TECHNO SOCIO-ECONOMIC CHARACTERIZATION OF SPECIALIZED HOMEGARDENS: A DOMINANCE-DIVERSITY APPROACH

by

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(2011-11-144)

THESIS

Submitted in partial fulfillment of the requirement
for the degree of

MASTER OF SCIENCE IN AGRICULTURE

Faculty of Agriculture
Kerala Agricultural University

DEPARTMENT OF AGRICULTURAL EXTENSION
COLLEGE OF AGRICULTURE
VELLAYANI, THIRUVANANTHAPURAM-695 522
KERALA, INDIA

2013

DECLARATION

I hereby declare that this thesis entitled **"Techno socio-economic characterization of specialized homegardens: a dominance-diversity approach"** 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 to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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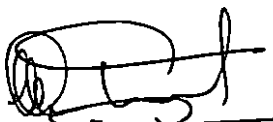

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ACKNOWLEDGEMENTS

*I bow to the **infinity**, the **Unknown** and the **Unknowable**, who is the only one behind each and every impulse of the universe. It will be a foolery to thank that cosmic consciousness with the triviality of human languages.*

*I feel great pleasure and deep sense of gratitude to **Dr. Allan Thomas, Assistant Professor, Department of Agricultural Extension and Chairman of the Advisory Committee** for his valuable and affectionate guidance, constant encouragement and unfailing patience throughout the course of this research work and in the preparation of the thesis. This work would not have been possible without his help and support.*

*I am particularly grateful to **Dr. R.Prakash, Professor and Head, Department of Agricultural Extension** for his valuable advice, keen interest, constructive criticisms and help during all stages of the study.*

*My sincere gratitude to **Dr. C. Bhaskaran**, **Dr. V.B. Padmanabhan**, Professors, Department of Agricultural Extension and **Dr. Sajan Kurien**, Professor and Director of Planning i/c, for their valuable guidance, helpful suggestions and advice rendered throughout the course of work.*

*I wish to place my gratefulness to **Sri. C. E. Ajith** , and **Dr. Brigit Thomas, Professor, Department of Agricultural Statistics** for their wholehearted effort in statistical analysis and interpretation of the results.*

*I express my sincere thanks to **Dr. N. Kishorekumar, Professor & PG in-charge , Department of Agricultural Extension** ,for his keen interest, help, constructive suggestions, timely support and co-operation rendered throughout the course of this research endeavor.*

*My heartful thanks to Agricultural Extension teaching staffs, **Dr.S.Shilaja, Dr. G. Sobhana, Dr.S.Mothilal Nehru, Dr. A.Anilkumar,** and **Dr. G. S. Sreedaya** for their friendly approach, creative suggestions and constant encouragement rendered to me during the course of my study and research work.*

*I am filled with the emotions of gratitude for the sincere assistance which I got from **Sir Joseph, Agricultural Officer,** Karimpuzha Panchayat, Mannarkad taluk, Palakkad. Without his*

invaluable support, the work would have been impossible. I am obliged to ***Sir Pratheesh Kumar, Agricultural Officer,*** *Thallikulam Panchayat and* ***Sir. K. O. Jose, Agricultural Officer,*** *Ashmanoor panchayat, for their kind help in availing the basic recourses for conducting this study in the districts.*

I also extent my acknowledgement to ***Kamarudeen Sir,*** *Farm Manager,* ***Radhakrisnan AG*** *and to* ***all non-teaching staffs*** *of the Department of Agricultural extension for the help rendered to me during the course of study.*

My grateful thanks are due to my senior ***Athul Jaypal, Chinchu, Esakkimuthu*** *and* ***Sangeetha, S*** *for their blissful presence and assistance and also* ***my juniors*** *Anuroop, Priya, Anupama, Rubeena, Haseena ,Hinduja and Ravi for their wishes and help rendered at each and every stage of my work.*

My loving and wholehearted thanks to my classmates Smt. ***Sobha. S*** *and* ***Sadam Hanjabam*** *for their help, good company, positive criticism and moral support throughout my P.G. programme without whose help it would have been impossible to complete my research work.*

I wish to place my heartful thanks to classmates ***M Subramanion , S. Sivakumar*** *and also to* ***Aswathy Vijayan*** *for their valuable help and moral support.*

I joyfully recollect the friendly help and contributions which I got from my heart-bound batch-mates friends ***Anand Vishnu Prakash, Vineeth .V .Varma, Praveen John, Asish, Roitha Raemi*** *and* ***Aswini. S*** *and thank them for their companionship during my P.G. study.*

I am ineffably thankful to ***Anoop, Anuroop, Adhil, Achuth, Pareeth, Arun, Shahazad*** *and* ***Shelvy*** *with a deep regret on the impossibility of repayment of their support, help, love and affection showered on me throughout the period of this study.*

For my parents, ***P. M. Krishnan and Santha Krishnan,*** *to whom I always return for the asylum and rejuvenation from the desperate moments of life, I submit the oceans of gratitude. Words fail to express my deep sense of indebtedness to my brother* ***Dr. Abhilash Krishnan*** *and sister-in-law* ***Dr. Meera Abhilash*** *for their constant encouragement, sustained help, patience and blessings, personal sacrifice, incessant encouragement, timely persuasion and moral support without which this venture would have remained a dream.*

Rahul Krishnan

Introduction

CHAPTER 1
INTRODUCTION

Homegardening is an age-old practice in various parts of the world and homegardens play an important economic as well as cultural roles in rural societies. Homegardens are unique agroforestry systems that are often described in detail, but whose biophysical and socioeconomic characteristics have not been extensively studied. These intensive land-use systems involving the deliberate management of multipurpose trees and shrubs (the woody component) grown in intimate association with herbaceous species (mainly annual, perennial, and seasonal agricultural crops) and livestock are all managed within the compounds of individual homes (Fernandes and Nair, 1986). They are widespread throughout the tropics and are of immense importance in the socioeconomic structure of the rural communities (Michon *et al.*, 1983, Soemarwoto, 1987). They provide both economic and social benefits that are essential to the nutritional welfare and security of the household. These gardens, with their diversified agricultural crops and trees, fulfill the basic needs of the local population. In addition, the multistoried arrangements of plants and relatively high species diversities prevent the environmental degradation that is commonly associated with monocultures (Nair, 1993). Salam *et al.* (1992) opined that homegarden is a special type of sustainable agricultural production system practised around the home with or without extended garden, where a multi-species of annual and perennial crops along with/without animal husbandry components and other specialized components like aquaculture, sericulture, apiculture, etc. for the purpose of meeting the fundamental requirements of home and also to generate additional income through the sale of surplus to fulfill the requirements of household. Thus these homegardens provide economic benefits while remaining ecologically sound and biologically sustainable.

Presumably, homegardening is the oldest land use activity next only to shifting cultivation. It evolved through generations of gradual intensification of cropping in response to increasing human pressure and the corresponding shortage of arable lands. The two great Indian epics Ramayana and Mahabharata (based on events that might have supposedly happened around 7000 B.C. and 4000 B.C. respectively) contain an illustration

of Ashok Vatika, a form of today's homegardens (Puri and Nair 2004). The Javanese homegardens have reportedly originated as early as the seventh millennium B.C. (Hutterer 1984) and the Kerala homegardens are thought to be at least 4000 years old. Homegardening in Kerala, like elsewhere, has been conditioned by ecological and socio-economic imperatives. The rise of the market economy and cash crop monocultures like rubber has been threatening the continuity of the homegarden as an integrated ecosystem. However, the small and marginal farmers of Kerala continue to rely on homegardening as a strategy to stabilise their household food security and income against the risks and uncertainties of monocropping. Kerala's rural households place high value on their homegardens' role in enhancing the quality of their habitat.

It is well known that traditional land-use systems are influenced to a great extent by the biophysical and socio-cultural characteristics of the locales where they are practised. Homegardens are no exception. A typical homegarden, nevertheless, is an integral part of the farmer's farming system and an adjunct to the house, where selected trees, shrubs and herbs are grown for edible products and cash income, as well as for a variety of outputs that have both production and service values including aesthetic and ecological benefits. Due to commercialization, cultivation systems are becoming more specialized on the one hand, and rural people are increasingly employed in non-primary production activities on the other. As a result, in many rural areas, farming systems in general, and homegardens in particular, are changing.

Since the recognition of agroforestry as a type of land use worthy of research and development, homegardens have been considered as an excellent example of a traditionally developed agroforestry system with good promise for the future (Soemarwoto, 1984; Hochegger, 1998; Gajaseni and Gajaseni, 1999). Much attention has been given to analyzing the structure and function of tropical homegardens and describing their features in respect to both ecological and socio-economic sustainability (Torquebiau, 1992; Kumar and Nair, 2004). A commonly perceived indicator of homegardens' socioeconomic sustainability is the fact that homegardens typically contribute towards nutritional security, energy needs and income generation even under conditions of high population densities (Kumar and Nair, 2004). Recently it has been remarked that the concept of socioeconomic

sustainability should not only be related to the homegardens' function in the present livelihood conditions, but also to their ability to adjust to socioeconomic changes (Peyre et al., 2006). The diversity in tropical homegardens types is not only illustrated by the historic developments in tree gardening systems, but also by the existing variation in homegarden structure and composition. Soemarwoto (1984) added that in rural areas homegardens have important social functions through the provision of gifts in the form of fruits, leaves or products for religious or medicinal purposes. In urban areas this social function diminishes whereas their aesthetic function increases with ornamentals replacing food crops. Michon and Mary (1994) and Abdoellah et al. (2006) described that, in addition to urbanization, the rise of a market economy profoundly influences the homegarden function resulting in an increase in commercial crops.

Up until the present, most homegarden studies have focused mainly on species inventories or system description (Nair, 2001) and still little attention has been given to their structural and functional evolution and changes in the functions as a result of specialization. In the past, differences between homegardens were mostly described based on characteristics such as size, structure (vertical stratification, diversity indices) or socio-economic factors (level of inputs, subsistence/commercial production). Only recently, studies have been undertaken to systematically classify the structure of homegardens using analytical methods such as cluster analysis common to vegetation science (Leiva *et al.*, 2002; Quiroz *et al.*, 2002; Mendez *et al.*, 2001; Tesfaye Abebe, 2005). These methods offer good opportunities for obtaining a systematic insight into different types of specialized homegardens. The further evaluation of these different types in respect to socioeconomic conditions, under which they evolved, can provide useful insights into the development trends of homegardens.

Hence, the present study was taken up with the following objectives

i. To assess the structural configuration of specialized homegardens (in terms of dominance-diversity profile) and its functional dynamics.
ii. To delineate the technology needs (gaps) cum dimensions of technologies as perceived by farmers.
iii. To investigate the cost benefit analysis and cultural importance.

iv. To evaluate selected aspects of women's participation in homegarden activities

SCOPE AND IMPORTANCE OF THE STUDY

Soemarwoto (1987) opined that while it is relatively easy to increase yield and income, there are difficult problems in achieving long term sustainability of the homegardens. These difficulties are both in the biophysical and in the socio-economic realm. It is recommended that these problems should be looked into and research to seek appropriate solutions should be stimulated. The multi tier mixed cropping/farming system contributes to the structural configuration of homegardens. The structural configuration is utilized for inclusion of specialised components in homegardens making it functionally dynamic. Detailed investigations on the structure and composition of specialized homegardens of Kerala would enable both the extension and research system to formulate research agenda as well as delivery mechanism that will aid in development of technologies adapted to local situations. It will enable better income generation which will satisfy the bio-physical and socio-economic requirement of family and that of the state.

The specialized components will aid the homegarden with continuous production throughout the year that makes it biophysically superior and an ever evolving dynamic system. This system will facilitate better income generation and also family labour involvement. Hence, it becomes appropriate to study the social-cost analysis and differential gender role with special reference to activities in specialized homegardens.

Agricultural technology is a complex blend of materials, processes and knowledge. Homegardens becomes more complex with the inclusion of specialized components. Hence technology components to be incorporated will be also more complex requiring refinement to the level of its specialization. Because of the complexity of agricultural technology, different institutional arrangements are needed to transfer different types of technology to technology users. Hence it becomes imperative to delineate technology dimension and technology needs suited for specialized homegardens.

Studies have shown that although rural women play an important role in agriculture (Chacko, 1975; Kaur and Sharma, 1991), disparities in gender distribution of labor still

exist. In Kerala, however, there are high levels of participation by women, in agriculture. The average number of hours put in by women in small homegardens is greater than the hours put in by men. However, the commercial sized homegardens also have a very high household labour input by women and high levels of participation, thus suggesting that women are also very much involved in the financial health and productivity of the garden. Hence the degrees of gender involvement in specialized homegardens will also be investigated.

LIMITATIONS OF THE STUDY

As the study is part of Masters Research the area of study was confined to only three districts namely Ernakulam, Thrissur and Palakkad. Very few specialized homegardens from each district were selected and hence generalization of the results may not be appropriate. All the data were collected by personal interview with the respondents. Most of the responses were from the respondents recall memory and not based on written records. However, due care was taken to ensure high reliability of the data.

PRESENTATION OF THE THESIS

The entire Master's thesis is presented as five chapters:

The first chapter 'introduction' explains the importance of the topic, objectives, scope and limitation of the study. Second chapter, 'theoretical orientation' deals with review of relevant literature in line with the objectives of the study. Third chapter 'research methodology' describes the sampling design, the study area, measurement of independent and other variables, method of data collection and statistical tools used. Fourth chapter 'results and discussion' discusses the results of the study to draw specific inferences and the final chapter 'summary' briefly summarizes the work done and salient findings, explains the implications based on the results of the study and also suggests future areas of research.

Theoretical Orientation

CHAPTER 2

THEORETICAL ORIENTATION

A proper conceptual framework for the study based on the ideas and concepts gathered from review of existing literature of both theoretical and empirical nature will facilitate the researcher for planning the study in a comprehensive way. As the studies on the specialised homegarden systems in Kerala was less, the works on homegardens reported from other countries were reviewed to identify and internalise different variables that are relevant to the different areas of present research and to presume probable relationship among them. Hence, the available studies that are directly or indirectly related to the topic of research from various sources are exhaustively reviewed. The literatures based on the objectives of the present study are elucidated in this chapter under the following sub headings.

2.1 Personal and social characteristics of specialised homegardens

Farming system is a unique and reasonably stable arrangement of farming enterprises that the household manages according to well-defined practices in response to the physical, biological, and socioeconomic environments and in accordance with the household's goals, preferences, and resources. Hence it is very important to have a fundamental understanding about the various personal and social characteristics of influence of homegarden farmers. Some review for the selected variables of study is presented below.

a. Age

Age was defined as the number of years completed by the respondent at the time of investigation

Sl. No.	Author	Review statement
1	Jayakrishnan (1984)	A study on adoption found that age had significant and positive relationship with adoption of low cost technology among paddy growers.
2	Quazi and Iqbal (1991).	A study conducted in a village in Faizalabad district, Pakistan, indicated that age was inversely related as a determinant of innovation adoption

3	Babu (1995)	Reported that age of farmers of central Kerala had no relationship with adoption of scientific practices in homesteads

Singha (1996) studied the socio-economic characteristics of coconut growers in a progressive area of Assam and revealed that majority (66.67 per cent) of the farmers were middle aged (between 30-50 years)

Jaganathan (2004) observed that 44 per cent of vegetable growers belonged to the old age category.

b) Education

Education refers to the extent of non-formal or formal learning possessed by the homegarden farmer.

Sl. No.	Author	Review statement
1	Agarwal and Arora (1989)	Educational level was significantly associated with adoption of biogas plants.
2	Quazi and Iqbal (1991)	Education was an important determinant of innovation adoption.
3.	Beena (2002)	reported that nearly half (45 per cent) of the respondents had education upto high school level and 19.16 per cent studied upto primary level. Only 1.67 per cent of respondents under the study were illiterate.
4.	Jaganathan (2004)	reported that education status of the farmers had positive and significant relationship about knowledge and adoption of organic farming practices and majority (52 per cent) of the respondents had secondary level education.

c) Occupation

Occupation for this study was operationalised as the main vocation and other vocations that the respondents had at the time of interview.

Sl. No.	Author	Review statement
1	Agarwal and Arora (1989)	Educational level was significantly associated with adoption of biogas plants.
2	Krishnamoorthy (1988)	There was no significant relationship between occupation and extent of adoption of scientific practices in irrigated cotton and millets.
3.	Rathinasabapathi (1987)	Reported non-significant relationship of occupation with extent of adoption of integrated pest management practices in cotton.

d. Family size

This refers to the number of members of either sex living in a household/family dependent on the head of the family.

Sl. No.	Author	Review statement
1.	Verma and Rao (1969)	reported that family requirement has a direct relationship to garden size. So, size of family is important in influencing garden size.
2.	Rathinasabapathi (1987)	reported non-significant relationship of occupation with extent of adoption of integrated pest management practices in cotton.

e. Irrigation potential

This measured the extent to which the holding was irrigated.

Sl. No.	Author	Review statement
1	Perumal and Mariyappan (1982), Shivashankara (1986) and Chenniappan (1987)	reported positive relationship between irrigation index and extent of adoption.

2	Babu (1995)	reported a significant relationship between irrigation potential and extent of adoption of scientific practices in homegarden

f. Annual homegarden income

This refers to the total annual earnings of the farmer from farm activities in the homegarden.

Sl. No.	Author	Review statement
1	Salam and Sreekumar (1990)	concluded that in a homegarden of 68 cents of land with cropping component (having multi-tier canopy configuration), inclusion of livestock component (Jersey cross bred cow and poultry) and irrigation technology could meet the home demands as well as educational requirement of seven member family consisting of five children.
2	Thomas (1998)	reported that animal husbandry component contributed significantly to the homegarden farmers annual income wherever incorporated irrespective of the holding size or different crops of inclusion.
3	Mendez *et al* (2001)	reported that homegardens, although primarily used for subsistence purposes of the household, are increasingly being used to generate cash income.
4	Mohan (2004)	reported that the tangible benefits derived from the garden also included products for market sale, milk and other livestock products, and goods used for household consumption such as food, firewood and medicinal plants.
5	Alavalapati (2004)	reported that the most important contributors to the economic profit generated by homegardens were coconut, arecanut and banana (both cooking and

		dessert varieties), but the distribution of profit varied across garden sizes.
6	Odebode (2006)	reported that tree crops and livestock produced in home gardens accounted for more than 60% of household income.

g. Extension contribution

It refers to the extent of help and services rendered by various extension agencies like Agricultural Department, Commodity Boards and Krishi Vigyan Kendras, to the homegarden farmers in the form of various extension and educational activities that will help them in better homegarden farming.

Sl. No.	Author	Review statement
1	Shivasankara (1986)	reported that there was significant and positive relationship between personal guidance from personnel of different agencies for better farming and extent of adoption.
2	Sulaiman (1989)	reported that there was no significant relationship between personal guidance for better farming and extent of adoption.
3	Himaja (2001)	reported that majority of the respondents had medium level of extension contact followed by low (20.0 per cent) and high (16.67 per cent) levels of contact.
4	Reddy (2003)	reported that majority (60.00 per cent) of the respondents were having medium level of extension contact, followed by low (24.67 per cent) and high (15.53 per cent) levels of extension contact respectively.

h. Market orientation

Market orientation has been defined as the degree to which a farmer is oriented toward the market in terms of demand and price of his produce.

Sl. No.	Author	Review statement
1	Samantha (1977)	Market orientation is one of the three sub-scales of the scale measuring management orientation, which is operationally defined as the degree to which a farmer is oriented towards scientific farm management comprising planning, production and marketing functions/activities of his farm enterprises.
2	Sajeevachandran (1989)	reported that there was a positive and significant relationship between market orientation and adoption of scientific practices in pepper.
3	Thomas (1998)	reported that market orientation was significantly related to the knowledge and adoption of medicinal plants.
4	Jaganathan (2004)	found that 55 per cent of the respondents had medium level of market orientation and respondent's awareness and attitude towards the organic farming practices had a positive and significant relationship with market orientation.
5	Saikia and Khan (2012)	reported that, homegardeners maintained their gardens for meeting the household requirements of fruits, timber, vegetable, ornamentals, and fuelwood; market-oriented production was of secondary importance.

i. Rational orientation

This was operationalised as the extent of rationality and scientific belief of a homegarden farmer in relation to the different scientific recommendations applicable to homegarden enterprises.

Sl. No.	Author	Review statement
1	Rajendran (1992)	reported that there was a positive and significant relation between rational orientations of schedule caste farming families to the extent of adoption.
2	Thomas (2004)	that there was no relation between rational orientations of homegarden farmers to the extent of adoption

j. Evaluative perception on the sustainability of farming and cropping system in homegardens

There were very few specific studies of evaluative perception of homegarden farmers in relation to the appropriateness of farming systems and cropping patterns. Hence, studies conducted in other areas, which were indirectly connected with present study, were summarized under the following heads

i. Sustainability

The evaluative perception of homestead farmers in relation to sustainability of farming systems and cropping patterns in homegardens varies from individual to individual. The purpose of perception is to help individual to cope with the world by assigning meaning to it, which can stand the test of subsequent experiences (Toch and Maclean, 1970)

Sl. No.	Author	Review statement
1	Jambulingam and Fernandez (1986)	The woody perennials in farm with other agricultural crops are better able to cope with poor growing conditions and thereby increasing integration on farmlands, which represented a strategy to minimize the risk of crop failure.

2	Soemarwoto (1986)	opined that while it is relatively easy to increase yield and income, there are difficult problems in achieving long term sustainability of the homegardens. These difficulties are both in the biophysical and in the socio-economic realm.
3	Salam *et al.* (1991)	Developed the model that is capable to maintain soil health and to ensure environment safety.
4	Kumar and Nair (2004)	reported that a commonly perceived indicator of homegardens' socioeconomic sustainability is the fact that homegardens typically contribute towards nutritional security, energy needs and income generation even under conditions of high population densities
5	Peyre *et al* (2006)	concluded that the concept of socio-economic sustainability should not only be related to the homegardens' function in the present livelihood conditions, but also to their ability to adjust to socio-economic changes.
6	Bagson and Beyuo (2012)	reported that a home garden is ecologically sustainable if it production levels (output per unit area) is relatively adequate for the present and future generations without reducing the ecosystem potentials in the garden. This indicates that the continuous interaction between the living and non-living components should result in a stable and productive system.
7	Bagson and Beyuo (2012)	reported that, the socioeconomic sustainability in a home garden refers to the effective use of the indigenous knowledge system to continuously enhance output per unit area.

ii. Influence of homestead farming on quality of life, food, nutritional and medicare aspects

Homestead farmers place high value on the social, aesthetic and habitat functions of homegarden. Farmers have their own perception about the components of their homesteads. Homestead farmers value the components of their homesteads not only as a source of income and subsistence, but also for their role in improving habitat quality and conservation of soil and water resources and aesthetic value.

Sl. No.	Author	Review statement
1	Babu *et al.* (1992)	reported that inclusion of plants with some medicinal value would also help the immediate medicare needs of the family.
2	Thomas (1998)	opined that homegarden farmers of Kerala grow a large number of common medicinal plants that can take care of the immediate medicare requirements of the household members for commonly occurring illness like cold and fever.
3	Soemarwoto (1986)	He opined that while it is relatively easy to increase yield and income, there are difficult problems in achieving long term sustainability of the homegardens. These difficulties are both in the biophysical and socio-economic realm.
4	Salam *et al.* (1991)	Developed the model that is capable to maintain soil health and to ensure environment safety.
5	Albuquerque *et al.* (2002)	reported that, the homegardens make a substantial contribution to the supply of medicinal plants, which may be traded or consumed locally by the family or community.
6	Schupp (2009)	reported that home gardening, based on organic or alternative farming method has successfully met varied human demands, preserved indigenous agricultural

		practices and satisfied human pleasure of closeness to nature.
7	Akosa (2011)	reported that, home gardening has contributed to food security in ways, such as direct access to a diversity of nutritionally rich foods; increased purchasing power from savings on food bills and income from sales of garden products, and fall-back food provision during seasonal lean periods.

iii. Utilization of resources

The farming systems and cropping pattern adopted in homesteads help the farmer to exploit the available resources to the maximum level possible, where recycling of resources is the thumb rule.

Sl. No.	Author	Review statement
1	Nair and Sreedharan (1986)	Opined that close association of agricultural crops, tree crop and animals in homegardens of Kerala, is characterized by optimum utilization of available resources of land, solar energy, technical inputs and efficient recycling of farm wastes.
2	Save and Sanghavi (1993)	reported that the products from the natural farming have longer shelf life, high digestability and palatability.
3	Bagson and Beyuo (2012)	reported that, in home gardening, sustainability extends to maintaining equilibrium between the biotic and abiotic components of the immediate environment. Cultural practices within the home garden enhance soil fertility while harmonizing the interaction among the producers, the decomposers and the consumers to continuously establish a stable ecosystem.

iv. Economic aspects

Homegardens possess the potential to generate or add income of the homegarden farmers.

Sl. No.	Author	Review statement
1	(Soemarwoto and Christianity, 1985).	In areas far from towns, homegardens function primarily as subsistence systems and may produce over 15 per cent of the total food requirement. In such situations, income from homegardens is usually higher than from rice fields.
2	Abdoellah *et al.* (2006)	reported that in the commercial homegardens, the choice of species is determined largely by market demands.
3	Saikia and Khan (2012)	reported that agar-based homegardens were identified as a potential income source of Upper Assam as agar on an average contributed 4% ± 0.46 of the total annual income of the family.
4	Calvet-Mir *et al* (2012)	reported that, bibliographic evidence suggests that home gardens contribute to income generation, improved livelihoods, and household economic welfare as well as promoting entrepreneurship and rural development

v. Environmental facets

Environmental facets are the perception of the farmers as to the overall environmental benefits of homegarden farming.

Sl. No.	Author	Review statement
1	Neher (1992)	defined sustainable agriculture as a system, which contains four equally important components, namely, environmental quality, ecological soundness, plant and

		animal productivity and socio economic viability.
2	IOE (1979)	The study conducted revealed that homegarden respondents when asked why an unused tree is found in a garden, they typically responded by saying that they might need it sometime in the future and it protects the environment. Homegardens are also a good habitat for small wild animals such as birds, reptiles and amphibians. In a hamlet in West Java, 78 species of birds belonging to 38 families were found, including 13 species that were legally protected.
3	Nair and Sreedharan (1989)	The tree crops in homestead can act as windbreaks, shelterbelts and help in soil conservation and so on. Environment is well taken care of by this system.
4	Pushpakumara *et al* (2010)	reported that, home gardens also provide a number of ecosystem services such as habitats for animals and other beneficial organisms, nutrient recycling, reduced soil erosion, and enhanced pollination.
5	Seneviratne *et al.* (2010)	opined that, in homegardens abundance of plant and animal litter and continuous recycling of organic soil matter contributes to a highly efficient nutrient cycling system.

2.2 Structural configuration and functional dynamics of specialized homegardens

a) History of homegardens

The history of homegarden thus is as old as civilization. Literatures have been reviewed and presented to understand the origin of homegardens. Homegardens may have originated in pre-historic times when human started dwelling in a place for existence. The history of homegarden thus is as old as civilization. Literatures have been reviewed and presented to understand the origin of homegardens.

The first written record of the homegarden in Indonesia appeared in a Javanese charter of 860 A.D. (Terra, 1954). But the homegarden probably originated 10,000 years or

more ago, when hunters and gatherers discarded domestic refuse, containing seeds and other propagules, in the vicinity of their dwellings and then tended and protected the plants that appeared (Hutterer, 1984). It has been suggested that Central Java is the Indonesian center of origin of the homegarden (Terra, 1954).

Ninez (1984) has pointed out the description of the mythical Garden of Eden in Genesis II was that of a homegarden, containing "every tree that is pleasant to sight and good for food". Arnold (1987) reported that homegardens had long existed as the principal farming systems on dryland accounting for a substantial proportion of land use, with irrigated rice cultivation forming the other main component of the farming system.

From this very brief sketch there is evidence that homegardening is a very old tradition which may have evolved over a long period of time and is still continuing in the modern times.

b) Definitions of homegardens/specialised homegardens

Homegarden farming system is a unique production system practised throughout the state, across caste, creed, religion, lingua, ethnic groups and matriarchal and patriarchal settings. It has been referred to in many terms such as homestead, house garden, compound farm, household farm, homestead farming, mixed garden horticulture, forest garden, mixed garden, house compound land etc. Homegardens can be expressed or defined in a number of ways owing to the variability and diverse function in the homegarden. Some definitions provided by the scientists and experts are presented in the reviews mentioned below.

Hanman (1986) referred homestead to the home and its adjoining land owned and occupied by the dwelling unit of the household including the immediate area surrounding the dweller's unit and space used for cultivation of trees and vegetables.

Nair and Sreedharan (1986) defined homestead as an operational farm unit in which a number of crops (including tree crops) are grown with livestock, poultry and / or fish production mainly for the purpose of satisfying the farmer's basic needs.

A typical Kerala homestead consists of a dwelling house with small garden in front and variety of annuals and perennials crops grown in mixture in a small piece of land (KAU, 1989).

Salam *et al.* (1992) defined homestead farming as a special type of agricultural production system practised around the home with a multi-species of annual and perennial crops along with or without poultry and or fish for the purpose of meeting the fundamental requirements of the home namely, food, fodder, fuel, timber and organic mulch and also to generate additional income through the sale of surplus to purchase the non-producible items of the homesteads.

Thomas (2004) defined homegarden as a special type of sustainable agricultural production system practised around the home with or without extended garden, where a multi-species of annual and perennial crops along with or without animal husbandry components and other specialised components like aquaculture, sericulture, apiculture, etc. for the purpose of meeting the fundamental requirements of home and also to generate additional income through the sale of surplus to fulfil the requirements of household.

Cherry and Di Leonardo (2010) defined homegarden as a small system of household plant production and an unpopular aged-long food security strategy partly because of its wide variety of produce and its informal nature.

Encompassing all the above factors, specialised homegardens may be operationally defined as a special type of sustainable agricultural production system practised around the home with or without extended garden, with homegarden primary structure supplemented with specialized components like sericulture, apiculture, aquaculture, floriculture, nursery units etc making way for the homegardens to be categorized as subsistence with subsidiary commercial interest and/or made for a particular purpose to the extent that it becomes visibly different from the general types of the traditional types of homegarden farming system.

c) Concept, importance and types of homegardens with respect to farming systems and cropping systems

Homegarden farming system falls under the broad classification of agroforestry. It is determined by the structure of the system, its ecological functions and its continued ability to fulfil the socio-economic needs of the people.

Cropping system is the crop production activity where the meaningful utilisation of the cropping patterns takes place on a farm through their interaction with farm resources

and available technology which determine its makeup and that contribute to the homegarden requirement in terms of economy (Desai, 1961).

Farming system is the production activity of the farm or holding. The farming systems of homegardens thus encompass the sum total of all activities of the farm related to crop production and overall prosperity of farm household. It comprises all cropping systems in the farm or holding and their interaction with farm resources, other household enterprises and physical, biological, technological, environmental, socio-economic and cultural factors (Swaminathan, 1979).

Soemarwoto and Soemarwoto (1984) opined that homegarden as an agroforestry system should ideally combine the ecological functions of forests with those providing the socio-economic needs of the people.

. Farm animals, poultry and sometimes fisheries are also components of the system. The system is characterised by optimum utilisation of available resources of land, solar energy and technological inputs and efficient recycling of farm wastes. (Nair and Sreedharan, 1986)

The rural Kerala with a predominance of households and intensive production activity in its surrounding makes it necessary to understand the composite nature of farming systems and cropping systems practised in the homegardens for the comprehensive economic development of rural sector (Babu, 1995).

Indian agriculture is predominantly a small peasant based economy with approximately 80% of the operational holdings being below two hectares, and 34% of the agricultural land are cultivated by them. Because of small operational holdings, it is indeed very difficult by the small farmers to improve their earnings only by raising the yields of the existing crops, mainly cereals. Attention on high value crops with available modern farm inputs may provide a stable economic base of the poor peasants (Chattopadhyay and De, 2010).

Aravind *et al* (2004) concluded that the homegardens which are mimics of mini forests are the forests created by the farmers of Kerala by incorporating various perennial and annual crops which renders the system a dense scenario of vegetation.

Thomas (2004) was of the view that homegardens cannot be considered as system with emphasis on individual components alone but as a system of crop mix interaction with other farm components like animal husbandry components and other specialised components like sericulture, apiculture, aquaculture, floriculture etc.

Zerihun *et al* (2011) were of the opinion that home gardening has become an important part of cultural heritage which denotes specific farming practices at different localities. It is therefore inappropriate to ascribe definite and effective cultural practices to the management, siting and ownership of home gardening because home gardening has been a way of life for centuries.

Galhena *et al* (2013) reported that home gardens can be described as a mixed cropping system that encompasses vegetables, fruits, plantation crops, spices, herbs, ornamental and medicinal plants as well as livestock that can serve as a supplementary source of food and income.

d) Structural configuration and functional dynamics

Detailed analysis of homegardens reveals well-defined plant associations that reflect a variety of complementary functions and whose design and composition are under the influence of climatic, edaphic and economic factors, as well as cultural and traditional ones (Abdoellah, 1977; Karyono, 1981).

Inspite of the very small average size of the management units, homegardens are characterized by high species diversity and usually 3-4 vertical canopy strata, which result in intimate plant associations. The layered canopy configurations and combination of compatible species are the most conspicuous characteristics of all homegardens. Contrary to the appearance of random arrangement, the gardens are usually carefully structured systems with every component having a specific place and function. The Javanese pekarangan is a clean and carefully tended system surrounding the house, where plants of different heights and architectural types, though not planted in an orderly manner, optimally occupy the available space both horizontally and vertically (Wiersum, 1982; Soemarwoto and Soemarwoto, 1984).

Homestead farms with a multitude of crops presenting a multi-tier canopy configuration ensures a high level of exploitation of environmental resources. Top-most

canopy is occupied by coconuts, the second layer by arecanut, pepper, jack, tamarind and mango, the third layer is occupied by banana, tapioca and fruit plants and the lowermost layer of canopy consists of tuber crops, vegetables and guinea grass. The boundaries are live-fenced with glyricidia (Salam and Sreekumar, 1990; Aravind *et al*, 2004).

Trees are a common component, so much so that to the traveller in the Javanese countryside the villages are not recognizable by the presence of houses but by the dense "forest" that conceals them. According to popular belief, the structure of the homegarden deliberately mimics the natural forest, but in Javanese culture forests have a low social value. Indeed, Javanese feel offended when their homegarden is compared to a forest. In the popular shadow plays, the *Wayang*, forests are depicted as dangerous places where wild animals live and evil spirits reign. Hence forest clearing (*Babad alas*) is looked on as a noble deed and can only be done by men who have spiritual powers. Today the term *Babad alas* is used in everyday life for the initial activities of praiseworthy projects, such as the creation of a university. The forest structure of a homegarden is, more plausibly, a result of convergent evolution, both natural and artificial selection favoring diversity (Soemarwoto and Conway, 1991).

Shehana *et al.* (1992) pointed out that spice components grown in a polyculture that consisted of distinct canopy stratification, helped to reduce soil temperature inside the microclimate which inturn helped to reduce soil evaporation rate. The litter and crop residues were often left to get accumulated in soil and this was helpful to reduce soil evaporation rate.

Jensen (1993) concluded that sustainability of the homegarden was with the medium fertile soil with large nutrient reserves, the large plant biomass directly and indirectly protected the soil against erosion and drying and high species diversity provided a large variation in crop phenology and stability in nutritional supply.

Sharma (1996) pointed out that there was a long standing tradition of practising coconut based system in Kerala. An important aspect was the presence of more plant cover on the plantation floor, which increased the fixation of nutrients that is cycled within the soil plant system. The vegetative cover maintained reduced soil erosion risks, biotic diversity of species composition, age distribution, trophic levels and so on was sustained

above the level at which the activities of pests and diseases become an ecological and economic constraint. Previous experience have shown that large scale plantations restore forest coverage and achieve objective of sustainability, increased production which benefit the farmers as well as rural poor.

Wickaramasinghe (1995) analysed the spatial structure of traditional homegardens (not affected by modern intervention) in selected villages of Kandy. He reported that there was a large variation in the spatial arrangement of species. These were primarily linked with priority needs, potential uses and availability of space.

Thomas (2004) opined that the effect of the distance from home to the edge of the homegarden was identified as a factor contributing to the zonation of homegarden which implied that the match between the variations in priorities of the home and the spatial arrangements of homegardens is strong both socially and economically.

Zaman (2010) in his study showed that, to get fruits, fuel wood, timber and various agricultural products as well as to bring back equilibrium in the ecosystem, establishment of multi-layered cropping systems in the homesteads and/or orchard is inevitable.

Devi (2010) in her study recorded ten horizontal zones in the homegardens gardens, although these were not systematically arranged. These microzones included bamboo groves, spice zone (e.g., *Allium odorum*), cattle sheds, courtyards in front of the house, out-house, ponds used for fishery and for planting *Neptunia prostrata* and *Ipomea aquatica*, residential zone, vegetable growing area, boundary zone, and the sacred zone.

2.3 Characterisation of specialised homegardens.

a) Technology dimensions.

Technology involves the application of science and knowledge to practical use, enabling man to live more comfortably and securely (Hoda, 1979). Technology is systematic knowledge and action, usually of industrial processes, but, applicable to any recurrent activity (Mc Graw, 1982). The new technology in the context of agriculture means all forms of new farm inputs, practices and services such as fertilizers, insecticides, herbicides, tube-well water, improved farm machines and equipmentsand agricultural extension services. (Raju, 1982).

The rapid technology progress and the increased rate of obsolescence of technologies necessitate technology forecasting for any planning process. Technology forecast can be defined as a probabilistic prediction of technological changes in terms of future characteristics of useful machines, systems or procedures and needs of the clients (Rao, 1998).

Rajendran (1992) identified 14 dimensions that were related with technology and its feasibility using the mean relevancy score. They were initial cost, income generation potential, regularity of returns, availability of raw materials, availability of supplies and services, time utilization pattern, rapidity of returns, physical compatibility efficiency, profitability, availability, simplicity, viability, suitability and social acceptability.

Muthuraman (1995) in his article on sustainable agriculture has quoted some dimensions of sustainable agriculture identified by Swaminathan covering the social, economical, technological, political and environmental facets of sustainability as technological appropriability, economic feasibility, economic viability, environmental soundness, temporal stability, resource-use-efficiency, local adaptability, social acceptability, social sustainability, political tacitness, administrative manageability, cultural desirability, renewability, equity and productivity.

KAU (2002) identified five dimensions for technology assessment as productivity, adaptability, identity, continuity and security. Small producers particularly those operating in resource-poor areas and in small holdings (homegarden) have benefited much less from the recent technological breakthrough in agriculture. Identifying the dimensions of technology for homegardens will thus enable the cause for homegardens in the following ways.

a. Future oriented research and development towards need based technology for homegardens.
b. Prevention of import of obsolete technologies intended for homegardens.
c. Shift towards appropriate technology suited for homegarden conditions.
d. Effective technology transfer for homegarden farmers.

e. Leap across generations (continuity) in terms of technology use

f. Rapidity of innovations with an eye to homegardens of Kerala.

g. Trade restrictions on technology generation and dissemination to homegardens

Akinnifesi *et al* (2010) suggested that, there is need for research and investment on the post-harvest storage and handling of fruits and other products to reduce the high rate of spoilage from collection to consumption.

Zaman *et al* (2010) in their study found that, farmers depended on the naturally growing trees on the homegarden. The modern technologies and extension supports to develop the traditional production systems were almost not available.

b) Economic dimensions

Salam and Sreekumar (1991) concluded that in a homegarden of 68 cents of land with cropping component (having multi-tier canopy configuration), livestock component (Jersey cross bred cow and poultry) and irrigation component could meet the home demands as well as educational requirement of seven member family consisting of five children.

Aravind *et al* (2004) identified that profit motive of farmers is reflected by the inclusion of various profit yield crops in homesteads like Arecanut (*Areca catechu*), cashew (*Anacardium occidentale*), Pepper (*Piper nigrum*), Clove and Teak (*Tectona grandis*).

Zaman *et al* (2010) opined that homegarden has been shown to be a source of additional income because the household can sell a portion of the garden's produce, also important in overcoming seasonal availability of foods and promoting household self-sufficiency.

c) Social dimensions.

The increasing population, massive industrialization, agricultural transformation, underdevelopment, culture and tradition. are major crucial factors that have resulted in massive exploitation of natural resources that are necessarily the components of agriculture which aids in the development of a family, society, state and the nation.

Aravind *et al* (2004) reported that in many homesteads of Kerala, Kavus or 'Sacred grooves' are found. 'Sacred groves' or Kavus are tracts of virgin forests. These constitute an integral part of life, culture and folklore tradition of Kerala.

Thomas and Kurien (2013) identified the main aim of preserving a home Garden is to preserve ritualistic beliefs and cultural identity of joint families.

2.2 Benefit-Cost analysis in terms of contribution of specialised components to annual homegarden income and cultural importance of specialised homegardens.

A very few studies have been conducted on economics of homegardens in Kerala. A general review on the economic aspects related to the returns from homegardens, identifying the marketing channels for homegarden produces and the role of middleman in the marketing activities is attempted in this section.

Talib and Singh (1960) indicated that yield and income per acre were high in mixed farming as compared to monocrop farming. It was significantly high in the case of small farmers dwelling unit.

Das (1988) reported that in the case of multi-storied cropping under irrigation in coconut garden the benefit: cost ratio was 1.76 and the internal rate of return higher than 20 per cent and the net present value worth Rs. 32700/-. He also opined that different varieties of cereals, pulses, oil seeds, tubers and rhizomatous crops were relatively more compatible and remunerative intercrops than the other annuals in coconut garden in Kerala.

Kandasamy and Chinnaswamy (1988) found that among different mixed farming practices, dairy-based system was more profitable than others. The mean annual net income was Rs.6090/- with per day income of Rs.16.68/-. The next best system was diary-cum-poultry based farming system, having a mean annual net income of Rs.5899/- with per day income of Rs.16.16/-. Poultry based mixed farming gave only a marginal mean annual net income of Rs.2287/- with a per day income of Rs.6.27/-.

Galhena *et al* (2013) opined that home gardens are mainly intended to grow and produce food items for family consumption, but they can be diversified to produce outputs that have multiple uses including indigenous medicines and home remedies for certain illnesses, alternative fuel source, manure, building material, and animal feed.

2.3 Women's participation in homegarden activities.

Because homegardens are cared for primarily by women, they are more likely to be developed among matriarchal societies, typical of Central Java, thirty years ago. In Tegal on the northern coast, for example, a homegarden could not be sold without the consent of the wife. Similarly, well-developed homegardens are found in the matriarchal society of West Sumatra and among the Acehnese of North Sumatra but not among the patriarchal Batak people, also of North Sumatra (Penny and Ginting, 1984).

The term gender analysis in agriculture refers to the determination of who does what, why and with what resources towards improving their overall production and standard of living. He also stated that it is the most effective tool to open up the farm household and to understand its behaviour. Some studies on the role of family members in homestead agriculture pointed to women being the main participants in homegardens. An analysis of land use in Pananao, in the Dominican Republic showed that women were responsible for providing homegarden products to the household, for working in the gardens, and for controlling the resources and processes of the gardens (Rocheleau, 1987). In a study conducted in the homegardens of Lusaka, Zambia (Drescher, 1996), it was found that women tended to have higher species diversity in their homegardens than men, and utilized different strategies to improve soil fertility in semi urban, and rural areas. Studies examining the effect of gender in agriculture are increasingly being conducted (Ramamurthy, 2000, Raynolds, 2003), but research documenting the effect of homegarden farming on gender relations in tropical agriculture remains limited.

Howard (2006) reported that the gender division of labour not only provides many insights into how households organize homegarden production; it also highlights how contributions and responsibilities of individuals differ according to their positions within the household, which is very important for understanding the incentives, opportunities, and constraints that they confront when managing homegardens and how such individual factors influence homegarden structure, composition and functions.

Pandey (2007) opined that women's participation and responsibilities in home gardening varies across cultures, including land preparation, planting, weeding, harvesting, and marketing

Zaman *et al* (2010) opined that women work efficiency should be increased by training, education and extension supports since they are mainly involved in home gardening.

2.3.1 Constraints experienced by farmers of specialized homegardens

Research studies pertaining to the constraints encountered in practising agroforestry and homesteads was thoroughly reviewed. A summarised list of the important constraints experienced by farmers in the utilization of agricultural technologies as identified and reported by the researchers is presented below:

Sl No.	Author	Crop	Constraints
1.	Palaniswamy (1978)	Flowers	Lack of credit, marketing, storage, transport facilities, non-availability of labour, exploitation of middle men, fluctuation in market price
2.	Seshachar (1980)	Chilli	Lack of knowledge regarding application of farmyard manure, fertilizers and plant protection chemical.
3.	Gokulraj (1981)	Tomato	Fluctuating market price, inadequate fund, no technical guidance, lack of knowledge regarding improved practice.
4.	Ramanathan *et al.* (1987)	Cassava	Lack of marketing system, high cost of cultivation, non-availability of planting material on time, low cost of tubers of HYV
5.	Hew (1989)	Cutflower	Shortage of good quality planting material, lack of production and post-harvest handling technology, lack of market innovation and insufficient government support

6.	Anantharaman (1991)	Cassava	Uncertainty in resource mobilisation, production and marketing, shortage of labour during peak periods, lack of timely and accurate information
7.	John (1991)	Pepper	Lack of assistance of government agency in organizing the farmers and providing proper guidance, lack of knowledge and awareness
8.	Jnanadevan (1993)	Coconut	High labour cost, non-availability of labourers in time, inadequate and timely supply of seedlings, lack of adequate financial assistance and subsidies
9.	Sindhu (1995)	Cut flower	Capital-intensive industry requires technologically advanced infrastructure to ensure quality product, lack or insufficient availability of good quality planting materials, lack of technical expertise and lack of transporting facilities.
10.	Bose (1998)	Jasmine	Fluctuation of market price, exploitation of middle men, non-availability of credit, inadequate irrigation facilities and lack of storage facility
11.	Sherief (1998)	Homegarden components	Lack of information, low yield, high cost of organic inputs, high labour cost, problem of pest and diseases, skilled labour requirement, lack of credit facilities, lack of government

			support and lack of extension support
12.	Miller (2001)	Homegardens	Identified the main constraints to further developing home-gardens or expanding them out to fields for greater productivity and income generation are the lack of adequate germplasm, risk of accidental fires, survival of seedlings in the dry season and soil fertility.
13.	Resmy *et al* (2001)	Coconut and banana growers	Lack of knowledge of technical guidance and lack of information resources.
14.	Ongusumi *et al* (2002)	Cowpea growers	Non availability of inputs transportation and finance and lack of market information.
15.	Thomas (2004)	Homegarden components	Surplus cannot be marketed.
16.	Torquebiau and Perot (2006)	Large-sized trees	Pointed out that high reliance on manual labour, limited markets for specific products, delayed production (from large-sized trees) and delayed return on investment.

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CHAPTER 3
METHODOLOGY

This chapter deals with the brief description of methods and procedures that were used for meeting the objectives set forth in this study. The methodology followed in the study is presented under the following sub-headings:

3.1. Research design

3.2. Locale of the study

3.3. Selection of the respondents

3.4. Operationalisation and measurement of the variables

3.4.1. Distribution of the home garden respondents based on their personal, socio-cultural and techno-economic factors

3.4.2. Structural configuration and functional dynamics of specialized homegardens

3.4.3. Characterisation of homegardens in terms of technology needs (gaps) and techno- socio- economic dimensions.

3.4.4. Economics of specialized components in homegardens

3.4.5. Gender role in specialized home garden activities.

3.4.6. Constraints experienced by specialized homegarden farmers

3.5. Data collection procedure

3.6. Statistical tools

3.7. Hypothesis set for study

3.1. Research design

'Ex-post-facto' and 'explorative' research designs were used for conducting this study. 'Ex-post-facto' research design is a systematic inquiry in which the scientist does not have direct control over the independent variables because their manifestations have already occurred or because they are inherently not manipulable (Kerlinger, 1983). This research design was resorted to in this study, as there was no scope for manipulation of any variables under study. Since the researcher had to probe for crop resource and specialized components in the homegardens, explorative design too was used for the study.

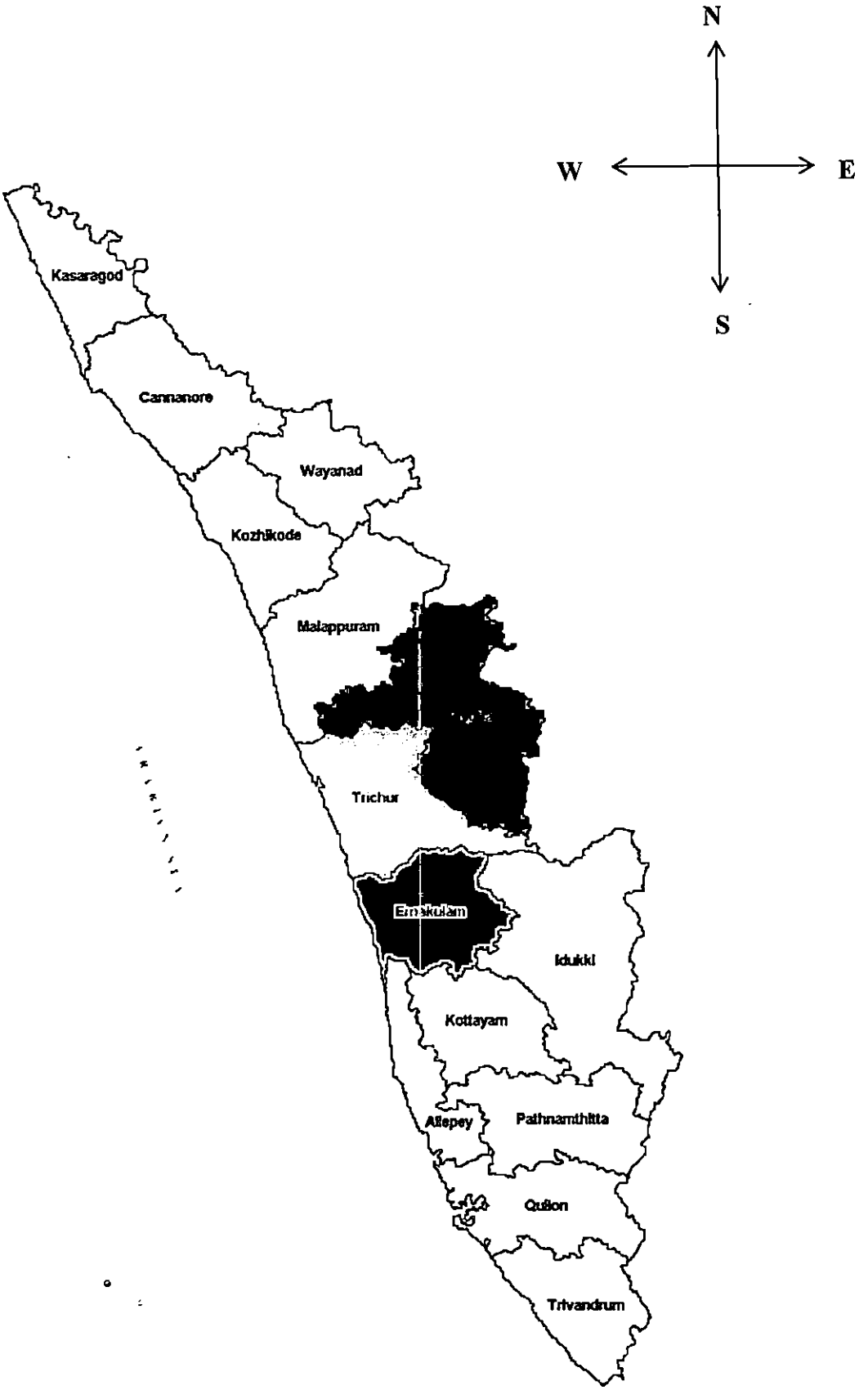


Fig.1 Map of Kerala of Kerala with districts of study.

3.2. Locale of study

The study was conducted in the Central Kerala region comprising Thrissur, Palakkad, and Ernakulam districts where the specialized homegarden systems are in vogue. The hitech/precision farming techniques were more popular in Palakkad and such specialization was a new trend in this area. The maps showing the location of the study are given as Fig.1.

3.3. Selection of the respondents

The respondent groups of the study comprised Farmers, Extension Personnel and Scientists. However, the respondent categories of Extension Personnel and Scientists were confined to the study pertaining to characterization of dimensions in homegardens in terms of technology, social and economic dimensions.

a) Farmers:

Specialized homegardens identified under 'ICAR Niche Area Excellence project' were selected for the study. Thirty specialized homegardens with ten each from each district were selected for data enumeration and the farmers of those specialized homegardens from Palakkad, Thrissur and Ernakulam were selected as the respondents making a total of 30 farmer respondents.

b) Extension Personnel:

Thirty Agricultural Officers were randomly selected as the respondents from the three districts. Preference was given to Agriculture Officers from the panchayats where the specialized homegarden were situated. This respondent category was only meant for the study pertaining to characterization of homegardens in terms of technological, social and economic dimensions.

c) Scientists:

The scientists concerned with homegarden systems research belonging to different institutions in Kerala (ICAR/KAU/Commodity Boards) were the respondents of the study. In all, 18 respondents were included in the final study. This respondent category was only meant for the study pertaining to characterization of homegardens in terms of technological, social and economic dimensions.

3.4. Operationalisation and measurement of the variables

3.4.1 Distribution of the respondents based on their personal, socio-cultural and techno-economic factors

In order to assess the influence of the profile characteristics of the homegarden respondents for meeting the objectives of the study, the characteristics of the homegarden farmers were identified as detailed below:

A list of 25 independent variables related to the personal characteristics of the home garden farmer respondents and important for meeting the objectives of the study were collected after detailed review of literature and discussion with subject matter specialists. The lists of variables were then sent to 30 judges comprising extension scientists and homegarden experts (Appendix-I). They were asked to examine the variables critically and to rate the relevancy of each variable on a five-point continuum ranging from most relevant, more relevant, relevant, less relevant and least relevant with weightages of five, four, three, two and one, respectively. Out of 30 judges only 21 responded.

The final variables were selected based on the criterion of mean relevancy score, which was obtained by summing up the weightages obtained by variable and dividing it by the number of judges responded. Those variables garnering a score more than the mean score were selected for the study. The variables with the mean relevancy scores are presented in Appendix II.

The personal characteristics of the homegarden respondents which constituted the independent variables thus selected for the study were age, education, occupation, family size, irrigation potential, and annual income from homegarden, extension contribution, market orientation, rational orientation, and evaluative perception of homegarden respondent farmers in relation to sustainability of the homegardens.

The selected 10 independent variables and their measurement for study are:

Sl. No.	Independent variables	Measurement and scoring procedures developed or adopted by
1	Age	Actual chronological age and classification based on census report, 2011
2	Education	Thomas (2004)
3	Occupation	Scoring procedure developed for the study
4	Family size	Scoring procedure developed for the study
5	Irrigation potential	Thomas (2004)
6	Annual income from homegarden	Scoring procedure developed for the study
7	Extension contribution	Scoring procedure developed for the study
8	Market orientation	Samantha (1977)
9	Rational orientation	Jeteley (1977)
10	Evaluative perception	Arbitrary scale developed for the study

1) Age

Age was operationally defined as the number of years completed by the respondent at the time of investigation.

This was measured as the total number of years completed by the head of the homegarden owning family at the time of interview and was classified based on census report, 2011 classification method.

Age category	Years
Young	(< 35)
Middle aged	(35-55)
Aged	(>55)

2) Education

In this study education is operationalised as the extent of non-formal or formal learning possessed by the homegarden respondent.

The scoring procedure adopted by Menon (1995) with slight modifications was used for the study and was as follows.

Category	Score
Illiterate	0
Can read and write	1

One score was added to every successful completion of formal schooling and the home garden respondent farmers were categorized under the classification, illiterate, can read and write, primary, secondary and collegiate education.

3) Occupation

Occupation was operationalised as the main vocation and other additional vocations that the respondents were possessing at the time of interview. The scoring procedure developed for the study were as described below.

Category of occupation	Code
Agriculture alone	1
Agriculture + private business	2
Agriculture + Government	3

The maximum and minimum score in accordance with the code assigned that could be attained by the respondent was 'three' and 'one' respectively.

4) Family size

This refers to the number of members of either sex living in a household/family dependent on the head of the family. This was measured in numbers.

5) Irrigation potential

This was operationally defined as the extent to which irrigation water was available in the holding and the extent of area irrigated.

It was quantified in terms of availability of irrigation water for irrigating the homegarden and the scoring procedure developed for the study is as stated below.

Irrigation potential category	score
Physical water scarcity	1
Economic water scarcity	2
Little or no water scarcity	3

The score obtained by the respondent was taken as his score for irrigation potential. The maximum and minimum score that could be attained by the respondent was 'three' and 'one' respectively.

Physical water scarcity refers to the perception of farmer that the water available in the homegarden is not enough for irrigation purpose.

Economic water scarcity refers to the perception of farmer that the water available in the homegarden is to be used very judiciously inorder to meet the irrigation requirements in the homegarden.

Little or no water scarcity refers to the perception of farmer that the water is abundantly available in the homegarden.

6) Annual income from homegarden

This refers to the total annual earnings from the farm and non-farm activities in the homegarden. This was measured in terms of rupees per year as expressed by the homegarden respondents.

7) Perceived Extension contribution

It refers to the extent of contribution of technology by the extension system to the homegardens as perceived by the homegarden respondents in the locality.

The respondent's perception on the contribution of technology by different extension agencies was scored in a three point continuum with scores of 'three', 'two' and 'one' respectively for 'very adequate', 'adequate' and 'not adequate' category of response. The responses for extension contribution from various agencies as expressed by homegarden respondents were collected as given in interview schedule (Appendix- III). By summing up the scores obtained by the respondent in all the category of responses, the extent of contribution from various institutes as perceived by the homegarden respondents were finally made.

The maximum and minimum score that could be attained by a respondent was '12' and '4' respectively.

8) Market orientation

Market orientation is one of the three sub-scales of the scale developed by Samantha (1977) for measuring management orientation, which is defined as the degree to which a farmer is oriented towards scientific farm management comprising planning, production and marketing functions/activities of his farm enterprises.

Market orientation was measured using the sub-scale, which consisted of six statements, three positive and three negative statements (interview schedule - Appendix III). In the case of positive statements, a score of 'one' was given for agreement and 'zero' for disagreement. For negative statements, the pattern were reversed. The total score obtained by the respondent was taken as his score for market orientation. The maximum and minimum score that could be attained by the respondent was 'six' and 'zero', respectively.

9) Rational orientation

This was operationalised as the extent of rationality and scientific belief of a homegarden respondent in relation to the different scientific recommendations of an enterprise. The procedure developed by Jeteley (1977) and adopted by Thomas (2004) was used for measuring rational orientation of a home garden respondent.

The question 'what do you feel about the increased improvement in your life'? was posed to the respondent which was rated based on the response as follows:

Response category	Score
Belief in stars and not in scientific recommendations	1
Belief in stars and scientific recommendations	2
Belief only in scientific recommendations	3

The score obtained by the respondent was taken as the rational orientation score of the respondent. The maximum and minimum score that could be attained by the respondent was 'three' and 'one', respectively.

10) Evaluative perception of homegarden farmers in relation to sustainability of the cropping pattern and farming system in homegardens

The evaluative perception of homegarden respondents in relation to sustainability of farming systems and cropping patterns in homegardens varies from individual to individual. The purpose of perception is to help individual to cope with the world by assigning meaning to it, which can stand the test of subsequent experiences (Toch and Maclean, 1970)

Evaluative perception of homegarden respondents on the sustainability of farming system and cropping patterns was measured using an arbitrary scale developed by Thomas (2004) for the purpose. The scale was considered as an arbitrary one since the various procedures of standardisation by estimating reliability and validity of the scale were not attempted in that study.

Based on the relevant review of literature and discussion with experts of Department of Agriculture and Kerala Agricultural University, items related to sustainability of farming systems and cropping patterns adopted by homegarden respondents were identified under five major heads namely environmental facets, sustainability, utilization of resources, economic aspects, quality of life- food, nutritional and medicare security.

1) Environmental facets refer to the overall consideration given to the environment by the homegarden respondent when agricultural production and allied activity is pursued by maintaining the cleanliness of the environment and preserving the same for the future generation.
2) Sustainability of homegardens refers to successful management of renewable resources for homegardening to satisfy the changing needs of members of farm family like improved productivity, providing food, income and livelihood for current and future generations while maintaining or improving the quality of homegarden environment and conserving the natural resources of homegardens.
3) Utilisation of resources refers to the effective use and management of homegarden resources through which maximum utility was attained from the use of homegarden inputs.

4) Economic aspects refer to the degree to which the overall economic improvement of the homegarden farmer was brought about as a result of adoption of technology/scientific practices in homegarden farming systems and cropping patterns.

5) Quality of life- food, nutritional and medicare security refers to the degree to which the standard of living, nutritional, medical and aesthetic aspects of the household would be influenced by the adoption of farming systems and cropping patterns that varies widely from homegarden to homegarden.

Evaluative perception of homegarden respondents on sustainability of farming systems and cropping patterns in the homegarden was thus operationally defined as the respondent's meaningful sensation about the worth and efficiency of homegarden farming systems and cropping patterns in terms of environmental facets, sustainability, utilisation of resources, economic aspects, and quality of life-food, nutritional, medicare and aesthetic aspects.

The perception of homegarden respondents on these items was measured on a four-point continuum varying from most important to least important with scores 'four' to 'one' respectively as given in the interview schedule (Appendix-III).

The scores for the evaluative perception of a homegarden respondent on each item were summed up to get the overall perception score for an individual respondent. The maximum and minimum scores were 124 and 31, respectively.

The mean values of the evaluative perception scores obtained by 10 respondents from each district (thus a total of 30 homegarden respondents) were computed and the respondents were grouped into low and high categories based on the mean score.

3.4.2 Structural configuration and functional dynamics of specialized homegardens

3.4.2.1 Dominance-diversity profile of specialized homegardens

a) Dominance profile.

The dominance of crops in the homegardens was measured in terms of structural dominance, numerical dominance and economical dominance as developed by Thomas (2004).

The measure of structural dominance was arrived at by observing promptly the pattern of canopy (configuration) formation, the height of plants, a perception of the root spread of plants and rating it in a 'seven point' scale with 'one' for a crop species with a highly dominating structure over the surrounding individual plants and 'seven' for the least dominating one in the homegardens.

The numerical dominance of a crop is the scale value assigned to that crop in accordance with the numerical strength of the individual plants belonging to the crops species. A seven point scale was used with 'one' assigned for the crop with maximum dominance stand and seven for the one with a minimum stand or scarcely distributed stand in the homegarden.

The economic dominance was also worked out using the similar procedures by assigning a rank 'one' in the seven point scale for the most remunerative crops and subsequently the other ranks of two, three, four, five, six and seven for the lesser remunerative crops in the order.

b) Diversity profile.

Sagar and Singh (1999) deliberated that, species diversity, which is a rough proxy for biodiversity, characterizes community structure and maintains the populations, food chains and nutrient cycles in ecosystem. In addition, human beings depend on biodiversity for food, medicines and materials for ecological services. A minimum level of biodiversity is required for proper functioning of the ecosystem, below which the ecosystem may collapse. Hence, the study on species diversity was essential so as to identify the structure and function of a homegarden ecosystem.

In this study, Shannon-Weiner index of diversity based on information theory (the information content is a measure of the amount of uncertainty) as used in the methodology developed by Thomas (2004) was used to calculate the diversity index of the homegardens. This index was purposively chosen as its measure since the whole of a homegarden as a single unit could be considered for the study unlike other cases where usually a portion of the ecosystem is considered

by way of further sampling. The formula used for determining the diversity index was

$$H' = -\sum_{i=1}^{s} (p_i \log_2 p_i)$$

Where

H` - Shannon-Wiener diversity index

P_i - A proportion of total sample belonging to i^{th} species

The Shannon-Wiener diversity index (H') is commonly used to characterize species diversity in a community. The proportion of species *'i'* relative to the total number of species (p_i) is calculated, and then multiplied by the natural logarithm of this proportion (ln p_i). The resulting product is summed across species, and multiplied by '-1'.

3.4.2.2 Extent of horizontal and vertical crop diversification in specialized home-gardens.

Agricultural diversification means growing/engaging new to an existing farm/non-farm activities using farm resources (Kasryno, 1992; Ali, 2004). The main advantage of the study of diversification in a region lies in the fact that it enables us to understand the impact of physical and socio-economic conditions on the agriculture. Moreover, it helps us in knowing the contemporary competition among crops for area, for rotation and effect on double cropping, total production and per hectare productivity (Bhalsing, 2009). The main form and the commonly understood concept is the addition of more crops to the existing cropping system, which could be referred to as horizontal diversification. The other type of crop diversification is vertical crop diversification, in which various other downstream activities are undertaken. This could be illustrated by using any crop species, which could be refined to manufactured products, such as fruits, which are canned or manufactured into juices or syrups as the case may be. In this study, the horizontal and vertical diversification was measured as given below:

The horizontal diversification was computed based on the number of levels of crop/specialized component observed in each of the specialized homegardens with special reference to the numerical and economic dominance and the results obtained was recorded in terms of average levels of inclusions in each of the specialized homegardens. The results were expressed in terms of the mean score obtained for each district.

Likewise the vertical diversification was computed based on the number of levels of economically dominant crops (Seven most economically dominant crops as already computed) dominant and the entire specialized components subjected to the levels of value addition until it reaches the market. The results were expressed in terms of the mean score obtained for each of the seven economically dominant crop and the different specialized components in the homegardens understudy all together.

The method of measurement of extent of horizontal and vertical diversification was included in the interview schedule (Appendix III).

3.4.3. Characterization of homegardens in terms of technology needs (gaps) and techno- socio- economic dimensions.

3.4.3.1 Technological gap in specialized homegarden systems.

After the feedback from the farmers during pilot survey and discussion with experts, the researcher came out with some concrete specification regarding various technology/ scientific operations and the technology needs of farmers were worked out. The need assessment was worked out by using score/rank as stated below.

Score/Rank	Criteria
1	Technology not available (most needed)
2	Technology available but not applicable
3	Technology available but not sustainable
4	Technology available, applicable and sustainable

The technology needs of farmers vary according to the crops they cultivate, the managerial levels in which they operate, the deficits in the demand and supply of the crops they raise with reference to the specificities of the land they engages for cultivation and the agronomic norms the plant demands. It was with these perspectives; grouping of technology needs of the farmers was done and classified into the aforesaid broad categories. Thus technology needs scores of all the 30 farmers of the three districts were tabulated and subjected to statistical analysis. The scores assigned being in ordinal scale, the non-parametric test of analysis of variance (chi-square test) was administered to assess the need disparities between the different districts/specialized homegardens.

3.4.4. Characterization of specialized homegardens in terms of technological, social and economic dimensions.

Based on the review of literature and detailed discussion with experts, a list of dimensions that appeared to be related with homegarden technologies was prepared. The list of attributes/dimensions was subjected to examination by the homegarden respondents, agricultural officers and scientists/experts. They were asked to examine the dimensions critically and also to include additional attributes/dimensions if found necessary. The judges were requested to rate the relevancy of each dimension on a 11-point continuum ranging from most relevant to least relevant with the weightages of 'zero' to 10 respectively. The response from all the homegarden respondents, 30 agricultural officers and 18 scientists / experts were collected. The selection of the final dimensions of technology in homegardens was based on 'based on their proximity values and means of the data collected.

3.4.4 Economics of specialized homegardens

The economics of specialized homegardens was assessed under the following subheads as mentioned below:

3.4.4.1 Cost-benefit analysis of specialized components in terms of extent of contribution of annual income from specialized components and towards annual homegarden income as perceived by the home garden respondents.

3.4.4.2 The need for middleman in marketing the homegarden produces as perceived by the homegarden respondents

3.4.4.1. Cost-benefit analysis of specialized components in homegardens in terms of its contribution towards annual homegarden income as perceived by the respondents.

Based upon the perception of specialized homegarden farmers a theoretical perspective of the contributing components to the homegarden economy was arrived. The actual amount in rupees received by the homegarden respondent annually from those specialized components and other dominant components was arrived at and subjected to statistical analysis. The results obtained will describe the extent of contribution of specialized components to the annual homegarden income and annual home garden income to total annual income of the farm family.

3.4.4.2. The need for middleman in marketing the homegarden produces as perceived by the homegarden farmers

Middlemen are operationally defined as the connecting link between the producer and consumer with an individualistic view and profit motive. In the present study the homegarden respondents were asked to respond whether the respondents felt a need for middlemen in marketing the homegarden produces (mentioned in the interview schedule as Appendix I). The response category 'Yes' or 'No' from the homegarden respondents was awarded with a code of 'One' and 'Zero' respectively. The frequency was worked out and it was expressed as percentage in the results.

3.4.5 Evaluation of selected aspects of women's participation in homegarden activities.

The present study was undertaken to determine the nature and extent of participation of rural women in various agricultural activities. Thus female

members of the selected specialized homegardens, were the respondents of this study.

3.4.5.1 Extent of women participation in various agricultural activities.

Overall participation was calculated by summing up all the activities done by the women either regularly or occasionally by giving a value of 2 for regularly, 1 for occasionally and zero for never. The items of operation intended for measuring the extent of womens participation in various homegarden activities including the specialized components was assessed as mentioned in the interview schedule (appendix III). Based on the womens participation the activities were ranked on the basis of total scores.

3.4.5.2 Causes of the involvement of women workers in various activities.

There are many reasons behind the involvement of rural women labour in various farm and non-farm activities. The causes are not mutually exclusive and the main causes found to be responsible in this study were to meet family needs, absence of male earning members, to increase family income, to meet personal needs and to meet additional family requirements. Attempts were made here to find out the most three important reasons. In order to do this, the respondents of this study were asked to give priority on the above mentioned causes in order of importance. Then final rank order was calculated after giving weight to each of the priority for example, 3 for priority I, 2 for priority II and 1 for priority III respectively. The statements regarding reasons of involvement are furnished in the interview schedule (appendix III).

3.4.6 Constraints experienced by specialized homegarden respondents .

Based on discussion with farmers, scientists, experts in agriculture and also through relevant review of literature, some of the constraints faced by homestead farmers were identified. A list containing twenty-six such constraints was included in the final interview schedule. The list was open ended so that the additional

constraints expressed by the homegarden farmer respondents at the time of interview could also be included.

The response to each constraint was obtained on a four-point continuum namely, most important, important, less important and least important, with the score 'four', 'three', 'two' and 'one' respectively. Mean rank cumulative index for each constraint was worked out and the constraints were ranked and catalogued under different subheads.

3.5. Data collection procedure

The data were collected using a well-structured interview schedule prepared for the purpose (Appendix III). A draft interview schedule was prepared which was pre-tested by conducting a pilot study in non sample area and suitable modifications were made in the final interview schedule which was then directly administered to the homegarden farmers by the investigator and responses recorded at the time of interview. Agricultural Officers and Agricultural Scientists were included as respondent categories in the study, only for the collection of data to rate the techno socio economic dimensions.

3.6 Statistical tools used in the study

The collected data were scored, tabulated and analysed using statistical methods as described below.

3.6.1 Mean

The respondents were grouped into categories with reference to the means of the independent variables. After grouping the respondents into categories, their percentages were worked out.

3.6.2 Percentage Analysis

After grouping the farmers into various categories based on the score on utilization or extent of adoption of agricultural technologies, simple percentage was worked out to find out percentage distribution of the farmers. It was also used to interpret the results of independent variables selected for the study.

3.6.3 Analysis of Variance

The analysis of variance (pooled) was used to assess the significant difference in structure of homegardens in terms of different regions within the homegarden.

3.6.4 Proximity Analysis

The procedure used for objectively grouping the dimensions of technology in homegardens on the basis of their nearness and importance. The nearness and importance of the dimensions of technology that characterize homegardens, socially, economically and technologically were inferred in terms of the proximity measure and mean values obtained.

Results and Discussions

CHAPTER 4

RESULTS AND DISCUSSIONS

The findings of the present study are presented in this chapter under the following heads.

4.1. Distribution of the respondents based on their personal, socio-cultural and techno-economic factors

4.2. Structural configuration and functional dynamics in specialized homegardens.

4.3. Economics of specialized homegardens.

4.4. Characterization of homegardens in terms of technology needs (gaps) and techno-socio- economic dimensions.

4.5. Evaluation of selected aspects of womens participation in specialized homegardens.

4.6. Constraints experienced by homegarden farmers

4.1 DISTRIBUTION OF THE RESPONDENTS BASED ON THEIR PERSONAL, SOCIO CULTURAL AND TECHNO-ECONOMIC FACTORS

4.1.1 Age

Table 1. Distribution of the respondents based on their age

N=30

Category (Years)	Ernakulam N=10		Thrissur N=10		Palakkad N=10		Total	
	No.	%	No.	%	No.	%	No.	%
<35	1	10	0	0	0	0	1	3.33
35-55	4	40	7	70	5	50	16	53.34
>55	5	50	3	30	5	50	13	43.33
Total	10	100	10	100	10	100	30	100

It was evident from the table 1 that more than half the sampled specialized homegarden farmers were in middle aged category whereas the old and young category were comparatively less with 43.33 and 3.33 per cent respectively.

Viewing the district wise distribution, in Ernakulam district almost half of the homegarden farmers belonged to the old age category and less than half i.e. 40 per cent belonged to the middle aged category and only one homegarden respondent was found to be belonging to the young age category. Whereas in Thrissur district majority of the homegarden farmers belonged to the middle aged category 70 per cent with no young age respondents. In case of Palakkad district half of the respondents were from the middle age category and the other half from the old age category.

Hence it was inferred that more than half of the farmers were in middle aged category and vast majority of the homegarden respondents belonged to the middle aged and old aged category together. This was because the elder most in the home is often considered to be the head of the homegarden.

4.1.2 Education

Table 2. Distribution of the respondents based on their education

N=30

Category	Ernakulam n=10		Thrissur n=10		Palakkad n=10		Total	
	No.	%	No.	%	No.	%	No.	%
Primary	2	20	3	30	3	30	8	26.67
Secondary	4	40	3	30	2	20	9	30.00
Collegiate	4	40	4	40	5	50	13	43.33
Total	10	100	10	100	10	100	30	100

The educational status of the farmers presented in table 2 projects that all farmers were under the literate category of which more than 80 per cent of the farmers were having the educational qualification ranging from high school to collegiate level.

The district wise distribution was also reflecting the total sample with more than the 70 per cent of farmers of the three districts having educational level from high school to collegiate education and only less than 30 per cent of the total respondents had middle level education.

Hence it was inferred that more than 70 per cent of the homegarden farmers had education level from high school to collegiate level and Ernakulam had maximum number of homegarden farmers (80 %) attaining high school to collegiate level of education. The higher level of education among the homegarden respondents was attributed due to the well developed educational system prevailing in the state as well as the high level of literacy owned by the people in the districts of study which was in conformity to the studies conducted by Babu, 1995 and Thomas, 2004.

4.1.3 Occupation

Table 3. Distribution of the respondents based on their occupation

In the distribution of farmers under occupational category (table 3) nearly 60 per cent of the homegarden farmers depended on agriculture as their primary source of income.

N=30

Category	Ernakulam		Thrissur		Palakkad		Total	
	No.	%	No.	%	No.	%	No.	%
Agriculture alone	6	60	6	60	6	60	18	60.00
Agriculture + Private	2	20	3	30	2	20	7	23.33
Agriculture + Government	2	20	1	10	2	20	5	16.67
Total	10	100	10	100	10	100	30	100

23.33 per cent of the respondents had engaged in private sources of income in conjunction with agriculture. About 16.67 per cent were government employees with a flair for farming. District wise analysis showed that in all the three districts 60 per cent of the homegarden farmers depended solely on agriculture whereas 40 per cent were engaged in

farming as a subsidiary to other occupations like private or governmental respectively. The result is contrary to the findings made by Thomas, 2004 and this could be due to the fact that the homegarden respondent would have to take up full time activity when including specialized components which is not of subsistence in nature but purely with economic interest.

4.1.4 Family Size

Table 4. Distribution of the respondents based on their family size

N=30

Category	Ernakulam		Thrissur		Palakkad		Total	
	No.	%	No.	%	No.	%	No.	%
3-4	7	70	6	60	7	70	20	66.67
5-6	3	30	4	40	3	30	10	33.33
Total	10	100	10	100	10	100	30	100

It was evident from the table 4 that more than three fourth of the sampled farmers (66.67 %) were having the family size with 3-4 members.

Similar cases were noted in the district wise analysis wherein 60 to 70 per cent of the respondents in Ernakulam, Palakkad and Thrissur districts had 3 – 4 members

Hence it could be inferred that three fourth of the sample respondents had a family size with 3-4 members. The average members of a family in the study area were below four clearly highlighting the shift towards nuclear family concept. Thus the physical involvement of family members in homegardening activities over years may get diminished and they might just resort to supervisory role. The finding of this study was in conformity to the results of Babu (1995).

4.1.5. Irrigation potential

Table 5. Distribution of the homegarden based on its irrigation potential

N=30

Category	Ernakulam		Thrissur		Palakkad		Total	
	No.	%	No.	%	No.	%	No.	%
Physical water Scarcity	0	0	1	10	7	70	8	26.67

Economic water scarcity	2	20	2	20	3	30	7	23.33
Little or no water scarcity	8	80	7	70	0	0	15	50
Total	10	100	10	100	10	100	30	100

A perusal of table 5 revealed that more than half of the sampled specialized homegardens had an irrigation potential of "little or no water scarcity" followed by "economic water scarcity" (23..33 %) and 26.67 per cent belonged to the category of "physical water scarcity"

The district wise distribution shows that about 80 per cent of Ernakulam homegardens had little or no water scarcity followed by Thrissur 70 per cent. But in contrast Palakkad district, 70 per cent of the specialized homegardens had physical water scarcity.

Hence it could be concluded that the climate and topography of the districts under study led to variable conditions of water scarcity in all the three districts like little or no water scarcity in some and high rates of water scarcity in another. However it was to be noted that the generalization of irrigation potential based on this small sample size finding cannot be simulated for all the districts, as their choice of specialized components would be based on the availability of water in the respective homegardens. The irrigation potential was believed to be high by the respondents owing to the fact that most of the homegarden tree crops were nurtured in rainfed conditions and only crops that were interventional in nature (immediate cash yielding crops) were irrigated and such specialized components required water were included in homegardens.

4.1.6. Annual homegarden income

Table 6. Distribution of the respondents based on their annual homegarden income

N=30

Category (Rs.)	Ernakulam n=10		Thrissur n=10		Palakkad n=10		Total	
	No.	%	No.	%	No.	%	No.	%
Low	8	80	5	50	7	70	20	66.67

High	2	20	5	50	3	30	10	33.33
Mean	221000		385000		245000		284000	

It was evident from table 6 that about 67 per cent of the sampled respondents had an annual homegarden income less than the total average income (Rs 2,84,000) followed by about 33.33 per cent respondents with an income higher than the total average income. District wise interpretation shows that 80 percent of the respondents of Ernakulam district received an annual homegarden income of less than the total average income (Rs 2,45,000), whereas about half of homegarden respondents from Thrissur district had an annual income of less than Rs. 3,85,000 i.e. the total average homegarden income. It was also observed that almost 80 per cent of respondents from Palakkad district received an annual income below Rs. 2,21,000 the total average homegarden income

4.1.7. Extension contribution

Table 7. Extent of extension contribution towards homegardens by different extension agencies as expressed by homegarden farmers

N=30

Category	Ernakulam		Thrissur		Palakkad		Total	
	No.	%	No.	%	No.	%	No.	%
Agri Department	3	30	7	70	5	50	15	50.00
KAU	3	30	2	20	0	0	5	16.66
Commodity Boards	0	0	1	10	1	10	2	6.67
ICAR	2	20	0	0	0	0	2	6.67
Others	2	20	0	0	4	40	6	20.00
Total	10	100	10	100	10	100	30	100

The extension contribution made by the various extension agencies as expressed by the homegarden farmers presented in the table 7 projects that half (50 %) of the contribution was from agricultural department followed by others like friends, media, or farmer groups (20 %). About 16 per cent of the homegarden farmers relied on Kerala Agricultural

University, whereas contribution of commodities boards (6.67 %), and ICAR (6.67 %) were negligible.

District wise analysis of homegarden farmer's perception on extension contribution showed that agricultural department contributed to the maximum for all the three districts. But in Ernakulam district the contribution by Agriculture Department and Kerala Agricultural University showed similar pattern (30%) and only half of the respondents in Palakkad district considered Agriculture Department as a worthy in extension contribution. About 20 per cent of the homegarden farmers in Palakkad district focused their extension contact on other sources like farmer groups, peer groups etc. Ironically in Thrissur district, in spite of being the citadel of the Kerala Agricultural University, only 20 per cent of the homegarden farmers choose it as a dependable extension source.

Hence it could be inferred that almost 50 per cent of the extension contribution came from Agricultural Department and Kerala Agricultural University as expressed by the homegarden farmers. The extension contribution was fairly good for the rubber growers when compared to that of other agricultural crops because agencies such as Rubber Board had a very good and efficient monitory cum evaluation system when compared to that of Krishibhavans where timely incentives and help in the form of subsidies and inputs was given to growers who cultivated it as per the recommended practices of the rubber board.

4.1.8. Market orientation

Table 8. Distribution of the respondents based on their market orientation

N=30

Category	Ernakulam		Thrissur		Palakkad		Total	
	No.	%	No.	%	No.	%	No.	%
<3	3	30	4	40	2	20	9	30
>3	7	70	6	60	8	80	21	70
Total	10	100	10	100	10	100	30	100

The market orientation of the total respondent sample was high with 70 per cent falling in the category of greater than three score vide table 10. It was found that market orientation was considerably low in Thrissur district with about 40 per cent of respondents getting the score below three.

Hence it was inferred that 70 per cent of the total homegarden farmers had a higher level of market orientation. This was presumably because of market oriented farming activity through inclusions of specialized components in homegardens. Also, the diversity in the products available to the homegarden makes it necessary for the specialized homegarden farmers to look with positive attitude that will reflect in terms of even higher market orientation which is in agreement with the studies of Saikia (2012).

4.1.9. Rational orientation

Table 9. Distribution of the respondents based on their rational orientation

N=30

Category (Belief)	Ernakulam		Thrissur		Palakkad		Total	
	No.	%	No.	%	No.	%	No.	%
Religion	1	10	0	0	0	0	1	3.33
Religion +Science	6	60	3	30	7	70	16	53.33
Science	3	30	7	70	3	30	13	43.34
Total	10	100	10	100	10	100	30	100

It was evident from the table 9 that more than 50 per cent of the sampled home garden farmers had belief on religion and science together. Only 43 per cent of the respondents tend to rely on scientific aspects alone whereas only one of the total respondents believed in religious aspects like stars and astrology.

District wise interpretation also showed that in Thrissur about 70 per cent of the homegarden farmers based their actions solely on scientific recommendations and only 30 per cent had belief on religion along with scientific practices. The reverse of this trend was seen in case of Palakkad district. Whereas is Ernakulam district only 60 per cent believed

that religion along with science had consequences in their farming outcome and only 30 per cent relied resorting to scientific practices alone.

Hence it was inferred that more than 50 per cent of the sampled farmers had medium level of rational orientation. And only 43.34 per cent had high levels of rational orientation. However, the results seem to be good in overall perspective that 93 per cent of homegarden respondents had medium to high level of rational orientation.

4.1.10. Evaluative perception

Table 10. Distribution of the respondents based on their evaluative perception on the sustainability of cropping and farming systems in homegarden.

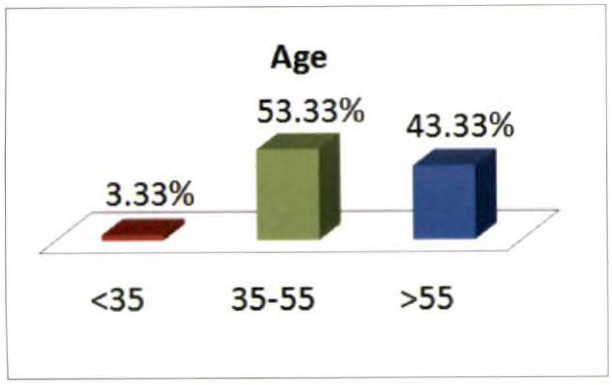
N=30

Category	Ernakulam		Thrissur		Palakkad		Total	
	No.	%	No.	%	No.	%	No.	%
<60	3	30	0	0	2	20	5	16.67
>60	7	70	10	100	8	80	25	83.33
Total	10	100	10	100	10	100	30	100

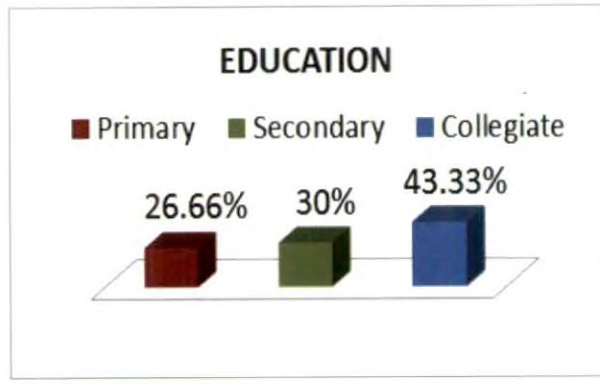
A perusal of the table 10 revealed that more than three fourth (83.33 %) of the sampled respondents fell in the high category of evaluative perception. The same was observed in case of different districts except in Ernakulam district.

Under district wise distribution the evaluative perception on the cropping and farming systems was high for Thrissur district (100 %) followed by Palakkad (80 %) and Ernakulam (70 %) respectively.

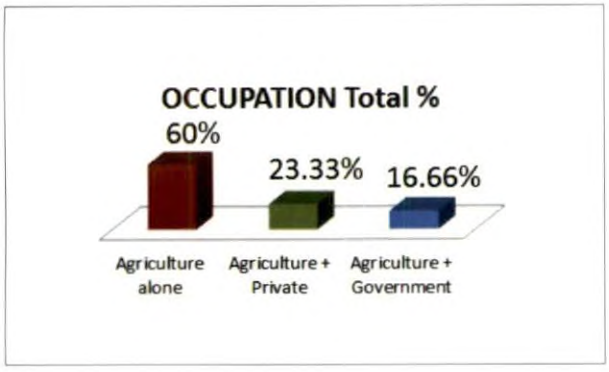
Hence it is inferred that 83.33 per cent of the total sampled homegarden respondents had high evaluative perception on the sustainability of cropping and farming systems in the specialized homegardens. This could be due to the fact that homegardens typically contribute towards nutritional security, energy needs and income generation even under conditions of high population densities and also their perceived needs and their ability to adjust to socioeconomic changes. Kumar (2004) and Peyre *et al* (2006) also supports this finding.



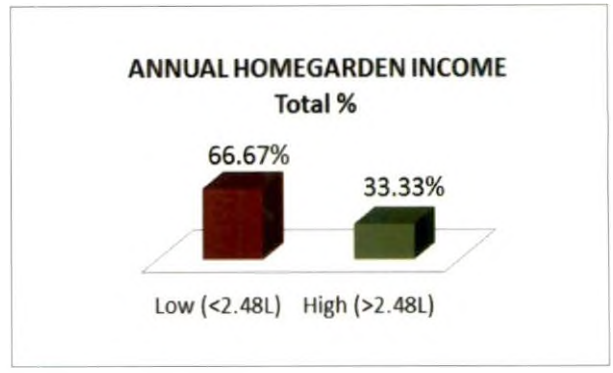
a. Age



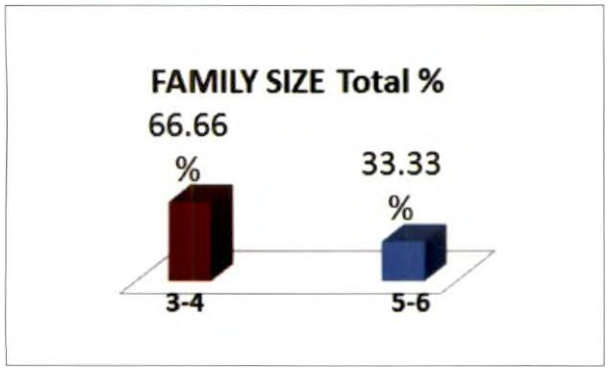
b. Education



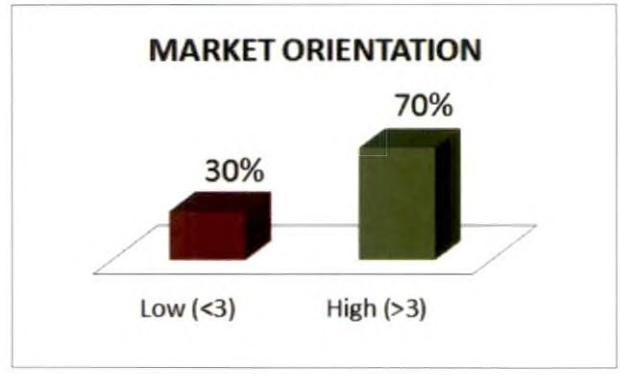
c. Occupation



d. Annual Homegarden Income

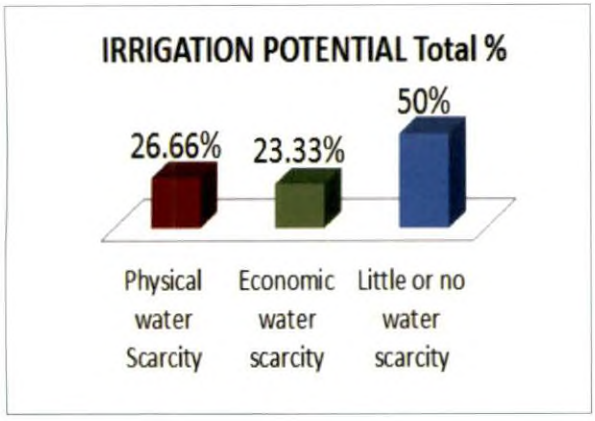


e. Family Size

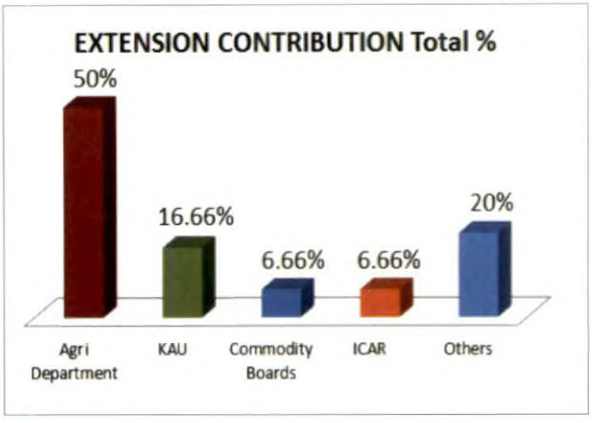


f. Market Orientation

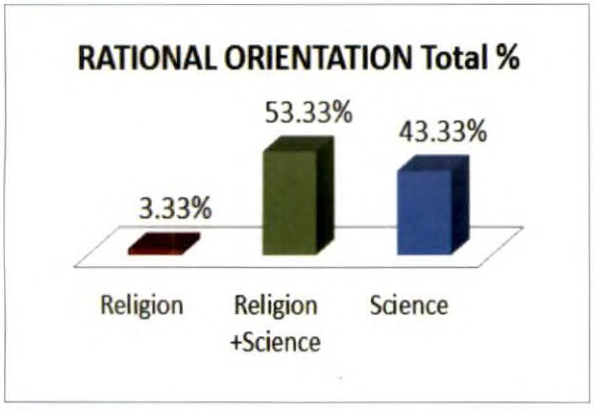
Fig. 2 Profile Characteristics of specialized homegarden farmers



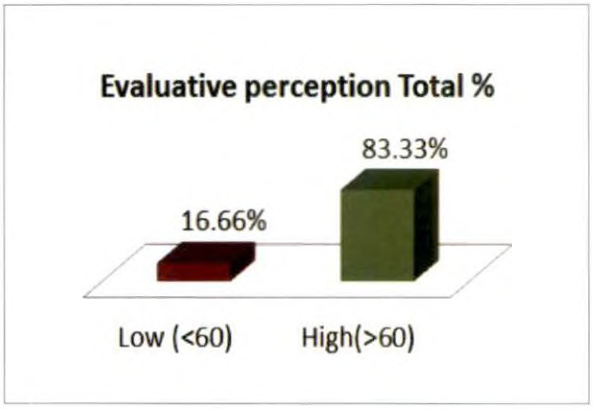
g. Irrigation Potential



h. Extension Contribution



i. Rational Orientation



j. Evaluative Perception

Fig. 2 Profile Characteristics of specialized homegarden farmers

4.2 STRUCTURAL CONFIGURATION AND FUNCTIONAL DYNAMICS IN SPECIALIZED HOMEGARDENS.

The results for the structure and function of specialized homegardens are presented under the following subheads:

4.2.1. Dominance profile of specialized homegardens

4.2.2. The diversity index of homegardens in relation to the different regions in each district

4.2.3. Extent of horizontal and vertical crop diversification in specialized home-gardens

4.2.1. Dominance profile of specialized homegardens

The results generated in this study very explicitly focused on structural, numerical and economic dominance giving an insight into species richness and evenness. Within the broad realness of homegarden a paradigm shift is required wherein focus is not only on the qualitative aspects of mere structure (often referred to as structural dominance) but should account for numerically important and more importantly from the economic aspects. Hence the study though originally was proposed to identify the structural dominance, it became imperative that dominance *perse* had to be categorized from all the major angles namely structural, numerical, and economic, against conventional evaluation and analysis of ecosystem as mentioned above. A paradigm shift became necessary to identify dominance from all three angles (Thomas, 2004).

A typical example of the Kerala homegardens is visualized from a glance at the dominance profile in table 11. Even though variable levels of structural, numerical and economic dominance is exhibited by the major crops in each specialized homegardens under the study, it is complying with the present Kerala homegarden scenario. The split wise dominance pattern that is structural, numerical and economical dominance and the means of crops are presented in Table 11. Individually each index reveals a definite pattern.

Structural dominance rating clearly depicts the structurally dominant crops in specialized homegardens. This need not necessarily imply that they are only stout and tall perennials. On the contrary crops that contribute to a sizeable chunk of total biomass of an ecosystem are termed as structurally dominant. From the table it was observed that rubber

Table 11. The crops those are structurally, numerically and economically dominant (District wise)

	Structural				Numerical				Economic			
Crop	Palakkad	Thrissur	Ernakulam	**Mean**	Palakkad	Thrissur	Ernakulam	**Mean**	Palakkad	Thrissur	Ernakulam	**Mean**
Coconut	2.2	1.5	1.5	1.73	5.2	3.9	2.9	**4**	4	4.2	2.8	**3.666**
Arecanut	2.43	2.2	3	2.54	4	2.6	3	**3.2**	3.57	3.4	3	**3.32**
Mango	3.66	2.83	3.2	3.23	9.33	6.5	5	**6.94**	6.33	6.16	4.6	**5.69**
Nutmeg	3.5	3	3	**3.166**	5.25	4.77	3.5	**4.5**	4.25	3.33	3	**3.526**
Banana	3.5	3.28	2.57	**3.11**	4.25	3.57	3.85	**3.89**	3.37	3	2.85	**3.07**
Rubber	1	0	1	**1**	1.75	0	1	**1.375**	1	0	1	**1**
Rice	7	7	0	**7**	1	1	0	**1**	1	1	0	**1**
Pineapple	7	6	0	**6.5**	4	2	0	**3**	3	2	0	**2.5**
Pepper	6	5	5	**5.33**	4	4	4	**4**	5	3	4	**4**
Cocoa	6	4	0	**5**	7	6	0	**6.5**	7	7	0	**7**
Ginger	4.4	0	0	**4.4**	3.2	0	0	**3.2**	3.2	0	0	**3.2**
Turmeric	5	0	0	**5**	4.25	0	0	**4.25**	2.75	0	0	**2.75**
Jack	0	6	1.33	**3.67**	0	6	5.33	**5.665**	0	6	5.33	**5.665**
Teak	4	5	0	**4.5**	7	6	0	**6.5**	5	4	0	**4.5**
Vanilla	4.5	4	4	**4.17**	5	3	4	**4**	5.5	6	2	**4.5**
Pappaya	0	0	4	**4**	0	0	5.5	**5.5**	0	0	5	**5**
Tapioca	5	2	0	**3.5**	4	3	0	**3.5**	3	1	0	**2**
Palms	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**
Foddergrass	5.5	0	6	**5.75**	2.5	0	1	**1.75**	6.5	0	1	**3.75**
Mulberry	0	6	0	**6**	0	3	0	**3**	0	4	0	**4**
Glyricidia	4.75	4	3	**3.916**	4.5	3.5	3	**3.66**	6.5	5.5	5	**5.66**
Vegetables	6.43	6	5.4	**5.94**	2	2.7	1.6	**2.1**	3	3.1	1.8	**2.63**
Ornamentals	5.66	5.5	4.14	**5.1**	2	1.25	1.57	**1.606**	7	2.25	3.14	**4.13**

was the most structurally dominating crop followed by coconut, arecanut, banana, nutmeg, mango, tapioca, jack and glyricidia being the major ones. The least structurally dominant ones were rice, pineapple, vegetable and fodder grass.

Likewise the numerical and economical dominance rating gives a clear picture of the numerical and economically importance of dominating crops. Like previous, when we consider numerical and economic dominance, rubber and rice came out as the leading crops in both the instances. Other crops which were numerically dominant were ornamental crops, foddergrass, vegetables, pineapple, arecanut. The economically dominant ones include rubber, rice, tapioca, pineapple, vegetables, turmeric and pineapple. The contribution of tapioca and pineapple to the annual homegarden income was also revealed from the result of the study. High profit coupled with minimal attention on management aspects and input was a valid reason for the predominance of this crop. The findings are in agreement to the results of Salam and Sreekumar (1990).

The Kerala homegardens prevent a case of typical dominance – diversity profile. Some species of homegardens habitually dominates and have controlling effects on the fitness of their subordinates (Kurien and Sam, 2004). When we analyze the reasons for structural dominance of the different crops the finger is pointed at rubber because of the current agricultural market situation. Farmers tend to be very cautious in crop selection and take the decisions based on economic benefits. The prevalent agricultural market conditions subjugate the homegarden farmer to resort to convert to economically fructifying crops rather than dwell on the benefits of ecosystem conservation and biodiversity. Rubber provides income for an extended period than the other crops and is matched only by a few crops like arecanut, nutmeg and coconut. Even if the homegarden farmer incorporated other economically beneficial crops like pineapple, vegetables etc. they remain structurally inferior to rubber.

While considering the population of crops, nothing can out match the economically beneficial smaller crops; hence rice slightly dominates over rubber. Other numerically relevant crops are almost economically relevant too. Increase in number (or area) is the only solution to reap benefits of these crops.

Economic dominance clearly lists out the crops which can facilitate the maximum returns to the homegarden farmer. In the specialized homegardens under the study, the economically dominant ones share a similarity or augment the specialized component in the homegarden in certain ways. The inclusion of fodder grass is seen in homegardens with livestock components to cite an example. But the primary economically dominant crops are again rubber due to the returns. Other economically dominant ones were rice (organic), tapioca, pineapple, vegetables, turmeric, nutmeg and arecanut. However a comparison over specialized components in terms of economic returns suggest that homegardens can economically sustain only by making it even more profitable through inclusions of specialization and vertical integration.

Even though the aforesaid crops and specialized components were found out to be more contributing in nature for homegardens, tree crops like mango, jack, cashew, tamarind, teak, mahogany and many other fruit crops widely grown in the homegardens for meeting the various requirements contributed more to the homegarden self-reliance (See Appendix IV). The result is in agreement with the report of Thomas, *et.al.* (2011). Thus the homegardens, which, were originally expected to the function of food security, has now undergone a radical change where a prioritization with income generation has been the prime concern. This is mainly due to the fact that higher income gives the homegarden farmers better access of his entire requirement plus a surplus savings. This is again in agreement with the findings of Thomas, *et.al.* (2011) and contrary to the reports of Fernandes and Nair (1986).

In short, this study has gone to identify species that are structurally, numerically and economically dominant crops in the homegarden ecosystem which ultimately decided what are the important and less important crops. Equally it also exposes crops of less importance or of no consequence to the home. Hence will help to plan and intervene in specialized homegardens to reap more benefits without hampering the biodiversity of specialized homegardens.

4.2.2. The diversity index of homegardens in relation to the different regions in each district

The similarities and differences of biodiversity index within various regions of specialized homegardens are presented in table 12 points to glaring differences that are explicit.

Table 12. The diversity index of homegardens in relation to the different regions

N=30

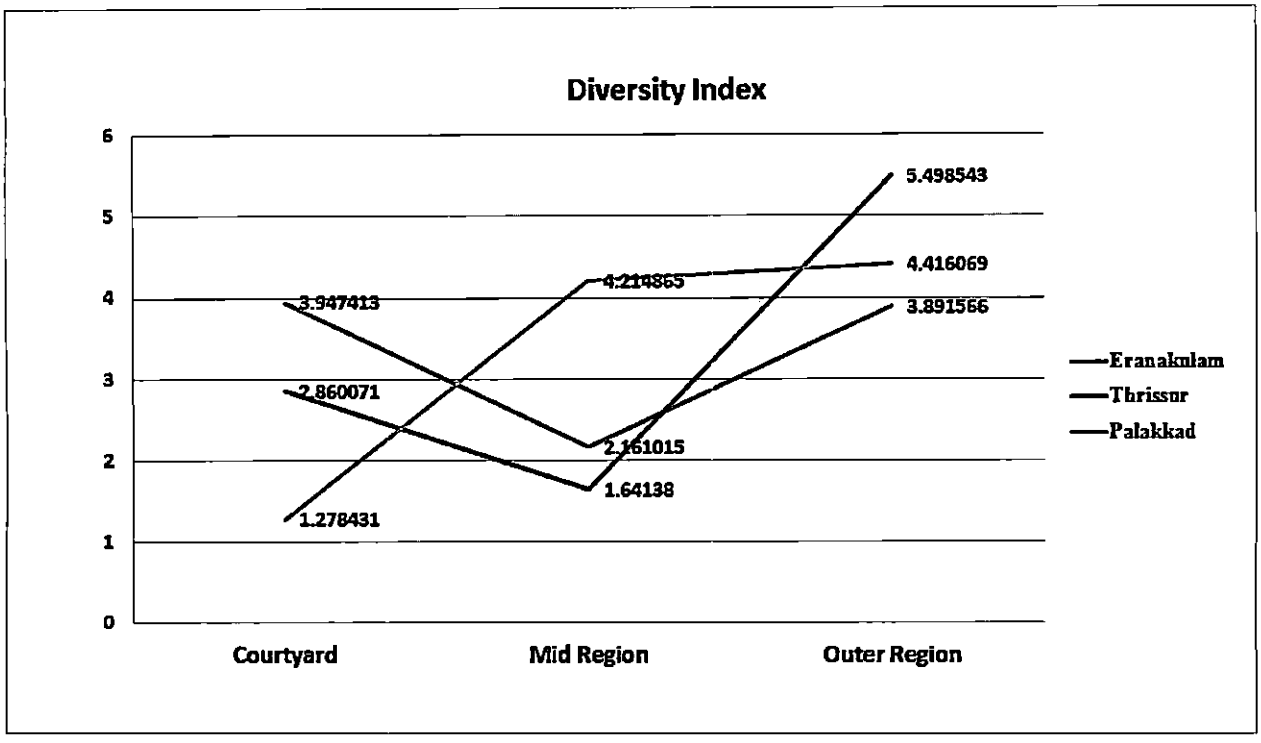
District	Courtyard	Mid Region	Outer Region
Ernakulam	3.947413	2.161015	3.891566
Thrissur	2.860071	1.641380	5.498543
Palakkad	1.278431	4.214865	4.416069
Mean	2.695305	2.672420	4.602059

The levels of biodiversity were high in different regions of a specialized homegarden in each district under study. The courtyard region of Ernakulam district recorded the highest biodiversity index. Thrissur had less levels of biodiversity in the courtyard region and Palakkad had the least among the three. On the other hand Palakkad district exhibited the highest level of biodiversity in the mid region and then followed by Ernakulam with almost half the intensity as Palakkad and thirdly Trissur, which had the lowest. On the contrary, Thrissur district proved to be highly biologically diverse in constitution when considering the outer region of the specialized homegarden, followed by Palakkad and Ernakulam districts. (Figure 3)

Hence it was inferred that the maximum biodiversity in specialized homegardens in the districts under study was occurring in the outer regions and minimum was in the mid region. However, from the interaction table 13 generated through pooled ANOVA following inferences have been drawn.

Table. 13. Measure of diversity index between regions and district wise.

Regions	Courtyard	Mid Region	Outer Region	CD(0.05)
Palakkad	0.13	0.42	0.44	0.267
Thrissur	0.29	0.16	0.55	
Ernakulam	0.39	0.22	0.39	
Mean	0.27	0.27	0.46	



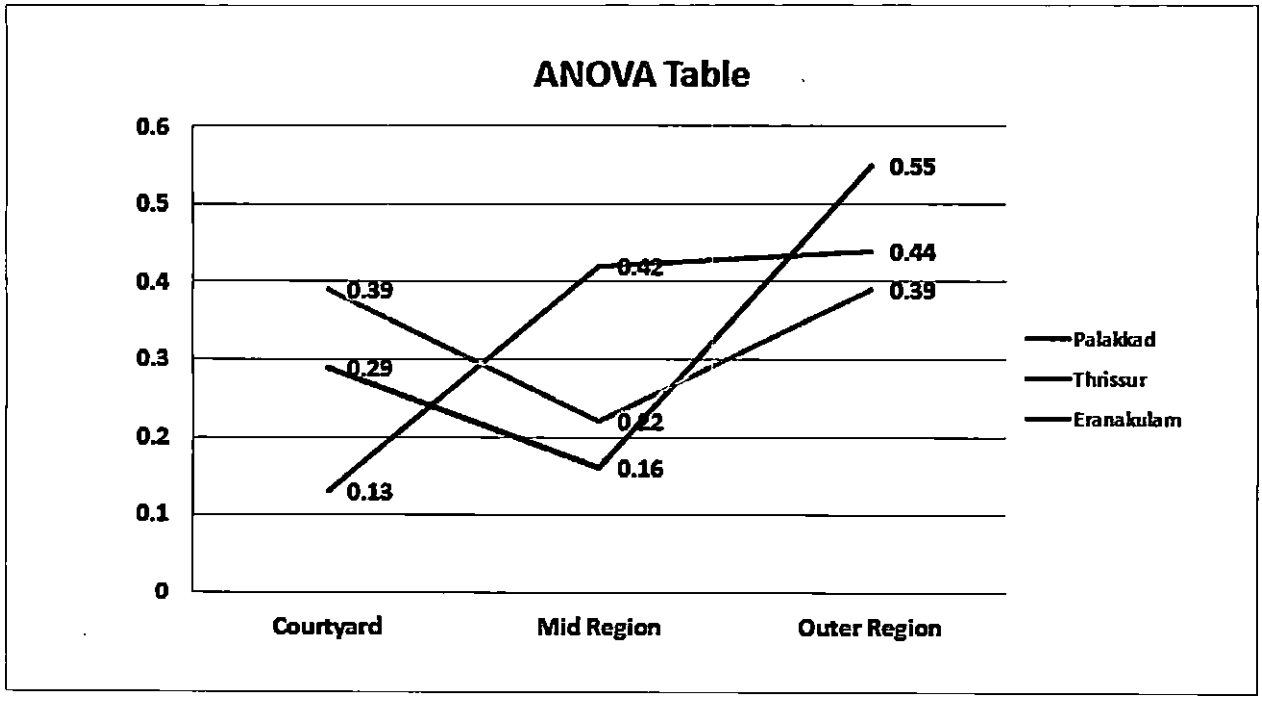


Fig.3 Diversity Index of specialized homegardens

From the Table it was found that there was no significant difference between crop diversity index with regard to the three regions (namely courtyard, mid region and outer region) and location (F not significant). But in Palakkad district, the courtyard region is found to have significantly less of diversity index than that of the other two regions (F=3.66*). The outer region in the district had the highest diversity index (0.44) which was on par with that of the mid region (0.42). However, this difference between the regions could not be observed in the other two districts as their respective F ratios were not significant.

A major concept of the diversity index of the three districts is this very basic aspects but whether this build up or spread as the case may be remains to be identified as to whether it is deliberate, powerful or simply by chance. As the case look more or less uniform within a district it should be deemed that the index which is a result of planned diversity build up or generations is more geographic, partially interventional or deliberate and more a specialty of the region.

Another factor worth discussing is that outer region of homegarden contributed to maximum index which is not in conformity to the findings of Thomas (2006) wherein he reported the overall biodiversity index was more for the mid-region. This reveals that irrespective of the district and size of holdings the gardens tends to preserve the maximum taxonomically distinct variance within the region and that too in the outer region. Another point is a reflection of the complementary exploitation of habitat resulting in more complete capture of resources. In short, the dominance exploiting the resources well and the subordinates and transience exploiting relatively unfavorable microhabitats. Such a complementarity has reported by Campbell *et al.* (1991). Finally, this result should be looked at the management level. As the mid-region was more convenient the gardener could have packed his gardens with more important species towards the centre and then structurally dominant towards the outer periphery, be it accidental or intentional, thereby accumulating more of non commodity crops and leaving the outer region more neglected in terms of less interventions and tidiness and high in biodiversity.

Another important social dimension of packing the outer regions with perennial tree crops is primarily a protection of one's own area and secondarily derivation of resources from the neighbouring homegarden. The effect of this social dimension becomes less pronounced in holding sizes, which were uniformly large. Also, the tendency to keep the courtyard and mid region relatively tidy and planned, but in order to let not lose anything that can be accommodated in the homegarden could also have had an influence in maximum diversity index in the outer region.

4.2.3. Extent of horizontal and vertical crop diversification in specialized homegardens.

Horizontal diversification is a measure of both the cropping intensity and the structure of homegardens. Vertical diversification throws light into the functional dynamics and the economic entities in the homegarden as a result of value addition or product diversification. The results of extent of horizontal and vertical crop diversification in specialized homegardens are presented in table 14 and table 15.

Table 14. Distribution of specialized homegardens based on extent of horizontal diversification. **N=30**

Horizontal diversification of numerically and economically dominant crops	Palakkad		Thrissur		Ernakulam		Total	
	No	%	No	%	No	%	No	%
One tier diversification	0	0	0	0	2	20	2	6.67
Two tier diversification	0	0	0	0	1	10	1	3.33
Three tier diversification	1	10	1	10	1	10	3	10.00
Four tier diversification	2	20	2	20	2	20	6	20.00
Five tier diversification	1	10	3	30	2	20	6	20.00
Six tier or more diversification	6	60	4	40	2	20	12	40.00
No diversification	0	0	0	0	0	0	0	0
Total	10	100	10	100	10	100	30	100

A perusal of table 14 clearly shows that there no homegardens without any type of diversification irrespective of the location in which it belongs. However majority of the

homegardens in all the three districts together shows that there were six tiers or more diversification (40% of the specialized homegardens), followed by five tier and four tier diversification (20%) each. Therefore , it can be deduced unequivocally that 80 per cent of the specialized homegardens had more than four tiers of horizontal diversification. Hence it can be inferred that the majority of the specialized homegardens in the three districts together under study had a four tiers or more levels of horizontal diversification which is typical and unique for Kerala homegardens.

Table 15. Extent of vertical diversification for the economically dominant crop in the specialized homegardens

Economically dominant crop for all three districts together	Levels	Total levels
Coconut	Nuts/Oil/Copra	3
Arecanut	Nuts/Seedlings(nursery)	2
Nutmeg	Nuts/Saplings(nursery)	2
Rubber	Sheet/Saplings	2
Rice	Grain	1
Banana	Fruit	1
Turmeric/Ginger	Raw/Dried/powder	3
Tapioca	Tuber	1
Vegetables	Raw/Seedlings	2
Ornamentals	Unit/Saplings/Flowers	3

Table 16. Extent of vertical diversification for the specialized components in the specialized homegardens

Specialized component for all three districts together	Levels	Total Levels
Rubber- Nursery	Sheet/Sap/Saplings	3
Organic Rice	Grain/Seed	2
Livestock	Milk/Unit/manure/Milk products	4

a. Specialized homegarden with Hi-Tech Poly house as specialization

b. Specialized homegarden with aquaculture as specialization

c. Specialized homegarden with poultry as specialization

d. Specialized homegarden with animal Husbandry component as specialization

Plate 1. Specialized homegardens

a. Specialized homegarden with animal husbandry component (rabbit) as specialization

b. Specialized homegarden with terrace farming unit as specialization

c. Specialized homegarden with apiculture as specialization

d. Specialized homegarden with organic tubers as specialization

Plate 2. Specialized homegardens

a. Specialized homegarden with ornamental plants as specialization

b. Specialized homegarden with farm tourism as specialization

c. Specialized homegarden with ornamental fish as specialization

d. Specialized homegarden with mushroomunit as specialization

Plate 3. Specialized homegardens

Aquaculture/ Ornamental fish	Unit/dried/fingerlings/ Processed	4
Polyhouse (vegetables)	Raw/Seedlings	2
Nutmeg orchard	Nuts/Saplings	2
Ornamentals- Nursery	Unit/Seedlings/Flowers	3
Ginger and Turmeric- Organic	Raw/Dried/Powder	3
Fruit trees- Nursery	Fruits/Seedlings	2
Pineapple	Fruit	1
Tubers- Organic	Tuber	1
Mushroom	Raw/Processed/Spawn	3
Poultry/Ornamental Birds	Unit/Egg/Manure	3
Terrace farming	Raw/seedlings	2
Farm tourism	Homestay/Fishing/Leisure/others	4

A perusal of table 15 and 16 highlighted simple but important finding. Considering the vertical diversification for both economically dominant crops and specialized components in homegardens, it was clear that the vertical diversification is more for the specialized components. Thus it can be inferred that inclusion of specialized components in the homegardens can bring in more returns and hence improve the profitability of the specialized home garden farmer. Specialization such as Hi-tech Greenhouse units also implied that value addition units attached to the same was needed in order to realize more profit and enhancing the level of vertical diversification. However, these can be realized only if strategies are framed so that each specialized homegarden units can be considered as a possible production catchment where more and more centralized facilities are required for homegarden farmer respondents for value addition and product diversification to increase their level of profit from specialized homegardens.

4.3. ECONOMICS OF SPECIALIZED HOMEGARDENS.

The results of the economics of specialized homegardens was documented under the following subheads:

4.3.1. Cost: benefit analysis of specialized components in homegardens.

4.3.2. Extent of contribution of income in specialized homegardens.

4.3.2.1 Extent of contribution of homegarden income to total annual income of the respondent family.

4.3.2.2 Extent of contribution of income from specialized components to annual homegarden income and to total annual income of the respondent family.

4.3.3 Role of middlemen in marketing of homegarden produce as perceived by the homegarden respondent.

4.3.1. Benefit-Cost analysis of specialized components in homegardens.

The benefit-cost ratios of the specialized components in the homgardens under study analysed using ANOVA is presented in table 17.

Table 17. Benefit-Cost analysis of specialized components in homegardens.

Specialized Components	Class size	Avg Farm size	Wgt BC Ratio
Rubber- Nursery	2	3	1.88
Organic Rice	2	2.246	1.68
Livestock	4	0.699	1.63
Aquaculture	3	5.466	3.19
Polyhouse (vegetables)	4	0.22	1.83
Nutmeg orchard	2	1.76	1.78
Ornamentals- Nursery	3	0.550	1.85
Ornamental Birds	2	0.25	1.67
Ginger and Turmeric- Organic	1	2.92	1.33
Fruit trees- Nursery	1	2	4
Pineapple	1	2.66	1.8
Ornamental fish	1	0.464	2.33
Tubers- Organic	1	0.8	1.75
Mushroom	1	0.016	1.23
Poultry	1	0.28	1.77
Terrace farming	1	0.024	3

Table 17 revealed the benefit-cost ratios of the specialized components in the homgardens under study. The table represents the different components that are being undertaken in the different homegarden situations in all the three districts under the study. The average area over which each of the specialized components is spread was also listed in the table along with the weighted benefit-cost ratios of the respective components.

Statistical analysis through ANOVA revealed that there is no significant correlation between the benefit-cost ratios of the different components, which suggest that the benefit derived by the homegarden farmer from the specialized component is independent of the type of specialization he chose to employ. Hence it can be concluded that the specialized component does not play a significant role in the total income derived from the farm.

However, high B: C ratio was observed for fruit trees in the homegardens. This can be attributed to the fact that being perennial in nature and the nature of its survivability the expenditure for inputs is low when compared to the modest returns through sale of its produce. In addition to this it has a nursery for sale of saplings. Followed by fruit tree nursery maximum weighted B: C ratio was observed for aquaculture followed by terrace farming. However the B: C ratio should be looked differentially for both these components. It was because, the high B: C ratio for terrace farming is again as a result of low expenditure. The returns from the terrace farming were worked out based on the savings accrued as a result of non-purchase of vegetables from market for consumption.

Following aquaculture, the highest weighted B: C ratios was observed for ornamental fish culture, rubber nursery, ornamental plants nursery, pineapple, nutmeg orchard, poultry, organic tubers, organic rice, ornamental birds and livestock in the order of decreasing values.

4.3.2. Extent of contribution of income in specialized homegardens.

Extents of contribution of income in specialized homegardens are presented under the following subheads:

4.3.2.1 Extent of contribution of mean homegarden income to total annual income of the respondent family.

4.3.2.2 Extent of contribution of income from specialized components to annual homegarden income and to total annual income of the respondent family.

4.3.2.1 Extent of contribution of mean homegarden income to total annual income of the respondent family.

Extent of contribution of mean homegarden income to total annual income of the respondent family is presented in table 18.

Table 18. Extent of contribution of homegarden income to total annual income of the respondent family.

Districts	Mean Annual Income	Mean Homegarden Income	Percentage contribution
Palakkad	364200	245400	67.38
Thrissur	621900	385200	61.94
Ernakulam	466250	220800	47.36
Total	**484117**	**283800**	**58.89**

The table revealed that homegardens contributed to more than 58 per cent of the total annual income in all the districts of study together. However, a detail perusal of the same showed that specialized homegardens in Palakkad contributed maximum (67%) to total annual income followed by Thrissur (62%). Ernakulum reported the least per cent of contribution in terms of mean homegarden income to total annual income of the homegarden. However the results cannot be generalized for the entire district of study owing to the small number of sample size but it can be inferred that homegardens with specialization can generally improve the homegarden income and can thereby contribute to the overall annual income of the homegarden family. Also, the income from specialized homegardens in Palakkad and Thrissur could be high due to its typical agrarian standing when compared to district like Ernakulam.

4.3.2.2 Extent of contribution of income from specialized components to annual homegarden income and to total annual income of the respondent family.

The results from table 19 proved that income from specialized components to total homegarden income is worthy enough and necessitates of horizontal and vertical integration of more specialization to make the specialized homegardens more profitable.

Table 19. Extent of contribution of income from specialized components to annual homegarden income and to total annual income of the respondent family.

Specialized Component	TAI	THI	ISC	ISC/THI (%)	ISC/TAI (%)
Ginger	500000	500000	150000	30.00	30.00
Livestock	165000	93000	48000	51.61	29.09
Organic rice	200000	80000	60000	75.00	30.00
Rubber nursery	730000	500000	300000	60.00	41.09
Fruit trees with nursery	221000	125000	25000	20.00	11.31
PF Polyhouse (vegetables)	540000	180000	150000	83.33	27.78
PF Polyhouse (vegetables)	310000	240000	60000	25.00	19.35
Organic Rice	350000	350000	150000	42.86	42.86
Rubber	206000	206000	96000	46.60	46.60
PF Polyhouse (vegetables)	420000	180000	150000	83.33	35.71
Ornamental Nursery	300000	300000	288000	96.00	96.00
Nutmeg Orchard	1400000	500000	350000	70.00	25.00
Pineapple	600000	600000	348000	58.00	58.00
Ornamental fish	702000	285000	30000	10.52	4.27
Ornamental nursery	419000	95000	80000	84.21	19.09
Ornamental nursery	432000	72000	67000	93.05	15.50
Livestock	600000	600000	260000	43.33	43.33
Polyhouse (vegetables)	250000	250000	180000	72.00	72.00
Nutmeg Orchard/ Arecanut nursery	750000	600000	420000	70.00	56.00
Tubers/Organic vegetables	766000	550000	234000	42.54	30.55
Aquaculture/Farm tourism	1020000	600000	300000	50.00	29.41

Aquaculture	664500	200000	91500	45.75	13.77
Aquaculture	488000	200000	100000	50.00	20.49
Ornamental birds/pets	750000	150000	100000	66.67	13.33
Livestock/Ornamental fish	240000	240000	192000	80.00	80.00
Mushroom	192000	120000	120000	100.0	62.50
Poultry	240000	180000	150000	83.33	62.50
Terrace farming	233000	218000	18000	08.26	7.72
Ornamental birds	650000	200000	180000	90.00	27.69
Livestock	185000	100000	52000	52.00	28.11
Total Average Contribution				**59.45**	**35.96**
TAI- Total (Mean) Annual Income; Total (Mean) Homegarden Income; ISC; Income (Mean) from Specialized Component					

A detailed perusal of table 18 and figure 4 revealed that 59 to 45 percentage of the total homegarden income is from specialized components which is again contributing to one third of the total annual homegarden income. This unequivocally shows that those homegardens with specialized components act as a component of income generation and profit which had a direct bearing on the bio-physical and social needs of the members of the homegarden.

Specialization, such as mushroom, ornamental birds and ornamental nurseries contribute 90 to 100 percent of income to total homegarden income. However specialized homegardens with homegardens nurseries contributed maximum to both total homegarden income and to the total annual income, which was to the tune of 96 percent.

Hence it can be inferred that, homegardens with specialized components add more meaningful contribution in terms of income to total homegarden income irrespective of the different types of specializations.

4.3.3 Role of middlemen in marketing of homegarden produces as perceived by the homegarden respondent.

Table 20 and figure 5 points out to very interesting results regarding the role of middlemen in marketing of homegarden produce as perceived by the homegarden respondent.

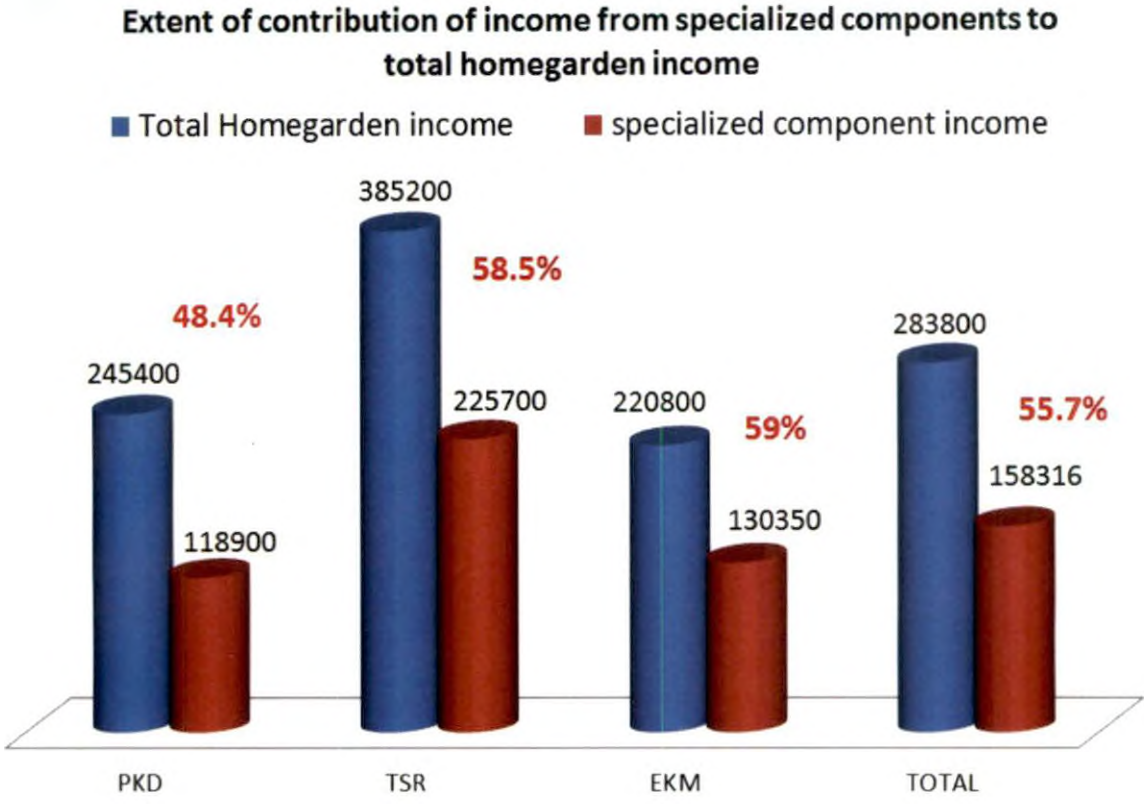


Fig. 5 Extent of contribution of income from specialized components to annual homegarden income

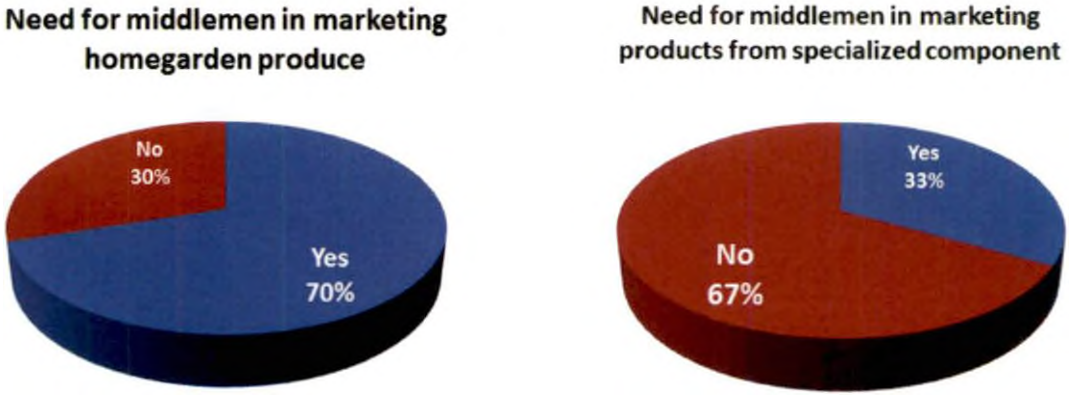


Fig. 6 Perception of Homegarden farmers on the role of middlemen

Table 20. Role of middlemen in marketing of homegarden produce as perceived by the homegarden respondent.

Response	Palakkad		Thrissur		Ernakulam		Total	
	No.	%	No.	%	No.	%	No.	%
Economic Dominant components								
Yes	7	70	6	60	8	80	21	70
No	3	30	4	40	2	20	9	30
Specialized components								
Yes	4	40	3	20	3	30	10	33.33
No	6	60	7	80	7	70	20	66.66

More than 70 percent of the total specialized homegarden respondents felt that middlemen were useful and essential in the marketing of homegarden produce, but about 67 per cent of the total respondents opposed the need for middlemen in marketing their specialized component. However, when 30 per cent of the specialized homegarden respondents felt that middlemen should be avoided from the marketing of their homegarden produce only about the same per cent (33.33%) of the respondents needed or favoured the role of middlemen in marketing their specialized components.

A district wise analysis showed that the respondents from all the three districts Palakkad, Thrissur and Ernakulam preferred to have middlemen for marketing their homegarden produce. Homegarden farmers from Ernakulam ranked first with 80 per cent of the homegarden farmers feeling the need for middlemen followed by 70 per cent of Palakkad home garden farmers and 60 per cent of Thrissur homegarden respondents respectively. On the contrary, a rather opposite stance was seen among the homegarden respondents in case of marketing their specialized components. 80 per cent of the homegarden respondents from Thrissur district was of the notion that they do not need the services offered by middlemen in the marketing of their respective specialized homegarden components. Almost a same trend was seen in the case of the other two districts, i.e. in Palakkad, 60 per cent and in Ernakulam, 70 per cent of the farmers preferred not to involve middlemen in marketing the specialized components from their homegardens.

The result of the study revealed that middlemen were necessary for marketing of homegarden products in all the three districts. This was primarily attributed of the varying diversity and species composition in the homegardens where animal husbandry components with many crop components contributed to homegarden with different products but in less quantity. In short there was surplus of products but not enough for direct marketing. Hence it became essential that some agencies who could market the products be involved in the marketing activities. Since there was no organised or regulated structure for the purpose, the homegarden respondents had to rely on the middlemen to get their products marketed forgoing some of the actual profit they intend from the products which was often taken by the middlemen as commission.

But when the focus was on specialized components, many of the same farmers preferred to keep the middlemen out of the equation. Primarily because many of the specialized components was predominantly fruits, vegetables and perishable products like milk, egg, mushroom, fish etc. where there were identified markets, high value and also commodities that could not be stored for considerable periods. Hence the homegarden farmer resorted to market his specialized components by himself directly or in the local/identified markets. More over when the factor of diversification came into play, the farmers considered it fit to keep the average middlemen out of the marketing chain and go for direct marketing as the farmer considered the middlemen lacked the skill and expertise in handling the specialized commodity or its derived products. Also in some cases the homegarden farmer was in direct contact with the customer (ornamental nursery, ornamental birds and livestock) and in other cases farmer groups were present in marketing the specialized components (organic rice and precision farming vegetables). Minimum cases of need for middlemen were observed in specialized components like pineapple, aquaculture and farm tourism.

4.4. CHARACTERISATION OF HOMEGARDENS IN TERMS OF TECHNOLOGY NEEDS (GAPS) AND TECHNO- SOCIO- ECONOMIC DIMENSIONS.

The results on characterisation of homegardens in terms of technology needs (gaps) and techno- socio- economic dimensions are presented under the following heads:

4.4.1. Technological gap in specialized homegardens

4.4.2. Techno- Socio- Economic Dimensions as perceived by homegarden respondents, Agricultural Officers and Scientists.

4.4.1. TECHNOLOGICAL GAP IN SPECIALIZED HOMEGARDENS

Table. 21. Technological gap in specialized homegardens

Technology Statements	Frequency		
	Palakkad	Thrissur	Ernakulam
Technology not available (most needed)	0	2	0
Technology available but not applicable	4	2	2
Technology available but not sustainable	1	3	3
Technology available, applicable and sustainable	5	3	5

The scores recorded from the specialized homegarden farmer based on the available technology was analysed and a frequency distribution for each of the three districts was tabulated. A Chi square test was performed and the interpretations was that, the distribution were, by and large had the same technology needs (χ^2= 0.598) as far as the perception of the farmer were concerned.

In general, technology needs of the farmers had radically changed from the conventional ones to that of technologies like scientific storage, processing and value addition of homegarden produces. This could be due to the higher social and biophysical standards of homegarden respondents of Kerala and the various specialization it incorporates in the limited spatial land resource associated with the homegardens with an intend to maximize returns. Eventhough the technology needs were the same as far as the perception of the farmers, irrespective of locality, there could be a chance that majority who opined 'Technology available, applicable and sustainable' would be as a result of adequate knowledge on technology before going into some sort of specialization.

4.4.2. Techno- Socio- Economic Dimensions as perceived by homegarden respondents, Agricultural Officers and Scientists.

Table 22, shows the technological, economical and socio-cultural dimensions related to the specialized components in homegardens which have been rated according to the evaluation by 30 homegareden farmers, 30 agricultural officers and 18 scientists connected to homegarden farming systems. The examination of the results shows a variation in priorities between the specialized homegarden farmers and the agricultural officers and scientists. Some of the dimensions which were of high relevance to the homegarden farmers were considered rather insignificant to the other category of respondents.

Table 22. Dimensions of technology in specialized homegardens

DIMENSIONS	Farmer	Rank	AO	Rank	Scientists	Rank
1. ECONOMICAL DIMENSIONS						
1. Initial cost	23.8	2	27.6	2	13.6	3
2. Continuing cost	24.4	1	27	5	13.2	4
3. Income generation potential	20	3	29.1	1	14.4	1
4. Employment generation potential	18.9	4	20.4	6	11.8	6
5. Commercialization	10.5	7	18.8	7	11.6	7
6. Regularity of returns	16.7	5	27.1	4	12.7	5
7. Rapidity of returns	16	6	27.4	3	14.2	2
2. TECHNICAL DIMENSIONS						
1. Physical compatibility	22.1	2	25.5	4	13.1	6
2. Efficiency	23	1	23.3	9	13.3	5
3. Trialability	19.5	8	23.2	10	11.7	15
4. Complexity	21.6	3	22.3	11	12.1	13
5. Profitability	15.1	14	27	1	13.3	4
6. Communicability	14.7	15	20.4	15	11.1	16
7. Availability	16.7	12	23.5	8	12.7	9
8. Decrease in discomfort	14.6	16	22	12	12.5	10
9. Flexibility	16.5	13	19.5	16	12.1	12
10.Simplicity	17.9	10	21.9	13	12.8	8

11.Observability	21.1	5	21.3	14	11.8	14
12.Viability	20.8	6	23.8	6	13.1	7
13.Desirability	18.1	9	24	5	13.4	3
14.Suitability	19.9	7	26.6	2	13.4	2
15.Local resource utilization	21.2	4	26.5	3	13.8	1
16.Availability of supplies and services	17.5	11	23.5	7	12.5	11

3. SOCIAL DIMENSIONS						
a) ENVIRONMENTAL DIMENSIONS						
1. Energy saving potential	17	4	22.2	2	11.8	3
2. Resource recycling capacity	16.1	5	23.4	1	12	1
3. Spatial threshold	19.2	3	21.1	4	11.5	4
4. Availability of raw materials	19.3	2	20.1	5	10.9	5
5. Infrastructure development	9.9	6	22.1	3	11.9	2
6. Sustainability	23.1	1	16.1	6	10.9	6
b) SOCIO-CULTURAL DIMENSIONS						
1. Social acceptability	24	3	16.2	1	10.1	2
2. Social approval	24.4	2	14.5	2	9.7	3
3. Cultural compatibility	24.9	1	14.4	3	12.5	1
c) PSYCHOLOGICAL DIMENSIONS						
1. Goals orientation	25.7	2	14.8	7	12.9	3
2. Aspirations	26	1	14.9	6	12.9	4
3. Attitudes	24.2	3	19.4	4	13.2	1
4. Perceived social status	18.6	5	18.9	5	12.2	7
5. Level of satisfaction	23.4	4	20.3	3	12.6	5
6. Scientific orientation	13.6	6	23.8	2	12.5	6
7. Perceptions of technology	12.7	7	23.8	1	13.1	2
d) DECISION MAKING DIMENSIONS						
1. Record keeping	19.2	2	22.8	2	12.3	4
2. Time utilization pattern	19.8	1	19.6	3	12.6	3

3. Decision-making style	13.8	4	19.3	4	12.8	2
4. Extension-officers' influence	17	3	23.2	1	12.9	1
e)HUMAN RESOURCES DIMENSIONS						
1. Family labour	18.1	3	15	4	12.5	3
2. Hired labour	17.4	4	24.8	1	13.1	1
3. Physical labour requirement	24.4	2	22.6	3	12.2	4
4. Skilled labour requirement	25.4	1	23.5	2	12.7	2

In the economic dimensions, the cost of running the specialized components was of the utmost importance to the farmers (continuing cost) whereas the point of view of the agricultural officers and scientists was that the prospect of income generation was important. But all the three sections were unanimous in labeling commercialization as the least important economic dimension in relation to the specialized component. The farmers point can be substantiated by the fact that most of the specialized homegarden farmers had difficulties in maintaining the components due to the expenses involved. Initial cost could be covered by subsidies but the continuing cost is considered a hindrance. From the point of view of agricultural officers and scientists, the homegarden farmers should realize the income generation potential as it can supplement the continuing cost. Commercialization was ruled out since specialized homegardens had constraints of land, infrastructure, technology, equipment's and financial limitations

Coming to the technical dimensions, all the farmers felt that efficiency, physical compatibility and complexity were the deciding factors, agricultural officers was considering profitability, suitability and resource utilization as the major dimensions. Scientists refer that in case of the technical point of view more importance has to be given to local resource utilization, suitability and desirability of the specialized components to the farmer. Farmers view was based on the concept that whichever specialized component he specializes in should be highly efficient and physically compatible with his technical conditions. Profitability was the option selected by the agricultural officers because they are well versed with the accusations about slogans like farming is not profitable and specialized homegardens should have a label of profitability and act as a suitable example

for the farming community and for the entire population. Scientists, with their concerns about ecosystem, sustainability and biodiversity take an option of local resource utilization and suitability to the environmental aspects.

Under the environmental dimensions farmers felt the need for sustainability and the availability of raw materials for their specialized components, but agricultural officers and scientists the need for resource recycling capacity, infrastructure development and the potential to save energy was the primary steps. This was in concordance with the aforementioned conditions.

Cultural compatibility was the major concern for both farmers and scientists in socio-cultural dimensions but agricultural officers felt that social acceptability was more relevant.

From the psychological point of view farmers felt that aspirations and orientation towards the goal, play a vital role in the specialized homegardens, and agricultural officers asserted that perceptions of technology and scientific orientation were the essential dimensions. Scientists opined that the right attitude towards the farming aspects and the system is of major importance along with good perceptions of technology.

According to the farmers time utilization was the top priority as it was a major constraint for him but agricultural officers and scientists targeted the influence of extension personnel as the primary dimension in case of decision making was concerned. This was because extension officers with their wide array of skill sets and experience could make the wise and apt decisions for the farmers. Farmer respondents opined that skilled labour was critical in a specialized homegarden along with physical labour requirement. Contrary to that, agricultural officers and scientists considered that hired labour and skilled labour requirements was significant in specialized homegarden situations.

Overall the dimensions which ranked highest between the homegarden farmers, agricultural officers and scientists were initial cost, continuing cost, income generation potential, skilled labour requirement and local resource utilization and the lowest ranks were for commercialization, infrastructure development, family labour, decision making style and communicability.

After critical analysis of all the dimensions the views of the specialized homegarden farmers, agricultural officers and scientists can be culminated into certain converging and diverging dimensions. These converging and diverging dimensions perceived to be important to the homegarden respondents, Agricultural Officers and Scientists were categorized as high and low by keeping mean as the check. Thus the dimensions perceived to be important to all categories of respondents can be represented with the help of a Venn diagram (Figure 6).

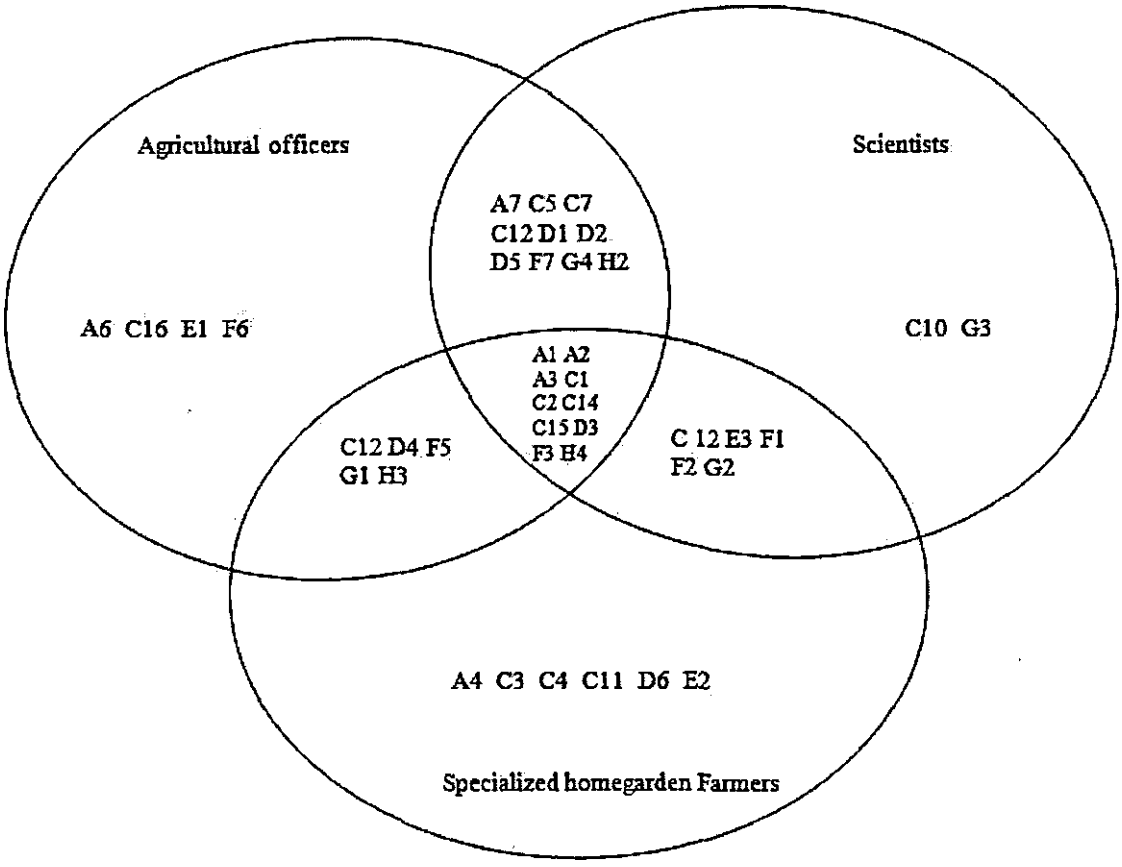


Figure 6. Important 'techno-socio-economic' dimensions as perceived by the homegarden respondents, Agricultural Officers and Scientists.

A careful perusal of the figure shows that 42 dimensions were rated important with mean value as the check. However only 10 on 42 dimensions were perceived to be important to all categories of respondents. They were:

Table 23: Dimensions were perceived to be important to all categories of respondents.

Sl. No.	Code	Common Dimensions	Category
1.	A1	Initial cost	Economic
2.	A2	Continuing cost	Economic
3.	A3	Income generation potential	Economic
4.	C1	Physical compatibility	Technological
5.	C2	Efficiency	Technological
6.	C14	Suitability	Technological
7.	C15	Local resource utilization	Technological
8.	D3	Spatial threshold	Environmental
9.	F3	Attitude	Psychological
10.	H4	Skilled labour requirement	Human Resource

The dimensions perceived to be important to all categories of respondents as stated above have been operationally defined and set for reference in Appendix V. Likewise there were another set of six dimensions that was worthy to be mentioned. They are dimensions that were felt important by homegarden farmer respondents but which was not that important as perceived by the Agricultural Officers and Scientists. Table 24 highlights such dimensions.

Table 24: Dimensions were perceived to be important to homegarden farmers alone.

Sl. No.	Code	Common Dimensions	Category
1.	A4	Employment generation potential	Economic
2.	C3	Regularity of returns	Economic
3.	C4	Rapidity of returns	Economic
4.	C11	Observability	Technological
5.	D6	Sustainability	Environmental
6.	E2	Social approval	Social cultural

The effect of the distance from home to the edge of the homegarden was referred to as courtyard , mid region and outer region, was identified as a factor contributing to the zonation which implies that the match between the variations in the structure of homegardens and functions thereof was strong both techno socio economic and biophysical. High intensity of vertical and horizontal space use, highly dynamic chronological structure and the capacity to perform ecological processes through use and

reuse of resource makes homegarden ecosystem sustainable. The dimension mentioned in table 23 becomes very important for specialized homegardens as its inclusion remains largely for more returns for the benefit of the household.

SOCIO CULTURAL IMPORTANCE OF SPECIALIZED HOMEGARDENS

Homegardens are important in providing both economic and ecological benefits. They are also very important for the provision of social and cultural benefits to the individual farmer and to the community. Many plants were cultivated and retained for ornamentation and aesthetics, medicinal uses and in some cases for religious reasons. The farmers also considered food grown in their homegardens to be of higher quality, both in terms of taste and shelf life, than produce obtained from the local commercial markets.

The homegarden is often a haven for the family members of rural communities to relax and gather together after a hard day's work. In Palakkad district the specialized homegardens presents a surreal climate to the home amidst the searing summer seasons. The gardens sometimes have a variety of flowers and other ornamental decorations which are often a source for community in cases of religious (wherein Thulasithara was noticed in almost all the specialized homegardens belonging to Hindu religion) or other cultural functions. Specialized homegardens can be used to grow certain traditional herbs and spices. Specialized homegardens of Palakkad district was reported to have a wide array of medicinal and culturally important plants between the major components which was being used in home and religious occasions, for example the *darbhapullu* usually used in Hindu funeral rites was grown and provided to the needy. The aquaculture specialized homegardens was of high cultural importance because it was considered a status symbol in the coastal community. Also the aquaculture component was significant to the society because it was a perfect example of conservation of biodiversity of the region. This was also of high relevance of the present economic and real estate climate where, the present day farmers are selling of their aqua fields to give way for housing projects and flats which are the present day culprits of biodiversity degradation. The specialization of the aquaculture homegardens into farm tourism presents another hierarchy of social and cultural benefits. Flourishing of farm tourism will indefinitely help the social mood of the community as it will augment some allied sectors like travel and accommodation, local

handicrafts, local art and cultural institutions. Also it will bring the needed recognition for the community and its people in domestic and even in international levels. It will also pave way for development, as seen in case of the Pizhal Model Pokkali Tourist Farm of Ernakulam district where a single specialized homegarden unit was acted as the sole reason for the areas development. These benefits are exclusive to homegardens because no other single system has been found to provide all these benefits in conjunction with each other. For example, a rice field might provide many economic benefits, and some cultural benefits, but they would not provide an avenue to conserve genetic diversity of a wide variety of species.

4.5. EVALUATION OF SELECTED ASPECTS OF WOMENS PARTICIPATION IN SPECIALIZED HOMEGARDENS.

4.5.1 Extent of women participation in various agricultural activities in the specialized homegardens

It was evident from the table 25 that among the various homegarden activities applicable for women majority of the women engaged themselves in activities like kitchen gardening and then followed by activities like rearing poultry, post-harvest operations and applying irrigation.

Table 25. Extent of women participation in various agricultural activities in the specialized homegardens

Homegarden Operations	Mean Frequency			Total
	Palakkad	Thirssur	Ernakulam	
Land Preparation	0	4	2	6
Applying manure	1	4	3	8
Uprooting Seedling	0	5	3	8
Planting Seedling	7	7	5	19
Applying Fertilizer	2	6	5	13
Drain Preparation	0	0	0	0
Weeding	3	6	5	14
Applying Irrigation	9	12	7	28
Fencing	0	0	0	0
Applying Insecticides	0	4	1	5
Kitchen Gardening	15	14	15	44

Harvesting	6	8	8	22
Post-Harvest Operations	10	11	9	30
Rearing Poultry	19	8	10	37
Rearing Livestock	9	4	6	19

Upon a chi square analysis of the frequency distribution, it was found that there was a significant difference in the score obtained for homegarden activities like rearing of poultry, uprooting seedlings and applying irrigation among the three districts. As evident from the results, the women in the specialized homegardens tend to focus their involvement mainly towards the proximity of the home *i.e.* in the kitchen gardening activities like growing essential vegetables which require the little effort like chillies, brinjal, amaranthus etc and those which could be used for the daily culinary chores. The same can be said in case of poultry rearing, as what was seen in from homegardens with poultry as its specialized component. The units of poultry involved are more or less managed by the women in the specialized homegardens. Since in non-commercial cases of poultry rearing there involved only minimal tasks and efforts that need to be adhered in managing the poultry population, hence it was considered the duty of the women folk to cater the section. Later, themselves involving with more intensity after acquisition of necessary skills for commercial poultry rearing. Hence there is a significant contribution from the women folk in the management of a livestock specialized homegarden. While coming to post harvest operations, usually in smaller specialized homegardens, the levels of post-harvest operations was under a level that could be handled by both men and women in the homegardens. So in certain cases the participation of women was seen to be in a commendable level along with men of the family. While considering activities like, applying irrigation, harvesting, planting seedling, and applying fertilizer, the extent of participation was consider to be admirable. In the homegardens with ornamental plants nursery as its specialized component the entirety of the work and management was done by women. They got themselves involved in almost all the activities related to the specialized component beginning from, planting, weeding, applying pesticides and fertilizers and land preparation.

Women in the specialized homegardens of the three districts tend to deter from activities like drain preparation and fencing either due to the lack of need or skill involved in the two. Those activities were completely handled by the men in the family or by hired labour.

4.5.2 Causes of the involvement of women in various activities in the specialized homegardens

The table 26 showed the reasons for involvement by women folk in the homegarden activities in the specialized homegardens under the study.

Table 26. Causes of the involvement of women in various activities in the specialized homegardens

Reasons for involvement	Mean frequency			Total
	Palakkad	Thrissur	Ernakulam	
To meet basic family needs	2.1	2.1	1.9	6.1
Absence of male members	1.1	1	1	3.1
Absence of male earning members	1.1	1.6	1.5	4.2
To increase family income	1.5	1.6	1.6	4.7
To meet personal needs	1.9	2.2	1.8	5.9
To meet additional family needs	1.8	1.8	1.7	5.3

From the table it was evident that the major reason for the involvement by the women into regular homegarden activities is basically to meet the needs of the family. A further cause for the women engaging themselves in the activities comes as a result for their need to fulfill their personal needs and to meet the additional needs of the family if any. Absence of male members in the homestead or the absence of an earning male member only influences to minimalistic levels on the women folk to take up homegarden activities.

4.6. CONSTRAINTS EXPERIENCED BY SPECIALIZED HOMEGARDEN FARMERS

Constraints experienced by specialized homegarden farmers are presented in table 27.

Table 27. Constraints experienced by specialized homegarden farmers

Sl. No.	Constraints	Rank means	Rank over class	Rank over total
A	**Marketing constraints**			
1	Surplus but insufficient for marketing	87	2	2
2	Low price of produce	97	1	1
3	Lack of markets for products of homegarden	68	3	10
B	**Economic constraints**			
4	High labour cost	70	2	7
5	Prohibitive cost of inputs	74	1	4
6	Non availability of credit	54	3	13
C	**Personal constraints**			
7	Lack of extension service and assistance	44	6	17
8	Inadequacy of capital	71	5	5
9	Poor economic status of homegarden farmers	69	3	8
10	Lack of knowledge about technology	52	4	15
11	Lack of motivational factors	68	4	11
12	Lack of time in homegarden activity	81	1	3
13	Lack of knowledge in post harvest handling	42	7	19
D	**Physical constraints**			
14	Non availability of supplies and services	71	1	6
15	Non availability of labour	68	2	9
16	Uneconomic holdings	54	4	14
17	Poor transportation facilities	58	3	12
18	Interrupted power supply	3	7	26
19	Scarcity of quality irrigation water	30	6	24
20	Non availability of implements	37	5	20
E	**Technological constraints**			
21	Lack of homegarden suited implements	31	3	22
22	Lack of technology suited for homegarden	49	1	16
23	Poor storage facilities	32	2	21
24	Lack of processing implements	30	4	23
25	Lack of post-harvest implements	28	5	25
F	**Political constraints**			
26	Trade unionism	43	1	18

The table shows that the most important constraints faced by the homegarden farmer was "Low price of produce" which is on par with surplus but insufficient for marketing. Lack of time in homegarden activity, prohibitive cost of inputs, inadequacy of capital, non availability of supplies and services, high labour cost, poor economic status of homegarden farmers, non availability of labour, lack of markets for products of homegarden, lack of motivational factors, poor transportation facilities, non availability of credit, uneconomic holdings, lack of knowledge about technology, lack of technology suited for homegarden, lack of extension service and assistance, trade unionism, lack of knowledge in post-harvest handling, non availability of implements, poor storage facilities and lack of homegarden suited implements were the other constraints in the order of decreasing importance. The constraints that were of least importance for the homegarden farmers were lack of processing implements, scarcity of quality irrigation water, lack of post-harvest implements and interrupted power supply.

As the results imply and as is the present predicament of Kerala farmers in the state, the major constraint is that the specialized homegarden farmer does not get the right, desirable price for the produce even if it's the homegarden produce or the specialized component. Also there is a major problem of the produce too much for household consumption and too low for marketing which in conjunction with poor or lack of storage facilities is eventually wasted. This result supports the finding of Thomas (2004). Most of the respondents from the specialized homegardens under study reported that they don't get sufficient time to concentrate on the entire homegarden activities let alone the specialized components. Generally, the farmers who have other source of agricultural income apart from the specialized component find it difficult to manage the time available between the two factors. The cost and availability of inputs necessary for the specialized components is the other major factor.

Non-availability of labour, coupled with other factors in Kerala has a direct influence in high labour cost in the specialized homegardens. The political and social situations prevailing in the state with respect to the work culture also points out to the cause of high labour cost. Even- though family labour is highly involved, and the constraint of lesser number of members in each family due to the nucleotide structure,

some physical labour requirement for operations like land preparation, harvesting of produces from coconut, arecanut and other tree crops necessitates the involvement of skilled labour and hence the homegarden farmers are forced to pay high wages for the labour. The results were in accordance with the findings reported by Geethakutty (1993) and Aravind (2004).

The prospect of homegarden even though high, has not touched the hearts of the homegarden farmers. This was because the extension service and assistance had not reached the homegarden farmers, which resulted in neglected homegardens. The lack of extension service could be attributed due to the less number of staff for an area or the work culture prevailing in the place or state. Many of the homegarden farmers were of the view that with adequate support in terms of extension services and technology awareness there were willing to take up any enterprise as it eventually helps them in income generation activity. Specialization is a way and means for adoption but through the advisory and credit support through institutionalized mechanisms. Also, agri-enterprise culture should be facilitated with better family involvement which will enable the members of homegarden to have a happy life in terms of better understanding and active involvement in all activities of home through economic prosperity. Extension service or support system thus should be reoriented to the homegarden situation with special reference for inclusion of specialized components as a means to horizontal and vertical diversification for better economic prosperity at household level, as it constitutes the majority or bulk of the Kerala land area.

Surmmary

CHAPTER 5
SUMMARY

Homegarden is one of the oldest forms of agricultural production system where homegarden farmers utilize the available land around their house for poly cropping with a variety of crop components along with or without animal husbandry components or other specialized components of their choice for production of various produces based on their household requirements and surplus production, if any for marketing according to market demand. The structural composition, the functional diversity and technology related aspects of homegardens are very much related and supports the dynamic nature of this ever-evolving system. The farmers have evolved homegardens as a means of subsistence production system, which has today transformed to a means of additional income generation system. The economic motive of the homegarden farmer motivates him for introduction of specialized components and hence, this study on specialized homegardens. Against this background, the present study was undertaken with the following specific objectives.

1. To assess the structural configuration of specialized homegardens (in terms of dominance-diversity profile) and its functional dynamics.
2. To delineate the technology needs (gaps) cum dimensions of technologies as perceived by farmers.
3. To investigate the cost benefit analysis and cultural importance.
4. To evaluate selected aspects of women's participation in homegarden activities
5. To identify the constraints experienced by homegarden farmers

The study was conducted during 2012-2013 in selected districts of Kerala comprising Palakkad, Thrissur and Ernakulam districts. A total of 30 homegardens were purposively selected with 10 each from each district wherein some form of specialization could be observed.

The independent variable selected for the study were age, education, occupation, family size, irrigation potential, annual income from homegarden, extension contribution,

market orientation, rational orientation and evaluative perception of homestead farmers in relation to sustainability of the homegarden.

Structural configuration was assessed based on dominance-diversity profile. The diversity index (Shannon-Wiener index) and dominance index (developed by Thomas, 2004.) was used to identify the change in structure and function in homegardens with special reference to three regions viz., courtyard, midregion and outer region and to identify the structural, numerical and economic dominance of crop components in homegarden. The structural configuration and functional dynamics were delineated by measuring the extent of horizontal and vertical diversification observed in the specialized components. The technology gaps assessment of homegarden farmers was worked using a 'four-point ordinal scale' and working out using chi-square. The dimensions of technology were identified using means and proximity measure. The economics of specialized homegardens was assessed through Benefit-Cost analysis of specialized components in terms of extent of contribution of annual income from specialized components and towards annual homegarden income as perceived by the homegarden respondents and the need for middleman in marketing the homegarden produces as perceived by the homegarden respondents. A constraint index was worked out for identifying the constraints experienced by specialized homegarden farmers. The independent variables were quantified using already existing scales or following established procedures. The data were collected by conducting personal interviews with the homegarden farmers, using well-structured and pre-tested interview schedule developed for the purpose. Percentage analysis, means, Analysis of Variance, Chi-square analysis, and proximity measure using mean were employed in the analysis of the data and interpreting the results.

The salient findings of the study are furnished below.

1. More than half of the farmers were in the middle aged category.
2. More than 70 per cent of the farmers had education level from high school to collegiate level.

3. More than 60 per cent of the sampled farmers had agriculture alone as occupation whereas only 40 per cent of farmers had 'agriculture + private' or 'agriculture + government' as occupation.
4. More than 65 per cent of the sampled farmers had a family size with 3-4 members.
5. Half of the homegardens fell in the category of "little or no water scarcity".
6. More than 65 per cent of the sampled respondents generated an annual homegarden income varying from Rs. 2,84,000 per annum.
7. Almost 50 per cent of the extension contribution came from Agricultural Department and Kerala Agricultural University as expressed by the homegarden farmers.
8. About 70 per cent of the total respondents had a higher level of market orientation.
9. More than 50 per cent of the sampled farmers had belief on science and religion rather than belief on religion or science alone.
10. More than 80 per cent of the sampled homegarden respondents had high evaluative perception on the sustainability of farming systems and cropping patterns in the homegarden.
11. The structural configuration of the homegardens of Kerala considerably varied. In this study, the means of the diversity index (using Shannon-Wiener diversity index) showed that structural configuration varies between sampled areas of study where Thrissur topped in the diversity index. The means of the interaction between different areas of neither study nor holding size differ indicating that the biodiversity was not influenced by the different districts. The outer region in specialized homegardens of all the locale of study had the highest biodiversity.
12. The types of specialized homegardens were delineated based on the added components to homegardens primary structure. The animal husbandry components constituted four types of homegardens due to the addends like, livestock, hen, pets and novelty birds. Five types of homegardens were identified based on specialized components, like mushroom, aquaculture, nursery, floriculture and agro-eco-tourism. Other specializations noted were rubber and it addends like nursery/apiculture, precision farming vegetables, organic rice, organic tubers, minor horticultural fruit

trees, spices orchard like nutmeg cum nursery units, organic turmeric/ginger and pineapple gardens.

13. Homegardens with specialized components add more meaningful contribution in terms of income to total homegarden income irrespective of the different types of specializations. The results prove that income from specialized components to total homegarden income is worthy enough and necessitates of horizontal and vertical integration of more specialization to make homegardens more profitable. Also, it was found that the benefit derived by the homegarden farmer from the specialized component is independent of the type of specialization he chose to employ.
14. The marketing channels identified in the study proved that middlemen in various forms had a role in marketing the homegarden products and but homegarden respondents did not favour the involvement of middlemen in marketing the specialized components.
15. In the measure for technology gap using chi square analysis it was inferred that among the homegarden respondents all of them had the same levels of technology needs over all the three districts and adequate technology was available for specialized components according to the homegarden respondents. The highest frequency was for respondents with the view that they have adequate technology that was applicable and sustainable to their standards.
16. Characterisation of specialized homegardens based on technological, social and economic dimensions revealed that out of the 47 dimensions a total of 10 dimensions were considered equally important by all the respondents. On delineating the dimensions of technology for homegarden farmers as perceived by the farmers, the agricultural officers and the scientists, following 10 dimensions were felt important by all categories of respondents were initial cost, continuing cost, income generation potential, physical compatibility, efficiency, suitability, local resource utilization, spatial threshold, attitude, skilled labour, requirement. However 6 common dimensions were considered significant only by homegarden farmers from among the

selected set of dimensions, they were employment generation potential, regularity of returns, rapidity of returns, observability, sustainability and social approval.

17. Evaluation of women's participation in specialized homegarden activities showed that, among the set of regular agricultural and its subsidiary activities, rearing of poultry, uprooting of seedlings and applying irrigation was found to be significant over the other activities. But the activity that the women engaged themselves in the most was found to be kitchen gardening followed by rearing of poultry and some post-harvest operations. And while considering the reasons for involvement, majority of the women consider that their involvement in homegarden activities will help in better realizing the basic family needs.
18. The constraint analysis revealed that the major ones identified were 'surplus but insufficient for marketing which was on par with, low price of produce, high labour cost, lack of markets for homegarden products and lack of extension service.

To conclude, in general, the results that analyses the structural configuration of cropping systems and type of homegardens reveals that there was a large variation found in the spatial arrangement of species within the different regions leading to the structural configuration of homegardens. All these were primarily linked with priority needs, potential uses and availability of space. The techno-socio-economics of the operational unit demonstrated a number of factors affecting the engagement of farmers in designing and improving the whole systems through more technology intervention and its optimal utilization. All these point to the fact that the match between the variations in priorities of the 'homegarden' and the structural configuration and functional diversity of homegardens is strong both, techno-socio, economically and biophysically fulfilling the objectives set forth in the technology assessment of homegarden systems.

Suggestions for future research

1. As this study was concentrated only to the Central parts of Kerala similar studies should be initiated in other parts of the state.
2. Homegarden farming, the predominant farming system prevailing throughout Kerala state may be identified as an exclusive system, which may be considered as

a pivotal unit, based on which future development, research and extension programmes have to be planned. This plan should engulf entrepreneurial components so as to facilitate inclusions of specialization that will augment profitability through specialized homegardens.

3. Impact of fragmentation of lands on the homegarden systems in Kerala can be a future area of research with thrust to vertical expansion and vertical diversification. Research activities may be focused to find out appropriate production technology for homegarden farming situation, which would be more valuable to farmers.
4. Homesteads of Kerala may be considered as the nodal unit of development of agriculture. Development schemes for homegarden may be formulated on a watershed basis. Every effort should be made in order to preserve the agro-ecosystem of Kerala State. Action research studies on the sustainable development of specialized homegarden farming systems by superimposing watershed development approach have to be designed and implemented.
5. A multidisciplinary research team must explore the prospect of developing farmers practices in homegarden farming systems taking into consideration the variety emporium of crop component and specialized components like animal husbandry components, sericulture, apiculture, aquaculture etc. in homegardens.

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Appendix

APPENDIX I

KERALA AGRICULTURAL UNIVERSITY

College of Agriculture, Vellayani, Thiruvananthapuram. 695 522

DEPARTMENT OF AGRICULTURAL EXTENSION

Dr. Allan Thomas
Assistant Professor and Chairman

Date: 27-12-2012.

Sir,

Greetings.

Sir/Madam,

Sri. Rahul Krishnan (Ad. No. 2011-11-144), one of the M.Sc. Scholar, Department of Agricultural Extension, College of Agriculture, Vellayani is undertaking a research study entitled "Techno socio-economic characterization of specialized homegardens: a dominance-diversity approach" as part of his PG research work.

After extensive review of the available literature and discussion with extension scientist's and other experts, variables supposed to have close association with the study have been identified.

Considering your vast experience and professional expertise you have been selected as a judge to rate the relevancy of the variables. I request you to kindly spare some of your valuable time for examining the questionnaire critically. Kindly return the list duly filled at the earliest.

Thanking you.

Yours sincerely

(Allan Thomas)

OPERATIONAL DEFINITION AND OBJECTIVES OF THE STUDY

In this study a specialized homegarden is operationally defined as an agro forestry farming system with homegarden primary structure supplemented with specialized components like sericulture, apiculture, aquaculture, floriculture, nursery units etc making way for the homegardens to be categorized as subsistence with subsidiary commercial interest and/or made for a particular purpose to the extent that it becomes visibly different from the general types of the traditional types of homegarden farming system.

The overriding objective of the study is to assess the structural configuration of specialized homegardens (in terms of dominance-diversity profile) and its functional dynamics. It also tries to delineate the technology needs cum dimensions of technologies as perceived by farmers. It further intends for its cost benefit analysis and cultural importance. Evaluation of selected aspects of women's participation in homegarden activities is also envisaged in the study.

Please rate the independent variables to be included in the study based on its relevancy from the most relevant to the least relevant by ticking against each variable under the respective rating scale.

Sl. No.	Independent variables	Relevancy rating (R- Relevant)				
		Most R	More R	R	Less R	Least R
1	**Age**- number of years completed by the respondent at the time of investigation					
2	**Education**- extent of non-formal or formal learning possessed by the homegarden respondent					
3	**Occupation**- the main vocation and other additional vocations that the respondents were possessing at the time of interview					
4	**Family size**- number of members of either sex living in a household/family dependent on the head of the family					
5	**Annual income**- total annual earnings from farm/non farm activities in the homegarden.					
6	**Annual homegarden income**- total annual earnings from farm activities in the homegarden.					

7	**Annual income from specialised component (s) in homegarden**- total annual earnings from the specialised components in the homegarden.					
8	**Homegarden farming Experience**- total years of experience in farming					
9	**Homegarden size**- The actual size of homegardens inclusive of the home area in hectare(s).					
10	**Irrigation potential**- extent to which irrigation water was available in the holding and the extent of area irrigated. (in terms of physical water scarcity, economic water scarcity and little or no water scarcity)					
11	**Availability of homegarden inputs**- The extent of availability of homegarden suited inputs.					
12	**Market orientation**- degree to which a farmer is oriented towards the market in terms of the profit from his homegarden / specialised components and marketing channels.					
13	**Economic motivation**- degree of awareness on incentives (subsidy etc.,) available for home gardens and specialised components in it.					
14	**Rational orientation**- extent of rationality and scientific belief of a homegarden respondent in relation to the different specialised components in homegardens.					
15	**Extension participation**- homegarden farmers gain a lot of information especially on specialised components by participating in extension programmes organized by developmental agencies and input dealers which would help them in implementing profitable technologies in their homegarden					
16	**Extension contribution**- extent of contribution of technology for the specialised components in homegardens as perceived by the homegarden farmers					
17	**Innovativeness**- extent of innovativeness in the homegarden components (with special reference to the specialisation in homegardens).					
18	**Social participation**- Extent of participation of the homegarden farmer with social and public organisations especially related to agriculture.					
19	**Labour utilisation**- extent of utilisation of family labour and hired labours for homegarden activities.					
20	**Scientific orientation**- extent of awareness/ knowledge of a homegarden respondent in relation to the different scientific recommend ations of the specialised enterprise in the homegarden					
21	**Credit utilisation**- availability of credit, extent of its use and extent of repayment is operation-alised in terms of credit utilisation.					
22	**Risk orientation**- degree of uncertainty involved with the					

	incorporation of specialised components in homegarden					
23	**Mass media participation-** degree of exposure to different mass media sources by the homegarden to avail information on specialised components and general farming in homegardens.					
24	**Knowledge-** on scientific practices in homegarden farming and its specialised components					
25	**Evaluative perception on the sustainability of cropping and farming systems in homegardens-** respondent's meaningful sensation about the worth and efficiency of specialised component in homegarden farming/cropping systems in terms of environment, quality of life-food, nutritional, medicare and aesthetic aspects, resource/technology utilisation and economic aspects.					
26	Others, if any: Please specify					

APPENDIX II

The variables with their mean relevancy score

Sl. No.	Independent variables	Mean relevancy score
1	Age	**3.65**
2	Education	**4.35**
3	Occupation	**3.95**
4	Family size	**4.20**
5	Annual homegarden income	**4.50**
6	Homegarden farming experience	2.25
7	Homegarden size	1.95
8	Irrigation potential	**4.05**
9	Availability of homegarden inputs	2.80
10	Market orientation	**3.70**
11	Economic motivation	2.95
12	Rational orientation	**4.40**
13	Extension participation	2.85
14	Extension contribution	**4.75**
15	Innovativeness	2.15
16	Social participation	3.10
17	Labour utilisation	3.15
18	Scientific orientation	2.65
19	Credit utilisation	1.85
20	Economic motivation	3.15
21	Risk orientation	2.15
22	Mass media participation	1.75
23	Knowledge on scientific practices in homegarden farming.	3.05
24	Evaluative perception on the sustainability of cropping and farming systems in homegardens	**4.25**
	Mean	**3.30**

APPENDIX III

TECHNO SOCIO ECONOMIC CHARACTERISATION OF SPECIALISED HOMEGARDENS IN KERALA

Code: Date:

Interview Schedule

1. District: 2. Taluk: 3. Village: 4. Survey number:

5. Address:

6. Total area of homegarden (in ha): 6. Infrastructural holding area:

7. Effective homegarden area:

a) Type: Irrigated/ Rainfed/ Gardenland

b) Topography: Level/ Undulating/Gentle slope/Steep

8. Family structure and characteristics:

Sl. No	Name	R/n with head	Sex	Age	Caste	Education	Occupation/Employment			
							P	Income/year	S	Income/year
1.	Head:									

P: Primary S: Secondary

9. MARKET ORIENTATION

Whether the respondent agrees with the following statements?

Sl.No	Statements	A	DA
1	Market is not useful to a farmer		
2	A farmer can get good price by eliminating the middle man		
3	One should sell his produce to the nearest market irrespective of price		

4	One should purchase his inputs from shops where his friends or relatives purchase		
5	One should grow those crops which have more market demand		
6	Co-operatives can help a farmer to get better price for his produce		

10. EXTENSION CONTRIBUTION

Mark the response to the extent /Frequency and Usefulness of extension contribution from different extension agencies the respondent got for better homegarden farming.

Statements	Extent of contribution	How frequently?	How useful?
	VA/A/NA	W/M/Y/O	VU/U/NU
The extent to which you discussed the homegarden farming problems with extension personnel from A) AO's/AA's of agricultural department B) Scientists of Kerala Agricultural University C) Scientists of ICAR institutes D) Personnel of other institutes/ Commodity boards, etc. E) Friends, neighbours and well wishers Others (Please mention)			

11. RATIONAL ORIENTATION

What do you feel about the increased income and improvement in life through homegarden? These may be due to:

(a) Beliefs in stars and not in scientific recommendation

(b) Beliefs in stars and scientific recommendations

(c) Beliefs only in scientific recommendation

12. CREDIT UTILISATION

1. Have you availed any crop loan? (Y/N) (Crop/ other activities, give details)

From private individuals/Co-operative societies/ Commercial banks/ Private banks/ Local money lenders/ Friends and neighbours/ Others specify :

2. Nature of the loan taken

Amount of loan and year Amount repaid Amount outstanding Purpose

Source

3. What prompted to divert the fund in case it was not utilised for the purpose?

13. TRAINING ATTENDED

Sl. No.	Name the training	Destination	Agency/ Source	Season	Whether useful?		In which subject matter area do you require training in future?
					Y	N	

Y: Yes N: No

14. INTERRELATIONSHIP OF BELIEF'S AND TABOOS WITH TREES CROPS/LIVESTOCK IN HOMEGARDEN

(a) Is the homegarden situated within proximity of places of worship like temple, church, mosque and other old structures etc? (Yes/No). If yes, mention the structure.

(b) Is there any relationship between the components in homegardens (be it-tree/crops/live stock etc.) and traditions in the families/beliefs/ location importance/rituals etc. (Yes/No)

If Yes:

Sl. No.	Component (Specify)	What is its importance?	Why is it so?	How long they are practising it?

(C) Is there some problem trees/ plants in the homegarden? If so, name the problems associated with it?

15. IRRIGATION POTENTIAL

a) Whether the home garden is (Irrigated/ Rain fed/Combination)

b) What is the perception of farmer on availability of water in the homegarden (Physical water scarcity/ Economic water scarcity/ Little or no water scarcity)

c) Source of irrigation water (Wells/ Tube wells/ Canals/ Ponds/ River/ Tap/ Others)

d) Capacity or period for which irrigation water is available.....

e) Area irrigated.....

Crops irrigated	Stages of irrigation	Method of irrigation	Frequency of irrigation (AD, 2/W, I/W, 2/M, 1/M)

f) Do you pay for the water used? (Y/N)

If yes, Amount incurred for irrigation purpose (Rs/Month)

Amount incurred for home use (Rs/ Month)

g) Do you adopt any water harvesting method/sustainable water management practices in your homegarden? Yes/ No.

If yes, what is the method practised?

How efficient it is? (Very efficient/ Moderately efficient/ less efficient)

16. DRAINAGE FACILITIES

(a) Whether drainage facilities are available in the home garden (Yes/No):

(b) If Yes:

Then the type of drainage facilities available (Natural or interventional):

(c)If interventional type, specify the type of intervention (Ridges and furrows/Channels/ Concrete channels/ Topographical utilisation/ Others)

(d) Efficiency as perceived by the home garden farmer: (Highly efficient/ Moderately efficient/ Not efficient)

(e) Other details of interest:

19. LIVE STOCK COMPONENTS IN HOME GARDEN

Sl. No	Name	Breed	No	Age	Present Status	Type of product	Yield	Returns	Product used for Home/ cash/ both
	Livestock Cow Buffalo Goat Pig Elephant Poultry Others								

Also indicate the feeding/vaccination and medicines given for the livestock

Are you satisfied with the returns from Livestock / poultry? Y/N

20. SPECIALISED COMPONENTS

List all other components in the homegarden with the details asked for

Sl. No	Components	Site	Source of infor-mation	Number /Area	Products	Value Rs / year	Uses Home / cash
1	Terrace garden						
2	Apiary unit						
3	Sericulture unit						
4	Aquaculture unit						
5	Bio gas unit						
6	Composting unit						
	a) Coir pith						
	b) Vermi compost						
	c) Others (specify)						
7	Processing units						
	Any other (specify)						

21. What is the approximate investment and returns per year on different components of home garden as perceived by the home garden farmer?

Sl. No	Components	Area coverage	Investment/Year	Returns/year	
				Home	Through sale
1.					
2.					
3.					
	TOTAL				

22. INDIGENOUS TECHNICAL KNOWLEDGE (ITK)

If any indigenous practices (ITK) are followed in the homegarden, mention it with the probable reason

Sl.No	ITK Practices	Probable reason	Effectiveness VE/E/NE

VE: Very Effective **E**: Effective **NE**: Not Effective

23. What is the monetary value of the land encompassing the home garden (in Rupees)?

24. a. The farmer depends on home garden mainly for

(Livelihood /Livelihood + Economy / Economic purpose alone / All the above)

24.b. The perceived need for middle man (Yes/No)

24c. Food Security

24d. Are they getting adequate food and nutritional security from the homegarden?

Yes/ No

If yes, mention the same with its quantity and nutritional value

Sl. No	Products used	Form in which it is used (Raw/Processed)	Processed form	Availability (Round the year/ Seasonally/ Regular intervals/ Irregularly)	Post harvest processing technology, if any

25. CROP COMPONENTS

a) Details of crop component to identify the structural configuration in the **"Courtyard"/Mid region/ Outer region** of a homegarden. Mark the components for NE, NR, P, UP, D, SD, T in the crop species column. Perceived use in terms of Food, Fodder, Fuel, Timber, Vegetables, Spices, Medicines, Manure, Cash. Others
Type of canopy arrangement: (Multi-tier:- 6 tier, 5 tier, 4 tier, 3 tier/ 2- tier/ 1-tier)
Whether the homegarden structure is planned/ unplanned?
If planned , since when it has been planned?
If planned or unplanned it's observable structure and rationale behind the same

Sl. No.	Crop/ Species	No of species/ Area	Age	Use	Period of crops/ harvest

(NR - Naturally regenerated; NE - Naturally evolved; P - Planned; UP - Unplanned; D - Dominant; SD - Subordinate dominance; T – Transience)

27. CONSTRAINT ANALYSIS

Constraints and solutions as perceived by the farmers in homegardens in the order of importance

Sl. No.	Constraints	MI	I	LI	Li	NI	Perceived solutions
1	Prohibitive cost of inputs						
2	Non availability of labour						
3	High labour cost						
4	Inadequacy of capital						
5	Low price of produce						
6	Uneconomic holding						
7	Lack of technology						
8	Lack of knowledge about technology						
9	Scarcity of quality irrigation water						
10	Non availability of credit						
11	Poor storage facilities						
12	Interrupted power supply						
13	Lack of knowledge on post harvest handling						
14	Non availability of implements						
15	Lack of post harvest implements						
16	Lack of processing implements						
17	Lack of homegarden suited implements						
18	Poor transportation facilities						
19	Lack of extension service and assistance						
20	Non availability of supply and service						
21	Lack of time in homegarden activities						
22	Lack of motivational factors						
23	Poor economic status						
24	Lack of markets for products of homegarden Surplus but insufficient for marketing						
25	Trade unionism						
26	Others (Specify)						

28. SUSTAINABILITY OF HOMEGARDENS

Indicate the extent of evaluative perception on sustainability of farming system and cropping pattern in homegardens

Sl. No.	Statements	Evaluative perception			
		VM	M	L	VL
1	**Environmental** Homestead farming reduces soil, water and atmospheric pollution				
2	Woody perennials crop play an important role in the productivity and sustainability				
3	IPM, IDM, IWM, INM can be effectively utilised in homestead agriculture that will be Eco- friendly practices in the homegarden				
4	Interaction between the crop system and livestock system of a homestead facilitates high degree of organic recycling that maintains soil health and sustainability				
5	Homestead agriculture is ecologically compatible				
6	Cooling effect for home				
7	**Quality of life- food, nutritional , medicare security and aesthetic aspects** Homestead farming provides adequate provision for developing aesthetic aspects of the family members				
8	Homegardens provide the home with round the year food and nutritional security				
9	Homegarden products are much reliable and can be considered as safe products				
10	Homegardens help to meet the immediate medicare needs of the family				
11	Homestead farming provides for risk reducing practices				
12	**Resource utilisation** Catch cropping is more beneficial to the residual soil moisture and nutrients after the major crops				
13	Multi-storied cropping helps to exploit resources effectively				
14	Solar harvesting principles can be effectively implemented in the homesteads				
15	Livestock components in a homestead helps to improve the quality of agricultural produce				
16	In agroforestry homegardens land use systems ensures better resource management				
17	Insitu input generation and utilisation are possible in homegardens				
18	Woody perennials of homestead will dominate the arable crops and will compete for resources				
19	Agroforestry components help to meet requirement of food/fuel				

	Economic				
20	Homestead farming provides for year round income				
21	Homestead farming ensures highest returns per year				
22	Homestead farming ensure to optimising production				
23	Live stock components in a homegarden helps minimising the manuring cost of the homesteads				
24	Homestead agriculture helps to reduce cost of cultivation				
25	Integrated farming practices make homestead an economically viable unit				
26	Structural and functional diversity of the components in a homegarden provides for multiple demands of the family				
27	Homestead farming helps to get the farmer engaged in farm throughout the year				
28	Livestock components in a homestead helps to get the farmer engaged in the farm throughout the year				
29	Homestead ensures more family input				
30	Homestead farming ensures reasonable income through sale of surplus so as to purchase unproduceable articles in the farm				
31	Homestead farming provides employment opportunities for labourer etc.				

VM: Very Much **M**: Much **L**: less **VL**: Very less

29. DIMENSIONS FOR TECHNOLOGY IN HOMEGARDENS

The items for judgement are placed in an 11-point continuum ranging from 'Maximum relevance' to 'No relevance'. Indicate your responses to express your judgement on the level of relevance, from the farmers' point of view. You are welcome to suggest new dimensions, if any.

Dimensions	10	9	8	7	6	5	4	3	2	1	0
A. Economical Dimensions											
1. Initial cost											
2. Continuing cost											
3. Income generation potential											
4. Employment generation potential											
5. Commercialization											
6. Regularity of returns											
7. Rapidity of returns											
B. Technical Dimensions											
8. Physical compatibility											
9. Efficiency											
10. Trialability											
11. Complexity											
12. Profitability											
13. Communicability											

14. Availability											
15. Decrease in discomfort											
16. Flexibility											
17. Simplicity											
18. Observability											
19. Viability											
20. Desirability											
21. Suitability											
15. Local resource utilization											
22. Availability of supplies and services											
c. Environmental Dimensions											
23. Energy saving potential											
24. Resource recycling capacity											
25. Spatial threshold											
26. Availability of raw materials											
27. Infrastructure development											
28. Sustainability											
d. Socio-cultural Dimensions											
29. Social acceptability											
30. Social approval											
31. Cultural compatibility											
E. Psychological Dimensions											
32. Goals orientation											
33. Aspirations											
34. Attitudes											
35. Perceived social status											
36. Level of satisfaction											
37. Scientific orientation											
38. Perceptions of technology											
F. Decision Making Dimensions											
39. Record keeping											
40. Decision-making style											
41. Extension-officers' influence											
42. Time utilization pattern											
G. Human Resource Dimensions											
43. family labour											
44. hired labour											
45. Physical labour requirement											
46. Skilled labour requirement											
Any other dimensions, please specify:											

APPENDIX IV

Tree/crop resource inventory- Palakkad District

Name of the crop	Botanical name
Cereals	
Rice	*Oryza sativa*
Pulses	
Cowpea	*Vigna unguiculata*
Tubers	
Tapioca	*Manihot esculenta*
Sweet potato	*Ipomoea batatas*
Colocasia	*Colocasia* spp.
Elephant Foot yam	*Amorphophallus campanulatus*
Dioscorea	*Dioscorea* spp.
Fruits	
Banana	*Musa* spp.
Mango	*Mangifera indica*
Jack	*Artocarpus heterophyllus*
Papaya	*Carica papaya*
Pineapple	*Ananas comosus*
Guava	*Psidium guajava*
Sapota	*Achras sapota*
Bread fruit	*Artocarpus altilis*
Cashewnut	*Anacardium occidentale*
Lime	*Citrus aurantifolia*
Custard apple	*Annona squamosa*
Bullock's heart	*Annona reticulata*
Pomegranate	*Punica granatum*
Tamarind	*Tamarindus indica*
Vegetables	
Brinjal	*Solanum melongena*
Tomato	*Lycopersicon esculentum*
Amaranthus	*Amaranthus* spp.
Bhindi (Okra)	*Abelmoschus esculentus*
Bitter gourd	*Momordica charantia*
Snake Gourd	*Trichosanthese cucumerina*
Ash gourd	*Benincasa hispida*
Cucumber	*Cucumis sativus*
Drumstick	*Moringa pteriosperma*
Pumpkin	*Cucurbita pepo*
Curry leaf	*Murriya koenegii*
Oil yielding crops	
Coconut	*Cocos nucifera*
Spices and condiments	

Appendix IV. continued...

Pepper	*Piper nigrum*
Clove	*Syzygium aromaticum*
Chilli	*Capsicum* spp.
Nutmeg	*Mysristica Fragrans*
Cinnamon	*Cinnamoum zeylanicum*
Ginger	*Zingiber officinale*
Other crops	
Rubber	*Hevea brasiliensis*
Arecanut	*Areca catchu*
Coffee	*Coffea* spp.
Cocoa	*Theobroma cacao*
Betel vine	*Piper betle*
Fodder	
Napier grass	*Pennistum purpureum*
Guinea grass	*Panicum maximum*
Green manures	
Glyricidia	*Glyricidia maculate*
Crotalaria	*Crotalaria striata*
Calapagonium	*Calapogagonium macunoides*
Other tree crops	
Venga	*Pterocarpus marcupium*
Ayani	*Artocarpus hirsute*
Ilavu	*Bombax malabaricum*
Teak	*Tectona grandis*
Perumaram	*Ailanthus excels*.
Portia tree (seelanthi)	*Thespesia populnea*
Erythrina	*Erythrina indica*
Neem tree	*Azadirachta indica*
Bambo	*Bambusa arundinaea*
Elanji	*Mimusops elengi*
Mahagoni	*Swietenia mahogany*
Sandalwood	*Santalum album*
Ornamentals	
Hibiscus	*Hibiscus sinensis*
Jasmine	*Jasminum sambac*
Croton	*Codiaeum variegatum*
Rose	*Rosa sinensis*
Tulsi	*Ocimum sanctum*
Common Rose	*Aristolochia indica*
Common Blue Bottle	*Polyalthia longifolia*
Koovalam	*Aegle marmelos*
Common Mormon	*Atlantia racemosa*

Appendix IV. continued...

Tree/crop resource inventory- Thrissur District

Name of crop	Botanical name
Cereals	
Rice	*Oryza sativa*
Pulses	
Cowpea	*Vigna unguiculata*
Tubers	
Tapioca	*Manihot esculenta*
Sweet potato	*Ipomoea batatas*
Colocasia	*Colocasia* spp.
Elephat Foot yam	*Amorphophallus campanulatus*
Greater Yam	*Dioscorea alata*
Lesser Yam	*Dioscorea esculenta*
Arrow root	*Maranta arundinacea*
Dioscorea	*Dioscorea* spp.
Fruits	
Banana	*Musa.* Spp.
Mango	*Magnifera indica*
Jack	*Artocarpus heterophyllus*
Papaya	*Carica papaya*
Pineapple	*Ananas comosus*
Bilimbi	
Guava	*Psidium guajava*
Champa	
Lovi lovi	
Sapota	*Achras sapota*
Bread fruit	*Artocarpus altilis*
Nelli	*Emblica officinalis*
Date palm	*Phoenix dactylifera*
Cashewnut	*Anacardium occidentale*
Lime	*Citrus aurantifolia*
Custard apple	*Annona squamosal*
Bullock's heart	*Annona reticulate*
Garcenia	
Pomegranate	*Punica granatum*
Tamarind	*Tamarindus indica*
Vegetables	
Brinjal	*Solanum melongena*
Tomato	*Lycopersicon esculentum*

Appendix IV. Continued...

Amaranthus	*Amaranthus* spp.
Bhindi(Okra)	*Abelmoschus esculentus*
Bitter gourd	*Momordica charantia*
Snake Gourd	*Trichosanthese cucumerina*
Ash gourd	*Benincasa hispida*
Cucumber	*Cucumis sativus*
Drumstick	*Moringa pteriosperma*
Chekkurmanis	*Sauropus androgynous*
Pumpkin	*Cucurbita pepo*
Curry leaf	*Murriya koenegii*
Oil yielding crops	
Coconut	*Cocos nucifera*
Spices and condiments	
Pepper	*Piper nigrum*
Clove	*Syzygium aromaticum*
Chilli	*Capsicum* spp.
Nutmeg	*Mysristica Fragrans*
Cinnamon	*Cinnamoum zeylanicum*
Ginger	*Zingiber officinale*
Some more spices	
Other crops	
Rubber	*Hevea brasiliensis*
Arecanut	*Areca catchu*
Coffee	*Coffea spp.*
Cocoa	*Theobroma cacao*
Betel vine	*Piper betle*
Mulberry	*Morus alba*
Fodder	
Napier grass	*Pennistum purpureum*
Guinea grass	*Panicum maximum*
Green manures	
Glyricidia	*Glyricidia maculata*
Crotalaria	*Crotalaria striata*
Calapagonium	*Calapogagonium macunoides*
Other tree crops	
Kumbi	*Careya arborea*
Venga	*Pterocarpus marcupium*
Ayani	*Artocarpus hirsuta*
Ilavu	*Bombax malabaricum*
Ambayam	*Spondias mangifera*
Teak	*Tectona grandis*
Perumaram	*Ailanthus excelsa*
Portia tree (seelanthi)	*Thespesia populnea*
Erythrina	*Erythrina indica*

Appendix IV. continued...

Neem tree	*Azadirachta indica*
Bamboo	*Bambusa arundinaea*
Mahagoni	Swietenia mahogani
Asoka maram	*Saraca indica*
Ornamentals	
Anthurium	*Anthurium sp*
Orchids	*Orchidaceae sp*
Hibiscus	*Hibiscus sinensis*
Jasmine	*Jasminum sambac*
Croton	*Codiaeum variegatum*
Rose	*Rosa sinensis*
Tulsi	*Ocimum sanctum*
Koovalam	*Aegle marmelos*
Kanikonna	*Cassia fistula*
Neermathalam	*Crateva adansonii*
Malayilangi	*Chionanthes mala-elengi*
Konginipoo	*Lantana camera*
Chethi	*Ixora coccinia*
Kunni	*Abrus precatorius*
Chembaka	*Michelia chempaca*
Paanal	*Glycosmis arborea*

Tree crop resource inventory- Eranakulam District

Name of crop	**Botanical name**
Pulses	
Cowpea	*Vigna unguiculata*
Tubers	
Tapioca	*Manihot esculenta*
Sweet poteto	*Ipomoea batatas*
Colocasia	*Colocasia Spp.*
Elephat Foot yam	*Amorphophallus campanulatus*
Dioscorea	*Dioscorea* spp.
Fruits	
Banana	*Musa. spp.*
Mango	*Magnifera indica*
Jack	*Artocarpus heterophyllus*
Papaya	*Carica papaya*
Pineapple	*Ananas comosus*
Guava	*Psidium guajava*
Sapota	*Achras sapota*
Nelli	*Emblica officinalis*
Bread fruit	*Artocarpus altilis*

Appendix IV. continued...

Cashewnut	*Anacardium occidentale*
Lime	*Citrus aurantifolia*
Custard apple	*Annona squamosa*
Bullock's heart	*Annona reticulata*
Pomegranate	*Punica granatum*
Tamarind	*Tamarindus indica*
Vegetables	
Brinjal	*Solanum melongena*
Tomato	*Lycopersicon esculentum*
Amaranthus	*Amaranthus* spp.
Bhindi(Okra)	*Abelmoschus esculentus*
Bitter gourd	*Momordica charantia*
Mullan vellari	*Cucumus* spp.
Snake Gourd	*Trichosanthese cucumerina*
Ash gourd	*Benincasa hispida*
Cucumber	*Cucumis sativus*
Drumstick	*Moringa pteriosperma*
Pumpkin	*Cucurbita pepo*
Curry leaf	*Murriya koenegii*
Oil yielding crops	
Coconut	*Cocos nucifera*
Sesame	*Sesamum indicum*
Spices and condiments	
Pepper	*Piper nigrum*
Clove	*Syzygium aromaticum*
Chilli	*Capsicum* spp.
Nutmeg	*Mysristica Fragrans*
Cinnamon	*Cinnamoum zeylanicum*
Turmeric	*Curcuma domestica*
Ginger	*Zingiber officinale*
Other crops	
Rubber	*Hevea brasiliensis*
Arecanut	*Areca catchu*
Coffee	*Coffea* spp.
Cocoa	*Theobroma cacao*
Betel vine	*Piper betle*
Fodder	
Napier grass	*Pennistum purpureum*
Guinea grass	*Panicum maximum*
Green manures	
Glyricidia	*Glyricidia maculata*
Crotalaria	*Crotalaria striata*
Calapagonium	*Calapogagonium macunoides*
Other tree crops	

Appendix IV. continued...

Kumbi	*Careya arborea*
Venga	*Pterocarpus marcupium*
Ayani	*Artocarpus hirsuta*
Ilavu	*Bombax malabaricum*
Ambayam	*Spondias mangifera*
Teak	*Tectona grandis*
Perumaram	*Ailanthus excelsa*
Portia tree (seelanthi)	*Thespesia populnea*
Erythrina	*Erythrina indica*
Neem tree	*Azadirachta indica*
Bamboo	*Bambusa arundinaea*
Elanji	*Mimusops elengi*
Mahagoni	*Swietenia mahogani*
Ornamentals	
Anthurium	*Anthurium sp*
Orchids	*Orchidaceae sp*
Hibiscus	*Hibiscus sinensis*
Jasmine	*Jasminum sambac*
Croton	*Codiaeum variegatum*
Rose	*Rosa sinensis*
Tulsi	*Ocimum sanctum*
Eshwaramulla	*Aristolochia indica*
Koovalam	*Aegle marmelos*
Kanikonna	*Cassia fistula*
Neermathalam	*Crateva adansonii*
Malayilangi	*Chionanthes mala-elengi*
Konginipoo	*Lantana camera*
Chethi	*Ixora coccinia*
Kunni	*Abrus precatorius*
Karimkurinji	*Carvia callosa*
Chembaka	*Michelia chempaca*
Paanal	*Glycosmis arborea*
Marigold	*Tagetes erecta*
Lawn grass	*Cynadon dactylon*
Redneck palm	*Dypsis leptocheilos*
Royal palm	*Roystonea regia*
Roundleaf palm	*Livistona rotundifolia*
Silver palm	*Coccothrinax argentata*
Umbrella palm	*Hedyscepe canterburyana*

APPENDIX V

The operationalisation of selected dimensions of technology in homegardens

1. Initial cost

It is defined as the initial investment that covers all the costs of a technology enterprise that has to be accepted for adoption by the homegarden farmers.

2. Continuing cost

It is defined as the cost incurred by the technology for the full period of its use as a part of maintaining the technology that is used in the homegardens.

3. Income generation potential

It is the ability of a technology to generate additional income in the homegardens under the existing conditions.

4. Regularity of returns

It is defined as the capability of a technology to generate returns on a regular basis in the homegardens.

5. Rapidity of returns

It is defined as the temporal ability of technology to ensure immediate or quick returns to the homegarden farmer on use of the technology.

6. Sustainability

It is defined as the degree to which a technology fits in most appropriately with ones homegarden conditions or its environment without causing any problem to his or her surroundings.

7. Profitability

It is defined as the perception by the individual about the amount of money that will be realized as profit for the homegarden as a result of adoption of a technology

8. Simplicity

It is the perception by an individual about the degree to which an innovation is easy to understand and practice in the homegarden.

9. Observability

It is defined as the degree to which the successful results of a technology used in the homegarden can be visually observed by the homegarden farmer.

10. Local resource utilisation

It is defined as the capacity of the technology used in the homegarden to make best use of the available resources of the homegarden for productive purposes.

11. Availability of supply and services

It is defined as the extent of adequate and timely availability of agencies holding the supply and service functions related with a homegarden technology.

12. Resource recycling capacity

It is defined as the extent to which the available resources in a homegarden can be recycled among the existing homegarden components so that the production system can become more productive, dynamic and sustainable

13. Availability of raw material

It is defined as the adequate amount of timely availability of raw material required for the right and efficient use of any homegarden technology.

14. Social acceptability

It is defined as the degree to which a technology for homegarden is considered useful, practical and feasible by the majority of the members of a social system.

15. Social Approval

It is defined as the perception by an individual about the degree to which an homegarden farmer would achieve the approval of others and gains in prestige or esteem by adopting a particular technology.

16. Cultural compatibility

It is defined as the perception by an individual about the degree to which a homegarden farmer would consider the cultural feelings of the place in which a particular technology is been adopted.

17. Goal orientation

It is defined as the extent to which a homegarden farmer achieve a definite prefixed

goal on use of a technology in homegardens.

18. Attitude

It is defined as the positive or negative feeling of the homegarden farmer towards a technology that is to be used in homegarden.

19. Level of satisfaction

It is defined as the extent to which the homegarden farmer is happy and satisfied with the output generated in the homegarden as a result of use of a technology.

20. Scientific orientation

It is defined as the extent to which a homegarden farmer is oriented to the use of scientific methods in decision making with respect to the farming activities in his or her homegarden.

21. Perception of technology

It is defined as the clear understanding on selection, organisation and interpretation of a technology to be used by a homegarden farmer in a situation according to prior learning, activities, interest, experiences etc.

22. Extension Officer's influence

It is the perception by an individual about the degree to which an extension officer can influence or persuade the homegarden farmer to use the new scientific practices/methods for better farming in the homegarden.

23. Record keeping dimensions

It is defined as the perception by the homegarden farmer on the importance of maintaining the records on each and every aspects of the technology that is in use in the homegarden.

24. Family Labour

It is defined as the perception by an individual about the extent of family labour involvement or participation in practising a technology in the homegarden.

TECHNO SOCIO-ECONOMIC CHARACTERIZATION OF SPECIALIZED HOMEGARDENS: A DOMINANCE-DIVERSITY APPROACH

by

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Abstract of the thesis
Submitted in partial fulfillment of the requirement
for the degree of

MASTER OF SCIENCE IN AGRICULTURE

Faculty of Agriculture
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2013

ABSTRACT

This study entitled 'Techno socio-economic characterization of specialized homegardens: a dominance-diversity approach' was conducted at Palakkad, Thrissur, and Ernakulam districts covering 30 homegardens with 10 each from each district. It examines the structural configuration and its functional dynamics, delineates the technology gaps cum dimensions of technologies as perceived by farmers, investigates the cost-benefit analysis and cultural importance, evaluates selected aspects of women's participation in homegarden activities and constraints experienced by the specialized homegarden farmers.

In this study Specialized homegardens are operationally defined as a special type of sustainable agricultural production system practised around the home with or without extended garden, with homegarden primary structure supplemented with specialized components like sericulture, apiculture, aquaculture, etc. making way for the homegardens to be categorized as subsistence with subsidiary commercial interest and/or made for a particular purpose to the extent that it becomes visibly different from the general types of the traditional types of homegarden farming system.

The structural configuration and functional dynamics were identified using the measure of dominance, measure of Shannon and Wiener diversity index and the extent of horizontal and vertical integration in the specialized homegardens. 5-7 major crop dominance was observed and eighty per cent of the specialized homegardens had more than four tier horizontal diversification and 'two' levels of vertical diversification for economically dominant crop and around 'three' levels for specialized components.

The economics of specialized homegardens revealed no significance between the benefit-cost ratios of the different specialized components, which suggests that the benefit is independent of the type of specialization. Also, more than 70 per cent of the respondents felt that middlemen were useful and essential in the marketing of homegarden produce but majority did not prefer middlemen in marketing of produce from specialized components.

Technology gap assessment as perceived by the respondents using a Chi- square test revealed that, the distribution had the same technology needs (χ^2= 0.598). Ten dimensions were felt important by all categories of respondents and an additional six dimensions perceived by the farmers were found to fall out of the ambit of extension and

scientific community which was yet to be bridged. It was found that there were significant differences in the role of women in specialized homegarden activities. The foremost constraint identified was low price of the homegarden produce which was on par with the constraint 'surplus produces but insufficient for marketing'.

To conclude, primarily a system with dominance has been developed which is again derived from diversity index and extent of horizontal versus vertical diversification which will help in enumerating the commodity and non commodity nature of crops and hence enable better planning of homegardens for increased profit without depleting the biodiversity of specialized homegardens. Techno socio-economic dimensions of specialized homegardens were prioritized wherein 10 dimensions were felt important by all categories of respondents and six dimensions felt important by the farmers were not perceived to be important either by the Scientists or Agricultural Officers that needs to be addressed. Strategies like cluster marketing, group marketing and pooled marketing should be planned and implemented to overcome the constraints of the low price of produce and surplus insufficient for marketing to make this important production a durable and sustainable system.