			
Others specify			
Fertilizers			
Nitrogenous fertilizers			
Phosphatic fertilizers			
Potassic fertilizers			
Others specify			

Seed			
Plant protection			
Insecticides			
Fungicides/Bactericides			
Biopesticides			
Biocontrol agents			
Others specify			

Main land

Inputs	No of times applied	Quantity for each time	Cost
Manures			
Cowdung/FYM			
Poultry manure			
Biogas slurry			
Green leaf manure			
Green manure			
Others specify			
Biofertilizers			
Azolla			
Others specify			
Fertilizers			
Nitrogenous fertilizers			
Phosphatic fertilizers			
Potassic fertilizers			
Others specify			
Seed			
Plant protection			
Insecticides			
Fungicides/Bactericides			
Biopesticides			
Biocontrol agents			
Traps(Light/Pheromone)			

Wage Rate/hiring charges

Items	Cost
Tractor	
Power tiller	
Bullocks	
Hired labour(male)	
Land preparation	
Other works	
Hired labour(female)	

Transplantıng	
Harvest ng	
Female labour	
Male labour	
Harvester/Thresher	

Labour use pattern

Part culars		I crop
Nursery preparatıon	Hıred men	
	women	
	Famıly men	
	women	
Land preparatıon	Bullock	
	Mechan cal	
	Hıred men	
	women	
	Famıly men	
	women	
Transplantıng	Hıred men	
	women	
	Famıly men	
	women	
Plant protect on & fert lızer applıcatıon	Hıred men	
	women	
	Famıly men	
	women	
Harvest ng	Hıred men	
	women	
	Famıly men	
	women	
Transportat on (ınputs)	Hıred men	
	women	
	Fam ly men	
	women	
Market ng	Hıred men	
	women	
	Famıly men	
	women	

Transportatıon cost

Items	Cost
Seed	
Manures	
Cowdung/FYM/compost	
Poultry manure	
Bıogas slurry	
Green leaf manure	
Others	
Bıofertılızers	
Fertılızers	
Plant protectıon practıces	
Chemıcals	

Botanicals	
B o control agents	
Traps	
Grain	
Straw	

Receipts

Area	Quantity		Price		Total Value
	Paddy	Straw	Paddy	Straw	

Disposal of produce

Quantity given as wage	Quantity for family consumption	Quantity used for seed purpose	Quantity sold	Rate	Value

Marketing cost

Mode of transportation	Cost of transportation	Loading and unloading	Total

Cost of cultivation

Particulars	No of times applied	Quantity applied	Cost
Planting materials			
Manures			
Cowdung/FYM			
Poul ry manure			
B ogas slurry			
Green leaf manure			
Green manure			
Others			
Propping			
Rope wire			
Fert lizers			
N trogenous fert lizers			
Phosphat c fert l zers			
Potass c fert l zers			
Others			
Plant protect on			
Insecticides			
1			
2			
Fung c des/Bacteric des			
1			
2			
Biopesticides			
B o control agents			
Traps			

Labour cost

Particulars	Crop I			
	Male		Female	
	HL	FL	HL	FL
Land preparation				
a Plough ng				
b Levelling				
c Digg ng				
d Bunding				
i Outer bunds				
i Inner bunds				
iii Channel				
Manures and fertilizers				
a Cowdung/FYM				
b Poultry manure				
c Biogas slurry				
d Green leaf manure				
e Green manure				
f Others				
Fertilizers				
1st topdressing				
2nd topdress ng				
3rd topdressing				
Sowing				
Irrigat on				
Drainage				
Weeding				
i Manual				
ii Weedicide				
Plant protection				
a Insecticides				
b Fung cides/Bactericides				
c B opesticides				
d Biocontrol agents				
e Traps				
f Others				
Propping				
Lime application				
Harvesting				
Transportation				

Wage rate Men
Women

5 Constraints

Some of the major constraints perceived by the stakeholders in planning and implementation of development projects addressing environmental concerns in rice farming are given below Rank them in the order of its importance as experienced by you

Sl No	Constraints	Ranking
Planning Stage		
1	Lack of co ordination among the members of *padashekarasamithi*	
2	Lack of proper planning by the *padashekarasamithis* on the techniques to be adopted in eco friendly rice farming	
3	Inadequate number of meetings	
4	Low attendance of members in the meetings of *padashekarasamithi*	
5	Lack of interest of members in *padashekarasamithi* activities	
6	*Padashekarasamithi* is looked upon as a supplier of inputs given by Krishi Bhavan	
7	Lack of consensus among the members on the technologies to be adopted	
8	Longer distance to the venue of meetings	
9	Inconvenient timing of meetings	
10	Personal conflicts among the members	
11	Political interventions leading to conflicts	
12	Lack of effective leadership in coordinating the meetings and planning the activities	
13	Lack of proper documentation of the decisions taken in the meetings	
14	Lack of extension support / technical guidance	
15	Lack of financial support	
16	Lack of women participation in *padashekarasamithi* activities	
17	Inadequate role of women in decision making	
Implementation stage		
1	Labour unavailability	
2	Lack of availability of eco friendly inputs on time	
3	Lack of availability of adequate quantity of eco friendly inputs	
4	Lack of availability of adequate fund on time	
4	Higher transportation cost	
5	Difficulty in handling and application of eco friendly inputs	
6	Difficulty in storage of bulky eco friendly inputs	
7	Low storage life of eco friendly inputs	
8	Lack of good quality certified organic inputs in the market	
9	Lack of knowledge on eco friendly techniques	
10	Problems in marketing of organic rice due to difficulty in getting it certified	
11	Higher cost of eco friendly inputs	
12	Low yield compared to inorganic farming in the first few years of practicing organic farming	
13	Results are not visible immediately as in the case of inorganic inputs	
14	Unfavourable stance towards eco-friendly cultivation	
15	Lack of proper extension strategies in supporting eco friendly cultivation in rice	
16	Unavailability of all the members during major agricultural operations in rice which results in lack of synchronization of operations in the field	
17	Lack of involvement of some members during the implementation stage	
18	Lack of leadership in effective management of the group	

Appendıx – X

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE

Envıronmental concerns ın the development projects on rıce farmıng under decentralızed plannıng

INTERVIEW SCHEDULE AGRICULTURAL LABOURERS

PART – I

Resp No L

1 **Name**
2 **Address**
3 **Age** Years
4 **Educatıonal status**

Sl No	Category	Educat onal s atus
1	Ill terate	
2	Prımary school	
3	M ddle school	
4	H gh school	
5	H gher secondary school	
6	Graduat on	
7	Post graduat on & above	

5 **Occupatıonal status**
a) Farm ng as sole occupat on
b) Farm ng + Agrıcultural labour
c) Farm ng + Bus ness
d) Farm ng + Serv ce

6 **Experıence ın eco frıendly rıce cultıvatıon** Years

7 **Partıcıpatıon ın traınıngproggrammes on eco frıendly cultıvatıon**

Have you at ended any tra n ng programme on eco frıendly cult vat on? If yes state the deta ls of traın ngs attended

Sl No	Name of the traınıng programme	Place of traınıng	Duratıon of traınıng

8 Participation in activities related to environmental conservation

What is the extent of your involvement in environmental cause both invidually or as a part of any organizat on?

Sl No	Participation aspects	Level of involvement				
		Very high	High	Medium	Low	Very Low
1	Time spent					
2	Participation n activit es					
3	Assumed leadership status					
4	Mobil z ng people					

9 Attitude towards group management in rice farming

State your att tude towards group management n rice farming by g ving a tick mark (✓) in the appropriate column
SA Strongly Agree A Agree UD Un decided DA D sagree
SDA Strongly D sagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Group management leads to sociab lity improvement					
2	Group management can not solve the problems of others than field level problems of farmers					
3	Group management makes eco friendly technologies applicable					
4	Group management is not effective when compared to other extension approaches					
5	Group management leads to reduction m cost of cult vation					
6	Group management promotes more nteract on with scientists					
7	Group management leads to su table leadersh p development					
8	Input supply will be easy and economical					
9	Group management promotes more mvolvement of fam ly labour					
10	Group management helps in identifying suitable eco friendly tecnnology					
11	Due to group management increase n net income is assured					
12	Due to group management scientific farming s facilitated					
13	Time devoted for work is less in this approach					
14	Group management promotes national integrat on					
15	It brings more organizat ons and institutions together					
16	Group management helps to attain more benefits individually					
17	Group management leads to mismanagement of labour					

18	Group management does make unviable farm viable					
19	Less chances for idling in group management					
20	Group management is not suited to our condition					

10 Extent of influence exerted by various agencies in developing environmental concerns

Indicate the extent of involvement of various given agencies in developing environmental concerns by putting a tick mark (✓) in the appropriate column

Sl No	Agencies	Level of influence				
		Very positive	**Positive**	**Neutral**	**Negative**	**Very negative**
1	Teachers					
2	NGOs dealing with environmental activities					
3	Literature					
4	Peer group colleagues					
5	First hand experience on environmental aspects					
6	Nature clubs					
7	Mass media					
8	Any other specify					

11 Preference of manures and fertilizers

Give your preference of nutrient management from exclusively organic to exclusively inorganic on ten different production aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of nutrient management practices				
		Exclusively Organic	**Primarily Organic**	**Integrated Nutrient Management**	**Primarily Inorganic**	**Exclusively Inorganic**
1	Profitability					
2	Yield					
3	Cost of application					
4	Easiness in handling					
5	Market demand					
6	Market price					
7	Perceived quality of produce					
8	Soil health					
9	Human health					
10	Labour cost					

12 Preference of insect pests control methods

Give your preference of insect pests control methods from exclusively organic to exclus vely inorganic on ten d fferent product on aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of insect pests control methods				
		Exclusively Organic	Primarily Organic	Integrated Pest Management	Primarily Inorganic	Exclusively Inorganic
1	Profitability					
2	Yield					
3	Cost of application					
4	Easiness in handling					
5	Market demand					
6	Market price					
	Perceived qual ty of produce					
8	Soil health					
9	Human health					
10	Labour cost					

13 Preference of disease control methods

Give your preference of d sease control methods from exclusively organic to exclus vely inorganic on ten different production aspects of rice by putting a t ck mark (✓) in the appropriate column

Sl No	Production aspects	Preference of disease control methods				
		Exclusively Organic	Primarily Organic	Integrated Nutrient Management	Primarily Inorganic	Exclusively Inorganic
1	Profitabil ty					
2	Yield					
3	Cost of application					
4	Easiness in handling					
5	Market demand					
6	Market price					
7	Perceived qual ty of produce					
8	Soil health					
9	Human health					
10	Labour cost					

14 Preference of weed control methods

Give your preference of weed control methods from exclusively organ c to exclusively inorganic on ten different production aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of weed control methods				
		Exclusively Organic	Primarily Organic	Integrated Nutrient Management	Primarily Inorganic	Exclusively Inorganic
1	Prof tability					
2	Yield					
3	Cost of application					
4	Easiness in handl ng					
5	Market demand					
6	Market price					
7	Perceived quality of produce					
8	Soil health					
9	Human health					
10	Labour cost					

15 Perception on the importance of mitigating environmental degradation

Please ind cate your response in the appropriate alternative by putting a t ck mark (✓)

SA Strongly Agree A Agree UD Un decided DA D sagree

SDA Strongly Disagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Indiscriminate use of pest cide lead to toxic residual effects in soil and water					
2	Pressing demand on natural resources will result in ecological problems					
3	Lack of awareness about environment leads to ecological degradation					
4	Environmental degradation can be effectively controlled by shifting to organic farming practices					
5	Government policies help for ecological development					

16 Indigenous wisdom orientation

Ind cate your orientation towards ind genous wisdom by putt ng a t ck mark (✓) in the appropriate column given
SA Strongly Agree A Agree UD Un decided DA Disagree
SDA Strongly D sagree

Sl No	Items	SA	A	UD	DA	SDA
1	Development act v ties to be participative should cons der the indigenous wisdom of the local people					
2	Compared to many modern technologies that harms the environment indigenous pract ces are mostly sustainable					
3	Indigenous knowledge ought to be eradicated as soon as possible through educat on and modern zat on process					
4	Indigenous wisdom is a resource that l people can use to further their own development					
5	Ind genous wisdom has to be preserved insitu as they are foundat on to strengthen the existing knowledge					
6	We have to recognize indigenous wisdom as an important national resource					
7	Ind genous wisdom has no scientific bas s and hence need not be preserved					
8	Ind genous practices are better as they require less external inputs					
9	Indigenous wisdom can be utilized more effect vely for grassroots participatory development process					
10	Indigenous wisdom documentat on and comp lation ought to be a research priority of highest order					
11	Newer technologies has to be developed considering the ind genous pract ces of the locality					
12	Modern technologies should jud ciously make use of ind genous knowledge base for des gning and develop ng effect ve technologies					
13	Indigenous wisdom is very important as they are cumulative representing generations of experiences					
14	Indigenous knowledge systems are highly reliable as they are the result of careful observation and trial and error experiments					
15	Indigenous wisdom ought to be conserved as it integrates culture and religion					
16	Unique and promising ind genous technologies have to be patented by the community that has generated it					
17	Younger generation has to be made aware about the value of indigenous wisdom					

17 Sense of empowerment

The following inventory consists of 15 statements that represent your own dominant thoughts tendencies you experience from t me to t me whether at work place n the field or at home Read each statement carefully and judge whether the statement is in agreement with your tendency The response vary from strongly agree to strongly d sagree with numbers represent ng each response Tick mark (✓) your response against each statement

Sl No	Statements	Strongly Agree (1)	Agree (2)	Neither agree nor disagree (3)	Disagree (4)	Strongly disagree (5)
1	I feel much more comfortable when I work with clear cut instructions e when things are made clear to me					
2	I enjoy doing something new where results are not always known and where there may b some poss b lity of failure of monetary loss or some such either unfavourable result					
3	I have a habit of th nking over my various tasks examine the various possibilities and the r likely consequences Such a habit helps me to improve my performance					
4	Whenever I undertake any activity may be in some project or in the office or n farming or n the field I generally think I am go ng to do well and achieve some good results					
5	It s so difficult for me to work on my own Generally I wa t for some senior/influential persons to decide what and how I should do					
6	I like to do things in somewhat different ways and experiment with new deas and methods					
7	I tend to work hard even when I may be tired when some extra payment / compensation is assured					
8	I like to do things in the same way as my elders and seniors have been doing					
9	I generally tend to think, what can I do? After all I am only a subordinate/farmer					
10	I try to please the boss/ or superiors/or the elders and make them happy by working hard on the g ven task					

11	I have a habit of postponing problems thinking that such problems would be solved automatically as the time passes					
12	In my various tasks whether in the office or in the field I like to see that my work is going good instead of just finishing the task anyhow					
13	I tend to think I am unproductive and not an able worker because I am lazy and good for nothing					
14	I am generally interested in completing the job as quickly as possible rather than spending time in trying for good quality and performance					
<	Routine work does not generally interest me I like such jobs where I can use my skills and ideas					

18 Knowledge test on eco friendly practices in rice cultivation

Below are given some questions on your knowledge about the eco-friendly practices in rice cultivation Please give appropriate answers

Sl No	Questions	Correct	Incorrect
1	What should be done to the crop residue after harvest?		
2	What is the minimum time gap after incorporating organic manure and before transplanting rice seedlings?		
3	Name a crop when grown in rice fields adds to the soil fertility?		
4	Mention any one natural enemy of insect pests commonly seen in rice fields		
5	What is the use of summer ploughing in rice fields?		
6	Why do we expose the rice field to sun after deep ploughing?		
7	Why do we plaster and trim the bunds in the rice fields?		
8	Mention any one trap used to control insect pests of rice		
9	What are *Tricho* cards?		
10	Which is the insect pest against which kerosenised roping and field drainage is an effective practice?		
11	Name one insect pest that can be controlled by proper water management?		
12	Name a botanical pesticide effectively used in rice?		
13	What is the benefit of synchronized sowing in rice?		
14	What is the major benefit of practicing SRI?		
15	How does pheromone trap control insect pests (stem borers)?		

19 Participation in decision making with farmers

To what extent do you participate in decis on making with farmers on various agricultural operat ons in rice? Put a tick mark (✓) in the appropriate column

Sl No	Statements	Most Often	Often	Sometimes	Never
1	Farmers consult labourers regard ng start ng of agricultural operat ons in the season				
2	Farmers discuss with labourers about the number of persons to be engaged for each operation				
3	Farmers d scuss about the variety to be cultivated with labourers				
4	Farmers consult labourers about the various organic inputs to be appl ed quant ty to be appl ed and sources from which it has to be procured and transportation				
5	Farmers consult labourers regarding the integrated plant protection measures to be adopted				
6	Farmers discuss about the t me of harvest with labourers				
7	Farmers consult labourers about where the produce to be sold how t should be sold and at what price it should be sold				
8	Labourers help farmers by giving the r opinion on eco-friendly cultivat on practices in rice				
9	Farmers give due weightage to the opinion of labourers				
10	Farmers do not l ke to seek the op nion of labourers on eco friendly rice cultivation				
11	Farmers use to find faults with the opinion of labourers				
12	Farmers do the eco friendly practices in rice according to the opin on of labourers				

20 Political orientation

Please state agreement or disagreement to each of the statements below

Sl No	Items	Agree	Disagree
1	Recognizing power relations existing in the society is very mportant in resolving the problems of the society		
2	Democracy is the best polit cal princ ple and philosophy for ideal governance		
3	Individual approach will not help in solving problems		
4	Organ zing people for asserting their genuine and fundamental rights is an important pre requis te for a democratic society		
5	Political parties are inevitable and indispensable for a vibrant democratic society functioning in accordance with constitut on		
6	Sustainable progress and welfare of people can be achieved only through organized pol tical and soc al interventions		
7	Apol tical approach to social issues actually preserve the existing power relations and prevent distributive justice social transformation and progress		
8	Political parties and other social organizations play no role in social development and therefore it is a curse to the society		
9	Princ ple like freedom equal ty and fraternity should be the guiding cardinal principles of a strong civil society		
10	Distributive justice makes a social system humane and modern		

21 Poltical affiliation

Do you have any poltical affiliation? Yes/No

If yes give your stance with respect to the political ideolog es in the present democrat c system

Categories	Right conservative	Liberal Democratic	Liberal Left	Left	Radical Left	Non Political
Response						

PART II

1 Environmental concerns in rice cultivation

Please indicate your response for the statements given below by putt ng a t ck mark (✓) in the appropriate column

A Agree N Neutral DA Disagree

Sl No	Items	A	N	DA
1	There is no harm in converting rice f elds for commerc al purposes			
2	Cons dering the environmental hazards caused by chemical inputs organic farming has to be adopted			
3	We need to be concerned only about yield and profitab lity and not environmental susta nabil ty			
4	Any cultivation strategy can be adopted d sregarding its impact on the environment to increase productivity			
5	One has to strictly follow Integrated Nutrient Management in rice fields so as to reduce so l and water pollut on caused by chemical inputs			
6	Increasing the dose of fertilizers is necessary for better crop stand though it is harmful to the environment			
7	Intensive cultivation along with norganic inputs s a better option even though it depletes the soil nutrient status			
8	To prevent flooding and water logging conservation of rice fields has to be strictly enforced			
9	There is no need to conserve rice f elds just for the sake of restoring ground water table level			
10	Use of chemical inputs should be minimum as they are h ghly toxic to fish and other organisms in water bodies			
11	The harmful effects of chemicals in water bod es are not worth considering taking into account the higher yield			
12	The situation s so emergent that we have to conserve the existing rice fields so as to maintain stability of the ecosystem			
13	Cultivating High Yielding Varieties exclusively to get better yield is more important and relevant than maintaining genetic diversity			
14	Efforts at community level are very important in restoring the lost b odiversity			
15	Use of excessive chemical pesticides in rice fields has to be avoided as it leads to pest resurgence later on demanding higher dose of chemical pesticides			
16	Safety measures has to be strictly followed while applying plant protection chemicals to avoid environmental pollution			

2 Environmental awareness

Read each statement carefully and state your awareness level by putt ng a tick mark (✓) m the appropriate column

Sl No	Statements	Aware	Not Aware
1	Appl cation of chemical inputs impairs soil health		
2	Lack of vegetative cover deforestation etc lead to loss of so l through wind and water eros on		
3	Ground water availability has reduced due to excessive withdrawal and absence of mechanisms to recharge it		
4	Deforestation is one of the major causes for the uncertainty n the seasonal rainfall pattern		
5	Development of res stance in pests and diseases is due to repeated and excess applicat on of same chemicals over a period of t me		
6	Incidence of particular pest and d sease are more due to monocropping		
7	Appl cators suffer from hea razaros a to improper nanaling ol chemical nputs		
8	Cultivated areas are gradually getting converted for resident al and commerc al purposes which is adversely affect ng mankind		
9	Deforestation and environmental pollution are the main reasons for the gradual increase m atmospheric temperature		
10	Overuse of chem cals and improper sewage treatment has polluted our water bodies making it unfit for drinking		
11	Poaching of birds and animals for various reasons has resulted m the extinct on of many invaluable organisms		
12	Crop rotation is an effective practice m maintaining soil nutrient balance		
13	Use of bio pest cides m the place of chemicals helps in conserving soil beneficial organisms		
14	The ozone layer that protects living organisms is being destroyed by various human activit es		
15	Us ng cloth bags instead of plast c bags is eco friendly as the former is bio degradable		

3 Constraints

Some of the major constraints perceived by the stakeholders in planning and implementat on of development projects address ng environmental concerns m rice farming are given below Rank them m the order of its importance as experienced by you

Sl No	Constraints	Ranking
Planning Stage		
1	Lack of co-ordinat on among the members of *padashekarasamithi*	
2	Lack of proper planning by the *padashekarasamithis* on the techn ques to be adopted m eco friendly rice farming	
3	Inadequate number of meetings	
4	Low attendance of members in the meetings of *padashekarasam thi*	
5	Lack of nterest of members in *padashekarasamithi* activit es	
6	*Padashekarasamithi* is looked upon as a supplier of inputs given by Krishi Bhavan	
7	Lack of consensus among the members on the technolog es to be adopted	
8	Longer distance to the venue of meetings	

9	Inconvenient tim ng of meetings	
10	Personal conflicts among the members	
11	Political intervent ons leading to conflicts	
12	Lack of effect ve leadership n coordinating the meetings and planning the act vities	
13	Lack of proper documentat on of the decisions taken in the meet ngs	
14	Lack of extens on support technical gu dance	
15	Lack of financial support	
16	Lack of women part cipation n *padashekarasamithi* activities	
17	Inadequate role of women in dec sion making	
Implementation stage		
1	Labour unava lab l ty	
2	Lack of availab l ty of eco friendly mputs on time	
3	Lack of availab l ty of adequate quantity of eco friendly inputs	
4	Lack of availabil ty of adequate fund on t me	
4	Higher transportation cost	
5	Difficulty in handl ng and appl cation of eco friendly inputs	
6	Difficulty in storage of bulky eco friendly inputs	
7	Low storage life of eco friendly nputs	
8	Lack of good qual ty certified organic nputs n the market	
9	Lack of knowledge on eco friendly techniques	
10	Problems in market ng of organic rice due to d ff culty in getting it certified	
11	H gher cost of eco friendly inputs	
12	Low yield compared to inorganic farm ng in the f rst few years of practicing organic farming	
13	Results are not vis ble mmediately as in the case of inorganic mputs	
14	Unfavourable stance towards eco-friendly cultivation	
15	Lack of proper extension strateg es in supporting eco friendly cultivation in rice	
16	Unava lab lity of all the members during major agricultural operations in rice which results in lack of synchronizat on of operations in the field	
17	Lack of involvement of some members during the implementation stage	
18	Lack of leadersh p in effect ve management of the group	

Appendix XI

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE

Environmental concerns in the development projects on rice farming under decentralized planning

INTERVIEW SCHEDULE EXTENSION PERSONNEL

PART I

Resp No E

1 Name

2 Address

3 Age Years

4 Experience in dealing with eco-friendly rice cultivation Years

5 Participation in training programmes on eco friendly cultivation

Have you attended any training programme on eco friendly cultivation? If yes state the details of trainings attended

Sl No	Name of the training programme	Place of training	Duration of training

6 Participation in activities related to environmental conservation

What is the extent of your involvement in environmental cause both individually or as a part of any organization?

Sl No	Participation aspects	Level of involvement				
		Very high	High	Medium	Low	Very Low
1	Time spent					
2	Participation in activities					
3	Assumed leadership status					
4	Mobilizing people					

7 Attitude towards group management in rice farming

State your attitude towards group management in rice farming by giving a tick mark (✓) in the appropriate column
SA Strongly Agree A Agree UD Un decided DA Disagree
SDA Strongly Disagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Group management leads to sociability improvement					
2	Group management can not solve the problems of others than field level problems of farmers					
3	Group management makes eco-friendly technologies applicable					
4	Group management is not effective when compared to other extension approaches					
5	Group management leads to reduction in cost of cultivation					
6	Group management promotes more interaction with scientists					
7	Group management leads to suitable leadership development					
8	Input supply will be easy and economical					
9	Group management promotes more involvement of family labour					
10	Group management helps in identifying suitable eco-friendly technology					
11	Due to group management increase in net income is assured					
12	Due to group management scientific farming is facilitated					
13	Time devoted for work is less in this approach					
14	Group management promotes national integration					
15	It brings more organizations and institutions together					
16	Group management helps to attain more benefits individually					
17	Group management leads to mismanagement of labour					
18	Group management does make unviable farm viable					
19	Less chances for idling in group management					
20	Group management is not suited to our condition					

8 Extent of influence exerted by various agencies in developing environmental concerns

Indicate the extent of involvement of various given agencies in developing environmental concerns by putting a t ck mark (✓) in the appropriate column

Sl No	Agencies	Level of influence				
		Very positive	Positive	Neutral	Negative	Very negative
1	Teachers					
2	NGOs dealing with environmental act vities					
3	Literature					
4	Peer group colleagues					
5	First hand experience on environmental aspects					
6	Nature clubs					
7	Mass media					
8	Any other spec fy					

9 Preference of manures and fertilizers

G ve your preference of nutrient management from exclusively organ c to exclusively norganic on ten different production aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of nutrient management practices				
		Exclusively Organic	Primarily Organic	Integrated Nutrient Management	Primarily Inorganic	Exclusively Inorganic
1	Profitability					
2	Yield					
3	Cost of application					
4	Easiness in handling					
5	Market demand					
6	Market price					
7	Perce ved quality of produce					
8	So l health					
9	Human health					
10	Labour cost					

10 Preference of ınsect pests control methods

Gıve your preference of ınsect pests control methods from exclusıvely organ c to exclus vely ınorgan c on ten dıfferent productıon aspects of rıce by putt ng a tıck mark (✓) ın the approprıate column

Sl No	Productıon aspects	Preference of ınsect pests control methods				
		Exclusıvely Organıc	Prımarıly Organıc	Integrated Pest Management	Prımarıly Inorganıc	Exclusıvely Inorganıc
1	Prof tabılıty					
2	Yıeld					
3	Cost of applıcatıon					
4	Easıness ın handlıng					
5	Market demand					
6	Market prıce					
7	Pe ce ed qual ty of produce					
8	Soıl health					
9	Human health					
10	Labour cost					

11 Preference of dısease control methods

Gıve your preference of d sease control methods from exclusıvely organıc to exclusıvely ınorgan c on ten dıfferent product on aspects of rıce by puttıng a t ck mark (✓) ın the approprıate column

Sl No	Productıon aspects	Preference of dısease control methods				
		Exclusıvely Organıc	Prımarıly Organıc	Integrated Nutrıent Management	Prımarıly Inorganıc	Exclusıvely Inorganıc
1	Profitabılıty					
2	Yıeld					
3	Cost of applıcat on					
4	Eas ness ın handl ng					
5	Market demand					
6	Market prıce					
7	Perce ved qualıty of produce					
8	Soıl health					
9	Human health					
10	Labour cost					

12 **Preference of weed control methods**

G ve your preference of weed control methods from exclus vely organ c o exclus vely norgan c on ten d fferent product on aspects of rice by puttıng a t ck mark (✓) ın he appropria e column

Sl No	Production aspects	Preference of weed control methods				
		Exclusively Organic	Primarily Organic	Integrated Nutrient Management	Primarily Inorganic	Exclusively Inorganic
1	Prof tab l ty					
2	Y eld					
3	Cost of appl cat on					
4	Easiness n handling					
5	Market demand					
6	Market price					
7	Perce ved qual ty of produce					
8	So l health					
9	Human health					
10	Labour cost					

13 **Perception on the importance of mitigating environmental degradation**

Please ind cate your response ın the appropria e alternat ve by putt ng a t ck mark (✓)
SA Strongly Agree A Agree UD Un decided DA D sagree
SDA Strongly D sagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Ind scrim nate use of pest c de lead to tox c res dual effects n so l and water					
2	Pressing demand on natural resources will result n ecolog cal problems					
3	Lack of awareness about environment leads to ecolog cal degradat on					
4	Env ronmental degradat on can be effectively controlled by shift ng to organ c farm ng pract ces					
5	Government pol c es help for ecolog cal development					

14 Indigenous wisdom orientation

Ind cate your orientat on towards indigenous wisdom by putting a t ck mark (✓) in the appropriate column given
SA Strongly Agree A Agree UD Un decided DA D sagree
SDA Strongly Disagree

Sl No	Items	SA	A	UD	DA	SDA
1	Development act vities to be part c pative should consider the indigenous wisdom of the local people					
2	Compared to many modern technologies that harms the environment indigenous pract ces are mostly sustainable					
3	Indigenous knowledge ought to be erad cated as soon as poss ble through education and modernization process					
4	Indigenous wisdom is a resource that local people can use to further their own development					
5	Indigenous wisdom has to be preserved insitu as they are foundation to strengthen the ex st ng knowledge					
6	We have to recognize indigenous wisdom as an important national resource					
7	Indigenous wisdom has no sc entific bas s and hence need not be preserved					
8	Indigenous practices are better as they require less external inputs					
9	Ind genous wisdom can be util zed more effect vely for grassroots part c patory development process					
10	Ind genous w sdom documentation and compilat on ought to be a research priority of highest order					
11	Newer technologies has to be developed cons dering the ind genous pract ces of the locality					
12	Modern technologies should judiciously make use of indigenous knowledge base for des gning and develop ng effect ve technologies					
13	Ind genous wisdom is very mportant as they are cumulat ve representing generations of experiences					
14	Indigenous knowledge systems are highly reliable as they are the result of careful observation and trial and error experiments					
15	Indigenous wisdom ought to be conserved as it integrates culture and religion					
16	Unique and prom sing indigenous technologies have to be patented by the community that has generated t					
17	Younger generation has to be made aware about the value of indigenous wisdom					

15 Sense of empowerment

The follow ng inventory consists of 15 statements that represent your own dominant thoughts/ tendencies you experience from t me to t me whether at work place m the field or at home Read each statement carefully and judge whether the statement is m agreement with your tendency The response vary from strongly agree to strongly disagree with numbers representing each response Tick mark (✓) your response against each statements

Sl No	Statements	Strongly Agree (1)	Agree (2)	Neither agree nor disagree (3)	Disagree (4)	Strongly disagree (5)
1	I feel much more comfortable when I work with clear-cut instructions ie when things are made clear to me					
2	I enjoy doing something new where results are not always known and where there may be some poss b l ty of failure of monetary loss or some such either unfavourable result					
3	I have a hab t of thinking over my various tasks exam ne the various poss bilities and their likely consequences Such a habit helps me to improve my performance					
4	Whenever I undertake any act vity may be in some project or in the office or m farming or m the field I generally think I am going to do well and ach eve some good results					
5	It is so difficult for me to vork on my own Generally I wa t for some sen or/influential persons to decide what and how I should do					
6	I like to do things m somewhat different ways and experiment with new ideas and methods					
7	I tend to work hard even when I may be tired when some extra payment / compensation is assured					
8	I like to do things m the same way as my elders and seniors have been doing					
9	I generally tend to think, what can I do? After all I am only a subordinate/farmer					
10	I try to please the boss/ or superiors/or the elders and make them happy by working hard on the given task					

11	I have a habit of postponing problems thinking that such problems would be solved automatically as the time passes					
12	In my various tasks whether in the office or in the field I like to see that my work is going good instead of just finishing the task anyhow					
13	I tend to think I am unproductive and not an able worker because I am lazy and good for nothing					
14	I am generally interested in completing the job as quickly as possible rather than spending time in trying for good quality and performance					
15	Routine work does not generally interest me I like such jobs where I can use my skills and ideas					

16 Decision making ability with regard to eco-friendly rice cultivation

To what extent you are subject to the following with respect to decision making ability Please indicate your response by putting tick mark (✓) in the appropriate column

NC Not Considered CCO Considered after consultation with others

DTI Decision Taken Independently

Sl No	Statements	DI	CCO	NC
1	To attend training regarding eco friendly rice cultivation			
2	To experiment eco friendly practices in farmers fields			
3	To meet people s representatives before implementing programmes/schemes on eco-friendly rice cultivation			
4	To make farmers adopt eco friendly technologies in rice cultivation			
5	To give trainings to *padashekarasamithi* members on eco-friendly technologies in rice cultivation			

17 Leadership

Please state your response by putting a tick mark (✓) in the appropriate column

Sl No	Statements	Always	Sometimes	Never
1	Do you lead group meetings and discussions with farmers			
2	Are you available to group members at anytime to extend necessary help to them			
3	Do you guide and influence the group members in taking decisions			
4	Do you feel that the group members are convinced by you			
5	Do you think that you can change the attitude of the group members			

18 Communication effectiveness

Please state your response to the statements by putt ng a tick mark(✓) n the appropriate column
SA Strongly Agree A Agree UD Un decided DA D sagree
SDA Strongly Disagree

Sl No	Statements	SA	A	UD	DA	SDA
1	I tend to assume that other people always understand what I m talking about					
2	I somet mes tend to listen only what I want to hear					
3	I choose words that fit the l stener s intelligence and backgrounds					
4	I always take into consideration the response of the receiver to ensure effectiveness of communication					
5	I ask quest ons to check and ensure that the l steners have fully understood what is eing communicated					
6	I use the simplest possible language to express what I mean					
7	I let others finish what they are saying before jumping in with my views					
8	I make a point of using people s name while talking to them					
9	I always empath ze with the listeners					
10	I let people know I m listening by looking at them and acknowledging what they are saying					

19 Development Functioning

The following are statement depicting your perceptions on the funct on ng of our publ c system and development programmes Each statement is given against four responses ranging from strongly agree to strongly disagree You have to mark (✓) in the appropriate column against each statement

Sl No	Statements	Strongly agree	Agree	Disagree	Strongly Disagree
1	There s a tendency among our publ c officials to concentrate more and more powers in the r hands rather than to share power with the r colleagues and subord nates				
2	Civil servants are very part cular about their seniority in their cadre and generally try to get posting as per their seniority				
3	Many a times public functionaries are really not interested in their various development tasks They may carry out such activities rather reluctantly				

4	It has been observed that publ c officials and functionaries of various departments many a times tend to work at cross purposes				
5	Government officials tend to pay much more attention to spending the allotted budget by the end of the given financial year than concentrating on obtaining the des red objectives and social impact in a given development programme				
6	Many a times Government officials are inclined to implement development programmes as if people do not count and they hardly meet the concerned community				
7	Despite pol cy guidel nes Government officials are generally reluctant to promote people s participat on in their various programmes				
8	Public off cials tend to think and act more in terms of number of activities and numerical targets than pursu ng the given programme for improving the soc al l fe of the concerned people				
9	The civil servants are eager to maintain their separate cadre and generally talk in terms of the r cadre superiority				
10	It is often said that civil servants are reluctant to own responsib lity and accept accountabil ty for any lapse in function ng of and / or any shortfall in development programmes				
11	It is widely believed that various government programmes such as rural development and employment generat ng schemes are marked by widespread public corruption				
12	Our public functionaries tend to work as per their own attitudes rather than pursuing the stated goals and objectives of a given development programme				
13	It is often said that c vil servants tend to consider their service as better than others and want to maintain its distinctiveness				
14	Public off cials generally like to work on their own in their respective departments rather than work for inter departmental collaboration				
15	Government funct onaries generally behave and work so as to promote dependency of people on them				
16	Despite promises and pronouncements to this effect public functionaries are reluctant to share information about various deals transactions business agreements etc with people				

17	It is sa d that publ c funct onaries involved in implementing development programmes conduct their various activities in a routine way				
18	Desp te government and pol cy pronouncements state functionaries generally find t difficult to work as public servants				
19	It is said that public funct onaries are generally interested more in working with the departments like finance revenue and such other income-earn ng departments rather than in social development programmes l ke education				
20	It is said that people have developed a tendency to look at the government as parents who provide security and protection				
21	It is said that public funct onaries such as development offic als and others have a tendency to divert and ut lize publ c projects for their personal advantage They may even make money from public transactions				

20 Participation in decision making with farmers

To what extent do you part cipate in decision making with farmers on various agricultural operations in rice?

Sl No	Statements	Most Often	Often	Someti mes	Never
1	Farmers consult extension personnel regarding starting of agricultural operations in the season				
2	Farmers discuss with extens on personnel about the number of persons to be engaged for each operation				
3	Farmers discuss about the variety to be cultivated with extension personnel				
4	Farmers consult extens on personnel about various organ c inputs to be applied quantity to be applied and sources from which t has to be procured				
5	Farmers consult extension personnel regarding the integrated plant protection measures to be adopted				
6	Farmers d scuss on the time of harvest with extension personnel				
7	Farmers consult extens on personnel about the market ng of their produce				
8	Extens on personnel help farmers by giving timely advice on eco friendly cultivation practices in rice				
9	Farmers give due weightage to the recommendations given by extension personnel				
10	Farmers do not seek the advice of extension personnel on eco-friendly rice cultivation				

11	Farmers use to find faults with the recommendat ons of extension personnel				
12	Farmers do the eco friendly practices in rice as per the advice of extension personnel				

PART II

1 Environmental concerns in rice cultivation

Please indicate your response for the statements given below by putt ng a tick mark (✓) in the appropriate column

A Agree N Neutral DA D sagree

Sl No	Items	A	N	DA
1	There is no harm in convert ng rice fields for commerc al purposes			
2	Considering the environmental hazards caused by chem cal inputs organic farming has to be adopted			
3	[illegible] need to be concerned only about yield and pr[illegible] lity and not environmental susta nability			
4	Any cultivation strategy can be adopted d sregardmg ts mpact on the environment to increase productivity			
5	One has to strictly follow Integrated Nutrient Management in rice fields so as to reduce soil and water pollution caused by chemical inputs			
6	Increas ng the dose of fertilizers is necessary for better crop stand though it is harmful to the env ronment			
7	Intensive cultivation along w th inorganic inputs is a better option even though it depletes the soil nutrient status			
8	To prevent flooding and water logging conservation of rice fields has to be strictly enforced			
9	There is no need to conserve rice fields just for the sake of restoring ground water table level			
10	Use of chemical inputs should be minimum as they are highly toxic to fish and other organisms in water bod es			
11	The harmful effects of chemicals in water bodies are not worth cons dering taking into account the higher yield			
12	The situation is so emergent that we have to conserve the existing rice fields so as to maintain stabil ty of the ecosystem			
13	Cultivat ng High Yielding Varieties exclusively to get better yield is more important and relevant than maintaining genetic diversity			
14	Efforts at community level are very important in restoring the lost biod versity			
15	Use of excessive chemical pestic des in rice fields has to be avoided as it leads to pest resurgence later on demand ng higher dose of chemical pest cides			
16	Safety measures has to be strictly followed wh le applying plant protection chemicals to avoid environmental pollution			

2 Environmental awareness

Read each statement carefully and state your awareness level by putting a tick mark (✓) in the appropriate column

Sl No	Statements	Aware	Not Aware
1	Appl cation of chemical inputs impairs so l health		
2	Lack of vegetative cover deforestation etc lead to loss of so l through wind and water erosion		
3	Ground water availability has reduced due to excessive withdrawal and absence of mechanisms to recharge t		
4	Deforestation is one of the major causes for the uncertainty in the seasonal rainfall pattern		
5	Development of resistance in pests and d seases is due to repeated and excess applicat on of same chemicals over a period of t me		
6	Inc dence of particular pest and disease are more due to monocropping		
7	Applicators suffer from health hazards due to improper handl ng of chemical inputs		
8	Cultivated areas are gradually getting converted for resident al and commerc al purposes which is adversely affect ng mankind		
9	Deforestat on and environmental pollution are the ma n reasons for the gradual increase in atmospheric temperature		
10	Overuse of chem cals and improper sewage treatment has polluted our water bodies making it unf t for drinking		
11	Poaching of birds and animals for various reasons has resulted in the extinction of many invaluable organisms		
12	Crop rotat on is an effective pract ce in ma ntaining soil nutrient balance		
13	Use of bio-pest cides in the place of chemicals helps in conserving so l benef cial organisms		
14	The ozone layer that protects living organisms is being destroyed by various human activities		
15	Using cloth bags instead of plastic bags is eco-friendly as the former is bio degradable		

3 Constraints

Some of the major constraints perceived by the stakeholders in planning and implementation of development projects addressing environmental concerns in rice farming are given below Rank them in the order of its importance as experienced by you

Sl No	Constraints	Ranking
Planning Stage		
1	Lack of co-ordination among the members of *padashekarasamithi*	
2	Lack of proper planning by the *padashekarasamithis* on the techniques to be adopted in eco-friendly rice farming	

3	Inadequate number of meet ngs	
4	Low attendance of members in the meet ngs of *padashekarasamithi*	
5	Lack of interest of members in *padashekarasam thi* act vities	
6	*Padashekarasam th* is looked upon as a supplier of inputs g ven by Krishi Bhavan	
7	Lack of consensus among the members on the technologies to be adopted	
8	Longer distance to th venue of meet ngs	
9	Inconven ent tim ng of meetings	
10	Personal conflicts among he members	
11	Political intervent ons leading to conflicts	
12	Lack of effective leadersh p in coordinating the meetings and planning the activities	
13	Lack of proper documentat on of the decisions taken in the meet ngs	
14	Lack of extension support / techn cal guidance	
15	Lack of financ al support	
16	Lack of women part c pat on n *padasl ekarasam thi* activities	
17	Inadequate role of women n decis on making	
Implementation stage		
1	Labour unava lab l ty	
2	Lack of ava lab lity of eco-friendly inputs on time	
3	Lack of ava labil ty of adequate quant ty of eco friendly inputs	
4	Lack of ava lability of adequate fund on time	
4	Higher transportation cost	
5	Difficulty in handl ng and appl cat on of eco friendly inputs	
6	D fficulty in storage of bulky eco friendly nputs	
7	Low storage life of eco friendly inputs	
8	Lack of good qual ty cert f ed organ c inputs in the market	
9	Lack of knowledge on eco friendly techn ques	
10	Problems in market ng of organ c rice due to d fficulty in gett ng it cert fied	
11	Higher cost of eco friendly inputs	
12	Low yield compared to inorganic farming in the first few years of practicing organ c farming	
13	Results are not visible immediately as n the case of inorgan c inputs	
14	Unfavourable stance towards eco-friendly cultivation	
15	Lack of proper extens on strateg es in supporting eco friendly cultivat on in rice	
16	Unavailability of all the members during major agricultural operations in rice which results in lack of synchronization of operations in the field	
17	Lack of involvement of some members during the implementation stage	
18	Lack of leadership in effective management of the group	

Appendix – XII

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE

Environmental concerns in the development projects on rice farming under decentralized planning

INTERVIEW SCHEDULE PEOPLE S REPRESENTATIVES / SOCIAL ACTIVISTS
PART I

Resp No P

1 Name

2 Address

3 Age Years

4 Educational status

Sl No	Category	Educat onal status
1	Illiterate	
2	Primary school	
3	Middle school	
4	High school	
5	Higher secondary school	
6	Graduation	
7	Post graduation & above	

6 Experience in dealing with eco-friendly rice cultivation Years

7 Participation in training programmes on eco-friendly cultivation

Have you attended any training programme on eco friendly cultivation? If yes state the details of trainings attended

Sl No	Name of the training programme	Place of tra ning	Durat on of train ng

8 Participation in activities related to environmental conservation

What is the extent of your involvement in environmental cause both ind vidually or as a part of any organization?

Sl No	Participation aspects	Level of involvement				
		Very high	High	Med um	Low	Very Low
1	Time spent					
2	Part cipation in activities					
3	Assumed leadership status					
4	Mobilizing people					

9 Attıtude towards group management ın rıce farmıng

State your attıtude towards group management ın rıce farmıng by g vıng a tıck mark (✓) ın the appropnate column
SA Strongly Agree A Agree UD Un decıded DA Dısagree
SDA Strongly Dısagree

Sl. No	Statements	SA	A	UD	DA	SDA
1	Group management leads to socıabılıty ımprovement					
2	Group management can not solve the problems of others than field level problems of farmers					
3	Group management makes eco-frıendly technologıes applıcable					
4	Groun management ıs not effectıve when compared to other extens on approaches					
5	Group management leads to reduct on ın cost of cultıvatıon					
6	Group management promotes more ınteract on wıth sc entısts					
7	Group management leads to suıtable leadershıp development					
8	Input supply wıll be easy and economıcal					
9	Group management promotes more ınvolvement of famıly labour					
10	Group management helps ın ıdentıfyıng suıtable eco-frıendly technology					
11	Due to group management ıncrease ın net ıncome ıs assured					
12	Due to group management scıentıf c farmıng ıs facılıtated					
13	Tıme devoted for work s less ın thıs approach					
14	Group management promotes nat onal ıntegratıon					
15	It brıngs more organızatıons and ınstıtutıons together					
16	Group management helps to attaın more benefits ındıvıdually					
17	Group management leads to mısmanagement of labour					
18	Group management does make unvıable farm v able					
19	Less chances for ıdlıng ın group management					
20	Group management ıs not suıted to our condıtıon					

10 Extent of ınfluence exerted by varıous agencıes ın developıng envıronmental concerns

Indıcate the extent of ınvolvement of varıous gıven agencıes ın developıng envıronmental concerns by puttıng a tıck mark (✓) ın the approprıate column

Sl No	Agencıes	Level of ınfluence				
		Very posıtıve	Posıtıve	Neutral	Negatıve	Very negatıve
1	Teachers					
2	NGOs dealıng wıth envıronmental act vıtıes					
3	L terature					
4	Peer group / colleagues					
5	Fırst hand experıence on env ronmental aspects					
6	Nature clubs					
7	Mass medıa					
8	Any other specıfy					

11 Preference of manures and fertılızers

Gıve your preference of nutrıent management from exclusıvely organıc to exclusıvely ınorganıc on ten dıfferent productıon aspects of rıce by puttıng a tıck mark (✓) ın the approprıate column

Sl No	Productıon aspects	Preference of nutrıent management practıces				
		Exclusıve ly Organıc	Prımarıly Organıc	Integrated Nutrıent Management	Prımarıly Inorganıc	Exclusıvely Inorganıc
1	Prof tab lıty					
2	Yıeld					
3	Cost of applıcatıon					
4	Easıness ın handlıng					
5	Market demand					
6	Market prıce					
7	Perceıved qualıty of produce					
8	So l health					
9	Human health					
10	Labour cost					

12 Preference of insect pests control methods

Give your preference of insect pests control methods from exclusively organic to exclusively inorganic on ten different production aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of insect pests control methods				
		Exclusively Organic	Primarily Organic	Integrated Pest Management	Primarily Inorganic	Exclusively Inorganic
1	Profitability					
2	Yield					
3	Cost of application					
4	Easiness in handling					
5	Market demand					
6	Market price					
7	Perceived quality of produce					
8	Soil health					
9	Human health					
10	Labour cost					

13 Preference of disease control methods

Give your preference of disease control methods from exclusively organic to exclusively inorganic on ten different production aspects of rice by putting a tick mark (✓) in the appropriate column

Sl No	Production aspects	Preference of disease control methods				
		Exclusively Organic	Primarily Organic	Integrated Nutrient Management	Primarily Inorganic	Exclusively Inorganic
1	Profitability					
2	Yield					
3	Cost of application					
4	Easiness in handling					
5	Market demand					
6	Market price					
7	Perceived quality of produce					
8	Soil health					
9	Human health					
10	Labour cost					

14 Preference of weed control methods

G ve your preference of weed control methods from exclusıvely organıc to exclusıvely norganıc on ten dıfferent productıon aspects of rıce by putt ng a tıck mark (✓) ın the appropriate column

Sl No	Production aspects	Preference of weed control methods				
		Exclusıvely Organıc	Prımarıly Organıc	Integrated Nutrıent Management	Prımarıly Inorganıc	Exclusıvely Inorganıc
1	Profitabılıty					
2	Yıeld					
3	Cost of applıcat on					
4	Easıness ın handlıng					
5	Market demand					
6	Market prıce					
7	Perceıved qual ty of produce					
8	Soıl health					
9	Human health					
10	Labour cost					

15 Perceptıon on the ımportance of mıtıgatıng envıronmental degradatıon

Please ındıcate your response ın the appropriate alternatıve by puttıng a tıck mark (✓)
SA Strongly Agree A Agree UD Un dec ded DA D sagree
SDA Strongly Dısagree

Sl No	Statements	SA	A	UD	DA	SDA
1	Ind scrımınate use of pestıcıde lead to toxıc resıdual effects ın so l and water					
2	Pressıng demand on natural resources wıll result ın ecolog cal problems					
3	Lack of awareness about envıronment leads to ecologıcal degradatıon					
4	Envıronmental degradatıon can be effectıvely controlled by shıftıng to organıc farmıng practıces					
5	Government polıcıes help for ecolog cal development					