TECHNO-SOCIO-ECONOMIC ASSESSMENT OF FARMERS' PRACTICES IN THE CULTIVATION OF COWPEA (*Vigna unguiculata L.*) IN THIRUVANANTHAPURAM DISTRICT

BY

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THESIS
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TO MY BELOVED PARENTS

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Vellayani. **MAJJUSHA. A.R.**

DECLARATION

I here by declare that this thesis entitled **"Techno-socio-economic assessment of farmers' practices in the cultivation of cowpea (*Vigna unguiculata L.*) in Thiruvananthapuram district"** 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 other similar title, of any other University or society.

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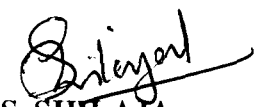
CERTIFICATE

Certified that this thesis entitled **"Techno-socio-economic assessment of farmers' practices in the cultivation of cowpea (*Vigna unguiculata L.*) in Thiruvananthapuram district"** is a record of research work done independently by **Ms. Majjusha . A.R** 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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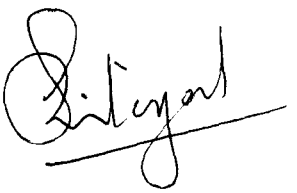

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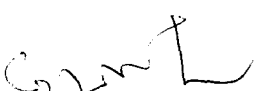

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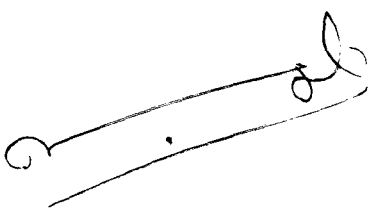

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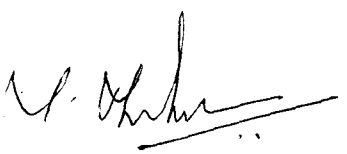

(R. M. MANOHARAN)

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CHAPTER- I

INTRODUCTION

"Farmers have valuable knowledge;..... they undertake their own agricultural experimentation; and scientists should tap into this system to improve agrarian research and development." (Bentley, 1990)

Knowledge of farmers' practices is very important for the planning of research and extension. Norman (1985), in an overview of research on African farmers' practices and potential for change, opined that an understanding of the farmers' practices can help in designing relevant improved technologies for limited resource farmers. Farmers' knowledge is an important source of information about the local farming system (including traditional practices which have fallen into disuse), experiences, institutions, culture etc. Above all, farmers' knowledge and skills in adapting new ideas to their local conditions and needs form the basis for change within the farming community.

In recent years, there has been a growing scientific interest in locally developed farming systems and technologies. These are seen as a source of sound ideas, locally adapted cultivars and practices which could lead to sustainable use of local resources. The process of combining local farmers' knowledge and skills with those of external agents to develop site-specific and socioeconomically adapted farming techniques has been given the name 'Participatory Technology Development' (PTD). Farmers work together with professionals from outside their community (eg:- extensionists, researchers) in identifying, generating, testing and applying new techniques. PTD seeks to strengthen the existing experimental capacity of farm-

ers and to encourage continuation of the innovation process under local control (Haverkort et al., 1988)

Throughout the history of agriculture, farmers were experimenting with various natural resources to improve the results in their fields and to optimize the input use. The knowledge of a farming population living in a specific area is derived from the local people's past experience, both that are handed down from previous generation and that of the present generation (Reijntjes et al., 1992). Their practical knowledge about the local ecosystem is reflected in their farming techniques and in their skill in using the natural resources to gain their livelihood.

Bentley (1993) suggests that scientists can learn most from farmers about factors in the farmers' lives that are important and easy to observe. But the conventional top-down approach to technology development within agricultural research institutions gave scientists little opportunity to become well acquainted with the conditions, objectives and knowledge of limited resource farmers. The situtation was not improved by the widespread attitude of extensionists and researchers, instilled already in school and university, that the formal system is the ultimate source of innovations and that information can come only from above.

A wealth of 'grey' literature (unpublished reports and articles in newsletters, circulars and project reports) reveals the experience of present-day innovators, both in developing and industrialized countries. However, most of the experiences of innovative farmers and field workers throughout the world have not been documented, although much has certainly been spread locally by word of mouth.

In Kerala, about 50 per cent of the requirements of vegetables are met by procurement from other states. In fact, the target of 3 lakh tonnes can meet only a per capita requirement of 30g per day which is deplorably below the recommended standards. To achieve a reasonably high standard of 150g per day per capita, the current requirement of vegetables works out to 15 lakh tonnes. Hence the need for intensification of vegetable cultivation for self-sufficiency is high. Vegetable cowpea *(Vigna unguiculata L.)* has great demand in Kerala due to its high dietary value and is cultivated throughout the year as pulse crop in rice fallows and in garden lands. With this in view, a research study was initiated with the following specific objectives.

1. Identification of farmers' practices in the cultivation of cowpea.

2. Assessment of socio-economic and technical aspects of the farmers' practices as perceived by the researchers, extension personnel and the farmers.

3. Assessment of knowledge of farmers about the recommended practices and its relationship with selected independent variables.

4. Analysis of extent of adoption of farmers' practices and its relationship with selected independent variables.

5. Analysis of constraints experienced by the farmers in the cultivation of cowpea.

Scope of the study

In developing countries, existing research systems are not always able to generate the technologies needed to solve the problems of resource poor farmers, due to constraints on

manpower and funds. Such farmers are forced to develop their own technologies to suit their particular conditions. Knowledge of farmers' practices is very important for the planning of research and extension. Such knowledge enables researchers and extension workers to directly focus on tackling inappropriate practices.

Cowpea is a major pulse/ vegetable crop of South India and forms one of the important vegetables of the homestead gardens in Kerala state. It is one of the cheapest sources of protein. Though the Kerala Agricultural University (KAU) has evolved a number of varieties and package of practices for cowpea cultivation in the state, the adoption of these varieties and practices by the farmers has not been throughly investigated. There are unconfirmed reports on the widespread and integrated use of the recommended practices and the indigenous practices by the farmers in cowpea cultivation.

A pilot study conducted in Thiruvananthapuram district by the researcher revealed that many recommendations of KAU with respect to vegetable cultivation were not followed by the farmers, whereas these farmers were getting substantial and higher yields from their crops. This indicates that some of the local practices followed by the vegetable farmers are more profitable when compared to recommendations of the University. In this circumstance, there is a felt need to identify and assess the different aspects of the farmers' practices in vegetable cultivation.

Limitations of the study

The study was undertaken by a single researcher as a part of the requirement of Post-Graduate programme and hence, the limited time and resources restricted the exploration of

the area in a greater depth and in a more comprehensive manner. Consequently the researcher was unable to extend the study to all parts of the state. This limitation has narrowed down the scope of generalising the results. Moreover, the present research study is the first of its kind in the state to the knowledge of the research and hence there was dearth of relevant findings which could be useful to the researchers and extension workers in the state.

No human effort is free from limitations. This study is no exception. However, sincere attempts have been made to accomplish the objectives, and utmost care has been taken to make the study as objective as possible.

Presentation of the thesis

Besides the present introduction chapter, the second chapter viz. theoretical orientation deals with the review of selected important and related studies in the field of the present investigation. The third chapter presents the methodology used in the study. The location of the study area, sampling procedure followed, quantification of variables selected for the study, statistical techniques employed etc. are dealt with in this chapter. The fourth chapter contains the results of the study and discussion on the results. The last chapter summarises the study with implications and suggestions for future research. The appendices and abstract of the thesis are given at the end.

THEORETICAL ORIENTATION

CHAPTER-II
THEORETICAL ORIENTATION

An attempt is made in this chapter to develop a theoretical framework based on the past research studies related to farmers' practices.

Only during the past few years, the researchers have been paying serious attention to the need and importance of farmers' practices as it is an important aspect in the process of participatory technology development. The present research study is the first of its kind in assessing scientifically the socio-economic and technical aspects of the farmers' practices in the cultivation of cowpea in Kerala. Hence only a few research studies are available in this new emerging field. However, the available research studies related directly or indirectly to the topic are reviewed and presented in this chapter under the following headings.

2.1 Concept of farmers' practices

2.2 Definition of farmers' practices

2.3 Importance of farmers' practices

2.4 Studies on farmers' practices

2.5 Techno-socio-economic assessment of farmers' practices

2.6 Efficiency of farmers' practices as perceived by the farmers, researchers and extension personnel

2.7 Knowledge of farmers about recommended practices

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2.9 Relationship of knowledge about recommended practices with adoption of farmers' practices

2.10 Relationship between knowledge of farmers about the recommended practices and the selected independent variables

2.11 Relationship between adoption of farmers' practices and the selected independent variables

2.12 Constraints in the cultivation of cowpea

2.13 Conceptual framework of the study

2.1 Concept of farmers' practices

Throughout the history of agriculture, farmers were experimenting with various natural resources to improve the results in their fields and to optimize the input use. The accumulation of the results of such farmer- made experiments, generally denoted as farmers' knowledge, local knowledge, community knowledge, rural people's knowledge etc. are being used to indicate this concept.

According to Verma and Dhukia (1991), indigenous knowledge was mainly inherited through the socio-cultural system and was minimised and developed through rural oral traditions, folk tales, proverbs. It is proved that the system of farming presented this way was based on solid wisdom and solid logic which now finds support from scientific studies too.

The knowledge of a farming population living in a specific area is derived from the local people's past experience, both that are handed down from previous generation and that of the present generation (Reijntjes *et al.*, 1992).

Vasu (1994) opined that indigenous know-how has two connotations. One is concerned with the traditional technologies and the other is with respect to the modern technologies either developed indigenously or imported and adapted to indigenous conditions.

2.2 Definition of farmers' practices

Wang (1988) defined farmers' knowledge as the sum total of knowledge and practices which are based on people's accumulated experience in dealing with situation and problems in various aspects of life and such knowledge and practices are special to a particular culture.

In this study, the term 'farmers' practices' is operationalised as all those practices followed by the farmers which include both indigenous and recommended practices.

2.3 Importance of farmers' practices

Rudramoorthy (1964) pointed out that a judicious combination of folk knowledge and scientific knowledge will help to speed up the adoption of improved practices by the farmers.

Rogers and Shoemaker (1971) stated that immanent change occurs when members of a social system with little or no external influence create and develop a new idea which then

spreads within the system.

Faniran and Areola (1976) reported that in the field of crop production and the management of the soil, the knowledge and experience of local farmers are unrivalled and no alternative system of food production is found as competant as farmers' knowledge.

Knight (1980) opined that agronomists, extension workers and other farmers can draw enlightenment and insight from the practical knowledge of farmers.

Nand and Kumar (1980) concluded that it becomes necessary that the scientists investigate the rationality of each one of the technical beliefs held by farmers so that they can clearly accept or reject a technical belief.

Narasimham (1981) opined that before considering the problems arising from the modernization of agricultural technology, the status of folk knowledge and practices must be evaluated only then it can be comprehensively updated.

Farmers' practical knowledge about the local ecosystem is reflected in their farming techniques and in their skill in using the natural resources to gain their livelihood. They may reveal ideas which contains 'seeds' of adaptive value (Alcorn, 1984 and Hunn, 1985).

Norman (1985) in an overview of research on African farmers' practices and potential for change, opined that an understanding of the farmers' practices can help in designing relevant improved technologies for limited resource farmers.

Brokensha (1989) in his study, critically examined the advantages and associated problems of trying to incorporate local management systems in attaining sustainability in rural households and implementing such development from below.

Ploeg (1989) contended that farmers' understanding of agricultural processes as a complex of personal, metaphorical and contextual knowledge which become almost impenetrable when subjected to scientific scruitny, then reaching a common understanding may be extremely difficult. This draws attention to intimate linkages between cosmological beliefs and processes of agricultural experimentation and innovation.

Waters (1991) observed that the agricultural knowledge of the cultivators was sufficient to support sustainable agriculture and urged the private or voluntary organisations as well as government to tune their policies that way.

Bentley (1993) suggested that scientists can learn most from farmers about factors in the farmers' lives that are important and easy to observe.

Vijayalekshmi (1993) suggested that knowing about and enriching tradition in Indian agricultural practices will help in finding ways of continuing with high yield farming without poisoning the soil, water and air with pesticides and fertilisers.

Berkes and Folke (1994) argued that inorder to ensure a more socially and ecologically sound approach to development, it was necessary to understand, respect and utilize the local knowledge systems.

Salas (1994) opined that one of the main reasons why conventional development approaches had failed was that they had tended to ignore the local knowledge systems and practices.

Lupanga *et al.* (1995) conducted a study which examines ways of linking research, extension and farmers through a two way exchange of both Indigenous Technical Knowledge (ITK) and scientific knowledge inorder to increase food production in Tanzania.

Vel (1995) pointed out that farmers' indigenous technical knowledge plays an important role in deciding about agricultural innovations.

Altieri (1996) stated that, in this new emerging conception of agricultural development, rural people's knowledge about plants, soils and animals gains unprecedented significance. He continued that scientists involved in small farm development must quickly systematize and incorporate farmers' knowledge, before the wealth of practical knowledge, is lost forever, given that most traditional farming systems are rapidly disappearing in the face of major social, economical and political changes occuring in developing countries.

The central point of the above review is that farmers' knowledge is the product of centuries of trial and error method of technology development. This knowledge provides a basis for identifying ecologically sustainable options of research use which are finely tuned both ecologically and socially. Abstraction and conceptualisation of farmers' knowledge and its integration with modern farming techniques can evolve efficient resource management system.

2.4 Studies on farmers' practices

Navarez *et al.* (1985) conducted a study on weed control by farmers' practices. They found that the weed growth can be effectively checked by these practices than the recommended practices.

Brosius et al (1986) found out a new approach to understand traditional knowledge-Ethnoecology. This forms the basis for structuring traditional agroecosystems which is modified in the form of knowledge passed from generation to generation.

Box (1987) revealed the existence of local networks of farmers who regularly discuss among themselves and form concepts, adopt ideas, integrate knowledge and determine acceptable action. The importance of farmer to farmer communication will differ according to social organisation and infrastructure.

Farrington and Martin (1987) observed that in problem identification scientists usually gave emphasis on the answer of the farmers to their own questions, which might be relevant to a given crop or technology.

Gupta (1987) opined that inorder to derive scientific value out of the indigenous practices, crucial observation was essential. They had to be put into proper scientific testing thereby the very frontiers of science could be extended.

Survey conducted at NARP, Southern region of KAU (1989) revealed some of the innovative agricultural practices followed by farmers in the southern region with the ratio-

nale. Most of these practices have been existing for the past several years, being followed traditionally.

Deshpande and Potdar (1990) revealed that an organic farmer from Dharwad district used Agnihotra ash to protect seeds from seed-borne fungal and bacterial pathogens.

Titilosa (1990) proposed a method to evaluate the incorporation of indigenous / traditional knowledge in agriculture to development projects in less developed countries, so that the benefits of traditional farmers' resource managment tecchniques, as dictated by the environment and other social conditions can be harnessed and improved upon.

Bharara (1991) described many farmers' practices based on local evidences and empirical data regarding traditional knowledge of rainfed farming practices and soil water conservation in arid zones of Rajasthan.

According to Gnanadeepa (1991) who has identified and categorized some traditional beliefs. Some may be rational and some of them have been scientifically proved by the scientists.

Gupta (1996) conducted a survey in 'Saurashtra' and identified the farmers' practices in vegetable cultivation.

Abraham and Thomas (1997) in their empirical study described the varieties developed by the Kerala farmers in cassava and cardamom. Ambakkadan variety of cassava developed by Ambakkadan Thommy has now spread all over Kerala and Njallani variety of carda-

mom developed by Njallani Varkey is widely accepted as a high yielding variety and a disease-resistant one. They also reported that aphids in paddy are controlled with a mixture of asaphoetida and cattle urine or spraying a mixture of garlic, chilli and asaphoetida in water, pasting ginger and yam seed material with cowdung, sundried, smoked and kept so that the seeds can retain the moisture for an year.

Bheemappa and Hosamani (1997) compiled the farmers' practices for protection of pulse seeds from storage pests using split seed coat pieces of cashew or leaves of moringa or camphor.

Manju (1997) identified 47 indigenous practices among vegetable growers of Thrissur district. The most important constraints identified by the farmers in the use of indigenous technologies were emergence of new pests and diseases (98 per cent) increased pests and diseases (88 per cent) and low productivity (86 per cent).

In an indepth study on the agricultural practices in the hills of Nepal, Subedi (1997) revealed that in most cases, farmers' local knowledge concurred with formal experimental results.

Vivekanandan (1997) described a farmers' practice in watermelon for its irrigation. During shortage of water, holes are made at the bottom of a fully matured fruit and is placed over the root portion of the plant. The inside water oozing not only will save the crop from drying, but also helps other fruits to attain full size. He also reported the application of neem on bengal gram to prevent pest attack and there is a farmers' practice in Tamil Nadu of plant-

ing a single row of Marigold around the tomato field to control tomato pod borer.

Abay *et al.* (1998) opined that farmers' experiments will be complemented by studies and, where necessary, on-station research which will help, explain or show how farmers' practices can be improved, and generate the information innovative farmers and communities need to continue development activities.

2.5 Techno-socio-economic assessment of farmers' practices

All innovations cannot be regarded as similar or equivalent in their capacity to induce adoption (Coughenour,1965). Barnett(1953) in this connection stated "the reception given to a new idea is not so forutious and unpredictable as it sometimes appears to be". The character of the idea itself is an important determinant. The properties of a given idea act as stimuli and their perception by an individual influences his behaviour (Rogers, 1983).

Rogers and Shoemaker (1971) stated that it is the receiver's perception of the attributes of innovations that affect their rate of adoption. The innovation-characteristics can be perceived differently by different individuals.

A study conducted by Kivlin (1960) and Fliegel and Kivlin (1962) among Pennsylvania farmers revealed that relative advantage, compatibility and complexity were found to be significantly related to rate of adoption.

Fliegel *et al.* (1968) conducted a study among 387 Indian peasants and opined that relative advantage (social approval, continuing cost and time-saving) and observability (clar-

ity of results) were found to be significantly related to rate of adoption.

Clinton(1973) observed that relative advantage (including cost), complexity, compatibility and observability had significant relation with rate of adoption.

All the five attributes of innovation viz. relative advantage, compatibility, complexity,trialabilityand observability were found to be significantly related to rate of adoption in a study conducted by Holloway (1977) among hundred high school principals.

Allan and Wolf (1978)observed that complexity was found to have significant relationship with rate of adoption.

Reddy (1983) made an attempt to collect the information regarding the rationale and wisdom behind traditional rainfed agricultural practices followed by experienced farmers of Andhra Pradesh. It was also suggested that the practices thus identified were to be tested by all concerned with agriculture development.

Arulraj (1984) in his study revealed that use complexity, content complexity and physical compatibility were found to be significantly related with adoption.

Anantharaman *et al.* (1985) stated that farmers have their own reason for practices followed. It was noted that they are not bound by economic or social factors but largely by scientific reasoning.

Ramegowda and Siddaramaiah (1987) observed that compatibility, trialability and

observability were found to have significant relationship with rate of adoption.

Gupta (1990) listed the reasons for documentation of indigenous knowledge as to understand scientific rationale, to accelerate technological change, to enable better understanding of technology development, development of newer concept to increase awareness among the young generation, to develop appreciation for the traditional system and receive and restore pride among the farmers themselves.

In his study Hanchinal *et al.* (1991) established that trialability is positively related to rate of adoption.

After conducting a case study on traditional practices in dry land agriculture in Tamil Nadu, Kanagasabhapathi (1991) identified many indiegenous practices of high use particularly in plant protection. He has also tried to collect the possible scientific explanation and made some valuable suggestions for further development of these practices.

Nitsch (1991) opined that the management of a farm requires the ability to handle a multitude of biological, technical, economical and social factors in a changing and largely unpredictable environment. He explained that such co-ordination skills were not so much based on the formal rationality employed by scientists as an adaptive rationality where adaptive rationality was seen as a continuous interaction among visions, experiences and experimentation. These co-ordination and adaptive rationality were made up of tacit knowledge; knowledge that could not be reduced to facts and rules and thus cannot be formalised.

Sanghi (1991) documented a number of farm management practices evolved by farmers in order to face the harmful effects of natural calamities, after conducting a comprehensive study about the traditional farming practices for risk management in rainfed agriculture.

2.6 Efficiency of farmers' practices as perceived by the farmers, researchers and extension personnel

According to Pitman English Dictionary, the word efficient, the adjective form of efficiency means capable, competent, able to get results.

New Comprehensive International dictionary of the English language gives the meaning of efficiency as the character of being efficient or effective; the ratio of the work done.

According to Heady (1968) efficiency is the convergence of potential in the real.

Johanssen *et al.* (1968) meant efficiency as the effectiveness of performance of the right thing at right way and place.

According to Amey (1969) efficiency is a loose term and a host of different concepts of efficiency come really to mind. Efficiency is an elusive concept, one in which an economist, an engineer and a policy maker all have greater stakes. To an engineer, it means ratio of output to input, or input to theoretical capacity, while a cost accountant uses the standard cost to actual cost, an economist refer it as a firm's success in producing as large as possible an output from a given set of inputs.

Radhakrishna (1969) expressed that efficiency is by definition a relative concept.

Suresh (1983) stated that efficiency is relative concept. It cannot be defined occurately and precisely because efficiency of any economic activity will vary according to working units and motivation of decision-making units. Different meanings are attributed to the terms like capacity or ability to do things well. It is commonly accepted as an index ratio or percentage. In general efficiency has been recognised as an index of performance of the degree of achievement to economic course of action.

Collin (1986) meant efficiency as ability to work well or to produce right results or the right work quickly and effectiveness to producing results.

Koontz *et al.* (1986) viewed efficiency as achievement of the ends with least amount of resources.

Ghosh *et al.* (1988) gave the meaning of efficiency as maximum output with minimum input of labour.

Efficiency, in this study, was operationalised as the effectiveness (ability) of a practice to produce right results and it was measured in terms of the perception of farmers, researchers and extension personnel.

2.7 Knowledge of farmers about recommended practices

Faniran and Areola (1976) reported that in the field of crop production and the man-

agement of the soil, the knowledge and experience of local farmers are unrivalled and no alternative system of food production is found as competant as farmers' knowledge.

Samad (1979) found that in areas where pepper and coconut package programmes were implemented, knowledge of farmers about improved scientific practices were more compared to other areas.

Jayakrishnan (1984) observed that paddy growers had medium level of knowledge of low cost technology.

Studies conducted by Juma (1987) in East Africa showed that women usually possess remarkable knowledge about the qualities and uses of indigenous tree spices and that many of those insights are unknown to men.

Waghmare *et al.* (1988) observed that 19.33 per cent of the respondents (fruit and vegetable growers) were found to be in the low knowledge category, 60 per cent were located in medium knowledge category and one-fifth of the respondents possess adequate knowledge about the Horticultural Development Programmes.

Sagar (1989) reported that majority of the respondents had medium knowledge about recommended practices of paddy cultivation.

Bony (1991) found that majority of vegetable growers had medium level of knowledge on improved vegetable cultivation.

Reijntjes *et al.* (1992) stated that indigenous knowledge is not uniformly spread throughout a community and the individual aptitudes for storing traditional knowledge and generating new knowledge differ. Each individual possess only a part of communities' indigenous knowledge, he observed.

Gangadharan (1993) found that majority of pepper growers have medium level of knowledge about improved agricultural practices.

2.8 Extent of adoption of farmers' practices

The word 'adopt' has the meaning to take up and practice as one's own, to accept formally and put into effect. Adoption of a particular message or production reccommendation by a farmer implies the voluntary acceptance of the message and its practice.

Sharma and Nair (1974) indicated that the adoption of recommended practices of high yielding variety was far below the recommended level and only nine percent of the participants adopted three practices ie., seed treatment, fertilizers and plant protection in combination.

Sawant and Thorat (1977) observed that rationality does not bring about critical differences in decision-making in adoption of various categories, except those who are the last to adopt an improved farm practice. Differential adoption of farm innovations by farmers was generally observed and it was attributed to some of the personal, social and economic characters of farmers.

Manivannan (1980) reported that about three-fourth of the farmers (72.50 per cent) had adopted half of the recommended dose of plant protection measures.

Asaithambi (1981) pointed out that one fourth of the big farmers and negligible percentage (2.5 per cent) of small farmers had adopted the plant protection measures.

A study conducted by Chakravarthy (1982) revealed that majority of farmers falling in small and medium category possessed low level adoption whereas, majority of big farmers possessed medium level adoption of indigenous practices.

Reddy (1983) opined that there was uneven or differential pattern of adoption of the recommended practices by farmers.

Godhandapani (1985) showed that the extent of adoption of nutrient recomendation was found to be medium to high for irrigated groundnut cultivation.

Rahman *et al.* (1986) reported that seed rates used by vegetable growers were quite high compared to the package of practices recommendations. They also identified that in contrast to the package of practices recommendations of specific chemicals for protecting vegetable crops from insect pests, the growers applied chemicals of their own choice.

Chenniappan (1987) revealed that extent of adoption of improved practices for irrigated cotton was medium.

Nehru *et al.* (1988) stated that 64 per cent of the lab to land beneficiary farmers adopted

the recommended dose of nitrogen and 72 per cent adopted the recommended dose of potash for vegetable cultivation.

Theodore (1988) reported that there was significant difference in the extent of adoption of farming practices among contact and other farmers.

Vijayan (1989) pointed out that all of the recommended practices in the cultivation of Banana var. Nendran except four practices viz., adoption of fertilizers, desuckering, mulching and plant protection measures all the other recommended practices were adopted by almost all the farmers.

Saxena *et al.* (1990) reported that 17.6 per cent of farmers adopted the recommended package of practices in full, while 49.6 per cent adopted partially and 32.8 pe rcent followed the recommendations to the minimum level on their fields. They also reported that the plant protection measures had been adopted by less percent of farmers.

Balasubramanium (1992) presented the adoption level of each of the identified indigenous practices in percentage.

Jaleel (1992) reported that majority of Kanikar tribes (69 per cent) had only lower level of adoption of modern techniques of cultivation.

Jnanadevan (1993) reported that in the practice-wise adoption of recommended practices of coconut, the adoption of high yielding hybrid varieties for new planting was the least adopted practice, while spacing, filling the pits with top soil at planting time were shown high

level of adoption among beneficiary farmers. He also reported that, none of the farmers adopted application of fertilizers according to the recommended doses.

Parvathi (1995) reported more than half of the farm women (56.88 per cent) had medium level of adoption of traditional and modern technologies.

2.9 Relationship of knowledge about recommended practices with adoption of farmers' practices

According to Ramsey *et al.* (1959) adoption behaviour involved two components-behavioural, which involves the actual use of the practices and cognitive which includes obtained knwledge and critical evaluation of the practice in terms of individual situations.

Singh and Singh (1970) revealed that knowledge of package of practices was significantly contributing in explaining the adoption behaviour of the farmers.

Rogers and Shoemaker (1971) opined that knowledge of innovations could create motivation for their adoption.

Sethy *et al.* (1984) reported that knowledge of technology is basic to adoption of high yielding rice technology for all categories of farmers.

Anantharaman *et al.* (1985), Haque (1989) and Singh (1989) reported positive relationship between knowledge and adoption behaviour of farmers.

2.10 Relationship between knowledge of farmers about the recommended practices and the selected independent variables

1. Age

Review of research studies showing relationship between age and knowledge

Sl.No.	Name of researcher	Year of study	Relationship
1.	Kaleel	1978	No relationship
2.	Krishnamoorthy	1988	Significant
3.	Thampan	1990	Not significant
4.	Nandini	1995	Not significant
5.	Jeyasubramanian	1996	Negative and significant
6.	Manju	1996	Not significant
7.	Preetha	1997	Not significant

Majority of the above studies show that age is not significantly associated with knowledge.

2. Educational status

Review of research studies showing relationship between educational status and knowledge

Sl.No.	Name of researcher	Year of study	Relationship
1.	Balachandran	1983	Positive and significant
2.	Philip	1984	Not significant

3.	Viju	1985	Positive and significant
4.	Thampan	1990	Positive and significant
5.	Sumathi and Annamalai	1993	Positive and significant
6.	Nandini	1995	Positive and significant
7.	Jeyasubramanian	1996	Positive and significant
8.	Manju	1996	Positive and significant
9.	Manju	1997	Positive and significant
10.	Preetha	1997	Negative and significant

A positive and significant relationship between educational status and knowledge is observed in majority of the above studies.

3. Main occupation

Review of research studies showing relationship between main occupation and knowledge

Sl.No.	Name of researcher	Year of study	Relationship
1.	Manju	1996	Not significant
2.	Preetha	1997	Positive and significant
3.	Jose	1998	Not significant

Majority of the above studies reveal a positive relationship between main occupation and knowledge.

4. Farming Experience

Review of research studies showing relationship between farming experience and knowledge

Sl.No.	Name of researcher	Year of study	Relationship

1.	Pitchai	1987	Not significant
2.	Ahiah	1993	Not significant
3.	Nandini	1995	Not significant
4.	Philip	1995	No relationship
5.	Jeyasubramanian	1996	Positive
6.	Manju	1996	Not significant
7.	Manju	1997	Positive and significant
8.	Preetha	1997	Positive and significant
9.	Jose	1998	Negative and significant.

The above studies reveal almost all types of relationships between farming experience and knowledge. But majority of the studies show a non-significant relationship between these two.

5. Annual income

Review of research studies showing relationship between annual income and knowledge

Sl.No.	Name of researcher	Year of study	Relationship
1.	Badagaonkar	1987	Significant
2.	Nandini	1995	Not significant
3.	Jeyasubramanian	1996	Not significant
4.	Manju	1996	Not significant
5.	Preetha	1997	Not significant
6.	Jose	1998	Not significant.

Most of the studies show that there is no significant relationship between annual income and knowledge

6. Area under cowpea

The researcher has not come across with any study showing the relationship between area under cowpea and knowledge. Hence related studies are reviewed here.

Review of research studies showing relationship between area under different crops and knowledge

Sl.No.	Name of researcher	Year of study	Relationship
1.	Godhandapani	1985	Not significant
2.	Satheesh	1990	Positive and significant
3.	Nandini	1995	Not significant
4.	Manju (crop-coconut)	1996	Not significant
5.	Manju (crop-vegetables)	1997	Negative and significant
6.	Preetha (crop-rice)	1997	Not significant
7.	Jose (crop-vegetables)	1998	Not significant

From the above studies, it is revealed that there is no significant relationship between area under cowpea and knowledge.

7. Exposure to information sources

Review of research studies showing relationship between exposure to information sources and knowledge

l.No.	Name of researcher	Year of study	Relationship
1.	Menon and Prema	1976	Positive and significant
2.	Prasad	1978	Positive and significant
3.	Sheela	1989	Positive and significant

4.	Gangadharan	1993	Positive and significant
5.	Nandini	1995	Not significant
6.	Manju	1996	Not significant
7.	Preetha	1997	Positive and significant

Majority of the above studies show that exposure to information sources is positively and significantly associated with knowledge.

8. Irrigation index.

There are not much studies showing the relationship between irrigation index and knowledge. But Manju (1996) reported a positive and non-significant association between irrigation index and knowledge.

9. Social participation

Review of research studies showing relationship between social participation and knowledge

Sl. No.	Name of researcher	Year of study	Relationship
1.	Kamarudeen	1981	Positive and significant
2.	Haraprasad	1982	Positive and significant
3.	Ramdass	1987	Positive and significant
4.	Thampan	1990	Positive and significant
5.	Gangadharan	1993	Positive and significant
6.	Nandini	1995	Not significant
7.	Manju	1996	Not significant

8.	Preetha	1997	Not significant
9.	Jose	1998	Positive and significant

A positive and significant association between social participation and knowledge is revealed from majority of the above studies.

10. Extension orientation

Review of research studies showing relationship between extension orientation and knowledge

Sl. No.	Name of researcher	Year of study	Relationship
1.	Badagaonkar	1987	Not significant
2.	Gangadharan	1993	Positive and significant
3.	Manju	1996	Not significant
4.	Manju	1997	Significant
5.	Preetha	1997	Not significant
6.	Jose	1998	Not significant

Almost all types of relationships can be observed between extension orientation and knowledge in the above studies.

11. Economic motivation

Review of research studies showing relationship between economic motivation and knowledge

Sl. No.	Name of researcher	Year of study	Relationship
1.	Somasundaram	1976	Positive and significant
2.	Jayakrishnan	1984	Positive
3.	Gopala	1991	Not significant
4.	Chaudhari and Makode	1992	Positive

5.	Manju	1996	Not significant
6.	Manju	1997	Negative and significant
7.	Preetha	1997	Not significant
8.	Jose	1998	Positive and significant

Majority of the above studies show that economic motivation is positively associated with knowledge.

12. Innovativeness

Review of research studies showing relationship between innovativeness and knowledge

Sl. No.	Name of researcher	Year of study	Relationship
1.	Ramdass	1987	Positive and significant
2.	Nirmala	1993	Positive and significant
3.	Manju	1996	Not significant
4.	Manju	1997	Negative and significant
5.	Preetha	1997	Not significant
6.	Jose	1998	Positive and significant

The above studies show varied nature of relationships. But majority of them show a positive relationship between innovativeness and knowledge.

13. Cosmopoliteness

Review of research studies showing relationship between cosmopoliteness and knowledge

Sl. No.	Name of researcher	Year of study	Relationship
1.	Knight and Singh	1975	Positive

2.	Kamarudeen	1981	Positive and significant
3.	Viju	1985	Positive
4.	Gangadharan	1993	Positive and significant
5.	Nandini	1995	Not significant
6.	Manju	1996	Not significant
7.	Preetha	1997	Not significant
8.	Jose	1998	Positive and significant.

Except one, all the above studies show that cosmopoliteness is positively associated with knowledge.

14. Credit orientation

The researcher have not come across with any study showing the relationship between credit orientation and knowledge.

15. Risk orientation

Review of research studies showing relationship between risk orientation and knowledge

Sl. No.	Name of researcher	Year of study	Relationship
1.	Kamarudeen	1981	Positive
2.	Jayakrishnan	1984	Positive and significant
3.	Viju	1985	Positive and significant
4.	Ratnabai	1990	Not significant
5.	Suresh	1993	Positive and significant
6.	Manju	1996	Not significant
7.	Preetha	1997	Positive and significant

8.	Jose	1998	Positive and significant

It can be seen from the above studies that majority show a positive and significant association between risk orientation and knowledge.

16. Participation in PTD

Dipali (1979) revealed that there was positive relationship between level of knowledge of rural women in farm practices and their degree of participation in agricultural operations.

17. Perception about PTD

Alex (1994) stated that knowledge was positively and significantly associated with the perception of male and female agricultural labourers.

2.11 Relationship between adoption of farmers' practices and the selected independent variables

The studies reviewed pertain to adoption in general and not specifically to adotpion of farmers' practices.

1. Age

Review of research studies showing relationship between age and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Annamalai	1980	Not significant
2.	Ravichandran	1980	Negative
3.	Kamarudeen	1981	Negative
4.	Vijayakumar	1983	Negative and significant

5.	Prasannan	1987	Negative
6.	Anithakumari	1989	Not significant
7.	Adhiguru	1991	Not significant
8.	Lekshmi	1995	Not significant
9.	Manju	1996	Not significant
10.	Preetha	1997	Not significant

Majority of the above studies showed a negative and non-significant association between age and adoption.

2. Educational status

Review of research studies showing relationship between educational status and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Kamarudeen	1981	Positive and significant
2.	Chakravarthy	1982	Not significant
3.	Vijayakumar	1983	Positive and significant
4.	Swaminathan	1986	Not significant
5.	Prasannan	1987	Positive and significant
6.	Anithakumari	1989	Positive and significant
7.	Manju	1996	Not significant
8.	Preetha	1997	Not significant

A positive and significant association between educational status and adoption is observed in majority of the above studies.

3. Main occupation

Review of research studies showing relationship between main occupation and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Kamarudeen	1981	Positive
2.	Vijayakumar	1983	Positive
3.	Anithakumari	1989	Not significant
4.	Manju	1996	Not significant
5.	Preetha	1997	Not significant

Majority of the above studies reveal that main occupation is positively associated with adoption.

4. Farming experience

Review of research studies showing relationship between farming experience and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Bute *et al.*	1981	Positive
2.	Balasubramanian and Kaul	1982	Negative
3.	Kumbar	1983	Not significant
4.	Jayakrishnan	1984	Positive
5.	Adhiguru	1991	Negative
6.	Manju	1996	Not significant
7.	Preetha	1997	Not significant
8.	Sivaprasad	1997	Not significant

From the above studies it is clear that farming experience has a non-significant

relationship with adoption.

5. Annual income

Review of research studies showing relationship between annual income and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Viju	1985	Positive
2.	Badagaonkar	1987	Positive
3.	Aziz	1988	Positive
4.	Manju	1996	Not significant
5.	Preetha	1997	Not significant
6.	Sivaprasad	1997	Not significant

Majority of the research studies reported a positive association between annual income and adoption.

6. **Area under cowpea**

The researcher has not come across with any study showing the relationship between area under cowpea and adoption of farmers' practices. Hence studies relating to area and adoption in general are furnished here.

Review of research studies showing relationship between area under different crops and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Sivaramakrishnan (crop-cassava)	1981	Positive and significant
2.	Anantharaman *etal.* (cassava)	1985	Indirect
3.	Anantharaman (cassava)	1991	Significant
4.	Bony (vegetables)	1991	Significant

5.	Manju (coconut)	1996	Not significant
6.	Preetha (rice)	1997	Not significant

A positive and significant association between area under cowpea and adoption is reported by majority of the above studies.

7. Exposure to information sources

Review of research studies showing relationship between exposure to information sources and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Manju	1996	Positive and significant
2.	Preetha	1997	Significant

There are not much studies showing the relationship between exposure to information sources and adoption. But the above two studies reveal a positive and significant association between exposure to information sources and adoption.

8. Irrigation index

Not much studies are available to show the relationship between irrigation index and adoption. But, Manju (1996) reported a positive and non-significant association between irrigation index and adoption.

9. Social participation

Review of research studies showing relationship between social participation and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Balasubramonian	1985	Negative and significant
2.	Dudhani *et al.*	1987	Not significant

3.	Prasannan	1987	Significant
4.	Anithakumari	1989	Not significant
5.	Bavalatti and Sundaraswamy	1990	Positive and significant
6	Gangadharan	1993	Positive
7.	Kumar	1994	Not significant
8.	Sarmah and Singh	1994	Positive
9.	Lekshmi	1995	Not significant
10.	Manju	1996	Not significant
11	Preetha	1997	Negative and significant

Almost all types of relationships are observed between social participation and adoption in the above studies.

10. Extension orientation

Review of research studies showing relationship between extension orientation and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Govind	1992	Positive
2.	Jnanadevan	1993	Not significant
3.	Manju	1996	Not significant
4.	Preetha	1997	Negative and significant
5.	Sivaprasad	1997	Negative and significant

Both positive and negative association between extension orientation and adoption is observed in the above studies.

11. Economic motivation

Review of research studies showing relationship between economic motivation and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Tyagi and Sohal	1984	Positive
2.	Singh and Ray	1985	Positive
3.	Sajeev chandran	1989	Positive
4.	Anithakumari	1989	No relationship
5.	Sutha *et al.*	1991	Positive
6.	Gangadharan	1993	Not significant
7.	Jnanadevan	1993	Positive
8.	Meera	1995	Positive
9.	Manju	1996	Not significant
10.	Preetha	1997	Not significant
11.	Sivaprasad	1997	Positive

Majority of the above studies reveal that economic motivation is positively associated with adoption.

12. Innovativeness

Review of research studies showing relationship between innovativeness and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Manju	1996	Not significant
2.	Preetha	1997	Not significant

Studies showing the relationship between innovativeness and adoption are rare. But

the above two studies reveal both positive and negative association between innovativeness and adoption.

13. Cosmopoliteness

Review of research studies showing relationship between cosmopoliteness and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Kamarudeen	1981	Positive
2.	Viju	1985	Positive
3.	Syamala	1988	Not significant
4.	Jaleel	1992	Positive
5.	Manju	1996	Not significant
6.	Preetha	1997	Negative and significant

Most of the research studies reported that cosmopoliteness is positively associated with adoption.

14. Credit orientation

Review of research studies showing relationship between credit orientation and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Perumal & Mariappan	1982	Positive
2.	Kappattanavar	1983	Positive
3.	Al-mogel	1985	Positive
4.	Porchezhiyan	1991	Positive
5.	Jaleel	1992	Not significant

Majority of the above studies show that credit orientation and adoption has a positive and significant relationship.

15. Risk orientation

Review or research studies showing relationship between risk orientation and adoption

Sl.No.	Name of researcher	Year of study	Relationship
1.	Prasannan	1987	Not significant
2.	Jaleel	1992	Positive and significant
3.	Gangadharan	1993	Positive and significant
4.	Jayalekshmi	1996	Significant
5.	Varma	1996	Significant
6.	Manju	1996	Not significant
7.	Preetha	1997	Positive and significant

Most of the studies reveal a positive association between risk orientation and adoption.

16. Participation in PTD

Samad (1979) revealed that participation had significant contribution on adoption behaviour of farmers in IPD and CP areas.

17. Perception about PTD

Review or research studies showing relationship between perception and adoption

Sl.No.	Name of researcher	Year of study	Relationship

1.	Sakthivel	1979	Positive and significant
2.	Anithakumari	1989	Positive and significant

All the above studies reveal a positive and significant relation between perception and adoption.

2.13 **Constraints in the cultivation of cowpea**

Farmers come across a lot of problems during the course of cultivation of crops. According to Pandya and Trivedi (1988) constraints are those items of difficulties or problems faced by individuals in adoption of technology.

The problems faced by farmers in the cultivation and marketing of cowpea are considered as constraints in the present study. Constraints in farming as identified by different researchers were reviewed and presented below.

Constraint Analysis

Sl.No.	Researcher	Year	Area of study	Constraints identified
1.	Seshachar	1980	Chilli growers	Lack of knowledge regarding spacing, application of farmyard manures and fertilizers and use of plant protection measures.
2.	Jaiswal and Arya	1981	Transfer of technology	Relative advantage of the innovation,its compatibility, simplicity,divisibility and communicability.
3.	Norman	1982	Vegetable cultivation	High attack of pests and diseases, high input cost and serious transportation problem.
4.	Anantharaman *et al.*	1986	Adoption of improved varieties of cassava	Non-availability of seed materials, lack of capital, lack of awareness and lack of knowledge.
5.	Prasannan	1987	Adoption of coconut cultivation practices	Non-availability of inputs in time, non-availability of labour, high labour cost involved and high cost of materials.
6.	Theodore	1988	Adoption of seed treatment with fungicides	No previous experience of summer ploughing, high cost and non-availability of recommended varities,not practised by neighbouring farmers, no knowledge, complexity, no interest and lack of guidance.
7.	Prakash	1989	Rice cultivation	High wage rate, small sized holdings, incidence of pests and diseases, non-availability of inputs in time,lack of co-operation among farmers, low adoption of HYV, lack of irrigation and fragmentation.
8.	Bony	1991	Commercial vegetable cultivation	High cost of plant protection chemicals, inadequate marketing, storage and post-harvest facilities.
9.	Sandhya	1992	Marketing of vegetables	Perishability, bulkiness and seasonality inproduction, uncontrolled inorganised and insufficient marketing system, absence of proper grading and standardisation and involvement of large number of middlemen.
10.	Meera	1995	Differential adoption of plant protection technology	Untimely supply and high cost of inputs,difficulty in the selection of alternate chemicals.

2.14 Conceptual framework of the study

A conceptual model of the study has been framed based on the objectives setforth for the study, the concepts theoretically derived from the review of literature and the factors influencing the knowledge of farmers about the recommended practices and adoption of efficient farmers' practices and discussion with experts.

The framework is expected to facilitate theoretical and empirical analysis of the knowledge and extent of adoption of the respondents. (Fig.1) It depicts the major objective of generating comprehensive feedback regarding the practices followed by the farmers in the cultivation of cowpea. Techno-socio-economic assessment of farmers' practices identified as perceived by the farmers, researchers and extension personnel is illustrated on the top portion of Fig.1. It also explains the wide spectrum of profile characteristics of farmers (independent variables) that influence the knowledge of farmers about the recommended practices and adotpion of farmers' practices (dependent variables). This is illustrated on the bottom portion.

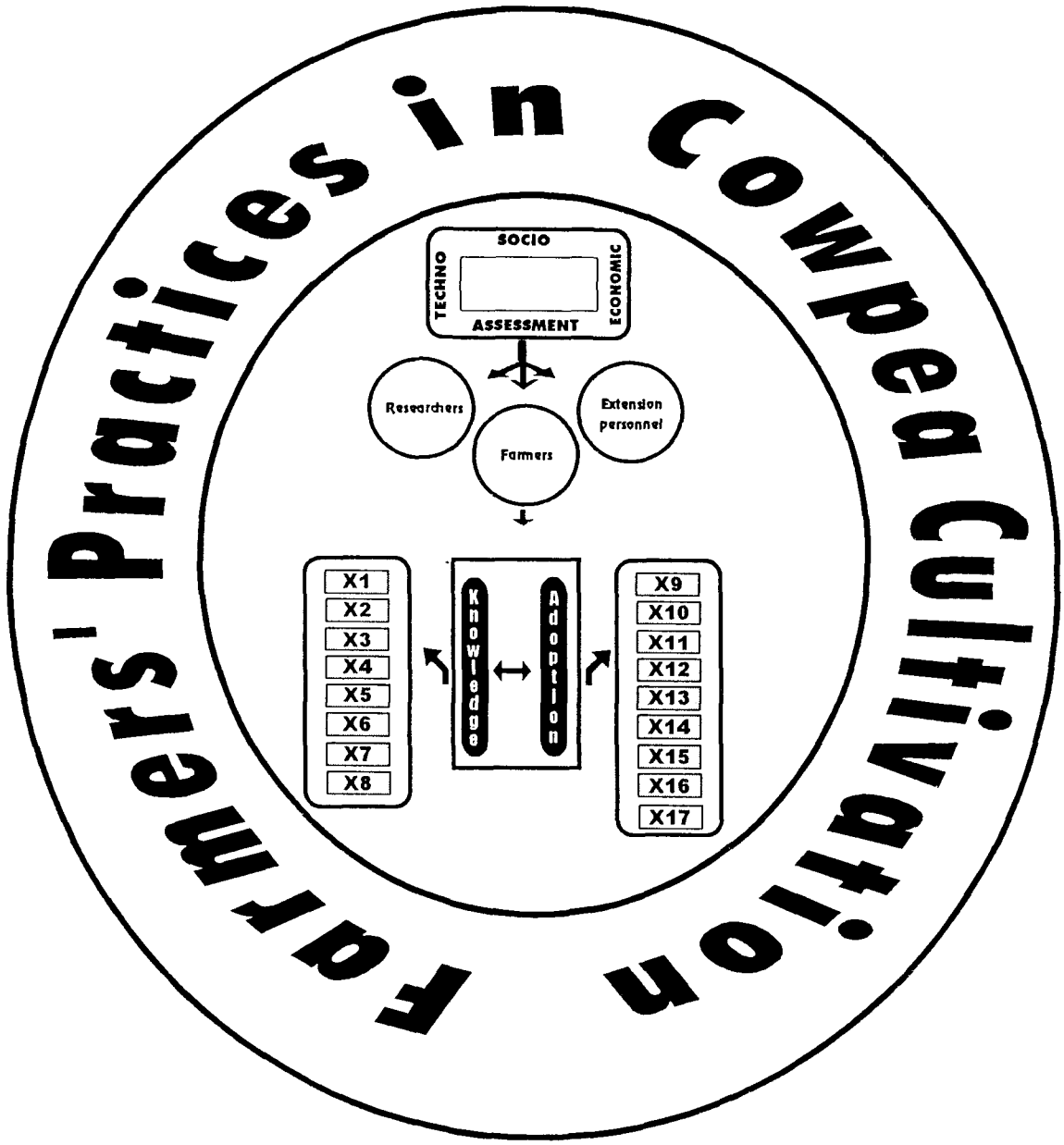

Fig. 1. Conceptual frame work of the study

X1	-	Age	X9	-	Social participation
X2	-	Education	X10	-	Extension orientation
X3	-	Main Occupation	X11	-	Economic Motivation
X4	-	Farming experiance	X12	-	innovativeness
X5	-	Annual Income	X13	-	Cosmopolitiness
X6	-	Area under cow-pea	X14	-	Credit Orientation
X7	-	Expasure to information sources	X15	-	Risk Orientation
X8	-	Irrigation Index	X16	-	Participation in PTD
			X17	-	Perception about PTD

METHODOLOGY

CHAPTER-III
METHODOLOGY

This chapter deals with the procedures adopted in the identification of the practices followed by the farmers in the cultivation of cowpea, selection of respondents and analysis and interpretation of the collected data.

The study was conducted in two phases. Phase 1 accomplised the major objective of generating comprehensive feedback regarding the practices followed by the farmers in the cultivation of cowpea. While phase II accomplised the other objective. ie, assessment of socio-economic and technical aspects of these farmers' practices as perceived by the researchers, extension personnel and the farmers.

The methodology followed in the study is furnished under the following sub-heads.

3.1 Locale of the study

3.2 Selection of respondents

3.3 Operationalisation and measurement of concepts

3.3.1 Techno-socio-economic assessment of farmers' practices

3.3.2 Efficiency of farmers' practices as perceived by the farmers, researchers and extension personnel

3.3.3 Ecofriendliness of farmers' practices as perceived by the farmers

3.3.4 Operationalisation and measurement of dependent variables

3. 1 Locale of the study

Considering the limitations of a student researcher and the study envisages in depth probing of the farmers' practices through the non-participant observation technique, the study has to be limited to a specific area which is significant as for the cultivation of cowpea is concerned. So the study was conducted only in Thiruvananthapuram district. On the basis of discussion with experts, researchers, extension personnel and peoples' representatives in the district, Kalliyoor panchayat was selected as the locale of the study. Map showing the area of the study is presented as Fig2. Kalliyoor Panchayat where College of Agriculture is located was selected for the following reasons.

(i) There are several progressive farmers who follow their own practices including those who have won the **Harithamitra award**, for the best fruit- vegetable grower in the state.

(ii) The vegetables especially cowpea from Kalliyoor fetch higher price in the foreign market as per the opinion of the exporting agency.

(iii) The field centre of Kerala Horticultural Development Programme in this area is the best among the ten field centres in the district.

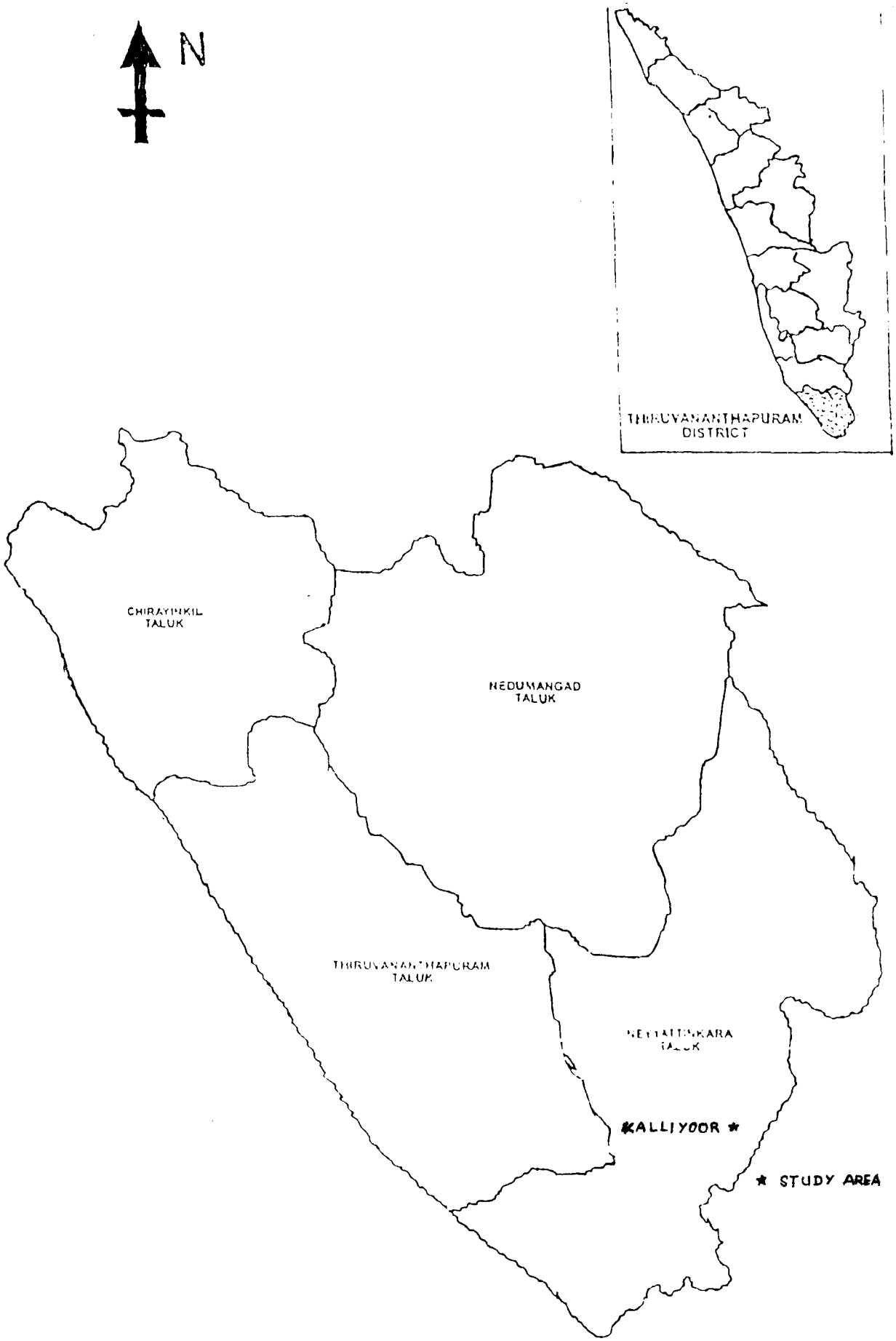

Fig.2. Map showing the location of the study - Thiruvananthapuram District

(iv) Kerala Horticultural Development Programme is conducting several Participatory Technology Development (PTD) experiments in Kalliyoor Panchayat as this is the best vegetable cultivating area in the district.

(v) Being the first systematic study of this kind conducted in the state, it was convenient to select an area in the near vicinity of College of Agriculture, Vellayani to get the benefits of its infrastructure and other resources.

3.2 Selection of respondents

Two sets of respondents were required for the study.

1. Practising farmers cultivating cowpea.
2. Extension workers and agricultural scientists working on cowpea.

Practising farmers cultivating cowpea were selected using purposive sampling procedure. List of farmers under different Harithasanghams were collected from the Krishi Bhavan. On the basis of discussion with Agricultural Officer of Kalliyoor Krishi Bhavan, two Harithasanghams viz., Sasthamkovil nada and Erayankode which were the best under the Krishi Bhavan were selected. These two Harithasanghams include 80 members. Since the project is of exploratory and exhaustive nature involving non-participant observation for data-gathering, a sample size of 40 farmers from these two Harithasanghams were selected puposively. On the basis of discussion with Agricultural Officer, technical assistant of KHDP and office-bearers of KHDP field centre working in the area 40 well-experienced cowpea cultivators was included as the respondents of the first category. This sample size was se-

lected depending on the quantity of information to be generated and the logistics. The selected farmers were members of both Harithasangham and KHD Programme.

Similarly, extension officials and agricultural scientists working with sufficient experience in extension or research related to the cultivation of cowpea were selected as the second category of respondents. This category include a total of fifty respondents. Twenty five extension officials were selected from among the Agricultural officers of Kerala State Department of Agriculture and Technical Assistants of KHDP working in Thiruvananthapuram district. Twenty five agricultural scientists/researchers were selected from different colleges under Kerala Agricultural University.

3.3 Operationalisation and measurement of concepts

3.3.1 Techno-socio-economic assessment of farmers' practices

For assessing scientifically the socio-economic and technical aspects of the farmers' practices, matrix ranking was adopted. The efficient farmers' practices identified were given to the farmers in a four -point continuum viz., most efficient, efficient, not efficient and least efficient to find out their perception about the technological, social and economical aspects of the practices. The responses of all the farmers obtained for technological aspect of the farmers' practice were summed up and divided by the number of respondents to get a technological index for the practice. The same scoring procedure was followed in the case of social and economical aspects. The combined techno-socio-economic index of each practice was also assessed.

Rogers (1983) opined that the characteristics of innovations, as perceived by individuals, help to explain their different rate of adoption. He also opined that innovations that are perceived by receivers as having greater relative advantage, compatibility, trialability and observability and less complexity will be adopted more rapidly than other innovations.

Operational definitions

1. Relative advantage

It is the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage is often expressed in economic profitability, but social-prestige factors, convenience, and satisfaction are also often important components. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is going to be.

2. Compatibility

Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters. An idea that is not compatible with the prevalent values and norms of a social system will not be adopted rapidly as an innovation that is compatible.

3. Complexity

Complexity is the degree to which an innovation is perceived as difficult to under-

stand and use. Some innovations are readily understood by most members of a social system; others are more complicated and will be adopted more slowly.

4. Trialability

Trialability is the degree to which an innovation may be experimented with on a lim ited basis. New ideas that can be tried on the installment plan will be generally be adopted more quickly than innovations that are not divisible.

5. Observability

Observability is the degree to which the results of an innovation are visible to others.The easier it is for individuals to see the results of an innovation, the more likely they are to adopt.

3.3.2 Efficiency of farmers' practices as perceived by the farmers, researchers and extension personnel

Suresh (1993) stated that efficiency is a relative concept. It cannot be defined accurately and precisely because efficiency of any economic activity will vary according to working units and motivation of decision-making units. Efficiency is a loose term and a host of different concepts of efficiency come really to mind.

To measure the efficiency of farmers' practices as perceived by the scientists and extension personnel, farmers' practices selected were given to twenty five scientists working in Kerala Agricultural University and twenty five extension personnel in Department of Agriculture and KHDP. The responses of the selected practices were collected in a four point

continuum viz., extremely efficient, efficient, not efficient and extremely not efficient with weights 4,3,2 and 1 respectively. The efficiency of the farmers' practices as perceived by the respondent farmers were also collected in a similar way. For each practice, the frequency of each point of the continuum was multiplied with its weights and summed up. This score divided by the number of respondents was taken as the mean score for each practice. Based on this ranks were given.

3.3.3 Ecofriendliness of farmers' practices as perceived by the farmers

Inorder to get higher productivity, farmers are spending huge amount on pesticides and fertilizers not keeping in view the losses that are caused to soil fertility, soil microflora, environment and ecosystem. They are applying chemicals to soil due to lack of technical know how. To overcome these shortfalls farmers may be encouraged to adopt safe and ecofriendly practices like organic farming, integrated and balanced nutrition, integrated plant protection etc. Knowledge about these practices can be the basis of sustainable development. Little use is made of this valuable resources. Hence it is very important to study the perception of farmers about the ecofriendliness of farmers' practices.

Perception of farmers about the ecofriendliness of farmers' practices was measured on a four point continuum having scores 4,3,2 and 1 for 'extremely ecofriendly, ecofriendly not ecofriendly and extremely not ecofriendly' respectively. For each practice, the frequency of each point of the continuum was multiplied with its scores and summed up. The mean score for each practice was calculated to find the most and least ecofriendly practices.

3.3.4 Operationalisation and measurement of dependent variables

3.3.4.1 Knowledge about recommended practices

In the present study, knowledge refers to the extent of information possessed by the respondent on recommended practices (Package of Practices Recommendations 'Crops', 1996, KAU) of cowpea.

Sankariah and Singh (1967) measured knowledge of the respondents about improved methods of vegetable cultivation based on teacher made test.

Similarly, teacher made test was used in this study to measure knowledge about recommended practices.

A set of 32 statements reflecting knowledge in cowpea cultivation were selected based on review of literature and discussion with experts. Seventeen statements were later discarded due to ambiquity and duplication. Finally 15 statements were selected for the test. A score of 'one' was assigned to the correct answer and 'zero' to wrong answer. The sum of scores obtained for all items indicated the knowledge score of a respondent. Thus the maximum knowledge score that could be obtained by a respondent was 15 and the minimum zero.

3.3.4.2 Extent of adoption of farmers' practices

Extent of adoption, in this study, refers to the degree to which a farmer has actually adopted an efficient farmers' practice.

Manju(1996) and Preetha (1997)used an index to measure the extent of adoption of indigenous practices on coconut and rice by the farmers.

In this study, the procedure followed by Manju (1996) was used to measure the extent of adoption of farmers' practices. A total of 25 famers' practices identified were given to the researchers and extension personnel. Based on their perception of efficiency, eighteen practices having higher scores for efficiency were selected for calculating the adoption index. Weightages were given to these practices based on their suggestions. For giving the weightages, the procedure followed was as follows. The practices were given to the researchers and extension personnel with a 4-point continuum of efficiency to find out their perception of efficiency. The points of the continuum were extremely efficient, efficient, not efficient and extremely not efficient with weights 4,3,2 and 1 respectively. For each practice, the frequency of each point of the continuum was multiplied with its weights and summed up. Finally, this score divided by the number of judges was taken as the weightage of each practice.

In this study, adoption index was calculated using the following procedure.

$$AI = 1/S \times \frac{\sum_{i=1}^{K} Wi \times Li \times Ai \times 100}{\sum_{i=1}^{n} Wi}$$

where

AI - Adoption Index

S - Number of subheadings

$\sum_{i=1}^{K} Wi$ - Sum of the weightages of the adopted practices where K is the number of adopted practices by each farmer

$\sum_{i=1}^{n} Wi$ - Sum of the weightagesof the selected practices where n is the number of se-

lected practices which is eighteen

L_i - Proportion of years since when the respondent is following the i^{th} Practice (value ranging from 0 to 1)

A_i - Proportion of area in which the respondent is following the i^{th} practice (0 to 1)

3.3.5 Operationalisation and measurement of independent variables

3.3.5.1 Age

This was operationally defined as the number of years the respondent has actually completed at the time of interview.

This was measured directly by asking the respondent the number of years he or she has completed at the time of investigation.

3.3.5.2 Education

This was operationalised as the extent of formal education acquired by the respondent.

It was measured by assigning scores for different levels of education. The categorisation of the respondents and the corresponding scores assigned are as follows.

Level of Education	*Score*
Illiterate	0
Primary level	1

Secondary level	2
Collegiate	3

3.3.5.3 Main occupation

The professional status of agriculture for a farmer respondent was measured by this variable. It refers to whether agriculture is the respondent's primary occupation or not.

The scoring procedure followed was

Agriculture as primary occupation	1
Agriculture as secondary occupation	0

3.3.5.4 Farming experience

This variable was measured as the number of years since the farmer has been involved in the cultivation of crops.

3.3.5.5 Annual income

This indicates the total annual earning of the respondent expressed in rupees from both farm and non-farm enterprises put together.

3.3.5.6 Area under cowpea

Area under cowpea was quantified in terms of the area owned and leased in by the

farmer particularly for the cultivation of cowpea at the time of interview and it was measured in acres.

3.3.5.7 Exposure to information sources

This refers to an individual's contact with various sources of information ie, his/her mere exposure to various sources.

Scores of 0,1 and 2 were given for responses never, occasionally and regularly respectively for each information source.

3.3.5.8 Irrigation index

Irrigation index is the extent to which cowpea is being irrigated.

For quantifying this variable, the procedure developed by Geethakutty (1993) was used. Two dimensions viz.,availability of irrigation water and area covered under irrigation are considered for this purpose. The scores for these two dimensions are as follows.

1. ***Availability of irrigation water***

Throughout the year	2
Partial availability	1
Never	0

2. ***Area irrigated***

75 per cent and above	4

Between 74.99 and 50.00	3
Between 49.99 and 25.00	2
Below 25 per cent	1

The scores obtained by a farmer for the availability of irrigation water and area under irrigation are multiplied to get the irrigation index.

3.3.5.9 Social participation

It was operationally defined as the degree of involvement of respondent in formal and informal social organisations either as a member or as office bearer which also includes their degree of participation in organisational activities.

The scale used by Subramaniam (1986) was adopted with necessary modifications. The scoring procedure is given below.

1. ***Membership in organisation***

No membership in any organisation	0
Membership in each organisation	1
Office bearer in each organisation	2

2. ***Frequency of attending meetings***

Never attending in any meeting	0
Occasionally attending a few	1
Regularly attending all meetings	2

The final score of the respondent was obtained by mulptiplying the score of item no.1 with that of item no.2 for each organisation and then summed up.

3.3.5.10 Extension orientation

It was the extent of contact of a farmer with different extension agencies and their participation in various extension activities or programmes like meetings, seminars etc.

This was measured by using the scoring procedure followed by Bhaskaran (1979). He measured extension orientation by taking into account both extension contact and extension participation. The scoring pattern is as given below.

1. Extension contact

Category of personnel	Frequency of contact		
	Often (2)	Frequently (1)	Never (0)
i. Scientist			
ii. Agricultural officer			
iii. Agricultural assistant			
iv. Others			

2. Extension participation

Activities	Whenever conducted (2)	Sometimes (1)	Never (0)
i. Study tours			

ii. Seminars

iii. Farm fair

iv. Group farming meetings

v. Demonstration

vi. Master farmers' training classes

vii. Others (specify)

The scores for extension orientation for a respondent was arrived at by adding up the scores for extension contact and extension participation.

3.3.5.11 Economic motivation

Economic motivation referred to the extent to which an individual is oriented towards achievement of the maximum economic ends such as maximisation of farm profits.

This was measured using Supe's scale (1969) with modification in the scoring procedure. Instead of a five-point continuum of response as developed by Supe, a dichotomy of 'Yes' or 'No' response pattern was used as done by Prasad (1983). The scale consisted of 6 statements of which 5 statements were positive, while the last one was negative. A score of 'one' was assigned for the 'Yes' response and 'Zero' score for the 'No' response in the case of positive statement. The scoring pattern was reversed in the case of negative response. The score obtained on each statement were commutated to obtain the total score of a respondent on this variable. The maximum score that could be obtained by a respondent was six and minimum zero.

3.3.5.12 Innovativeness

Innovativeness was operationally defined as the degree to which a farmer is relatively earlier in adopting new ideas. The procedure developed by Singh (1977) was used to measure the innovativeness of a farmer. The question asked was,

"When would you prefer to adopt an improved practice in farming?"

Three responses are given with scoring procedure as follows.

1.	As soon as it is brought to my knowledge	3
2.	After I have seen some other farmers using it successfully	2
3.	Prefer to wait and take my own time	1

3.3.5.13 Cosmopoliteness

It was defined as the degree to which a farmer is oriented to his immediate outside social system, such as visiting to the nearest town, purpose of visit etc.

It was measured using the scale developed by Desai (1961) with slight modifications in the weightages given.

The scoring procedure followed was

(a) Frequency of visiting the nearest town

Twice or more times a week	5
Once in a week	4
Once in a fortnight	3
Once in a month	2
Very rarely	1
Never	0

(b) Purpose of visit

All visits relating to agriculture	4
Some relating to agriculture	3
Personal or domestic matters	2
Entertainment	1
Any other purpose	0

The scores obtained are summed up to get the final score of the variable.

3.3.5.14 Credit orientation

This refers to the favourable and positive attitude of a cowpea grower towards obtaining credit from institutional sources.

The procedures developed by Beal and Sibley (1967) was adopted in the present study to measure the variable, credit orientation with slight modification in scores assigned. The scores given to the responses along with the set of questions are described below. Give your opinion for the following statements.

i. Do you think a farmer like you should borrow for agricultural purpose?

Yes / No

(2) (1)

ii . In your opinion, how difficult is to secure credit for agricultural purpose?

Very difficult / difficult / Easy / Very easy

(1) (2) (3) (4)

iii. How a farmer is treated when he goes to secure credit?

Very badly / badly / fairly / very fairly

(1) (2) (3) (4)

iv. There is nothing wrong in taking credit from institutional sources for increasing farm production.

SDA / DA / UD / A / SA

(1) (2) (3) (4) (5)

v. Did you use the credit in the last two years for crop production?

Yes / No

(2) (1)

The total score was obtained by summing up the scores obtained for all the responses.

3.3.5.15 Risk orientation

Risk orientation was operationalised as the degree to which the respondent is oriented towards the risk and uncertainty and he exhibits courage to face problems of risk. The scale developed by Supe (1969) was used to measure risk orientation of the respondent.

The scale consists of six statements of which two were negative. The respondents were rated on a five point continuum with scores 4,3,2,1 and 0 for their responses strongly agree, agree, undecided, disagree and strongly disagree respectively. For the negative statements, the scoring procedure was reversed. The scores obtained on each statement were cumulated to obtain the total score. Thus the maximum score that could be obtained for a respondent was 24 and the minimum zero.

3.3.5.16 Participation in Participatory Technology Development (PTD)

PTD was operationalised as a process of purposeful and creative interaction between rural people and outside facilitators which aims to strengthen the capacity of farmers and rural communities, enable them to analyse ongoing processes, and develop relevant, feasible and useful innovations.

Participation in PTD was operationalised as the extent of participation of farmers in the important participatory technologies in cowpea developed by KHDP in the district.

Participation in PTD was measured by asking to the respondent whether he was participating in any of the PTD experiments conducted by KHDP in the district. Four PTD experiments were identified by making discussions with KHDP experts. The response was collected in a dichotomous pattern with a score of 'one' for the 'Yes' response and 'zero' score for 'No' response. The score obtained on each practice was cumulated to obtain the total score of a respondent on this variable. The maximum score that could be obtained by a respondent was four and minimum zero.

3.3.5.17 Perception about PTD

This was operationalised as the meaningful sensation of the respondent about Participatory Technology Development which is introduced by KHDP in the district.

An arbitrary scale developed was used for measuring this variable. The scale consisted of six statements of which one was positive. The response were collected on a two-point continuum with scores '2' for agree and '1' for disagree response for the positive statement. The scoring pattern was reversed in the case of negative statement. The score obtained on each statement was cumulated to obtain the total score of a respondent on this variable. The maximum score that could be obtained by a respondent was twelve and minimum six.

3.4 Constraints in the cultivation of cowpea

Meera (1995) identified constraints in the adoption of plant protection technology by finding the frequency of responses for each constraint which were ranked to facilitate easy

inference.

In the present study, the constraints in the cultivation of cowpea as experienced by the farmers were identified by following the method adopted by Meera (1995). A list of constraints collected through review of literature, discussion, experience of the researcher and pilot study were given and the respondents were asked to indicate whether they were experiencing the constraints or not in the cultivation of cowpea. The frequency of responses for each of the constraint was found separately and ranked.

3.5 Methods used for data collection

The data pertaining to the present study were collected in two stages.

Stage I. The first stage was meant for the collection of data pertaining to the first objective of the study ie, generating comprehensive feedback regarding the practices followed by the farmers in the cultivation of cowpea.

For this purpose, 40 well-experienced cowpea farmers were selected using purposive sampling procedure from the most known vegetable cultivating area in the district. Non-participant observation technique was followed for data gathering. In non-participant observation technique, the researcher will be always with the farmer from the initial to final stage of the crop and collect data then and there itself.

A structured interview schedule was prepared in English and translated to Malayalam for collecting data from the farmers regarding their profile characteristics. The interview sched-

ule was prepared after discussing with experts. Necessery modifications were made after pre-testing in a non-sample area where the conditions are similar. The data were collected through personal interview by the researcher using the final interview schedule.

Stage II. This was meant for the collection of data pertaining to the second objective of the study ie., assessment of socio-economic and technical aspects of the farmers' practices as perceived by the farmers, researchers and extension personnel. For collecting the data regarding the perception of researchers and extension personnel about the farmers' practices a proforma was prepared after discussions and used with necessary modifications. Perception of farmers about the socio-economic and technical aspects of the farmers' practices were collected using both personal interview and non-participant observation technique.

3.6 Statistical tools used for analysis

The data collected from the respondents were scored, tabulated and analysed using suitable statistical methods. The statistical analysis was done using computer facilties available at the College of Agriculture, Vellayani.

The following statistical methods were used in this study based on the nature of the data and relevant information required.

Mean

The mean scores for all the variables were worked out to make suitable comparisons wherever necessary.

Percentage analysis

The percentage analysis was done to make simple comparison wherever necessary.

Correlation analysis

Correlation coefficient is a measure of the association between two variables. The correlation coefficient was worked out to measure the relationship between the dependent variables knowledge and adoption and the independent variables.

In order to test the significance of the observed correlation coefficient, the students' t test at (n-2) degrees of freedom was used.

Multiple Regression Analysis

Multiple regression analysis was carried out to determine the combined contribution of the independent variables considered for the variations in the dependent variables. It was also carried out to find the variables which have contributed singificantly for the changes in the dependent variables.

The square of the multiple correlation coefficient(R) ie., the coefficient of determination (R^2) was worked out which represented the proportion of the total variation explained bythe independent variables in the regression equation taken together. The following prediction equation was used in the present study to determine the multiple regression.

$Y = a+b_1x_1+b_2x_2+..... b_nx_n$

where a = constant

b_i = *the coefficient which appears in the equation which represents the amount of change in Y that can be associated with unit increase in 'x_i' with the remaining independent variables held fixed.*

Step-wise regression analysis

This was done to know the relative effect of the independent variables at each stage in predicting the dependent variable and for elimination of unimportant variables.

RESULTS AND DISCUSSION

CHAPTER- IV

RESULTS AND DISCUSSION

This chapter deals with the results obtained in the study and the discussion based on the results. Keeping the objectives in view, the findings as well as the discussion on them are presented in the following sequence.

4.1 Identification of farmers' practices in the cultivation of cowpea.

4.2 Techno-socio-economic assessment of farmers' practices

4.3 Efficiency of farmers' practices as perceived by the farmers and researchers and ex tension personnel

4.4 Ecofriendliness of farmers' practices as perceived by the farmers

4.5 Profile analysis of the farmers

4.6 Knowledge of farmers about the selected recommended practices

4.7 Extent of adoption of efficient farmers' practices

4.8 Relationship of knowledge of recommended practices and adoption of efficient farm ers' practices with selected independent variables

4.9 Constraints in the cultivation of cowpea

4.1 Identification of farmers' practices in the cultivation of cowpea

4.1.1 Seed selection

1. Collection of seeds from farmers' own field or neighbouring field.

This is because of the yield assurance, quality, marketability and keeping quality of the produce obtained in the previous year.

2. Preference for the variety 'Haritha'.

'Haritha' is a variety which is named by the farmers themselves. Some farmers consider this as 'Kurutholapayar'. As per the opinion of some farmers and technical assistant of KHDP, this was introduced in the area by KHDP. The reasons for the preference of this variety are increased number of seeds per pod (21-28 no. / pod), stable green colour and thin skin; hence more preferred for export. Sixty to Sixtyfive pods weigh one kg. Even if it is harvested after one day, there will be no damage for the pods.

4.1.2 Seed treatment

1. Drying the pods for four to six days.

The pods are dried for four days ie, two days under sunshine and two days under partial shade. If the intensity of sunshine is less, the farmers dry the pods for six days. Both excessive and improper drying are harmful. This will reduce the ability of the seeds to germinate (slow down the germination process). More than fifty percent of the researchers and extension personnel consider this as an efficient practice.

2. Subjecting the pods under storage to sunshine.

This is done to protect the seeds from the attack of storage pests.

3. Inoculation of cowpea seeds with rhizobium

This is a very efficient and recommended practice and hence the rationality need not be explained.

4. Pelleting of cowpea seeds with lime.

This is a recommended practice.

5. Seed treatment with Bavistin(Carbendazim).

Seeds are treated with Bavistin at the rate of 2 g per kg seed for 24 hours before sowing. Farmers believe that this will effectively control wilt, collar rot, basal swelling and anthracnose of cowpea. Scientists also agree with this belief.

4.1.3 Seed storage

1. Storing the seeds in sacks (gunny bags) or tins.

Mainly tins are preferred for storing the seeds because this will prevent the attack of rats and storage pests.

2. Storing seeds along with the pods.

After proper drying the seeds are stored in the pods itself. Farmers opine that it will be difficult for the insect pests to pierce the hard pods and thus prevent the attack of storage pests.

3. Hanging the sacks (gunny bags) with the dried pods.

This practice is very effective in controlling the storage pests of cowpea. According to the scientists this is a rational practice because this will help in lengthening the viability of seeds and also protecting the seeds from storage pests.

4. Smoking the seeds by hanging the sacks above 'Kalladuppu'.

Farmers believe that this will prevent the attack of storage pests as well as fungus growth. This is a traditional practice and some farmers are following this practice nowadays also. This is an efficient practice as per the opinion of scientists and extension personnel.

5. Keeping the seeds by adding DDT or BHC.

Some farmers are still using these pesticides as they believe that these will control the storage pests of cowpea. Researchers also agree with the belief of these farmers. Since they are mixing the insecticides with the seeds, there is no ill effect. BHC being a banned chemical and DDT has restricted use for public health purpose, this practice will not last for long. The farmers are compelled to use these pesticides because chance for Bruchus beetle attack in cowpea seeds is very high.

6. Storing seeds of cowpea with split seed-coat pieces of cashew *(Anacardium occidentale)*

Cowpea seeds after drying in the sun for four to six days are kept in gunny bags with split seed-coat pieces of cashew. The oil content in cashew nut seed coats has a heat conserving and pungent effect which repels the storage pests. This may be the reason for the adoption of this practice by the farmers. Some farmers also add ash. Abrasive materials like ash controls all insects because the insects die due to descication. Researchers consider this as a rational practice.

7. Mixing moringa leaves with stored seeds.

After properly drying cowpea seeds leaves of moringa *(Moringa pterygosperma)* are added and then seeds are stored in gunny bags.

8. Mixing neem leaves with stored seeds.

Neem leaves possess strong insect repellant action and hence the practice of mixing neem leaves with seeds of cowpea is an insurance against the attack of storage pests. Neem will act as antifeedant, repellant, suppressant and oviposition deterrant.

9. Storing seeds of cowpea with some black pepper seeds.

By mixing the black pepper seeds with cowpea seeds, the insect pests can be ward off well. The insect repellant properties may be the effect of pungent principle piperine in pepper.

10. Keeping some mango leaves along with seeds of cowpea.

Farmers believe that the stain in mango leaves prevents the attack of storage pests. This is believed to be a very effective practice in controlling storage pests of cowpea.

11. Keeping the dried pods for three to five months before sowing.

Some farmers believe that three to five months storage is beneficial for proper germination of cowpea seeds. But scientists opined that mostly the farmers go in for rotation. Thus there will be a gap of four to five months between two cowpea crops. So farmers are compelled to store the seeds with the known practices.

4.1.4 Land Preparation

1. Ploughing the land after adding lime.

Farmers believed that liming is a panacea to all crop diseases. Liming increases the p^H and controls the growth of several fungi and insect pests. Most of the farmers add lime at the rate of one kg per cent. Scientists found that application of lime had some chance in reducing basal swelling and wilt of cowpea. About 86 per cent of the extension personnel also consider this as an efficient practice. Above all, application of lime at the time of first ploughing is a recommended practice.

2. Ploughing the land thoroughly two to three times.

This is a scientifically recommended practice and hence very rational. This is usually done to remove weeds and stubbles.

3. After ploughing keeping the land as such for five to seven days.

This practice is suitable for the destruction of pests and their larvae. This will expose the soil pests for predatory birds, dogs etc. In addition to this, there will be some solarization effect.

4. Burning basins before sowing

During summer season, just before raining basins are taken, dry leaves, twigs etc. are burned to ash on these basins. This practice serves two purposes according to the farmers. 1) Field sanitation 2)Adds fertility to the soil. As per the opinion of extension personnel and researchers also, this is a rational practice as it increases soil K and reduces the soil inoculum

of disease causing soil fungi. This also destroys many pests and weeds.

4.1.5 Planting

1. Taking pits at a distance of 1.5 to 2 ft (45 to 60 cm) for sowing.

The recommended spacing is 45 cm between rows and 15 cm between plants. The above practice agrees with this and hence rational also.

Some farmers take pits at a closer distance. This is done to compensate the loss in yield due to the non-germination of some seeds. But farmers experienced that the more the spacing between the plants, the more healthier will be the crop. The reason may be the availability of sunshine and reduced incidence of diseases.

2. Sowing four to six seeds per pit.

This practice is also done to compensate the yield loss when some seeds are not germinated. Hence the practice may be rational. After fifteen days, only two to three plants are maintained per pit. This will reduce the competition for nutrients among the plants. Maintaining two plants per pit is a recommended practice also.

4.1.6 Manures and fertilizers

1. Basal application of cattle manure or poultry manure.

Most of the farmers apply cattle manure at the rate of one kg per pit. Some farmers use poultry manure along with cattle manure. Farmers believed that the quantity of nitrogen is more in cattle manure. This is also believed to be effective in controlling the collar rot of cowpea and in reducing the pest attack. Scientists opined that basal application of cattle

manure favours the prolonged availability of nutrients to the plants and the dose applied by the farmers is 37 t/ha as against the recommended dose of 20 t/ha. The bulk of the poultry manure available for the farmer is made with a mixture of either saw dust or sand which reduces the quality. This may be the reason why the farmers consider that the nitrogen content is more in cattle manure.

2. Applying poultry manure ten days after sowing.

Poultry manure at the rate of one kg per plant is applied ten days after sowing after intercultural operations like weeding. The rationality is very well explained because the growth of the crop will be more because of the calcium content in poultry manure when compared to cattle manure. The nutrients contained in the poultry manure is more easily available in the area.

3. Application of neem cake, groundnut cake and bonemeal twenty days after sowing.

According to farmers, application of neem cake considerably reduces pests and diseases in cowpea and groundnut cake increases the weight of fruits. Scientists also experienced that neem cake when applied in several splits has been found to reduce the incidence of soil fungus. This may be due to the enhanced growth of antagonistic fungi. Bonemeal increases the weight scientists also experienced that neemcake when applied in several splits of fruits and supplies phosphorus for the plants. They also opined that more yield will be obtained by using these three. As per the opinion of some farmers, there is no need of fertilizers during summer season if neem cake is applied. Fertilizers can be applied after observing the growth. But scientists opined that probably in such farmers' field, they may be getting the

residual effect of the huge quantity of organic manure added to the soil during the previous seasons. Split application of fertilizers after observing the growth of the plant has been found to yield good results when compared to the blanket fertilizer recommendation.

4. Applying fresh cowdung at the time of flowering.

Fresh cowdung at the rate of one basket per twenty plants are applied at the time of flowering (35 days after sowing). Dried cowdung will not be available to the plants quickly and that may be the reason for the application of fresh cowdung. But fresh cowdung should be applied at a distance of 5 cm away from the base of the plant. Otherwise the plants will be destroyed by the attack of larvae of pests in fresh cowdung.

5. Applying one kg ash per plant forty days after sowing .

Ash in general controls all insects. This is worth to be considered as a plant protection measure. This practice needs further investigation. Scientists opined that apart from making available potassium and other micronutrients wood ash will help in correcting the soil reaction and thereby making the soil nutrients available to the plants.

6. Manuring with a mixture of green leaves and fresh cowdung.

Farmers believe that this will increase the duration of the crop upto 120 days. Green leaf manuring also reduces pests and diseases. As per the opinion of the scientists, wherever organic manure is added in sufficient quantities with reduced split application of fertilizers taking into consideration the growth of the plants, there is tendency for the crop to give yield for prolonged duration eventhough the growth of the plants in the initial stage is slow.

7. Application of mussoriephos instead of factamphos for meeting the requirement of phosphorus.

Some farmers opined that mussoriephos is very effective than factamphos and only two applications are necessary. Factamphos will give more green colour compared to mussoriephos. This may be altributed to the reason that factamphos contain both nitrogen and phosphorus. Nitrogen will give green colour to the pods. In the case of mussoriephos, phosphorus is the main ingredient. Calcium contained in the mussoriephos will be helpful in correcting the soil reaction. Since mussoriephos is acid soluble, it is more suitable to our soils (acid soils).

8. Applying more fertilizers if the fruits have less weight.

This is a farmers' practice where urea will be added more when the fruits have less weight. The increase in weight may be due to the increase in water content of the fruits. But such fruits should be easily marketed because the keeping quality will be reduced by this practice. So this practice is not efficient as per the opinion of researchers and extension personnel.

4.1.7 Trailing

Trailing the crop twenty days after sowing.

As the crop shows trailing tendency, twenty days after sowing the crop is trailed using bamboo, rope and metal wire.

4.1.8 After cultivation

1. Hoeing at the time of application of fertilizers.

The main purpose of this practice is to incorporate the fertilizers with the soil. This will provide adequate aeration. Weeding is also done along with this. Sand from the channel will be added to the basins and this will help in the development of more healthy plants.

2. Burning waste leaves and twigs in the adjacent field.

Farmers believe that waste leaves and twigs burnt in the adjacent field in the direction of wind will induce more flowers on cowpea. Most of the researchers and extension personnel consider this as an efficient practice. This practice needs further investigation as it is not scientifically explained.

3. Removal of excess leaves in cowpea.

This practice will induce early flowering on cowpea as per the opinion of the farmers. According to the scientists also this is a rational and efficient practice as it reduces the vegetative growth and encourages the reproductive growth.

4.1.9 Plant protection

1. Applying Bordeaux mixture or Phytolan against fungal diseases during rainy season.

1% Bordeaux Mixture is prepared and applied to the base of the plant so that the roots will get it and also on the leaves and twigs. Most of the farmers are following this practice. Scientists opined that major problems in cowpea are basal swelling, wilt and anthracnose. So the efficiency of this practice will be very high.

2. Drenching the basins using Bordeaux Mixture or Phytolan ten days before sowing.

1% Bordeaux Mixture is used for drenching the basins. About 100 g phytolan powder dissolved in 10-15 l water and one litre per pit is used for drenching. Farmers reported 75 per cent success with this practice in controlling wilt, collar rot, basal swelling and anthracnose. But according to the scientists, farmers are using over dose of phytolan, the correcrt dose being 0.4%.

3. Crop rotation using other vegetables like bitter gourd, amaranthus etc.

Most of the farmers are accepting and adopting this practice and this is found to be very efficient in controlling the serious attack of collar rot and wilt.

4. Drenching the base of the plant at the time of twining with copper oxychloride (phytolan) 0.4% and swaying the plants with the same chemical at same concentration.

This is a very efficient practice according to the scientists also in controlling wilt, collar rot, basal swelling and anthracnose.

5. Spraying neem oil emulsion at a concentration of 10%.

This is a scientifically proven practice and is very efficient in controlling pea aphids which are the vectors of mosaic disease. It is found that the intensity of mosaic disease is very much reduced by the application of neem oil emulsion. This practice is communicated to the farmers and is widely accepted by the farmers.

6. Spraying carbaryl to protect the crop from pod borers.

Harvesting of cowpea is done in alternate days. Hence insecticides like carbaryl should

not be applied to the crop after the flowering stage. Only few farmers are following this practice.

7. Application of kelthane against American Serpentine Leaf Miner.

Farmers believe that spraying kelthane at the rate of 4 ml per 4 ℓ water will reduce the attack of American Serpentine Leaf Miner. But researchers disagree with this belief. They opined that kelthane had no effect on American Serpentine Leaf Miner. Kelthane is a specific miticide useful for controlling mites.

8. Spraying neem oil emulsion against American Serpentine Leaf Miner.

Researchers are of opinion that neem oil emulsion will effectively reduce the attack of American Serpentine Leaf Miner. The main components of neem oil emulsion are one ℓ neem oil and 60 g bar soap. This bar soap dissolved in half litre water is throughly mixed with neem oil. The neem oil emulsion thus prepared can be sprayed on the upper and lower sides of leaves.

9. Spraying the plants with Bavistin 0.1% when the plants attain one month age.

As per the opinion of the scientists, this is found to be very efficient in controlling wilt, collar rot, basal swelling and anthracnose of cowpea. Spray application of Bavistin may be discouraged after flowering. Instead of Bavistin, spray application of copper oxychloride at 0.4% can be resorted to.

10. Spraying malathion(0.05%) against pea aphids.

When malathion is added, the matured pods and the pods about to ripen should be

harvested and a waiting period of 3 days should be given before harvesting. This is a recommended practice and hence considered to be efficient also.

11. Applying garlic against pod borers.

The pest repellant properties may be due to the effect of pungent principles like allen in garlic. The foul smell of garlic will remain for a long time also. This may repel the pod borers.

12. Spraying malathion-garlic mixture against leaf caterpillars during winter season.

20 g well-ground garlic is dissolved in one litre water. After filtering this solution, 4 ml malathion per one litre solution is mixed with this and is sprayed on the lower side of the leaves in small drops. This practice according to the scientists will definitely control leaf caterpillars.

13. Application of garlic-chilly extract.

Sucking pests of cowpea can be effectively controlled by the application of an aqueous extract of garlic-chilly mixture.

14. Spraying indofil against the disease 'Karivalli'(anthracnose)

Farmers believe that spraying indofil at the rate of 50 g per 10 ℓ water will effectively control the disease 'karivalli' which is nowadays a serious problem. According to the scientists, effective control of the disease can be obtained by seed treatment with Bavistin and spray application of Bavistin one month after sowing or based on need.

15. Dusting wood ash over cowpea.

During early morning, wood ash is dusted over leaves of cowpea. Farmers believe that this practice would be helpful in controlling vegetable pests.

16. Application of extract of *Leucas aspera.*

The extract of Thumba *(Leucas aspera)* is taken and mixed with soap solution and is sprinkled over the crop. Farmers opined that this practice is very effective in controlling many of the pests attacking cowpea. *Leucas aspera* may be acting as a repellant. Scientists opined that this practice is worth to be considered as an important component of IPM standards for cowpea.

17. Dusting fine sand over leaves of vegetables.

During early morning fine sand is dusted over leaves of vegetables without damaging the twigs, leaves etc. This is for protecting the plants from insect attack and also to enhance the growth of the plant. Fine sand will act as desicant.

18. Spraying tobacco decoction against pea aphids.

Farmers believe that this will effectively control pea aphids and other soft-bodied insects. Tobacco decoction can be prepared by the following method. Half kilogram tobacco cut into small pieces and soaked in 4.5 litres of water for one day. The extract of tobacco is taken by pressing these tobacco pieces. To this, a solution of 120 g bar soap dissolved in water and mixed well. This mixture is diluted with 6-7 times water and sprayed over the crop.

19. Spraying the extract of Hyptis *(Hyptis suaveolens)* over cowpea

The extract of Hyptis is taken from the tender twigs and leaves. Sixty g bar soap

dissolved in half litre water and the solution is mixed with 1 ℓ extract of Hyptis. This is diluted with ten times water and is sprayed over the crop. Very effective in controllig aphids and adults of stem flies.

20. Hanging polythene covers on pandals against bird pests.

With the blow of wind, the polythene sheet flaps and flutters and the sound that is produced ward off birds. As per the opinion of scientists it is a very rational practice.

21. Covering with nets inorder to protect the crop from birds.

Eventhough it is a very efficient and rational practice it is not practical in large scale cultivation of cowpea.

4.2 Techno-socio-economic assessment of farmers' practices

In accordance with the main objective, the technological, social and economic aspects of the farmers' practices were studied and the results in this regard are presented in table 1.

A critical glance on the table reveals that the practice' application of neem cake, groundnut cake and bonemeal twenty days after sowing' (index 10.26) registered the highest index followed by the practices 'spraying neem oil emulsion against American Serpentine Leaf Miner' (index 9.82) and 'ploughing the land after adding lime' (index 9.59). In general, almost all bio farming practices recorded high scores compared to the practices involving chemicals.

The table also reveals that the practices 'application of neemcake, groundnut cake and bonemeal twenty days after sowing' (index 3.53), 'applying more fertilizers if the fruits have

Sl. No.	Farmers' practices
I. 1.	**Processing of seeds:-** Drying the pods for four to six days
2.	Hanging the sacks (gunny bags) with the dried pods
3.	Smoking the pods by hanging the sacks above `Kalladuppu'
4.	Keeping the seeds by adding DDT or BHC
5.	Keeping th dried pods for three to five months before sowing.
II. 6.	**Land preparation:-** Plouging the land after adding lime
III. 7.	**Manures and fertilizers :-** Basal application of cattle manure or poultry manure.
8.	Application of poultry manure ten days after sowing
9.	Application of neem cake, groundnut cake and bonemeal twenty days after sowing.
10.	Burning waste leaves and twigs in the adjacent field.
11.	Applying fresh cowdung at the time of flowering.
12.	Applying one Kg ash per plant forty days after sowing.
13.	Applying more fertilizers if the fruits have less weight.
IV. 14.	**Plant protection:-** Covering with nets inorder to protect the crop from birds.
15.	Hanging polythene covers on pandals to scare the birds.
16.	Using banana fruit traps to protect the fruits from squirrels.
17.	Application of kelthane against American Serpentine Leaf Miner.
18.	Spraying neem oil emulsion against American Serpentine Leaf Miner.
19.	Applying garlic against pod borers.
20.	Using turpentine against pod borders.
21.	Spraying kelthane against aphids.
22.	Spraying malathion - garlic mixture against leaf caterpillars during winter season.
23.	Spraying dicofol or kelthane for controlling mosaic disease.
24.	Applying Bordeaux Mixture or Phytolan against fungal diseases during rainy season.
25.	Spraying indofil against the disease `Karivalli.'

Table 1. Techno-socio-economic assessment of farmers' practices

	Farmers' practices																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Technological index	3.13	2.88	2.60	2.25	1.93	3.33	3.38	3.15	3.53	2.80	3.20	3.15	3.50	2.88	2.85	1.93	2.12	3.30	3.03	2.08	2.18	3.33	2.76	3.18	3.15
Social index	2.40	2.13	2.05	1.98	2.43	2.88	2.90	3.13	3.35	2.35	2.88	2.70	2.80	2.93	3.05	3.03	2.13	3.38	3.13	2.73	2.10	3.20	2.03	3.00	3.03
Economic index	3.15	3.13	3.00	2.65	2.03	3.38	3.03	2.95	3.38	2.25	3.35	3.13	3.15	2.85	2.73	2.28	2.38	3.14	3.05	2.28	2.15	3.00	2.08	3.13	3.05
Techno-socio-economic index	8.68 (11)	8.14 (14)	7.65 (15)	6.88 (19)	6.39 (23)	9.59 (3)	9.31 (7)	9.23 (8)	10.26 (1)	7.40 (16)	9.43 (6)	8.98 (10)	9.45 (5)	8.66 (12)	8.63 (13)	7.24 (17)	6.63 (21)	9.82 (2)	9.21 (9)	7.09 (18)	6.43 (22)	9.53 (4)	6.87 (20)	9.31 (7)	9.23 (8)

less weight' (index 3.50) and 'basal application of cattle manure or poultry manure' (index 3.38) were considered by the farmers as technologically most efficient. The rationality of these practices were already explained and farmers were getting more yield by adopting these practices.

Farmers perceived the following practices viz., 'spraying neem oil emulsion against American Serpentine Leaf Miner' (index 3.38), 'application of neemcake, groundnut cake and boenemeal' (index 3.35) and 'spraying malathion-garlic mixture against leaf caterpillars' (index 3.20) as socially most efficient. These practices were widely adopted by the farmers. Because of more social efficiency, these practices spread easily among the farmers.

A cursory look at the table reveals that the practices 'ploughing the land after adding lime' and 'application of neem cake, groundnut cake and bonemeal twenty days after sowing' (index 3.38) registered the highest index for economical efficiency followed by the practices 'applying fresh cowdung at the time of flowering' (index 3.35) and 'applying more fertilizers if the fruits have less weight' (index 3.15).

In addition to this, there are some practices viz., 'spraying tobacco decoction against pea aphids' and 'spraying the extract of *Hyptis sauveolens* over cowpea' which were recently practised by the farmers and considered to be very efficient. As per the opinion of scientists, these practices are worth to be considered as important components of IPM.

4.3 Efficiency of farmers' practices as perceived by the farmers and researchers and extension personnel.

The results presented in Table 2 reveal the efficiency of farmers' practices as per-

Table 2. Efficiency of farmers' practices as perceived by the farmers and researchers and extension personnel

Sl. No.	Farmers' practices	Efficiency as perceived by			
		farmers (n = 40)		researchers and extension personnel (n = 50)	
		Mean Score	Rank	Mean Score	Rank
I. 1.	**Processing of seeds:-** Drying the pods for four to six days	3.55	1	3.54	2
2.	Hanging the sacks (gunny bags) with the dried pods	2.40	19	3.04	7
3.	Smoking the pods by hanging the sacks above 'Kalladuppu'	1.93	21	2.86	13
4.	Keeping the seeds by adding DDT or BHC	2.75	15	1.92	23
5.	Keeping th dried pods for three to five months before sowing.	3.20	6	3.02	8
II. 6.	**Land preparation:-** Plouging the land after adding lime	3.13	9	3.14	5
III. 7.	**Manures and fertilizers :-** Basal application of cattle manure or poultry manure.	3.50	3	3.76	1
8.	Application of poultry manure ten days after sowing	3.18	7	3.30	3
9.	Application of neem cake, groundnut cake and bonemeal twenty days after sowing.	3.53	2	3.10	6
10.	Burning waste leaves and twigs in the adjacent field.	2.80	14	3.00	9
11.	Applying fresh cowdung at the time of flowering.	3.15	8	2.58	16
12.	Applying one Kg ash per plant forty days after sowing.	3.15	8	2.88	12
13.	Applying more fertilizers if the fruits have less weight.	2.25	20	2.18	20
IV. 14.	**Plant protection:-** Covering with nets inorder to protect the crop from birds.	3.33	5	2.54	17
15.	Hanging polythene covers on pandals to scare the birds.	2.85	13	2.92	11
16.	Using banana fruit traps to protect the fruits from squirrels.	2.25	20	2.66	15
17.	Application of kelthane against American Serpentine Leaf Miner.	2.73	16	1.90	24
18.	Spraying neem oil emulsion against American Serpentine Leaf Miner.	3.10	10	2.96	10
19.	Applying garlic against pod borers.	2.58	18	2.76	14
20.	Using turpentine against pod borders.	2.88	12	2.12	21
21.	Spraying kelthane against aphids.	3.03	11	2.36	19
22.	Spraying malathion - garlic mixture against leaf caterpillars during winter season.	3.33	5	2.92	11
23.	Spraying dicofol or kelthane for controlling mosaic disease.	2.60	17	2.08	22
24.	Applying Bordeaux Mixture or Phytolan against fungal diseases during rainy season.	3.38	4	3.18	4
25.	Spraying indofil against the disease 'Karivalli.'	3.10	10	2.42	18

ceived by the farmers and researchers and extension personnel.

As per the opinion of the farmers 'drying of pods for four to six days' was most efficient (mean score 3.55) followed by the practices 'application of neem cake, groundnut cake and bonemeal twenty days after sowing (mean score 3.53) and basal application of cattle manure or poultry manure' (mean score 3.50). Among the plant protection practices, the practice 'application of Bordeaux Mixture or Phytolan against fungal diseases during rainy season' (mean score 3.38) was perceived to be most efficient followed by the practices 'covering with nets inorder to protect the crop from birds' (mean score 3.33). and 'spraying malathion-garlic mixture against leaf caterpillars during winter season' (mean score 3.33)

With regard to the perception of researchers and extension personnel, 'basal application of cattle manure or poultry manure' (mean score 3.76) was most efficient followed by the practices 'drying of pods for four to six days' (mean score 3.54) and 'application of poultry manure ten days after sowing' (mean score 3.30). The practice 'application of Bordeaux Mixture or Phytolan against fungal diseases during rainy season ' (meanscore 3.18) followed by 'spraying neem oil emulsion against American Serpentine Leaf Miner' (mean score 2.96) were perceived to be most efficient among the plant protection practices.

4.4 Ecofriendliness of farmers' practices as perceived by the farmers

The results indicating the ecofriendliness of farmers' practices as perceived by the farmers are furnished in Table 3.

A critical glance on the table reveals that the practice 'drying of pods for four to six days' registered the highest score for ecofriendliness (mean score 3.63) followed by the prac-

Table 3. Ecofriendliness of farmers' practices as perceived by the farmers

Sl. No.	Farmers' practices	Mean Score	Rank
I. 1.	**Processing of seeds:-** Drying the pods for four to six days	3.63	1
2.	Hanging the sacks (gunny bags) with the dried pods	2.98	6
3.	Smoking the pods by hanging the sacks above `Kalladuppu'	2.43	11
4.	Keeping the seeds by adding DDT or BHC	1.85	19
5.	Keeping th dried pods for three to five months before sowing.	2.85	8
II. 6.	**Land preparation:-** Plouging the land after adding lime	3.25	3
III. 7.	**Manures and fertilizers :-** Basal application of cattle manure or poultry manure.	3.08	5
8.	Application of poultry manure ten days after sowing	2.90	7
9.	Application of neem cake, groundnut cake and bonemeal twenty days after sowing.	3.50	2
10.	Burning waste leaves and twigs in the adjacent field.	2.35	12
11.	Applying fresh cowdung at the time of flowering.	2.60	10
12.	Applying one Kg ash per plant forty days after sowing.	3.13	4
13.	Applying more fertilizers if the fruits have less weight.	2.13	17
IV. 14.	**Plant protection:-** Covering with nets inorder to protect the crop from birds.	3.25	3
15.	Hanging polythene covers on pandals to scare the birds.	2.28	14
16.	Using banana fruit traps to protect the fruits from squirrels.	2.33	13
17.	Application of kelthane against American Serpentine Leaf Miner.	2.15	16
18.	Spraying neem oil emulsion against American Serpentine Leaf Miner.	2.98	6
19.	Applying garlic against pod borers.	2.90	7
20.	Using turpentine against pod borders.	2.25	15
21.	Spraying kelthane against aphids.	2.08	18
22.	Spraying malathion - garlic mixture against leaf caterpillars during winter season.	2.25	15
23.	Spraying dicofol or kelthane for controlling mosaic disease.	2.35	12
24.	Applying Bordeaux Mixture or Phytolan against fungal diseases during rainy season.	2.90	7
25.	Spraying indofil against the disease `Karivalli.'	2.70	9

tices 'application of neem cake, groundnut cake and bonemeal twenty days after sowing' (mean score 3.50) and 'covering with nets inorder to protect the crop from birds' (mean score 3.25)

Among the plant protection practices, the practice 'covering with nets inorder to protect the crop from birds' was most ecofriendly (mean score 3.25) followed by the practice 'Spraying neem oil emulsion against American Serpentine Leaf Miner' (mean score 2.98).

It may be inferred from the results that the farmers selected for the study purpose were aware of the detrimental effects of pesticides on man, animals, birds, fish and their ecosystem. Among the practices having highest mean scores for ecofriendliness, there was not even a single practice which includes the use of pesticides. Eventhough some farmers are aware of the ill-effects of pesticides and fertilizers, there is an urgent need to achieve effective pest control and curb possible adverse effect on the environment and for that the concept of 'Integrated Pest Management (IPM)' technique should be made popular. This could be encouraged through popularising biological pest control, diverting more researchers into this area and through governmental policies such as identifying the most poisonous pesticides and putting a ban and also restricting the use of pesticides in a sustainable way. Another way of restricting the use of pesticides is by educating the farmers through on and off-campus training programmes on IPM to safeguard man and environment from the hazards of these chemicals.

4.5 Profile Analysis of the farmers

4.5.1 Age

It was revealed from the table that more than fifty per cent (52.5 per cent) of the farmers come under the age group above 44 and remaining under below 44. But there is not much difference in the number of farmers under both these groups.

4.5.2 Education

Majority (72.5 per cent) of the farmers were having secondary school or higher level of education where as only 27.5 per cent of the farmers were having education upto primary level or below.

Since Kerala is the state having high literacy rate, majority of the people will get at least primary level of education and drop outs will occur only after primary level. Formal education develops mental power and character of individuals. Thus more the growers are literate and educated better will be their proneness to accept innovation in agriculture.

4.5.3 Main occupation

The farmers selected for this study were mainly cowpea cultivators and the area selected is well-known for vegetable cultivation in the district. It was observed from the table that more than 82 per cent of the farmers were having agriculture as their main occupation and it is quite logical also.

4.5.4 Farming experience

The table depicted that more than fifty per cent (55 per cent) of the farmers were

Table 4. Profile analysis of the farmers

Sl. No.	Variable	Mean Score	Category	Respondents	
				Frequency	Percentage
1.	Age	43.55	Low < mean	19	47.5
			High ≥ mean	21	52.5
2.	Education	1.78	Low < mean	11	27.5
			High ≥ mean	29	72.5
3.	Main occupation	0.83	Low < mean	7	17.5
			High ≥ mean	33	82.5
4.	Farming experience	21.50	Low < mean	22	55.0
			High ≥ mean	18	45.0
5.	Annual income	374.45	Low < mean	25	62.5
			High ≥ mean	15	37.5
6.	Area under cowpea	0.33	Low < mean	25	62.5
			High ≥ mean	15	37.5
7.	Exposure to information sources	13.75	Low < mean	18	45.0
			High ≥ mean	22	55.0
8.	Social participation	5.90	Low < mean	18	45.0
			High ≥ mean	22	55.0
9.	Extension orientation	12.75	Low < mean	19	47.5
			High ≥ mean	21	52.5
10.	Economic motivation	4.70	Low < mean	15	37.5
			High ≥ mean	25	62.5
11.	Innovativeness	2.18	Low < mean	25	62.5
			High ≥ mean	15	37.5
12.	Cosmopoliteness	7.30	Low < mean	25	62.5
			High ≥ mean	15	37.5
13.	Credit orientation	13.70	Low < mean	15	37.5
			High ≥ mean	25	62.5
14.	Risk orientation	15.60	Low < mean	20	50.0
			High ≥ mean	20	50.0
15.	Participation in PTD	1.83	Low < mean	13	32.5
			High ≥ mean	27	67.5
16.	Perception about PTD	10.03	Low < mean	3	7.5
			High ≥ mean	37	92.5

having farming experience below twenty one years. Since majority of the cowpea growers are coming from farm families and they are involved in farming operations at very young age, most of the farmers have high farming experience.

4.5.5 Annual income

The average annual income of the farmers selected was Rs. 37 445 and it ranges from Rs. 30 000 to Rs 60 000. The study revealed that majority (63 per cent) of the farmers were having income below Rs.37 445. The high annual income may be interpreted as due to the high profitability of vegetable cultivation.

The result is in accordance with the findings of Shanmugavadivu (1992), Devi (1994) and Haemalatha (1997).

4.6.6 Area under cowpea

About 38 per cent of the farmers selected were cultivating cowpea in more than 30 cents. The speciality of the location is that the area owned by the vegetable growers ranges from five to fifteen cents. Majority of the vegetable growers were leasing land from land owning farmers for the cultivation of vegetables especially cowpea. This is mainly due to the availability of water throughout the year and the cowpea produced in this area are exported to Gulf countries due to its high quality.

4.6.7 Exposure to information sources

Fifty five per cent of the respondents selected for the study purpose had exposure to information sources. In Kerala due to high literarcy level majority of farm families subscribe

one newspaper, possess radio and television. Majority of the farmers selcted were having high school education and average annual income of more than Rs. 30 000. Hence they would have at least average living conditions. Since the respondents selected were members of the self-help groups of KHDP and Harithasangham they were exposed to seminars, melas etc. and they were frequently contacting KHDP personnel, scientists etc for collecting uptodate information regarding planning, production and marketing aspects of vegetable cultivation especially cowpea.

4.6.8 Irrigation index

All the respondents selected were utilizing the channel irrigation facilities available. Since water is available throughout the year, there is no difference in the irrigation index among the respondents.

4.6.9 Social participation

It can be seen that fifty five per cent of the respondents were having high social participation. All the respondents selected were members of both KHDP and Harithasangham and they were attending meetings frequently.

4.6.10 Extension orientation

More than fifty per cent of the farmers had high extension orientation. Since the selected respondents were members of KHDP self-help group and Harithasangham of State Department of Agriculture they were having frequent contact with the officials of these organizations and were participating in the activities of these organizations.

4.6.11 Economic motivation

Majority of the respondents (62.5 per cent) were having high economic motivation (4.7) and remaining under low category (below 4.7).

The respondents selected for the study purpose were vegetable growers. Cowpea produced from here is exported to foreign countries because of good quality. So their main motive is to harvest maximum from their available land utilizing improved technologies. Moreover these farmers were having frequent contact with extension agency and high mass media participation. All these factors contribute for the high economic motivation score.

4.6.12 Innovativeness

This study established that about 63 per cent of the farmers were having low innovativeness.

4.6.13 Cosmopoliteness

More than 60 per cent of the respondents selected were having low cosmopolite score (< 7.3). The produces were collected by the exporting agency themselves from the KHDP field centre which is located very near to the field and there is no need for going to the town frequently for selling the produces. The inputs required for the cultivation were also procured in bulk by a group of farmers. This might be the reason for low cosmopolite score among the respondents.

4.6.14 Credit orientation

This study established that about 63 per cent of the farmers were having high credit

orientation due to the reason that the high extension orientation might have prompted them to have more credit orientation for practising innovative practices in agriculture. The farmers were aware of the credit facilities and they were getting credits frequently from KHDP.

4.6.15 Risk orientation

It was interesting to note that equal percentage of the respondents had high and low risk orientation. Vegetable cultivation itself is highly risky. Cowpea is harvested within a period of three to four months. If the conditions are favourable, they will get a bumper harvest. Otherwise it will be a complete failure.

4.6.16 Participation in PTD

About 68 per cent of the farmers were having high participation in PTD experiments introduced by KHDP in the area. Since the farmers in this area were very enthusiastic, they were willing to actively participate in KHDP experiments. The farmers were also impressed by KHDP personnel and KHD programme.

4.6.17 Perception about PTD

The table depicted that 92.5 per cent of the farmers were having high perception about PTD. The reason suggested above may be applicable here also.

4.7 Knowledge of farmers about the selected recommended practices

4.7.1 Distribution of farmers based on their knowledge about recommended practices

The distribution of farmers based on their knowldge about the selected recommended practices is shown in table 6.

Table 5. Distribution of farmers based on their knowledge score

Sl.No.	Category		Mean score	Frequency	Percentage
1.	Low	≤ Mean – SD	≤ 9.62	19	47.50
2.	Medium	Mean ±SD	Between 9.62 and 10.44	5	12.50
3.	High	≥Mean + SD	≥ 10.441	16	40.00

Mean – 10.025

S D – 0.41

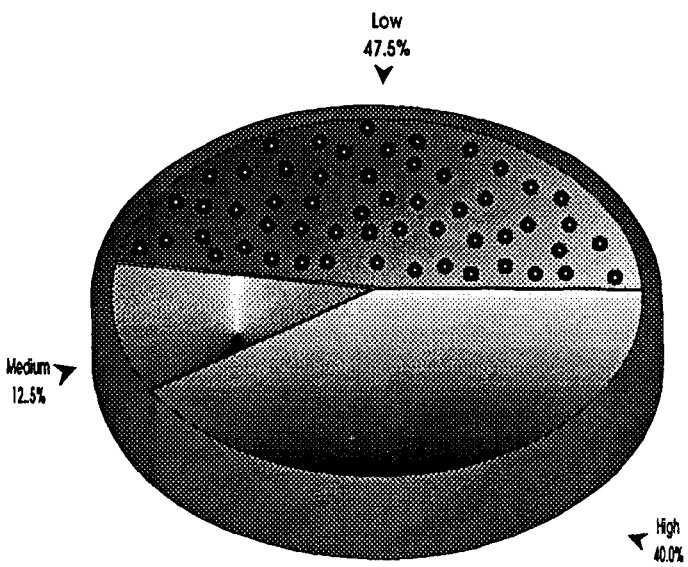

Fig 4. Distribution of farmers based on their knowledge score

The table reveals that 47.5 per cent of farmers belonged to the low knowledge category, 12.5 per cent of farmers were in the medium knowledge category and 40.0 per cent of farmers were having high knowledge about the selected recommended practices. From the data furnished elsewhere in this chapter, it could be noticed that about 45 per cent of respondents had more than twenty one years of farming experience. As these farmers are engaged in vegetable cultivation on a commercial basis for many years, they may be in touch with the innovations in this field.

4.7.2 Percentage of knowledge of farmers about the selected recommended practices

Table 7 shows that three practices viz., 'Sowing after first week of June which is the most suitable time', 'Ploughing the land thoroughly two to three times to remove weeds and stubbles' and 'Hoeing at the time of application of second dose of nitrogen to give adequate aeration' were the most known practices to cent per cent of the farmers selected for the study purpose.

'Spraying Bordeaux Mixture in early stages to protect the crop from fungal diseases' was the next most known practice (95 per cent). Among the plant protection practices, this was the most known practice to the farmers selected for the study purpose.

The practice which was least known to the farmers was 'the application of neem and eupatorium leaves for managing the root knot and reniform nematodes' (30 per cent). In earlier days, nematode infestation was not a serious problem and farmers were not aware of this. Only in recent years, these nematodes attained the status of major pests. But majority of the selected farmers were not familiar with this recommended practice eventhough they knew

Table 6. Percentage of knowledge of farmers about the selected recommended practices

(n=40)

Sl.No.	Items (Practices)	Knowledge	
		Frequency	Percentage
I.	**Season**		
1.	Most suitable time for sowing is after first week of June	40	100.00
II.	**Varieties**		
2.	Important vegetable types are Kurutholapayar, Sharika and Malika	22	55.00
III.	**Seed rate and seed treatment**		
3.	For vegetable types, the seed rate is 20-25 kg/ha	20	50.00
4.	Inoculation of cowpea seeds with rhizobium	26	65.00
5.	Pelleting of cowpea seeds with lime	13	32.50
IV.	**Land preparation**		
6.	Ploughing the land thoroughly 2-3 times to remove weeds and stubbles	40	100.00
V.	**Spacing**		
7.	Spacing of 45 cm between rows and 15 cm between plants	24	60.00
VI.	**Manuring**		
8.	Application of lime at the time of first ploughing	40	100.00
9.	Applying half the quantity of N, full P and K at the time of final ploughing	18	45.00
VII.	**After cultivation**		
10.	Hoeing at the time of application of second dose of N to give adequate aeration	40	100.00
VIII.	**Plant protection**		
11.	Spraying carbaryl to protect the crop from pod borers.	13	32.50
12.	Smearing the seeds with groundnut or coconut oil at 1% for protecting the seeds from storage pests.	14	35.00
13.	Spraying malathion for controlling the pea aphids.	35	87.50
14.	Application of neem and eupatorium leaves for managing the root knot and reniform nematodes.	12	30.00
15.	Spraying Bordeaux Mixture in early stages to protect the crop from fungal diseases.	38	95.00

the principle behind the application of neem. The researchers also were not giving much importance to this practice.

4.8 Extent of adoption of efficient farmers' practices

4.8.1 Distribution of farmers based on their extent of adoption of efficient farmers' practices

The adoption indices of the selected farmers with respect to the efficient farmers' practices were computed and it ranged from 2.84 to 9.81 with mean index 5.42.

The result of the table 8 reveals that 52.5 per cent of the farmers belonged to the low adoption category, 10.0 per cent of the farmers were in the medium category and 37.5 per cent of them were in the high category with respect to adoption of efficient farmers' practices. It could be concluded that farmers who were aware of the recommended practices were adopting the efficient farmers' practices also. Eventhough cent per cent sample farmers selected were aware and symbolically adopted the efficient farmers' practices, only 37 per cent of them adopted it in the actual field condition. This may be due to the various problems existing in their farming situation.

4.8.2 Percentage of adoption of efficient farmers' practices

'Drying of pods for four to six days' was the practice adopted by majority of the farmers (92.5 per cent) in this area. Twelve practices out of eighteen listed in table 9 were adopted by fifty or more than fifty per cent of the farmers.

The table clearly indicates that 'covering with nets inorder to protect the crop from birds' was the least adopted practice (2.5 per cent). Eventhough it is a very efficient practice it

Table 7. Distribution of farmers based on their adoption index

Sl.No.	Category	Mean score	Frequency	Percentage
1.	Low ≤Mean – SD	≤ 5.16	21	52.50
2.	Medium Mean ±SD	Between 5.16 and 5.68	4	10.00
3.	High ≥Mean + SD	≥ 5.68	15	37.50

Mean – 5.42

SD – 0.26

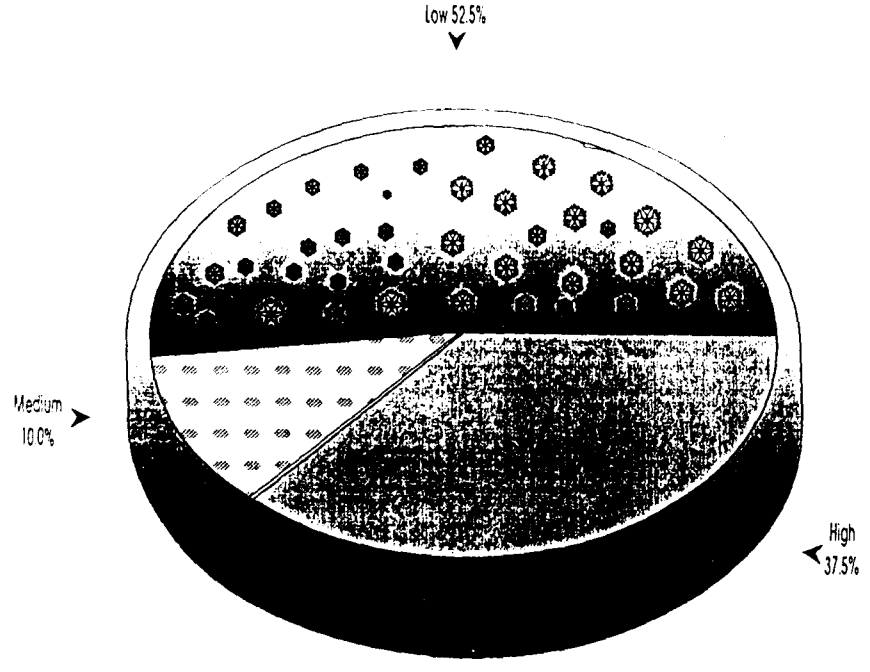

Fig 3. Distribution of farmers based on their adoption index

Table 8. Percentage of adoption of efficient farmers' practices

(n=40)

Sl.No.	Items (Practices)	Adoption	
		Frequency	Percentage
I.	**Processing of seeds**		
1.	Drying of pods for four to six days (two days under sunshine and two days under partial shade)	37	92.50
2.	Hanging the sacks with the dried pods.	15	37.50
3.	Smoking the pods by hanging the sacks above `kalladuppu'.	10	25.00
4.	Keeping the pods by adding DDT or BHC for protecting the seeds from pests infesting under storage conditions	21	52.50
II.	**Land Preparation**		
5.	Ploughing the land after adding lime	27	67.50
III.	**Manures and fertilizers**		
6.	Basal application of cattle or poultry manure.	30	75.00
7.	Application of poultry manure ten days after sowing	20	50.00
8.	Applying neemcake, groundnut cake and bonemeal twenty days after sowing	22	55.00
9.	Burning waste leaves and twigs in the adjacent field in the direction of wind to have more flowers in cowpea.	12	30.00
10.	Applying fresh cowdung at the time of flowering	20	50.00
11.	Adding 1 kg ash per pit forty days after sowing.	21	52.50
IV.	**Plant protection**		
12.	Covering with nets inorder to protect the crop from birds.	1	2.50
13.	Hanging polythene covers on pandals to scare the birds.	11	27.50
14.	Spraying neem oil emulsion against American Serpentine Leaf Miner	27	67.50
15.	Applying garlic against pod borers.	10	25.00
16.	Spraying malathion - garlic mixture against leaf caterpillars during winter season.	28	70.00
17.	Applying Bordeaux Mixture or Phytolan against fungal diseases during rainy season.	26	65.00
18.	Using Indofil against the disease `Karivalli'.	20	50.00

is not applicable in the actual field condition since almost all the farmers in this area are cultivating cowpea on a commercial scale and also due to the high cost.

For processing of seeds, 'drying of pods for four to six days (two days under sunshine and two days under partial shade)' was the practice adopted by about 92 per cent of the selected farmers. About 52 per cent of the farmers were adopting the practice 'keeping the pods by adding DDT or BHC for protecting the seeds from storage pests'. Eventhough these chemicals were banned some farmers opined that this is a very efficient practice against storage pests.

Among the manuring practices 'basal application of cattle or poultry manure' was the most (75 per cent) adopted practice followed by 'application of neem cake, groundnut cake and bonemeal twenty days after sowing' which was adopted by 55 per cent of the farmers.

'Spraying malathion-garlic mixture against leaf caterpillers during winter season' was adopted by 70 per cent of the farmers selected for the study purpose. Sixty five per cent of the farmers were adopting the practice 'application of Bordeaux Mixture or Phytolan against fungal diseases during rainy season' which is also a recommended practice in the POP.

4.9 Relationship of knowledge of recommended practices and adoption of efficient farmers' practices with selected independent variables

4.9.1 Relationship between the knowledge of farmers about the recommended practices and the independent variables

The correlation between knowledge and the independent variables were analysed using correlation analysis and the results are presented in table 10.

Table 9. Correlation between knowledge of farmers about the recommended practices and the selected independent variables

(n=40)

Variable No.	Characteristics (variables)	Correlation Coefficient
X_1	Age	-0.5147**
X_2	Education	0.3620*
X_3	Main occupation	-0.1252 NS
X_4	Farming experience	-0.3973*
X_5	Annual income	0.3586*
X_6	Area under cowpea	0.2825 NS
X_7	Exposure to information sources	0.6802**
X_9	Social participation	0.4822**
X_{10}	Extension orientation	0.6028**
X_{11}	Economic motivation	0.2148 NS
X_{12}	Innovativeness	0.2784 NS
X_{13}	Cosmopoliteness	0.4485*
X_{14}	Credit orientation	–0.0796 NS
X_{15}	Risk orientation	0.5043**
X_{16}	Participation in PTD	–0.0537 NS
X_{17}	Perception about PTD	0.1586 NS

** Significant at 1% level

* Significant at 5% level

N S Not significant

It can be seen that out of sixteen independent variables only seven variables viz., education, annual income, exposure to information sources, social participation, extension orientation, cosmopoliteness and risk orientation were found to have significant and positive relationship with knowledge of recommended practices. Age and farming experience were also significantly related with knowledge, but in the negative direction.

Education in the present study related to the formal schooling of the farmers which necessarily provided them with required orientation to new developments in their field. More than 70 per cent of the farmers were having secondary and high school level of education. Also, they were members of self-help groups of KHDP and Harithasangham of State Department of Agriculture and they get opportunities to attend the programmes conducted by these organisations especially training in modern trends of vegetable cultivation which is reflected in the positive and significant relation between education and knowledge.

Annual income was found to have positive and significant relationship with knowledge. It could be logically concluded that with increased income, the farmers had the resource potential to invest money on cultivation, which motivate them to acquire knowledge about recommended practices on cowpea and hence the observed significant and positive relation between annual income and level of knowledge is quite logical.

In the present era of technological explosion, it is quite logical that a person who has better access to the different mass media and personal sources of information gain higher level of knowledge. Social participation is quite important in determining the individual cognition, where in objects, situations and people are evaluated based on collective thinking. Moreover, greater involvement of farmers in various organisations will provide them with

opportunity for better exposure to interpersonal channels of communication and innovative ideas. It could be inferred that as a result of social participation farmers might have established more contact with other people which might result in improving their knowledge level. Above all, as the selected farmers were members of both KHDP and Harithasangham, having frequent contact with extension agencies like Agricultural Officers, Agricultural Assistants, KHDP personnel and scientists and having more exposure to information sources, social participation and extension orientation and were likely to acquire more knowledge about the recommeded practices. Hence the observed significant and positive relationship of exposure to information sources, social participation and extension orientation with knowledge is quite logical.

Farmers who are more cosmopolite in nature will be more aware of the present day trends. In this study, almost all the visits of the farmers selected to the nearest city/town were related to agriculture mainly for the purchase of manures and fertilizers, marketing of produces etc. During their visits they interacted with other people and received cues from them, that added to their knowledge and thus improved their knowledge level.

A significant and positive relationship between risk orientation and knowledge may be attributed to the fact that a farmer who is willing to take risk is sure to adopt improved agricultural practices and this might resulted in increasing their knowledge about the recommended practices.

The present study established a significant and negative relationship of age and farming experience with knowledge. Farmers who have more experience in farming will come under the high age group. They may not be aware of the latest scientific developments and so

Table 11. Step-wise regression analysis of knowledge about the recommended practices and independent variables

Step No.	Variables entering regression	Partial regression 'b'	SE of b	F Value	Percentage variation explained
I.	X_7 Exposure to information sources	0.6454	–	32.7266	46.2720
II.	X_7 Exposure to information sources	0.5354	0.1201	21.0053	53.1118
	X_1 Age	0.0700	0.0031	5.3974	

will be lagging behind in adopting that practice.

4.9.1.1 Multiple linear regression analysis of knowledge and the selected independent variables

The results of multiple regression analysis between knowledge of farmers about the recommended practices and the selected independent variables are presented in table 11.

The R^2 of 0.7104 indicates that about 71 per cent of the variation in knowledge could be explained by the selected independent variables. As in the case of correlation, here also, age was found to have a significant and negative association with knowledge.

4.9.1.2 Step-wise regression analysis of knowledge and the selected independent vari ables

From the step-wise regression analysis (table 12) it was observed that out of the total contribution to variation of 71 per cent, 46.27 per cent was contributed by exposure to information sources (X_7) and 53.11 per cent variation was explained by both exposure to information sources (X_7) and age (X_1). Thus these variables could be considered the best in predicting knowledge about the selected recommended practices.

4.9.2 Relationship between extent of adoption of farmers' practices and the selected independent variables

The results of correlation analysis showing the relation between extent of adoption of efficient farmers' practices and the selected independent variables are presented in Table 13.

Out of seventeen independent variables only five variables viz., education, exposure

Table 12. Correlation between adoption of farmers' practices and the selected independent variables

(n=40)

Variable No.	Characteristics (variables)	Correlation Coefficient
X_1	Age	–0.2997 NS
X_2	Education	0.3252*
X_3	Main occupation	0.0435 NS
X_4	Farming experience	–0.2696 NS
X_5	Annual income	0.2954 NS
X_6	Area under cowpea	0.2315 NS
X_7	Exposure to information sources	0.3224*
X_9	Social participation	0.5191**
X_{10}	Extension orientation	0.3815*
X_{11}	Economic motivation	0.2781 NS
X_{12}	Innovativeness	0.2420 NS
X_{13}	Cosmopoliteness	0.2994 NS
X_{14}	Credit orientation	–0.0009 NS
X_{15}	Risk orientation	0.1819 NS
X_{16}	Participation in PTD	0.1677 NS
X_{17}	Perception about PTD	0.0877 NS
X_{18}	Knowledge about recommended practices	0.3629*

** Significant at 1% level

* Significant at 5% level

N S Not significant

to information sources, social participation, extension orientation and knowledge about recommeded practices were significantly and positively associated with adoption of efficient farmers' practices.

Eventhough not significant a positive relation was observed between main occupation, annual income, area under cowpea, economic motivation, innovativeness, cosmopoliteness, risk orientation, participation in PTD and perception about PTD and extent of adoption.

As in the case of knowledge, a significant and positive relation between education and extent of adoption was observed. In Kerala, upto primary level of education is compulsory and free and drop outs will occur only after primary level. Majority of farmers selected for the study purpose were having education upto secondary or high school level. Thus more the growers are literate better will be their proneness to accept innovations in agriculture.

The farmers who actively participate in farm meeting, farm days etc. have a favourable attitude and that would have tempted them to adopt the cultivation practices. The farmer to farmer communication or exposure to other information sources is a determinant factor influencing adoption of efficient farmer's practices. Social participation denotes involvement of the farmers in various activities of different organisations, which provide them with enough exposure to new developments in different fields which in turn serve as a sufficient condition for adoption of improved practices in farming indicating a positive trend between social participation and extent of adoption. Extension education provides the farmers with functional and purposive information on scientific farming. In addition to this, all the farmers selected for the study purpose were members of both self-help groups of KHDP and Harithasangham

of State Department of Agriculture. This serves as a favourable condition resulting in adoption of efficient farmers' practices as indicated by a positive relation between exposure to information sources, social participation and extension orientation and extent of adoption. The profile analysis of the respondents had high scores on exposure to information sources, social participation and extensionn orientation and hence the significant relation between these variables and extent of adoption.

Knowledge is a pre-disposing factor for adoption. So if a farmer has proper knowledge, he can evaluate the practice more logically and adopt it. A higher level of knowledge on scientific cultivation and about the recommended practices makes the farmer to take positive decisions on adoption of improved practices as is evident from observed significant relation between adoption and knowledge.

With agriculture as main occupation, the farming experience of the farmer increases. It enables the individuals to realise the merits of efficient farmers' practices. Hence a farmer with agriculture as main occupation will be more knowledgeable about the benefits of farmers' practices, thereby promoting higher adoption.

Mostly the farmers adopt improved vegetable cultivation practices for increased income. If they have sufficient income, they will adopt almost all the efficient farmers' practices The percentage of the farmers came under high category were having an annual income of above 37 445.

A farmer who invests money in farming will take into account the relative advantage that may occur when he adopts the efficient farmers' practices. In otherwords, economic motive

in a more cautious adoption of improved practices by them. Viewed in this perspective, the observed positive relationship between economic motivation and extent of adoption is understandable.

The study revealed a positive relationship of the extent of adoption with the independent variable innovativeness. As the term itself envisages, the innovative farmers will be ready to adopt practices which are not very widely used.

Cosmopoliteness was found to have a positive and non-significant relationship with adoption. This would be better explained that due to wide contact with farmers, visualisation of development is possible. Visit to different fields would motivate them to adopt the practices at an early date.

A farmer who is willing to take risk is sure to adopt agricultural practices which is not followed by all. Eventhough there is complete loss during previous season, farmers will raise the crop during the next season because of the profitability of the vegetable cultivation. Hence the observed positive relation between risk orientation and extent of adoption is quite logical.

Four participatory technology development experiments in cowpea were introduced by Kerala Horticultural Development Programme recently in this area. Farmers in this area were very enthusiastic and they were willing to actively participate in these experiments because of their faith in the KHD programme. Since the experiments were recently introduced, farmers were not much aware of the advantages and hence the participation was in a slow rate. In this perspective, the observed positive and non-significant relation of participa-

Table 13. Multiple linear regression analysis of adoption of efficient farmers' practices and the independent variables

(n=40)

Variable No.	Independent variables	Regression coefficient	t value
X_1	Age	0.0326	0.431 NS
X_2	Education	0.7041	1.002 NS
X_3	Main occupation	0.6140	0.654 NS
X_4	Farming experience	–0.0265	–0.343 NS
X_5	Annual income	–0.0065	–0.420 NS
X_6	Area under cowpea	–1.1182	–0.279 NS
X_7	Exposure to information sources	–0.0604	–0.228 NS
X_9	Social participation	0.0333	0.105 NS
X_{10}	Extension orientation	0.0202	0.069 NS
X_{11}	Economic motivation	0.2037	0.511 NS
X_{12}	Innovativeness	0.2945	0.683 NS
X_{13}	Cosmopoliteness	0.0564	0.140 NS
X_{14}	Credit orientation	–0.0926	–0.247 NS
X_{15}	Risk orientation	0.0905	–0.759 NS
X_{16}	Participation in PTD	–0.0976	–0.178 NS
X_{17}	Perception about PTD	–0.1769	–0.506 NS
X_{18}	Knowledge about recommended practices	0.1361	0.795 NS

Intercept – 3.9743

R^2 – 0.6177

F Value – 1.5347

N S Not significant

Table 14. Step-wise regression analysis of adoption of efficient farmers' practices and independent variables

Step.No.	Variable entering regression	Partial regression 'b'	SE of b	F value	Percentage variation explained
I.	X_9 Social participation	0.3808	0.1045	14.0190	26.9498

tion in PTD and perception about PTD with extent of adoption is quite understandable.

4.9.2.1 Multiple linear regression analysis of extent of adoption and the selected inde pendent variables

Using all the seventeen independent variables multiple linear regression analysis was done and the findings are presented in table 14.

The table revealed that all the variables together contributed to the variations in adoption of efficient farmers' practices. However, coefficient of determination revealed that 61.77 per cent of the variation in adoption was explained by these seventeen independent variables.

4.9.2.2 Step-wise regression analysis of extent of adoption and the selected indepen dent variables

From the step-wise regression analysis, it was observed that out of the total 61.77 per cent of explained variation, 26.95 per cent was contributed by social participation only.

4.10 Constraints in the cultivation of cowpea

An attempt was made to identify the constraints as experienced by the farmers in the cultivation of cowpea.

The major constraints experienced by the farmers in the cultivation of cowpea, grouped into production and economic constraints are presented in Table 16. A cursory view of the table reveals that, among the production constraints, incidence of pests and diseases was the constraint experienced by majority of the respondents. The other constraints experienced by them were labour scarcity, variability in production, weather problems, awareness of plant

Table 15. Constraints as experienced by the farmers in the cultivation of cowpea

(n=40)

Sl. No.	Constraints	Frequency	Rank
I.	**Production constraints**		
i.	Incidence of pests and diseases	36	1
ii.	Labour scarcity (Non-availability of labour)	30	2
iii.	Non-availability of inputs	4	7
iv.	Weather problems	12	4
v.	Lack of knowledge about the recommended practices	6	6
vi.	Uneven production	15	3
vii.	Unawareness of plant protection measures	9	5
II.	**Economic constraints**		
i.	High labour charges	34	1
ii.	Price fluctuation of the produce	32	3
iii.	Inadequate credit facilities	20	5
iv.	High transporting charges	28	4
v.	Inadequate marketing facilities	15	6
vi.	High cost of material inputs	33	2

protection measures, lack of knowledge about the recommended practices and non-availability of inputs. Incidence of pests and diseases seriously limit cowpea cultivation. The high incidence of pests and diseases prompts for repeated and intensive use of plant protection chemicals in cowpea. This may be the reason for identifying high cost of material inputs which also includes the cost of plant protection measures as the second most important economic constraint. Non-availability of labour was the second most important constraint experienced by the farmer. Eventhough unemployment is the major problem faced by the people in Kerala, they are reluctant to do any of the farming operations. This may be the reason for the labour scarcity in the cultivation of cowpea. Variability in production and weather problems are the next important constraints. These may be interrelated. Weather problems may be one of the reason for variability in production. Weather hazards like drought, flood etc. may cause heavy loss to vegetables expecially cowpea.

Among the economic constraints, high labour charges followed by high cost of material inputs and price fluctuation of the produce was expressed as major constraints by the farmers cultivating cowpea. In addition to this, they also expressed high transporting charges and inadequate credit and marketing facilities as major constraints. Among the economic constraints, high labour charges was ranked as the most important one in cowpea cultivation. Most of the operations in the cultivation of cowpea demand use of labour involving heavy expenditure.

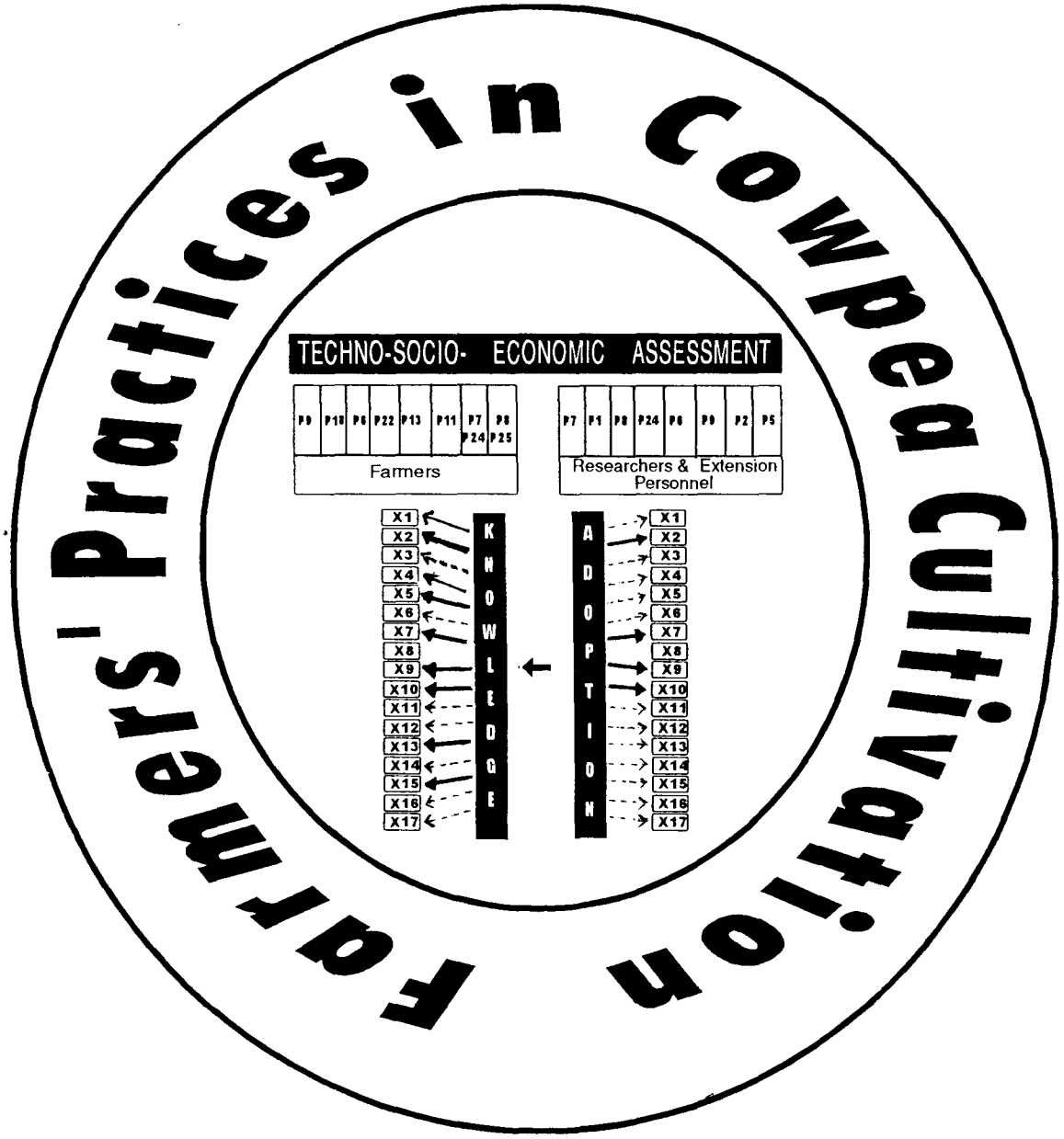

Fig. 5. Empirical model of the study

Bold Line ⟶ - Positive & Significant Relationship
Thin Line ⟶ - Negative& Significant Relationship
Dotted Line ⇢ - Non - significant Relationship

SUMMARY AND CONCLUSION

CHAPTER - V

SUMMARY AND CONCLUSION

Throughout the history of agriculture, farmers were experimenting with various natural resources to improve the results in their fields and to optimize the input use. The accumulation of the results of such farmer-made experiments, generally denoted as farmers' knowledge, rural people's knowledge etc. are being used to indicate this concept.

Knowledge of farmers' practices is very important for the planning of research and extension. An understandng of the farmers' practices can help in designing relevant improved technologies for limited resource farmers. For understanding and popularising these farmers' practices systematic studies are essential.

The specific objectives of the study were

1. Identification of farmers' practices in the cultivation of cowpea.

2. Assessment of socio-economic and technical aspects of the farmers' practices as perceived by the researchers, extension personmmel and the farmers.

3. Assessment of knowledge of farmers about the recommended practices and its with selected independent variables.

4. Analysis of extent of adoption of efficient farmers' practices and its relationship

with selected independent variables.

5. Analysis of constraints experienced by the farmers in the cultivation of cowpea.

The study was conducted in Thiruvananthapuram district of Kerala State. On the basis of discussion with experts, researchers, extension personnel and people's representatives in the district, Kalliyoor panchayat was selected as the locale of the study which is the prominent vegetable cultivating area in the district. Two sets of respondents were selected for the study. Practising farmers cultivating cowpea were selected from the list obtained from the Krishi Bhavan and KHDP field centre working in the area. Since the project is of exploratory and exhaustive nature involving non-participant observation for data gathering, a sample size of forty farmers cultivating cowpea in Kalliyoor Panchayat was included as the respondents of the first category. Similarly, extension officials and agricultural scientists working with sufficient experience in extension or research related to the cultivation of cowpea was selected as the second category of respondents. This category include a total of fifty respondents.

The dependent variables for the study were knowledge of farmers about the recommended practices and extent of adoption of efficient farmers' practices. These dependent variables were quantified using measurement devices developed for the study. Fifteen independent variables were selected for the study which included age, education, main occupation, farming experince, annual income, area under cowpea, exposure to information sources, irrigation index, social participation, extension orientation, economic motivation, innovativeness, cosmopoliteness, credit orientation, risk orientation, participation in PTD

and perception about PTD. All these independent variables were quantified with the help of available measurement procedures. The relationship between these independent variables and the dependent variables was also studied.

For assessing scientifically the socio-economic and technical aspects of the farmers' practices identified, matrix ranking was adopted. The identified farmers' practices were given to the farmers and they were asked to indicate their responses in a four-point continuum. Similarly efficiency, ecofriendliness and technical aspects of farmers' practices were also measured in a four-point continuum.

The data were collected using both non-participant observation technique and a pre-tested structured interview schedule prepared for the purpose. Different statistical tools like mean, percentage analysis, correlation analysis, multiple linear regression analysis and step-wise regression analysis were used to analyse the data.

The salient findings of the study are summarised below.

1 In total, 57 farmers' practices were identified and presented in the results.

2. The practices 'application of neem cake, groundnut cake and bonemeal twenty days after sowing', 'spraying neem oil emulsion against American Serpentine Leaf Miner' and 'ploughing the land after adding lime' registered the highest techno-socio-economic indices.

3. Majority of the farmers considered the practices 'application of neem cake,

groundnut cake and bonemeal twenty days after sowing', 'applying more fertilizers if the crop has less weight and 'basal application of cattle manure or poultry manure' as technologically most efficient.

4. 'Spraying neem oil emulsion against American Serpentine Leaf Miner', application of neem cake, groundnut cake and bonemeal twenty days after sowing' and 'spraying malathion- garlic mixture against leaf caterpillars' were the practices which were perceived by the farmers as socially most efficient.

5. Farmers experinced that the economically most efficient practices were 'ploughing the land after adding lime', 'application of neem cake, groundnut cake and bonemeal twenty days after sowing', 'applying fresh cowdung at the time of flowering' and 'applying more fertilizers if the crop has less weight.

6. The practices 'drying of pods for four to six days', application of neem cake, groundnut cake and bonemeal twenty days after sowing' and 'basal application of cattle manure or poultry manure' were considered by the farmers as most efficient. But researchers and extension personnel considered the practices 'basal application of cattle manure or poultry manure', 'drying of pods for four to six days' and 'application of poultry manure ten days after sowing' as most efficient.

7. The most ecofriendly practices, as perceived by the farmers, were 'drying of pods for four to six days', 'application of neem cake, groundnut cake and bonemeal twenty days after sowing', 'ploughing the land after adding lime' and 'covering with nets inorder to

protect the crop from birds.

8. The practices 'drying of pods for four to six days' and 'hanging the sacks with the dried pods' registered the highest score for relative advantage and trialability. For observablity the practices 'drying of pods for four to six days' and 'smoking the pods by hanging the sacks above kalladuppu' registered the highest score. According to the farmers, the most compatible practices were 'basal application of cattle manure or poultry manure' and ploughing the land after adding lime.' The most complex practices as perceived by the farmers were 'covering with nets inorder to protect the crop from birds and 'spraying kelthane against American Serpentine Leaf Miner'.

9. Regarding the profile variables of farmers, more than fifty per cent of farmers come under the age group below 44. Majority (72.5 per cent) of the farmers were having secondary school or higher level of education. More than 82 per cent of the farmers were having agriculture as their main occupation. About 55 per cent of the farmers were having farming experience below twenty one years. Majority of the farmers were having income below Rs. 37 445. About 38 per cent of the farmers selected were cultivating cowpea in more than 30 cents. Fifty five per cent had high exposure to information sources. All the respondents selected were utilizing the channel irrigation facilities available. More than fifty per cent of farmers were having high social participation and extension orientation. Majority of the respondents were having high economic motivation. More than 60 per cent of them were having high credit orientation , but low cosmopoliteness. It was interesting to note that equal percentage of the respondents had high and low risk orientation. About 68

per cent of the farmers were having high participation in PTD experiments introduced by KHDP in the area. About 93 per cent of the farmers were having better perception about PTD.

10. About 48 per cent of farmers belonged to the low knowledge category and 40 per cent possessed high knowledge about the selected recommended practices.

11. 'Sowing after first week of June is the most suitable time', 'ploughing the land thoroughly two to three times to remove weeds and stubbles' and 'hoeing at the time of application of second dose of nitrogen' were the most known practices to cent per cent of the farmers selected for the study purpose.

12. About 53 per cent of the farmers belonged to the low adoption category and 38 per cent of the farmers were in the high category with respect to adoption of efficient farmers' practices.

13. 'Drying of pods for four to six days' was the practice adopted by majority of the farmers in this area. Twelve practices out of eighteen were adopted by more than 50 per cent of the farmers.

14. With regard to relationship of knowledge with selected independent variables, variables viz., education, annual income, exposure to information sources, social participation, extension orientation, cosmopoliteness and risk orientation were found to have significant and positve relationship with knowledge of recommended practices. Extent of adop-

tion of efficient farmers' practices was related positively and significantly with five independent variables viz., education, exposure to information sources, social participation, extension orientation and knowledge about recommended practices.

15. The results of multiple regression analysis revealed that about 71 per cent of the variation in knowledge and 61.77 per cent of the variation in extent of adoption were explained by the selected independent variables.

16. Step-wise regression analysis revealed that of the 71 per cent of the variation in knowledge, 47 per cent was contributed by exposure to information sources alone, about 6.0 per cent by the variable age and remaining by all the other independent variables. With regard to extent of adoption, out of the total contribution to variation of 61.77 per cent, 26.9 per cent was explained by social participation and remaining by the other variables.

17. Incidence of pests and diseases, labout scarcity and uneven production were the major production constraints experienced by majority of the respondents and high labour charges, high cost of material inputs and price fluctuation of the produce were the major economic constraints.

Implications of the study

The present research study is the first of its kind in assessing scientifically the socio-economic and technical aspects of the farmers' practices in the cultivation of cowpea in Kerala, and hence the results of the study will be of use to researchers and extension

workers in the State. Besides, the research methods developed and standardised for this purpose will also be worthy additions to the body of research methodology in agricultural extension. In view of the above, the research study proposed is both topical and timely.

Suggestions for future research

The study has been limited to only one district in Kerala and with a restricted sample size and therefore, generalization based on this alone will not be meaningful. So to render generalization, a comprehensive research project of wider depth and coverage stretching all over the state need to be undertaken.

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APPENDICES

APPENDIX-1

INTERVIEW SCHEDULE

TECHNO-SOCIO-ECONOMIC ASSESSMENT OF FARMERS' PRACTICES IN THE CULTIVATION OF COWPEA (VIGNA UNGUICULATA L.) IN THIRUVANANTHAPURAM DISTRICT.

Date :
Panchayat :
Ward :
Respondent No :

1. Name and address of the respondent :
2. Age (in completed years) :
3. Education : Illliterate/Primary/Secondary/Collegiate
4. Main occupation : Agriculture as main occupation/Agriculture as secondary occupation
5. Farming experience : (in years)
6. Annual income (in Rs.)
   a) On farm income :
   b) Off farm income :
   Total :
7. Area under cowpea

Sl.No	Type of land	No.of crops	Total area under cultivation
i.	Wet land		
ii.	Dry land		
	Total		

8. Exposure to information sources

Sl.No.	Information sources	Frequency of exposure		
		Never	Occasionally	Regularly
i.	Agricultural officer			
ii.	Agricultural assistant			
iii.	Progressive farmer			
iv.	Scientist			
v.	Family members			
vi.	Neighbours			

vii. Print media

viii. Radio

ix. Television

x. Seminars

9. Irrigation index

Sl.No.	Source of irrigation	Period of water availability			Area irrigated
		Throughout the year	Partial availability	Never	
i	Tank				
ii.	Well				
iii.	Canal				
iv.	River				
v.	Others (specify)				

10. Social participation

Are you a member of the organisation? Yes/No

If Yes.

Sl.No	Organisations	Nature of membership		Frequency of participation		
		Member	Office bearer	Regularly	Occassionally	Never
i.	Panchayath					
ii.	Co-operatives					
iii.	K.H.D.P					
iv.	Farmers' organisations					
v.	Harithasangham					
vi.	Others (specify)					

11. Extension orientation

a) Extension contact

Sl.No.	Category of personnel	Frequency of contact		
		Regularly	Occasionally	Never
i.	Scientist			
ii.	Agricultural officer			
iii.	Agricultural assistant			
iv.	Others			
	Total			

b) Extension participation

Sl.No.	Activities	Attended whenever conducted	Occassionally attended	Never attended
i	Study tours			
ii.	Seminars			
iii.	Farm fair			
iv.	Group farming meetings			
v.	Demonstrations			
vi.	Master farmers' training classes			
vii.	Others (specify)			
	Total			

12. Economic motivation

Indicate whether you agree or disagree with the following statements.

Sl.No.	Statements	A	DA
i.	A farmer should work towards large yield and economic yield.		
ii.	The most successful farmer is one who makes the most profit		
iii.	The farmer should try any new farming idea which may earn him more money		
iv.	A farmer should grow cash crops to increase monitory profits in comparison to growing of food crops for home consumption.		
v.	It is difficult for the farmers' children to make good start unless he provides them with economic assistance.		
vi.	A farmer must earn his living, but the most important thing in life cannot be defined in economic terms.		

13. Innovativeness

Q: When would you prefer to adopt an improved practice in farming?

i. As soon as it is brought to my knowledge.

2. After I have seen some other farmers using it successfully.

3. Prefer to wait and take my own time.

14. Cosmopoliteness

a) Frequency of visiting the nearest town:

Twice or more times a week/once in a week/once in a fortnight/once in a month/very rarely/never

b) Purpose of visit

All visits relating to agriculture/some relating to agriculture/personal or domestic matters/ entertainment/any other purpose (specify)

15. Credit orientation

Give your opinion for the following statements.

i. Do you think a farmer like you should borrow for agricultural prupose?

Yes/No

ii. In your opinion, how difficult is to secure credit for agricultural purpose?

Very difficult/difficult/easy/very easy

iii. How a farmer is treated when he goes to secure credit?

Very badly/badly/ fairly/ very fairly

iv. There is nothing wrong in taking credit from institutional sources for increasing farm production

SDA / DA/ UD/ A/ SA

v. Did you use the credit in the last two years for crop production?

Yes/ No

16. Risk Orientation

Sl. No.	Statements	SA	A	UD	DA	SDA
i.	A farmer should grow larger number of crops to avoid greater risks involved in growing one or two crops.					
ii.	A farmer should take more of chance in making a big profit than to be content with a smaller but less risky profit					
iii	A farmer who is willing to take greater risk than the average farmer usually does better financially					
iv	It is good for a farmer to take risk when he knows his chance of success is fairly high.					
v.	It is better for a farmer not to try a new farming method unless most others in the locality have used it with success.					
vi.	Trying entirely a new method in farming by a farmer involves risk but is worth it.					

17. Participation in Participatory Technology Development (PTD)

Sl.No.	PTD experiments	Yes	No	If yes, to what extent
i.	Hormone application			
ii.	Bio-farming			
iii.	Control of fungal diseases management			
iv.	Integrated pest and disease management			
v.	Nemasol application			

18. Perception about PTD

Sl. No.	Statements	A	DA
i.	PTD is a sure way of solving location-specific agricultural problems		
ii.	PTD is a wasteful excercise		
iii.	PTD helps only in increasing rivalry among farmers		
iv.	PTD makes the farmer dependent on the researcher all the time		
v.	It is a waste of time to participate in PTD trials		
vi.	Technology development must be exclusively left to researchers and farmer must have no roles		

APPENDIX-II

KERALA AGRICULTURAL UNIVERSITY
DEPARTMENT OF AGRICULTURAL EXTENSION,
COLLEGE OF AGRICULTURE,
VELLAYANI, THIRUVANANTHAPURAM.

Dr. S.SHILAJA
Associate Professor.

Department of Agricultural Extension
Dated:.....

Sir/Madam.

Ms. Majjusha,A.R., one of the M.Sc.(Ag) students of the department is undertaking a research study titled **"Techno-socio-economic assesment of farmers' practisces in the cultivation of cowpea in Thiruvananthapuram district"** as a part of her research work under my guidance.

In view of your professional experience and expertise you have been identified as a judge for evaluating the efficiency of farmers' practices listed. Your degree of response to the efficiency has to be indicated using a' 'mark.

I request you to kindly spare some of you valuable time for the purpose and return the list duly filled at the earlist. Hoping your kind co-operation.

Yours sincerely

(Dr.S.SHILAJA)

Please indicate your response with a '✓ ' mark in the appropriate column against each practice.

Sl No.	Farmers' Practice	Extremely efficient	Efficient	Not efficient	Extremely not efficient
I.	**Processing of seeds**				
1.	Drying of seeds for four to six days (two days under sunshine and two days under partial shade)				
2.	Hanging the sacks with the dried seeds to protect them from rats.				
3.	Smoking the seeds by hanging the sacks above 'kalladuppu'				
4.	Keeping the seeds by adding DDT or BHC for protecting the seeds from pests infesting under storage conditions.				
5.	Keeping the dried seeds for three to five months before sowing.				
II.	**Land preparation**				
1.	Ploughing the land after adding lime.				
III.	**Manures and fertilizers**				
1.	Application of cattle manure or poultry manure as a basal manure.				
2.	Application of poultry manure ten days after sowing.				
3.	Applying neemcake, groundnut cake and bonemeal twenty days after sowing.				
4.	Burning waste leaves and twigs in the adjacent field in the direction of wind to have more flowers in cowpea.				

Sl No.	Farmers' Practice	Extremely efficient	Efficient	Not efficient	Extremely not efficient
5.	Applying fresh cowdung at the time of flowering.				
6.	Adding 1 Kg ash per pit forty days after sowing.				
7.	Applying more fertilizers if the fruits have less weight.				
IV.	**Plant Protection**				
1.	Covering with nets inorder to protect the crop from birds.				
2.	Hanging polythene covers on pandals to scare the birds.				
3.	Using banana fruit trap to protect the crop from squirrels.				
4.	Spraying kelthane against American Serpentine Leaf Miner.				
5.	Spraying neem oil emulsion against American Serpentine Leaf Miner.				
6.	Applying garlic against pod borers.				
7.	Using turpentine against pod borers.				
8.	Spraying kelthane against aphids.				
9.	Spraying malathion-garlic mixture against leaf caterpillars during winter season.				
10.	Spraying dicofol or kelthane for controlling mosaic disease.				
11.	Applying Bordeaux mixture or phytolan against fungal diseases during rainy season.				
12.	Using indofil against the disease 'Karivalli'.				

APPENDIX-III

FARMERS' PRACTICES SELECTED FOR THE STUDY
ALONG WITH THEIR WEIGHTAGES

Sl.No	Farmers' practices	Weightage
I.	Processing of seeds	
1.	Drying of pods for four to six days	3.18
2.	Hanging the sacks with the dried pods to protect them from pest attack	3.04
3.	Smoking the pods by hanging the sacks above 'kalladuppu'.	2.86
4.	Keeping the pods by adding DDT or BHC for protecting them from storage pests	2.76
5.	Keeping the dried pods for three to five months before sowing.	3.02
II.	Land preparation	
6.	Ploughing the land after adding lime.	3.14
III.	Manures and fertilizers	
7.	Basal application of cattle manure or poultry maure.	3.76
8.	Application of poultry manure ten days after sowing.	3.30
9.	Applying neem cake, groundnut cake and bonemeal twenty days after sowing.	3.10
10.	Burning waste leaves and twigs in the adjacent field	
11.	Applying fresh cowdung at the time of flowering	2.58
12.	Adding 1 Kg ash per pit forty days after sowing	2.88
13.	Applying more fertilizers if the fruits have less weight	2.34
IV.	Plant protection	
14.	Covering with nets inorder to protect the fruits from birds.	
15.	Hanging polythene covers on pandals to scare the birds.	
16.	Using banana fruit trap to protect the fruits from squirrels	2.66
17.	Spraying kelthance against American Serpentine Leaf Miner	1.90
18.	Spraying neem oil emulsion against American Serpentine leaf Miner	2.96
19.	Appying garlic against pod borers	2.76
20.	Using turpentine against pod borers	2.12
21.	Spraying kelthance against aphids	2.36
22.	Spraying malathion-garlic mixture against leaf caterpillars	2.92
23.	Spraying dicofol or kelthane for controlling mosaic disease	2.08
24.	Appying Bordeaux Mixture or Phytolan against fungal diseases	
25.	Using indofil against the disease 'karivalli'.	2.42

TECHNO-SOCIO-ECONOMIC ASSESSMENT OF FARMERS' PRACTICES IN THE CULTIVATION OF COWPEA (*Vigna unguiculata L.*) IN THIRUVANANTHAPURAM DISTRICT

BY

MAJJUSHA A. R.

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF
MASTER OF SCIENCE IN AGRICULTURAL EXTENSION
FACULTY OF AGRICULTURE
KERALA AGRICULTURAL UNIVERSITY

DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM

2000

ABSTRACT

The study aimed at assessing the socio-economic and technical aspects of the farmers' practices in the cultivation of cowpea as perceived by the researchers, extension personnel and the farmers.

The study was conducted in Thiruvananthapuram district of Kerala State. On the basis of discussion with experts, researchers, extension personnel and people's representatives in the district, Kalliyoor panchayat was selected as the locale of the study which is the prominent vegetable cultivating area in the district. Two sets of respondents were selected for the study. Forty practising farmers cultivating cowpea was included as the respondents of the first category. Fifty extension officials and agricultural scientists working with sufficient experience in extension or research related to the cultivation of cowpea was selected as the second category of respondents.

The dependent variables of the study were knowledge of farmers about the recommended practices and extent of adoption of farmers' practices. These dependent variables were quantified using measurement devices developed for the study.

Fifteen independent variables were selected for the study which included age, education, main occupation, farming experience, annual income, area under cowpea, exposure to information sources, irrigation index, social participation, extension orientation, economic motivation, innovativeness, cosmopoliteness, credit orientation, risk orientation, participation in PTD and perception about PTD.

All these independent variables were quantified with the help of available measurement procedures. For assessing scientifically the socio-economic and technical aspects of the farmers' practices identified, matrix ranking was adopted. The data were collected using both non-participant observation technique and a pre-tested structured interview schedule prepared for the purpose. Different statistical tools like mean, percentage analysis, correlation analysis, multiple linear regression analysis and step-wise regression analysis were used to analyse the data.

The study revealed 57 farmers' practices in the cultivation of cowpea. The practices 'application of neemcake, groundnut cake and bonemeal twenty days after sowing', 'spraying neemoil emulsion against American Serpentine Leaf Miner' and 'ploughing the land after adding lime' registered the highest techno-socio-economic indices. The practices 'drying of pods for four to six days', 'application of neem cake, groundnut cake and bonemeal twenty days after sowing ' and 'basal application of cattle manure or poultry manure' were considered by the farmers as most efficient. But researchers and extension personnel considered the practices 'basal application of cattle manure or poultry manure', 'drying of pods for four to six days' and 'application of poultry manure ten days after sowing' as most efficient. About 48 per cent of farmers belonged to the low knowledge category and 40 per cent possessed high knowledge about the selected recommended practices. 'Sowing after first week of June is the most suitable time', 'ploughing the land thoroughly two to three times to remove weeds and stubbles' and 'hoeing at the time of application of second dose of nitrogen' were the most known practices to cent per cent of the farmers selected for the study purpose. About 53 per cent of the farmers belonged to the low adoption category and 38 per cent of the farmers were in the high category

with respect to adoption of efficient farmers' practices. 'Drying of pods for four to six days' was the practice adopted by majority of the farmers in this area. Twelve practices out of eighteen were adopted by more than 50 per cent of the farmers. With regard to relationship of knowledge with selected independent variables, variables viz., education, annual income, exposure to information sources, social participation, extension orientation, cosmopoliteness and risk orientation were found to have significant and positve relationship with knowledge of recommended practices. Extent of adopion of efficient farmers' practices was related positively and significantly with five independent variables viz., education, exposure to information sources, social participation, extension orientation and knowledge about recommended practices. The results of multiple regression analysis revealed that about 71 per cent of the variation in knowledge and 61.77 per cent of the variation in extent of adoption were explained by the selected independent variables. Step-wise regression analysis revealed that of the 71 per cent of the variation in knowledge, 47 per cent was contributed by exposure to information sources alone, about 6.0 per cent by the variable age and remaining by all the other independent variables. Incidence of pests and diseases, labout scarcity and uneven production were the major production constraints experienced by majority of the respondents and high labour charges, high cost of material inputs and price fluctuation of the produce were the major economic constraints.