TECHNOLOGY ASSESSMENT OF PLANT PROTECTION PRACTICES OF ECONOMICALLY DOMINANT CROPS IN HOMEGARDENS

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by

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(2013-11-119)

THESIS

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2015

DECLARATION

I, hereby declare that this thesis entitled **"TECHNOLOGY ASSESSMENT OF PLANT PROTECTION PRACTICES OF ECONOMICALLY DOMINANT CROPS IN HOMEGARDENS"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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Certified that this thesis entitled **"TECHNOLOGY ASSESSMENT OF PLANT PROTECTION PRACTICES OF ECONOMICALLY DOMINANT CROPS IN HOMEGARDENS"** is a record of research work done independently by **Ms. Sujitha P. S.**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

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Sujitha P. S.

TABLE OF CONTENTS

Sl. No.	Content	Page No.
1	INTRODUCTION	
2	REVIEW OF LITERATURE	
3	METHODOLOGY	
4	RESULTS AND DISCUSSION	
5	SUMMARY	
6	REFERENCES	
	ABSTRACT	
	APPENDIX	

IST OF TABLES

Table no.	Title	Page no.
1	Independent variables and measurement scales/scores used	
2	Distribution of the respondents based on age	
3	Distribution of the respondents based on education	
4	Distribution of the respondents based on family size	
5	Distribution of the respondents based occupation	
6	Distribution of the respondents based on effective homegarden area	
7	Distribution of the respondents based on farming experience	
7	Distribution of the respondents based on rational orientation	
8	Distribution of the respondents based on information source utilization	
9	Distribution of the respondents based on extension participation	
11	Distribution of the respondents based on knowledge on plant protection	
12	Distribution of the respondents based on evaluative perception	
13	Distribution of the respondents based on economic motivation	
14	Economic dominance of crops in homegardens	
15	Distribution of respondents based on adoption of selected plant protection technologies of KAU	
16	Distribution of respondents based on adoption of selected plant protection technologies of KAU in coconut	
17	Distribution of respondents based on adoption of selected plant protection technologies of KAU in banana	
18	Distribution of respondents based on adoption of selected plant protection technologies of KAU in tapioca	
19	Distribution of respondents based on adoption of selected plant protection technologies of KAU in pepper	
20	Distribution of respondents based on adoption of selected plant protection technologies of KAU in vegetables	
21	Distribution of respondents based on adoption of selected plant protection technologies of KAU in yams and colacasia	
22	Distribution of respondents based on adoption of selected plant protection technologies of KAU in arecanut	
23	Correlation between the independent variables and dependent variable adoption	
24	Plant protection preferences of homegarden farmers	
25	Usefulness of KAU plant protection practices in homegardens	
26	Effectiveness of KAU plant protection practices in homegardens	

27	Plant protection technology gap in homegarden	
28	Crop wise/ general ITK practices identified	
29	Constraints experienced by farmers in adopting selected KAU plant protection practices	
30	Contribution of suggestions for refinement of technology as perceived by the respondents	

LIST OF FIGURES

Sl. No.	Title	Page no.
1	Map of Thiruvanthapuram district of Kerala	
2	Emperical framework of the study	
2	Profile characteristics of homegarden respondents	
3	Conceptual framework of the study	
4	Overall adoption adopter categorization of homegarden respondents	
5	Adopter categorization of respondents in coconut	
7	Adopter categorization of respondents in banana	
8	Adopter categorization of respondents in tapioca	
9	Adopter categorization of respondents in pepper	
10	Adopter categorization of respondents in vegetables	
11	Adopter categorization of respondents in yams and colacasia	
12	Adopter categorization of respondents in arecanut	
13	Empirical framework of the study	

INTRODUCTION

1. INTRODUCTION

Kerala state on the southwestern coast of India in the tropical humid zone has a predominantly agricultural economy, a very high density of population and therefore high pressure on cultivable land.Homegarden is a major uniqueand much developed agricultural production system in Kerala state.The homegarden is an operational farm unit in which a number of crops (including tree crops) are grown, along with rearing of livestock, poultry and fish, mainly for the purpose of meeting the farmer's basic needs. These gardens, not only provide economic benefits to the householder, butalso cultural and social life.Furthermore, the biophysical aspects of homegardens such as soil conservation effects and potential for carbon sequestration are giving ecological benefits to both the farmer and to the community. The homegardens which are mimics of mini forests are the forests created by the farmers of Kerala incorporating various perennial and annual crops which renders the system a dense scenario of vegetation. Aravind*et al*. (2004).

Homegardens are hallmark of staggered settlement pattern in Kerala and are the most valuable heritage that influences the unique living standards, cultural identity and other socio-economic features. Within the homegardens, the farmers have house, grow variety of crops with dominance of perennials, raise a combination of animals, birds and fish and run their agribusiness enterprises, all in marginal to small holdings. The system is practised in 75% of the cropped area and 84% of operational holdings are below 0.5 ha, covering 30% of the total cultivable area. Homegardens yield a basket of products and aim of the farmer is to maximise income from available land, utilizing their own skill and the services at his disposal. Kerala state is one of the unique regions in the world that enjoys high solar radiation and warm temperature round the year, rightly named "Gods own country" and "Gateway of monsoon in India". The evolution of homegardens is attributed to the unique natural resource

endowments of this tiny strip of land. The Kerala farm families are characterized by inheritance of rich indigenous traditional knowledge, high literacy and skill, high population density, access to credits, services and markets, political awareness and urban style of living. Though issues like acute scarcity of labour, high labour cost and reluctant youths in farming, homegardens are operated mainly through family labour with active participation of women and remain the source of livelihood for large majority.

Scope and importance of the study

Homegardening is a time-tested example of sustainable, multispecies, agroforestry land-use, practiced as a subset of the farming system, predominantly in the different agroclimatic regions of Kerala. The high structural and floristic diversity of tropical homegardens are a reflection of the unique biophysical environment and technology components in the homegarden systems. The farmers undertake cultivation of an array of crops like tree crops, plantation crops, seasonal and biennials all in intimate mixtures on the same piece of land around the homesteads. Farm animals and poultry and sometimes fisheries are alsoessential components of the system. The close association of agricultural crops, tree crops and animals in the homesteads represents an excellent example of sustainable and productive agroforestry homegardens. Optimum utilization of available resources of land, solar energy and technological inputs and an efficient recycling of farm wastes are important characteristics of the systems.Based on a study of 400 homegardens in Thiruvananthapuram district, Kerala, Jacob(1997) reported that the number of crop and tree species in homesteads varied fromless than 5 to more than 40.

Abdoellah*et al*(2002) reported that homegardens makes the homes aesthetically pleasing and help to maintain species of ethnic, cultural and religious importance.A majority of the farmers (more than 80% in all sizes of homegardens) reported that more than 75% of their household needs were met by their gardens.By promoting increased consumption of theavailable diversity; nutrition of farming families can be improved. Rural farmers continue to rely on their homegardens to enhance household food security against the risks presented

by monocroppingsystems. Family labour is utilized for management of these systems. All members of house participate in the day to day working of the homegardens to varying degrees. Both male and female members of the household participate in both the labour and in the economic decision making processes. Hired labourers are employed according to need. All these studies highlight the importance of homegarden as a system of farming in Kerala state.

One of the formidable challenges in front of agriculture is to enhancethe food production so as to feed an ever-increasing human population which is estimated to increase from the present 1.15 billion to 1.6 billion in India and from 6.8 billion to 9.2 billion globally by 2050.The greatest challenge will be to accomplish it without much additional demand on land, water and other resources which are becoming increasingly scarce coupled with possible extreme environmental conditions associated with climate change. Coakley*et al*. (1999) reported that the major predicted results of climate change are increased temperature, moisture and carbon dioxide can impact all three legs of the plant disease triangle in various ways.It is not only important to produce more but also to protect what we produce. Manjunath (2010) reported that at a conservative estimate 35 to 40% of our crop yields valued at Rs.600 billion are lost to pests, diseases and weeds annually despite using chemicals for their control costing around Rs.27 billion each year. A study by Chandran (1989) confirmed that 89 per cent of thevegetables studied were contaminated withresidues of insecticide last sprayed and about 14per cent of these had residues above their respective maximum residue limits level. Diverse ecosystems have been replaced in many regions by simple agro-ecosystems which are more vulnerable to pest attack. In order to safeguard productivity to the level necessary to meet the demand,these crops have to be protected from pests and diseases.

Plant protection technologies in homegardens become even more complex in terms of its adoption and needs assessment. Gopalakrishnan (2007) stated that farmers are very keen to advocate plant protection technologies but they quite often do not use chemicals as prescribed by the specialists. Sometimes they do not use it considering the homegarden ecosystem as a whole. Legans

(1985) stated that adoption behaviour could be specific to particular innovation individuals and environment. Lack of awareness of eco friendly plant protection aspects, safety measures while application and other related issues could be a constraint in adoptingplant protection technologies.

Directorate of Plant Protection, Quarantine and Storage (2012) has reported that indiscriminate and injudicious use of chemical pesticides in agriculture has resulted in several associated adverse effects such as environmental pollution, ecological imbalances, pesticides residues in food, fruits and vegetables, fodder, soil and water, pest resurgence, human and animal health hazards, destruction of biocontrol agents, development of resistance in pests etc.Thus it becomes very essential to study the level of adoption, technology needs and constraints in adopting the same.

Kerala Agricultural University (2011) has recommended various plant protection practices for control of pests and diseases of various crops. The success of a technology depends on how far it is adopted by the people and how it continuous to provide welfare to the social system. It is in this context a systematic study was undertaken in the homegardens with following objectives.

i. To assess the level of adoption of selected plant protection practices of KAU for the economically dominant crops in the homegardens.
ii. Toanalyse the plant protection preferences of homegarden farmers.
iii. To identify the constraints experienced by farmers in the utilization of plant protection technologies in the homegardens.
iv. Suggestions for refinement of plant protection measures as perceived by the homegarden farmers.

Limitations of the study

The study was conducted in five panchayats of Thiruvananthapuram district of Kerala state and hence the findings of the study have limited generability. The data collected from the respondents may or may

not be free from their individual biases and prejudices.In spite of these limitations, much care has been taken to make the study as objective as possible.

Organization of the thesis

The entire thesis is organized in five chapters. The first chapter 'introduction' includes the importance of the study, objectives, scope and limitations. Second chapter, 'theoretical orientation" deals with review of literature. Third chapter, 'research methodology' explains the sampling design, description of study area, measurement of independent variables, method of data collection and statistical tools used. Fourth chapter consists of 'result and discussion' which details about the specific inferences drawn from the study. 'Summary' chapter briefly summarizes the work done and salient features, its implications and also suggests future area of research.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The review of pervious research studies helps in providing a basis for developing a conceptual frame work for the study. It helps the researcher to get acquainted with the empirical procedures of the research, and the possible results available in the area thus giving a theoretical framework of the study undertaken.

2.1. Definitions of homegardens.
2.2. Personal and social characteristics of homegarden farmers.
2.3. Adoption.
2.4. Constraints in adoption.

2.1. Definitions of homegardens

KAU (1989) reported that a typical homegarden consists of a dwelling house with small garden in front and variety of annuals and perennial crops grown in mixture in a small piece of land

Christanty (1990) in a study on 'homegardens in tropical Asia with special reference to Indonesia' concluded that personal preferences, socioeconomic status and culture seem to be the main determinants of the appearance, function, and structure of homegardens.

Krishnan (2013) defined homegarden as a special type of sustainable agricultural production system practiced around the home with or without extended garden, with homegarden primary structure supplemented with specialized components like sericulture, apiculture,aquaculture,floriculture nursery 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 in a study on 'techno socio-economic characterization of specialized homegardens: a dominance-diversity approach'.

2.2. Personal and social characteristics of homegarden farmers

2.2.1. Age

Ganadeepa (1991) in a study on 'techno cultural profile of rice farmers'found a positive and significant relationship between age and knowledge among rice farmers.

Babu (1995) in a study on 'evaluative perception of homestead farmers in relation to appropriateness of farming systems and cropping pattern' reported that age of farmers of central Kerala had no relationship with adoption of scientific practices in homesteads.

Sreedaya (2000) in a study on 'performance analysis of the Self help Groups in vegetable production in Thiruvanathapuram' reported a non-significant relationship of age with extent of adoption of recommended practices among vegetables growers of both Intensive Vegetable Development Programme (IVDP) and Vegetable and Fruit Promotion Council Keralam (VFPCK).

Kamalakkannan (2001) in a study on 'content analysis of selected mass media in dissemination of farm technology' stated that most of the commercial vegetable growers (75%) belonged to medium group with respect to age.

Fayas (2003) in a study on 'viability of Self Help Groups in Vegetable and Fruit Promotion Council Keralam' stated that the majority of vegetable growers belonged to medium category of 35 to50 years of age.

Kamalakkannan (2003) in a study on 'research and extension gaps in commericial vegetable farming in eastern Palakkad' reported that most of the commercial vegetable growers (75%) belonged to medium group with respect to age.

Jayawardana (2007) in a study on 'organic agricultural practices in coconut based homesteads in Thiruvanathapuram' reported that majority of the coconut based homestead farmers (84%) belonged to old age category.

Esakkimuthu (2012) in a study on 'innovations in technical backstopping for the Thiruvanathapuram district panchayath- an appraisal of samagra project on banana cultivation'reported that most of the respondents belonged to either middle or old age group and this observation is justified because the participation of youth in Kerala's agriculture is low.

Anupama (2014) in a study on 'content development for agricultural expert system on organic vegetable cultivation' reported that more than 50% of the organic farmers (58%) belonged to the old age category and 42% belonged to middle age category.

2.2.2. Education

Rai (1965) in a study on 'diffusion of information and farmers response in relation to an improved farm practices' pointed out that higher the education of the farmer, greater the interest in reading various kinds of literature in relation to the improved agricultural practices.

Naidu (1978) in a study on 'investigation of the extent of adoption of package of practices recommendations by Central Tobacco Research Institute' reported that education may create a favorable mental atmosphere for the acceptance of new practices in tobacco.

Deepali (1979) in a 'study on the knowledge and participation of rural women in agricultural operation with respect to paddy crop and their value orientation in Dharward' found that the family educational profile was positively related with degree of participation of rural women in the adoption of agricultural operations in paddy.

Viju (1985)in a study 'on adoption behaviour of tribal farmers towards improved agricultural practices' stated that the education level of farmers was seen influencing their knowledge level and their attitude towards farming which in turn influenced their adoption level.

Seema (1986) in a study of 'role of farm women in decision making process of farming community'reported that there is a non-significant relationship of family educational status and perception.

Rathinasabapathi (1987) in ‘a study on knowledge and extent of adoption of integrated pest management for cotton’ reported that education had positive and non-significant association with adoption of improved paddy cultivation practices.

Quazi and Iqbal (1991) in their study on ‘relationship between personnel characteristics and adoption of recommended practices’reported that education was an important determinant of innovation adoption.

Gangadharan(1993) in a study on ‘adoption of improved agricultural practices by pepper growers of Idukki district’ reported that educational status, scientific orientation, information source used, innovativeness and economic motivation had positive and significant relationship with attitude towards adoption of recommended practices of pepper.

Mary *et al.* (1994) in a ‘study on agricultural farm youth’s attitude found a positive and significant relationship between educational status and attitude towards farming.

Jaganathan (2004) in a study on ‘analysis of organic farming practices in vegetable cultivation in Thiruvanathpuram district’ reported that education status of the farmers had positive and significant relationship with knowledge and adoption of organic farming practices and majority of the respondents (52%) had secondary level education.

Sasankan (2004) in a ‘study on production system typology and technology utilization pattern in cassava cultivation in Thiruvanathapuram district’ reported that nearly half of the respondents (49%) had education upto secondary level. There are negligible per cent (<2%) illiterate farmers in cassava cultivation.

Jayawardana (2007) in a study on‘organic agricultural practices in coconut based homesteads’ stated that most of the coconut based homestead farmers (42%) had primary school education.

The results of the study ‘women farmer’s agricultural information needs and accessibility’ by Okwu and Umoru (2009) revealed that 35.4 per cent of women farmers had no formal education, 40 per cent primary/adult education, 18.5 per cent secondary education and 60 per cent tertiary education.

Gupta *et al.* (2010) in a ‘study on extent of knowledge of vegetable growers about the side effects of pesticides’ stated that education was positively and significantly related with the knowledge of respondent about side effects of pesticides.

Chinchu (2011) in a study on ‘performance effectiveness of State Horticulture Mission Kerala’ reported thatfarmers of State Horticulture Mission were having high school/higher secondary education, 31% having primary school education and 9% college level education.

Dhayal*et al.* (2012) in their study on ‘information seeking behaviour of bergrowers in Jaipur district of Rajasthan’ found a significant association between the information seeking behavior of the ber growers and their education level.

Esakkimuthu (2012) in a study on 'innovations in technical backstopping for Thiruvanthapuram district panchayath- a critical appraisal of samagra project on banana cultivation' indicated that 30% of the banana farmer respondents had education upto high school level.

2.2.3. Occupation

Kamalakkannan (2001)in a study on 'content analysis of selected mass media in dissemination of farm technology' reported that majority (60%) of the respondents were having farming as their main occupation.

Oommen (2007) reported in his study on 'mode of viewer preference of agricultural programmes through various channels of television' that (53%) of farmer respondentshad subsidiary occupation also besides agriculture.

Lad and Wattamwar (2009) in a study on 'correlates of perceived effectiveness of televiewing farmers' reported that (67.5%) of the TV viewers had farming as their main occupation.

Sobha (2013) a study on 'farm telecast in Kerala'revealed that majority of the respondents (56.67%) were having an additional occupation along with farming.

Beevi (2014) in a study on 'radio listening behaviour of farm families in the digital age'reported that percentage of youngsters accepting agriculture as an occupation is lessdue to having higher education and non-avaliablity of land for economic cultivation.

2.2.4. Family size

Varma and Rao (1969) in a study on 'impact of farmer's training programme on adoption of recommended practices' reported that family requirement has a direct relationship to garden size.

Rathinasabapathi (1987) in 'a study on knowledge and extent of adoption of integrated pest management for cotton' reported non-significant relationship of occupation with extent of adoption of integrated pest management practices in cotton.

Manusingh (1990) in a study on 'women agricultural labourers in rice farming system' stated that two third of the women agricultural labourers lived in nuclear families having up to five members in a rice farming system.

Geetha (2007) found in study on 'socio- technical system analysis of tribal and settler farmers in the Western ghat regions of Wayanad district' that there is positive and significant relationship between size of family and risk preferences among tribal farmers.

Chinchu (2011) in a study on 'performance effectiveness of State Horticulture Mission Kerala'reported that 35% of the respondents of State Horticulture Mission were having joint families and rest 65% having nuclear families.

Krishnan (2013) in a study on 'techno socio-economic characterization of specialized homegardens: a dominiance-diversity approach' reported that the physical involvement of family members in homegardening

activities over years may get diminished and they might just resort to supervisory role.

2.2.5. Effective homegarden area

Krishnamurthy *et al.* (1997) in a study on 'impact of radio listening in knowledge and adoption of fertilizer' indicated that most (93.33%) of the respondents belonged to big land holding and only 6.67 % of them had small size land holding.

Dhayal and Khan (2012)concluded in a study on 'information seeking behaviour of bergrowers in Jaipur' that there is a significant association between the information seeking behaviour of the ber growers and their size of land holding.

Chinchu (2011) in a study on 'performance effectiveness of State Horticulture Mission Kerala' found that majority (55%) of the farmers had 1-2 acres of land while 35% of the farmers had less than 1 acre of farm size and only 10% had more than 2 acres of farm size among the Self Help Group farmers.

2.2.6. Farming experience

Senthilkumar (2000) in a study on 'mass media utilization behaviour of farmers' found that 40% of farmers were having more than 20 years experience followed by 32.5% having upto 10 years and 27.5% having 11- 20 years of farming experience.

Kamalakkannan (2001) in a study on 'content analysis of selected mass media in dissemination of farm technology' revealed that majority of the respondents (40%) had more than twenty years of farming experience.

Ananthamanikandan (2003)in a study on 'content analysis and audience research on farm and home programmes' found that majority of the respondents has 26 to 30 years of farming experience.

Fayas (2003) in a study on 'viability of Self Help Groups in Vegetable and Fruit Promotion Council Keralam a multidimensional analysis' reported that about 75% of the farmers have more than 20 years of experience in cultivation among the vegetable farmer respondents.

Sasankan (2004) reported in a study conducted among cassava growers found that 53% of respondents had an experience in cassava cultivation of more than 25 years.

Jaganathan (2004) observed in a study on 'analysis of organic farming practices in vegetable cultivation in Thiruvanthapuram district' that 47% of respondents were having medium level of experience in vegetable cultivation.

Jayawardana (2007) in a study on 'organic agricultural practices in coconut based homesteads in Thiruvanathapuram' reported that 38% of the farmer respondents in homestead were having more than twenty five years of experience in coconut cultivation.

Chinchu (2011) in a study conducted among vegetable and banana farmers concluded that only 13% of the farmers were having an experience in vegetable or banana cultivation for five or less than five years.

Hanjabam (2013) in a study on 'analysis of constraints and strategies for scaling up precision farming in Kerala' reported that majorityof the precision farmers (53.3%) and conventional farmers (76.67%) were having more than 25 years of farming experience.

Anupama (2014) reported in a study on 'content development for agricultural expert system on organic vegetable cultivation' that majority of the vegetable farmers (54%) were having high level of farming experience i.e., more than 25 years.

2.2.7. Rational orientation

Ranjendran (1992) in a 'study on feasibility and utilization of agricultural technologies among scheduled caste farmers' reported that there was a positive and significant relation between rational orientations of schedule caste farming families to the extent of adoption.

Thomas (2004) in a study on 'problems and prospects of medicinal plant cultivation in Thiruvanathapuram' concluded that there was no relation between rational orientation of homegarden farmers to extent of adoption.

Krishnan (2013) in a study on 'techno socio-economic characterization of specialized homegardens: a dominance -diversity approach' reported that more than fifty percent of the homegarden respondents had belief on science and religion rather than belief on religion or science alone.

2.2.8. Information source utilization

Saravanan (1992) in 'a diagnostic study on the capacity of factors associated with shift from paddy to tapioca' found that tapioca farmer respondents had mass media exposure in the order of medium (58.34%), low (26.66%) and high 15% category.

Reddy (2003) in a study on 'entrepreneurial behaviour of sericulture farmers of Chitttor district of Andhra Pradesh' revealed that majority of sericulture farmers (37.33%) had medium level of mass media exposure followed by low (22.67%) and high level of mass media exposure.

Kuttan (2005) in a study on 'credibility of the news media'revealed that TV was recorded the highest rating by old aged respondents give highest rated it as the lowest with respect to credibility.

Bhavya (2008) reported in a study on 'cause consequence analysis of indebtedness among farmers in Pulpallypanchayath of Wayanad district' that 50% of Wayanad indebted farmer respondents had medium level of exposure to mass media followed by 31.66%of respondents with high level of exposure.

Sengupta (2008) stated in a study on 'why farmers commit suicides' that many farmers were extremely vulnerable to misinformation about crops prospects due to lack of mass media exposure.

Senthilkumar (2000) in a study on ' mass media utilization behviour of farmers an analysis' found that 40% of farmers were having more

than 20 years experience followed by 32.5% having upto 10 years and 27.5% having 11- 20 years of farming experience in mass media utilization.

Government of India (2011) reported that in Kerala 32.2% of urban households and 27.2% of rural households are using radio as source of information.

Sobha (2013) in a study on 'farm telecast in Kerala' reported that 22.22. % of respondents having highlevel of mass media exposure where as majority of the respondents (67.78%) were having medium level of mass media exposure.

2.2.9. Extension participation

John (1991) in a study on 'feasibility analysis of group approach in the transfer of pepper production technology' found that mere membership in group itself enhanced the extension participation of the members and he also found that extension participation had positive and significant influence on adoption of pepper cultivation practices.

Sindhu (2002) in a study on 'social cost-benefit analysis in vegetable production programmes in Kerala through participatory approach' reported that the old farmers are likely to lose interest in active participation within and outside social system among vegetable farmers.

Singh *et al.* (2003) in their study on 'media use profile of farmers' reported that majority of the respondents had low to medium level of extension participation.

Wankhede and Khare (2005) in their study 'on perception of farmers viewing Krishidarshanprogramme'found that extension participation had significant relationship with effectiveness of farm telecast.

Geetha(2007)in a study on 'socio-technical system analysis of tribal and settle farmers in the Western ghat regions of Wayanad district' reported that most of the tribal and settler farmer respondents belonged to low category (49.00%) of extension participation and more than one fourth of the respondents (32.00%) belonged to high category and only few respondents (19.00%) belonged medium category of extension participation.

Anupama (2014) in a study on 'content development for agricultural expert system on organic vegetable cultivation' reported that majority (67%) of vegetable farmer respondents had medium extension orientation, followed by low (19%) and high (11%) levels of extension orientation.

2.2.10. Knowledge on plant protection practices

Rogers (1962) revealed that the Transfer of Technology (TT) approach reflects the idea that researchers develop knowledge and technologies, which are then transferred 'topdown' by extension services to farmers or other end-users.

Singh and Singh(1970) in a study on 'multi-variate analysis of adoption behaviour of farmers'found that the knowledge of package of practices was significantly contributing in explaining the adoption behaviour of the farmer.

Choukidar and George (1972) in a study on 'adoption behaviour and characteristics of farmers' found that the farmers lack of knowledge regarding the recommendation was one of the major factors responsible for the non adoption of the package of practice.

Naidu (1978) reported that greater knowledge of improved practices would lead to higher adoption. Once knowledge is acquired and retained in the mind, it undergoes and produces changes in the thinking process and a sort of mental alchemy will take place among tobacco farmers.

Rogers (1982) reported that knowledge accurse when an individual or other decision making units is exposed to an innovations existence and gain some understanding of how it function.

Meera (1995)in a study on 'differential adoption of plant protection technology by farmers of Kerala- a critical analysis' reported 35% of farmers of Thiruvanthapuram district and 27% of farmers of Alappuzha district were having high knowledge level in chemical method of plant protection. With regard to cultural method of plant protection 28% and 32% of farmers possessed high knowledge level in Thrivanthapuram and Alappuzha districts respectively.

Bernice (2000) reported that injudicious use of many persistent insecticides lead to various well documented side effects and hence it is desirable to evaluate alternate methods for the pest management practices.

Gupta *et al.*(2010) in a study conducted among vegetable growers reported that a complete working knowledge is very essential for a proper adoption of new agricultural technology by the vegetable farmers.

2.2.11. Evaluative perception on sustainability of plant protection practices

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.

Bagson and Beyuo (2012) in a study on 'homegardening: the surviving food security strategy in the Nandom traditional area- upper west region Ghana' reported that socio economic sustainability in a homegarden refers to the effective use of the indigenous knowledge system to continuously enhance output per unit area.

2.2.12. Economic motivation

Sriram (1996) in a study on 'ecofriendly agricultural practices in cotton cultivation, farmer's awareness attributes and adoption' observed that majority of cotton farmers (58.34%) had medium level of economic motivation.

Sivaprasad (1997) in a study on 'problems and prospects of self employment of trained rural youth in agriculture' found that economic motivation was important character that persuades people to adopt improved practices that are proven worthy.

Thomas (1998) in a study on 'fishermen development through thrift and credit' reported that the more one is motivated by economic ends, the more he will try to adopt to practices which are aimed at increasing sustainable returns among fishermen.

Ananthamanikandan (2003) in a study on 'content analysis and audience research on farm and home programmes'reported that majority of the respondents had medium level of economic motivation among audience of Doordharshan.

Fayas (2003) in a study on 'viability of Self Help Groups in Vegetable and Fruit Promotion Council Keralam' stated that majority of the respondents (86%) had medium level of economic motivation among vegetable farmers of Self Help Groups.

Priya (2003) in her study on vegetable growers indicated that majority of the vegetable growers (92%) had medium level of economic motivation.

Suthan (2003) reported that more than half of the vegetable growers (57.33%) high level of economic motivation.

Bhavya (2008) reported in a study on 'cause consequence analysis of indebtedness among farmers in Pulpallypanchayath of Wayanad district' that 60% of respondents had medium level of economic motivation followed by high (21.67%) among indebted farmers.

Hanjabam (2013) in a study on 'analysis of constraints and strategies for scaling up precision farming in Kerala' reported that 90% of the conventional farmers had medium level of economic motivation.

Anupama (2014) in a study on 'content development for agricultural expert system on organic vegetable cultivation'found that 78% of the organic farmers were highly economically motivated.

2.3. Adoption

Sivaramakrishnan (1981) in a study on 'differential adoption of selected recommended agricultural practices of selected crops' reported that the adoption of plant protection measures had comparatively less influence in increasing production and hence adoption might have been low in tapioca.

Rogers (1982) defined adoption as an individual process detailing the series of stages one undergoes from first hearing about a product to finally adopting it.

Harper *etal.* (1990) in a study on 'factors influencing the adoption of insect management technology' found that education had a significant effect on adoption.

Burton *et al.* (1999) in their study on 'analysis of the determinants of adoption of organic horticultural techniques' stated that an individual's characteristics, mainly age and gender and access to information are of paramount importance in adoption of organic horticultural techniques.

Fernandez *et al*. (1998) surveyed vegetable producers in US in a study on environmental and economic consequences of technology adoption: IPM in viticulture' and found that labour availability, credit or debit ratio, farm size and farmer's age are significant drivers in adoption.

Kumar (2000) in a study on 'knowledge adoption and economic performance of coffee growers in Virajpet taluk of Coorg district' expressed that the coffee growing farmers had less knowledge and adoption level with respect to plant protection, there by farmers need strong motivational forces for adoption of improved practices. They also required more mass media exposure and extension contact for adoption of improved practices.

Mauceri*et al.* (2007) reported in a study on 'adoption of integrated pest management technologies: a case study of potato farmers in Carchi, Ecuador' reported that access to information and household size are the main drivers of IPM adoption by potato growers in Ecuador.

Wason*et al.* (2009) in a study on 'farmer's perception and propensity for adoption of integrated pest management practices in vegetable cultivation' reported that extension contact was statistically significant in explaining adoption propensity of farmers towards integrated pest management in vegetable cultivation

2.4. Constraints in adoption

Sivaramakrishnan (1981) in a study on 'differential adoption of selected recommended agricultural practices of selected crops' reported that in case of coconut, though there is problem of pest and diseases, considering the high cost of chemicals and operational difficulties as perceived by the cultivators, they would have developed only less favorable attitude towards plant protection.

Prasananan(1987) in a study on 'extent of adoption of messages by contact farmers in T&V system' reported that non availability of inputs in time,

non availability of labour, high labour cost involved and high cost of materials were the constraints experienced by the contact farmers for adoption of messages in coconut cultivation

Gangadharan (1993) in a study on 'adoption of improved agricultural practices by pepper growers of Idukki district' concluded that high cost of inputs was found to be an important constraint by pepper growers in adoption of improved practices.

Meera (1995) in a study on 'differential adoption of plant protection technology by farmers of Kerala- a critical analysis' reported that high cost of plant protection inputs and lack of availability in time as the most serious constraints among the farmers of Thiruvanathapuram district.

Balachandran (2004) in a study on 'the status of organic farming in Kerala' reported that lack of awareness and knowledge about organic farming as important constrain in adoption of organic practices.

Kumari (2012) in a study on 'constraints in adoption of Integerated Pest Management (IPM) practices by rice growing farmers of Jammu division' defined constraints as certain forces or factors that prevent and restrict the action of others.

METHODOLOGY

3. METHODOLOGY

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

3.1 Research design

3.2 Locale of study

3.3 Selection of respondents

3.4 Operationalisation and measurement of the variables

3.5 Data collection procedure

3.6 Statistical tools used

3.1. Research design

The research design used for the study was 'Ex-post-facto' research design because most of the variables selected for the study were ex-post facto in nature as researcher had little chance to control these. '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 changeable. Kerlinger (1983)

3.2. Locale of study

Thiruvananthapuram district of Kerala state was purposively selected for the study owing to the wide variability in the structure and cropping pattern of homegarden systems in the southern zone. Kerala is delineated into 23 Agro-ecological units (AEUs), and it is only appropriate that the differences between these AEUs be taken into account while attempting to develop homegardens. The study area was stratified based on the five different agro ecological units that wereidentified by Kerala Agricultural University and Kerala State Land Use Board (KSLUB). The agro ecological units (AEU) were AEU- 1 Southern coastal plain, AEU-8 Southern laterites, AEU- 9 Southern central laterites, AEU- 12 Southern and central foot hills and AEU- 14 Southern high hills.

3.3 Selection of the respondents

The respondent group of the study comprised homegarden farmers of the selected panchayats. The Agroecological units that were identified by the KSLUB and KAU were regions considered for stratification procedure. Out of this 5 agro-ecological units of Thiruvanathapuram district of Kerala state were selected.A list of panchayats from each stratum were prepared and panchayats with maximum active and operational homegarden units was identified after consultation with thePrincipal Agriculture Officer. One panchayat from each Agroecological units which had maximum number of active operational homegarden were selected in consultation with officials of State Department of Agriculture. From each panchayat, 20 homegardens with holding size not less than 0.1 ha using Simple Random Sampling procedure were selected with the help of the Agricultural Officers of the respective panchayats. Thus a total of 100 homegarden farmer respondents were selected for the study.

3.4. Operationalisation and measurement of the variables

3.4.1. *Measurement of independent variables*

A list of 25 independent variables related to the personal characteristics of respondents and important for meeting the objectives of the study were collected after detailed review of literature and discussion with subject matter specialists. A list of variables was then sent to 20 judges for rating. They were asked to examine the variables and to rate each of the variable on 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 according to its relevance. Out of the 20 judges only 15 responded.

The final variables were selected based on the criterion of mean relevancy score, which was obtained by summing up the weightages obtained by each variable and dividing it by the total number of judgesthat responded. Those variables which had scores more than the mean score were selected for the study.

The independent variables thus selected for the study were age, education, occupation, family size, effective homegarden area, farming experience, rational orientation, information source utilization, extension

participation, knowledge on plant protection practices, evaluative perception on sustainability on plant protection practices and economic motivation.

The selected 12 independent variables and their measurement of study are presented in Table 1.

Table1. Independent variables and measurement scales/score used

Sl no	**Independent variables**	**Measure/ scoring procedures**
1	Age	Actual chronological age, Census report, 2011
2	Education	Thomas (2004)
3	Occupation	Scoring procedure developed for the study
4	Family size	No. of family members dependent on the head of family at the time of interview
5	Effective homegarden area	Functional area for farming
6	Farming experience	Experience of respondent in farming measured as number of years
7	Rational orientation	Jetley (1977) and adopted by Thomas (2004)
8	Information source utilization	Scoring procedure developed for the study
9	Extension participation	Krishnan, 2013
10	Knowledge on plant protection practices	Teacher made test developed for the study
11	Evaluative perception on sustainability of plant protection practices	Arbitrary scale developed for the study
12	Economic motivation	Supe (1969) and adopted by Jose (1998)

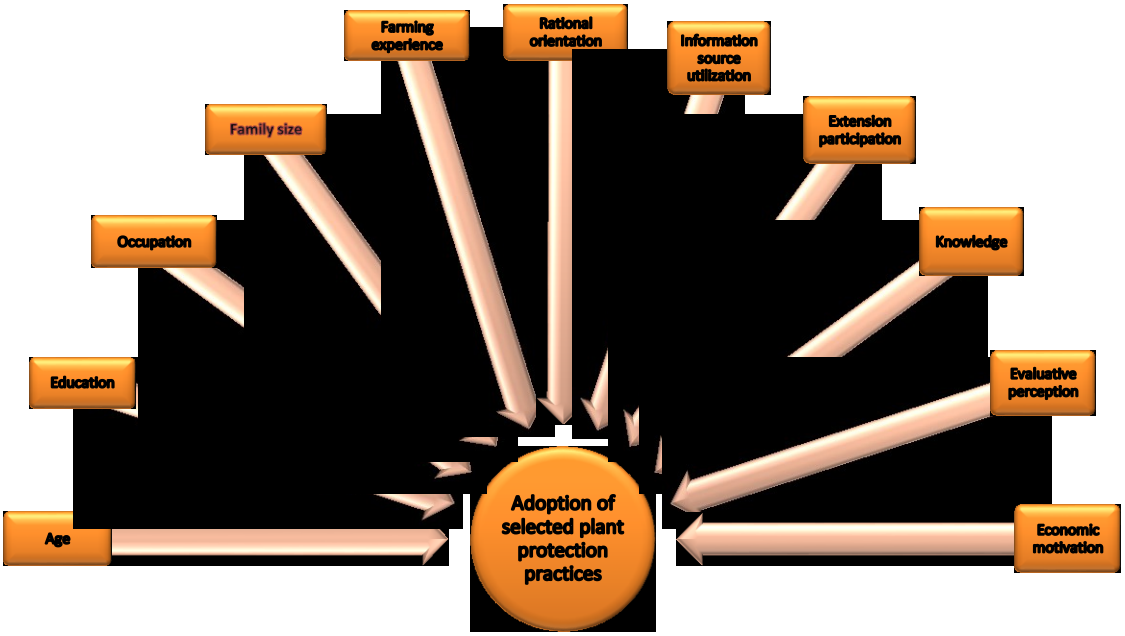

FIG. 2. CONCEPTUAL MODEL OF THE STUDY

3.4.1.1 Age

Age is operationalised as the number of calendar years completed by the respondent at the time of interview.This variable was measured directly by asking the respondent the number of years he/she has completed at the time of investigation. The responses were classified on the basis of Censes report 2011.

Category	Years
Young	<35
Middle	35-55
Old	>55

3.4.1.2.Education

Education is operationalised as the level of formal education achieved by an individual respondent. The scoring procedure used by Thomas (2004) was adopted to measure education. A score value of 0 was assumed for illiterates followed by an additional score of 1 to each level of formal education. Later the respondents were categorized as given below:

Category	Code
Illiterate	0
Primary	1
Secondary	2
High school	3
Collegiate	4

3.4.1.3.Occupation

Occupation can be operationalised as professional status of the respondent. It is measured using standard scoring procedure as shown below.

Category	Code
Farming as primary occupation	1

Farming as secondary occupation	2

First category includes farmer respondents who hadagriculture as their main occupation and secondary category includes respondents who have someother primary profession with agriculture as secondary occupation. The maximum score in accordance with the code assignedwas 'two' and minimum was 'one'by each respondent.

3.4.1.4.Family size

It is the number of individuals residing in a household/family who are dependent on the head of the family at the time of interview. The respondents were categorisied based on the number of members in each family as given below:

Category	Code
3-4	1
5-6	2

3.4.1.5.Effective home garden area

It refers to the total area around the home wherein farming takes place. The actual homegarden area worked out and was later categerised as given below:

Category	Code
<1 acre	1
1-2 acres	2
>2 acres	3

3.4.1.6.Farming experience

Refers to the total number of years the respondent has been engaged in farming at the time of interview. The categorization was made as given below:

Score	Category
>10	High
10-20	Medium
<10	Low

3.4.1.7.Rational orientation

It can be operationalised as extent of rationality and scientific belief of homegarden respondent with regard to the scientific recommendations proposed by an authorized organization. The procedure developed by Jetley (1977) and adopted by Thomas (2004) was used in this study.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 obtained by the respondent was 'three' and 'one' respectively.

3.4.1.8.Information source utilization

Refers to the frequency and usefulness of the information sources by the homegarden respondents. The variable was measured using the scoring procedure developed for the study as mentioned below. Information sources like newspaper, television, radio, magazines, mobile advisory service, kiosk and friends were classified and scored as not often ,often and regularly with scores 0,1 and 2 respectively. The maximum score that could be attainted was 14 and minimum 0.

Category	Score
Not often	0
Often	1
Regularly	2

3.4.1.9.Extension participation

It is operationalized as the number of extension agencies with which the farmer has contact and the frequency with which the farmer has contact with these agencies. A list of agencies *viz.* KAU, Krishi Bhavan, Commodity Board, friends andneighbours were given and the respondents were asked to mark these agencies based on the frequency of contact. The scoring procedure is given below:

Category	Score
Regularly	2
occasionally	1
Never	0

3.4.7.10. ***Knowledge on plant protection practices***

It refers to the measure of knowledge on selected plant protection practices by the farmer. A teacher made test developed for the

study was used to measure the knowledge on plant protection. Based on the review of literature and discussion with experts the test was operationalised and it consisted of ten questions related to plant protection (Appendix-1). Scores of 'one' and 'zero' were given for the correct and incorrect answers respectively. The maximum score a respondent could get was ten and a minimum of zero.

Category	Score
Yes	1
No	0

3.4.7.11. ***Evaluative perception on sustainability of crop protection practices***

Evaluative perception refers to the respondent's meaningful understanding and feeling about the worth and efficiency ofhomegarden plant protection practices which will ensure sustainability, proper utilization of resources, quality and safety of food as well as theenvironment.The perception of the respondents was measured on a four point continuum varying from most important to least with scores four to one as given in the interview schedule. The mean values of 100 respondents were computed and categorized as high and low based on their mean score.

3.4.7.12.Economic motivation

It was operationalisedas the extent to which a homegarden farmer

respondent is oriented towards profit with the available resources. The scale developed by Supe (1969) and adopted by Jose (1998) was used. The scale consists of four statements of which three are positive and one is negative. The statements were suggested to respondents in a three point continuum. The scoring procedure was reversed for negative statements. The maximum score that could be attained by a respondent was 12 and minimum 4. Based on the mean score obtained they were classified into high and low categories.

Category	Score
Strongly agree	3
Agree	2
Disagree	1

3.4.2. Economically dominant crops in homegarden

Economic dominance was used to measure the dominance of the crops in homegardens. In this study the economical dominance of a crop was operationalised as the remunerative value of individual plants belonging to the crop species as perceived by the respondent. A seven point scale with one assigned for the crop with maximum dominance and seven for the one with least dominance was used to measure the economical dominance. The farmers were asked to score the economically dominant crops in their respective homegardens.

3.4.3. Adoption

The dependent variable selected for the study was adoption of selected KAU plant protection practices of economically dominant crops in homegardens.

Chattopadhyay (1963) used adoption quotient for measuring adoption behaviour. This is a ratio scale that measures behaviour on dimensions of applicability, potentiality, time, consistency and differential nature of innovation.The method developed by Chattopadhyay (1963) which was also used by Thomas (2004) to study the Adoption Quotient of homegarden practices.

In the present study Adoption Quotient was worked out using the formulae:

$$AQ = \frac{\sum_{i=1}^{n} \frac{e_i}{p_i} \times 100}{N}$$

Where,

AQ = Adoption quotient

ei = Extent of adoption of each practice

pi = Potentiality of adoption of each practice

N = Total number of practices selected

3.4.4. Perceived usefulness and effectiveness of selected KAU protection technologies for the homegarden systems

A set of five plant protection practices given in Appendix-I as recommended by the Kerala Agricultural University were given to the homegarden farmers after focus group discussion with the subject experts and were asked to score these practices according to its usefulness and effectiveness. The scores given were 0, 1 and 2 for not useful, useful and very useful

respectively in the case of usefulness while for effectiveness the scores for not effective, effective and very effective were 0, 1 and 2 respectively. Thus one could get a maximum score of 10 and a minimum of 0.

3.4.5. Plant protection preferences of homegarden farmers

In order to study the perceived preference criteria of homegarden farmers on plant protection measures ten criteria were identified based on review of literature, discussion with experts and farmers. The ten criteria identified were cost effectiveness, sustainability, family safe food concept, ease in operation,compatibility with the management practices, eco-friendliness, local resource utilization, safety in handling, availability of inputs and immediacy of the effect. The farmers were asked to rank the criteria for each crop on a ten point continuum. Mean scores were worked out for each crop and based on this interpretations were made.

3.4.6. Technology needs assessment in homegarden

A pilot study was conducted among non sampled farmers to generate information on technology need. Discussions were also conducted withexperts to finalise the areas of technology need. Based on these the plant protection practices identified were botanicals, soil solarisation, seed treatment, equipments, plant protection chemicals, biocontrol agents, resistant variety, trap crop and non insect pest management. According to the crops in homegardenthe plant protection technology needs vary.The farmer was asked to score the various plant protection practices based on the criteria mentioned below as developed by Thomas (2004) and used by Krishnan (2013).

Score	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

3.4.7. ITK practices on plant protection aspects

Through many years of farming experience in the field of agriculture the homegarden farmers have developed a good number of indigenous

plant protection practices which are carried as a legacy. The indigenous practices followed bythe respondents were collected and they were grouped into crop specific plant protection ITKs and general plant protection ITKs.

3.4.8. Constraints experienced by homegarden farmers

Based on the pilot study conducted a list of 12 constraints were identified and included in the interview schedule. The farmers were also given an opportunity to include other constraints perceived as important by them. The farmers were asked to score the constraints in a four point continuum as most important, important, less important and least important with scores 'four', 'three', 'two' and 'one' respectively. Constraints were ranked according to the mean scored obtained.

3.5. Data collection procedure

For the purpose of collecting data a well-structured interview schedule (Appendix I) was prepared. A pilot study in non-sample area was done with a draft of interview schedule prepared 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. The data collection was done during 2014-2015 by directly interviewing the homegarden farmers.

3.6. Statistical tools used in the study

Following are the statistical methods that were employed for analysis after the scoring and tabulation of the collected data.

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***

The farmers were grouped 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 which was used as descriptive analysis. Percentage was corrected to two decimal

places. It was also used to interpret the results of independents variables selected for the study.

3.6.3. *Correlation analysis*

In order to measure the degree of relationship between the independent variables and the dependent variable, extent of adoption of KAU plant protection practices the correlation coefficient was worked out.

RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

The chapter presents resultsand discussion based on the data that was obtained from the study based on the objectives.The findings of the present study are presented under the following headings.

4.1 Distribution of the homegarden respondents based on their personal, social and economicalcharacteristics.

4.2 Delineation of economically important crops.

4.3 Level of adoption of selected KAU plant protection technologies by farmers.

4.4 Plant protection preferences of KAU plant protection technologies as perceived by the farmers.

4.5 Perceived usefulness and effectiveness of selected KAU plant protection technologies for the homegarden systems.

4.6 Technology needs/gaps in protection practices for the economically dominant homegarden crops as perceived by the homegarden farmers.

4.7 ITK practices on plant protection aspects.

4.8 Constraints experienced by farmers in adopting plant protection technologies in the homegardens.

4.9 Suggested refinement of the plant protection technologies as perceived by the farmers.

4.1Distribution of the homegarden respondents based on their personal and social characteristics

Distribution of respondents based on their age are presented in table 2.

4.1.1. Age

Table 2. Distribution of the respondents based on their age

N=100

Category (Years)	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Young	2	10	4	20	0	0	2	10	1	5	9	9
Middle	5	25	4	20	10	50	5	25	11	55	35	35
Old	13	65	12	60	10	50	13	65	8	40	56	56

It was clearly evident from the Table 2 that more than half of the sampled homegarden farmers belonged to the old aged category and about 35percent belonged to the middle aged category while a small percentage (9per cent) were found to be under the young category.

It was noted that AEU-9hadno respondents belonging to the young age category while the respondents were equally distributed in the middle and old aged category.

Hence it was inferred that majority of the homegarden respondent farmers were of the old aged category and least were found to be in the young group. This finding is in line with recent trend that the younger generations are not coming to the field of agriculture. One of the probable reasons could be that the low status attached to farming by the society.The results are in line with the findings of Jayawardana (2007) and Esakkimuthu (2012) that majority of the farmer respondents belonged to old age category.

4.1. 2. Education

Distribution of respondents based on their education are presented in table 3.

Table 3.Distribution of the respondents based on their education

N=100

Category	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Illiterate	0	0	0	0	2	10	0	0	0	0	2	2
Primary	0	0	1	5	0	0	0	0	0	0	1	1
Middle	0	0	0	0	0	0	1	5	1	5	2	2
High school	7	35	9	45	8	40	14	70	16	80	54	54
Collegiate	13	65	10	50	10	50	5	25	3	15	41	41

A bird's eye view of the data presented in the Table 3, showed that 54per cent of the homegarden farmer respondents had high school level of education, also there was quite a high percentage of collegiate farmers (41%). It is also clear that there are only a few illiterate and primary level educated farmers with a percentage of 2 and 1 respectively.

It is worth mentioning that there were a high rate of collegiate farmer respondents,(65per cent) in AEU-1 and 50per cent in AEU- 8 andAEU-9 had no illiterates.

The results were a clear reflection of the higher literacy rate of Kerala state. There were only few illiterates among the homegarden respondent farmers, thus showed that today's farmers are educationally forward. These results were in conformity with the conclusions of Jaganathan (2004) that majority of the respondents had high level of education.

4.1.3.Family size

Distribution of respondents based on their family size are presented in table 4.

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

N=100

Category	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%

3-4	17	85	19	95	17	85	18	90	15	75	86	86
5-6	3	15	1	5	3	15	2	10	5	25	14	14

A perusal of Table 4 revealed that about 86 per cent of the homegarden respondents belonged to family size of3-4 while the rest (14per cent) belonged to the family size of 5-6.

In AEU-8 about 95per cent of the respondents were having small family size while that of AEU-12, while 90per cent belonged to small family size. This clearly shows the typical case of Kerala state, where nuclear family system is predominantly present. The reason for more number of nuclear family may be because the family gets separated from their parents after marriage. Similar results were reported by Hussain (1992) and Chinchu (2011).

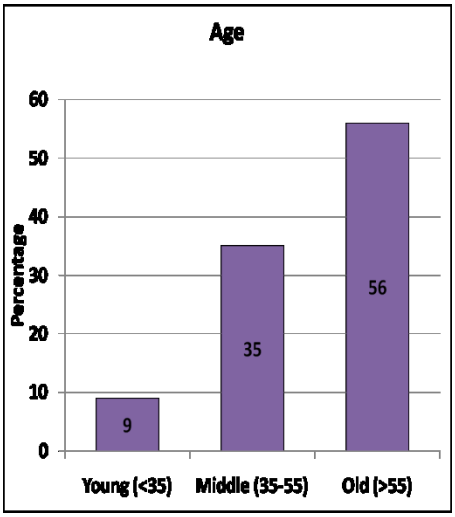

Fig.a. Age

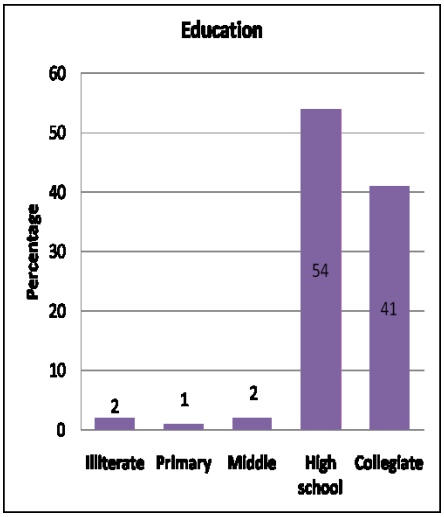

Fig.b. Education

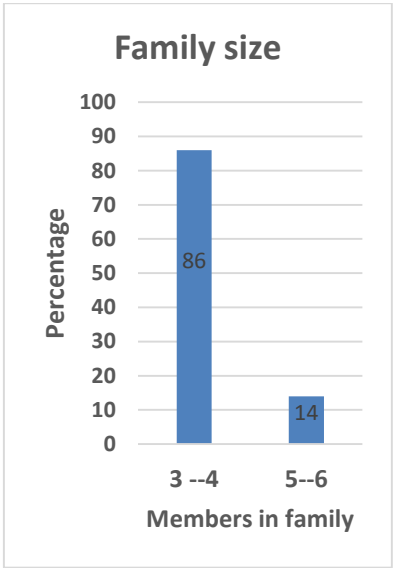

Fig.c. Family size

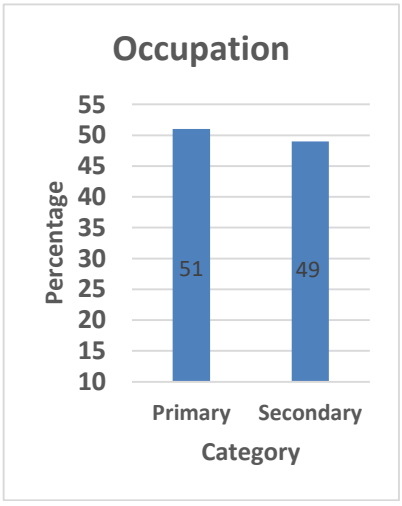

Fig.d. Occupation

Fig. 3. Profile characteristics of homegarden respondents

4.1. 4. Occupation

Distribution of respondents based on their occupation are presented in table 5.

Category	AEU-1 (n=20)	AEU-8 (n=20)	AEU-9 (n=20)	AEU-12 (n=20)	AEU-14 (n=20)	Total

	No	%	No	%	No	%	No	%	No	%	No	N=100
Primary	6	30	13	65	13	65	10	50	9	45	51	51
Secondary	14	70	7	45	7	45	10	50	11	55	49	49

Table 5. Distribution of the respondents based on their occupation

Table 5of homegarden respondents based on their occupation gives an idea that 51per cent of the farmer respondents were having agriculture as their primary occupation while 49per cent were having farming as secondary occupation.

AEU-12 stood aside, having equal distribution in both primary and secondary categories of occupation.AEU-8and AEU- 9 had majority of the respondents (65%) with agriculture as their primary occupation. This result is in conformity with the findings of Lad and Wattamwar (2009), Kamalakkannan (2001) and Krishnan (2013).

4. 1 .5. Effective homegarden area

Distribution of respondents based on their effective homegarden area are presented in table 6

Table 6. Distribution of the respondents based on effective homegarden

N=100

Category (acres)	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
<1	9	45	6	30	12	60	15	75	7	35	49	49
1-2	5	25	6	30	6	30	2	10	9	45	28	28
>2	6	30	8	40	2	10	3	15	4	20	23	23

T

able 6 clearly shows that 49 per cent of homegarden farmer respondents were having an effective homegarden area of less than 1 acre. Only 28 per cent of homegardens were having an area of 1-2 acres, while homegarden with an area of

>2 acres contributed 23 per cent towards the distribution of effective homegarden area.

A detailed analysis of the Table 6 showed that the respondents of AEU-12 had 75 per cent of the effective homegarden area of <1 acre followed by AEU-9 with a percentage share of 60 per cent.

The distribution shows the peculiar nature of homegardens where majority of the homegarden farmers holds remunerative lesser effective homegarden area. It also clearly showed the current trend in land fragmentation and modern settlements. Area for farming is reduced as they are shared among the siblings and are thus less managed. The results are in line with Madhu (2010) that majority of the farmers were having small holdings.

4.1.6. Farming experience

Distribution of respondents based on their farming experience are presented in table 7.

Table 7. Distribution of the respondents based on their farming experience

N=100

Category (years)	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
<10	5	25	4	20	1	5	3	15	0	0	13	13
10 - 20	3	15	4	20	7	35	8	40	7	35	29	29
> 20	12	60	12	60	12	60	9	45	13	65	58	58

Table 7 revealed that more than 50 per cent of the homegarden respondents were having a farming experience of above 20 years, while 29 per cent of the respondents belonged to the category of 10-20 years of experience while a low percentage (13%) were having less than 10 years of experience.

AEU-14 stood alone showing not even a single person having a farming experience of <10 years and followed by AEU-9 with least number in the same category. In the case of AEU-12 though three farmers belonged to young

age group since they might have started farming at very young age which justifies the result.

The farming experience distribution obtained was in line with the age distribution of the respondents. A rich experience in farming will lead to high level of knowledge with regard to farming in their homegardens and such active and operational homegardens were purposely selected to justify the plentiful farming experience by the respondents. A similar trend was reported by Kamalakannan (2001), Ananthamanikandan (2003) and Fayas (2003).

4.1.7. Rational orientation

Distribution of respondents based on their rational orientation are presented in table 8.

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

N=100

Category	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Religion	0	0	3	15	2	10	3	15	0	0	8	8
Religion + Science	14	70	13	65	6	30	10	50	2	10	45	45
Science	6	30	4	20	12	60	7	35	18	90	47	47

It was evident from Table 8 that 47 per cent of the respondent farmers believed in science alone at the same time respondents belonging to the category of religion and science together made up 45 per cent. Only 8 per cent of respondents tended to rely on religion alone.

A critical appraisal of the Table 8 revealed that in AEU-1, 70 per cent of farmer's activities were based on both religion and scientific practices. While a reverse trend could be seen in AEU-9 where in 60 per cent farmer respondents depended only on science for their farming activities. This was justifiable because the farmer respondents with collegiate level of education is more in AEU-9 which might have made them more scientifically oriented.

Overall it can be concluded that majority of the homegarden farmers had greater faith in science than their religious beliefs. The main reason for this may be due to high level of education and exposure to scientific knowledge. The results obtained were in line with the findings of Krishnan (2013).

4.1.8. Information source utilization

Distribution of respondents based on their information source utilization are presented in table 9.

Table 9. Distribution of respondents based on the information source utilization

N=100

Category	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
High	18	90	17	85	14	70	17	85	18	90	84	84
Low	2	10	3	15	6	30	3	15	2	10	16	16

Table 9 showed the distribution of respondents based on the information source utilization by the homegarden respondents. It was observed that 84 per cent of the respondents had a high level of information source utilization while a minority (16%) belonged to low level category.

The reason for high level of information source utilization might be due to greater accessibility to the information sources and also due to the high literacy rate of respondents. This might have resulted in increased level of knowledge in agricultural practices. Similar result had been obtained by Sobha (2013) that majority of farmer respondents had high level of media exposure.

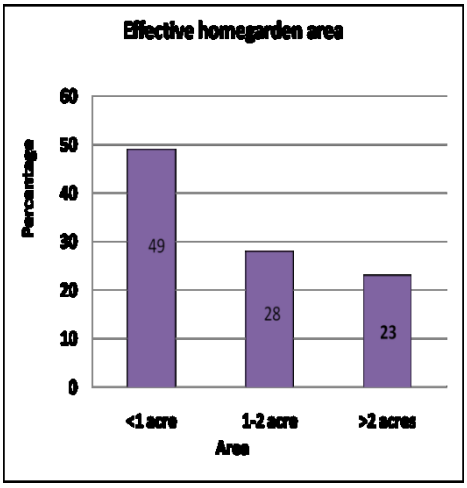

Fig.e. Effective homegarden area

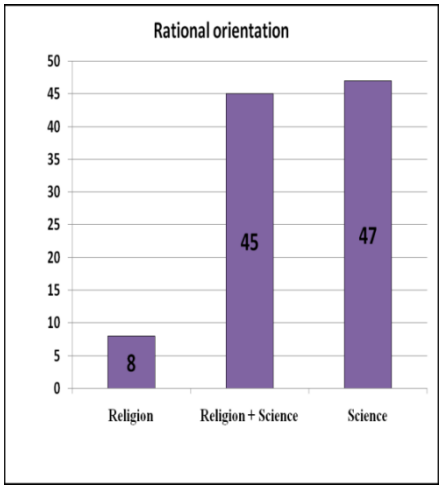

Fig.f. Rational orientation

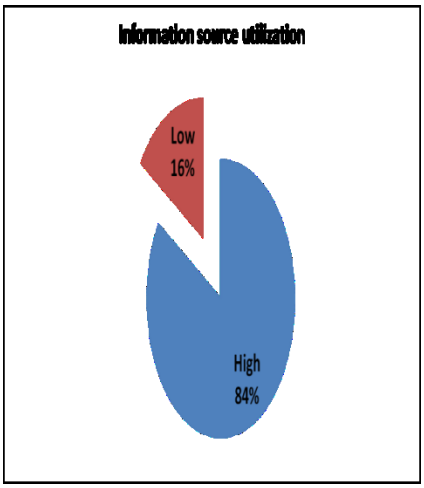

Fig.g. Information source utilization

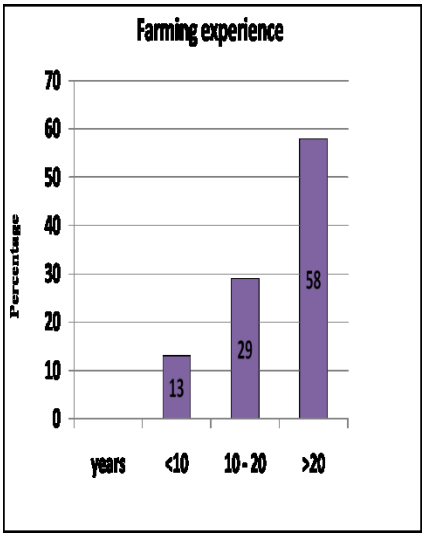

Fig.h. Farming experience

Fig. 3. Profile characteristics of homegarden respondents

.1.9. Extension participation

Distribution of respondents based on their extension participation are presented in table 10.

Table 10. Distribution of respondents based on their extension participation

N=100

Category	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
Regularly	10	50	8	40	7	35	4	20	2	10	31	31
Occasionally	10	50	10	50	12	60	9	45	11	55	52	52
Never	0	0	2	10	1	5	7	35	7	35	17	17

It was evident from the Table 10 that majority of the respondents (52%) had been occasionally involved in extension activities while 31 per cent were regular.

AEU-1 had 50 per cent of the homegarden farmers who had regular nature of extension participation while AEU-12 had 35 per cent of respondents who never visited or got in contact with the extension agency. Interestingly in AEU-1 all the respondents were having regular or occasional extension participation. The occasional participation in extension might have resulted in more knowledge and proper use of the information sources. The findings were in accordance with the result of Majjusha (2000).

4.1.10. Knowledge on plant protection practices

Distribution of respondents based on their knowledge on plant protection practices are presented in table 11.

Table 11. Distribution of respondents based on knowledge on plant protection practices

N=100

Category	AEU-1 (n=20)	AEU-8 (n=20)	AEU-9 (n=20)	AEU-12 (n=20)	AEU-14 (n=20)	Total

	No	%	No	%	No	%	No	%	No	%	No	%
High	10	50	9	45	12	60	10	50	11	55	52	52
Low	10	50	11	55	8	40	10	50	9	45	48	48

Results in Table11 depicted that 52 per cent of the homegarden farmers had a high level of knowledge on KAU plant protection practices while 48per cent had a low level of knowledge.

Though more than 50per cent were having high level of knowledge almost equal percentage (48%) belonged to low knowledge level category, which indicates the need for extension intervention. The findings showed that the knowledge level of respondents on plant protection practices were on par. This finding was found to be in accordance with the finding of Meera (1995) that farmers of Thiruvanathapuram district had high level of knowledge on plant protection practices.

.2.11. Evaluative perception on sustainability of plant protection practices

Distribution of respondents based on their evaluative perception on sustainability of plant protection practices are presented in table 12.

Table 12. Distribution of respondents based on the evaluative perception

N=100

Category	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
High	10	50	10	50	9	40	12	60	10	50	51	51
Low	10	50	10	50	11	45	8	40	10	50	49	49

Table12 showed that though more than 50per cent of the respondents had high level of evaluative perception on the sustainability of plant protection practices in their homegardens 49per cent had low level of evaluative perception. Thus it can be inferred that the distribution of respondents based on evaluative perception was on par for all AEU's except for AEU- 12 where in 60

per cent of the respondents had high level of evaluative perception which could have been attributed to their high literacy rate and better information source utilization.

4.1.12.Economic motivation

Distribution of respondents based on their economic motivation are presented in table 13.

Table 13. Distribution of respondents based on economic motivation

N=100

Category	AEU-1 (n=20)		AEU-8 (n=20)		AEU-9 (n=20)		AEU-12 (n=20)		AEU-14 (n=20)		Total	
	No	%	No	%	No	%	No	%	No	%	No	%
High	9	45	12	60	12	60	8	40	8	40	49	49
Low	11	55	8	40	8	40	12	60	12	60	51	51

Result obtained in the case of economic motivation was found to be in the reverse trend with majority (51%) of the respondents falling in the low level category. It could be inferred from the result that the homegarden farmers are not farming merely for economic benefit alone. They might be giving more importance to the nutritive aspects of the products and also the safe food concepts. The finding was contrary to the findings of Suthan (2003) and Manjusha (1999) reported that more than half of the vegetable growers were having high level of economic motivation.

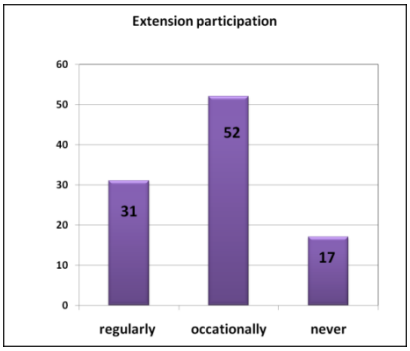

Fig.i. Extension participation

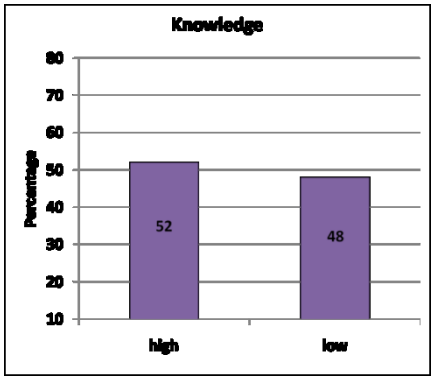

Fig.j. Knowledge

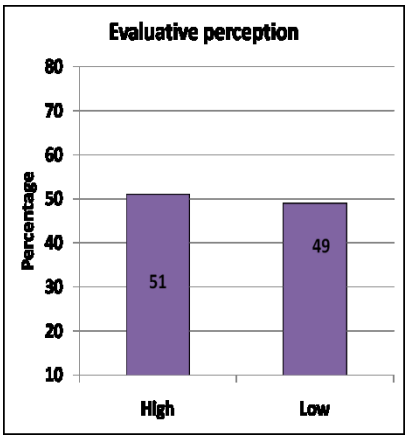

Fig.k. Evaluative perception

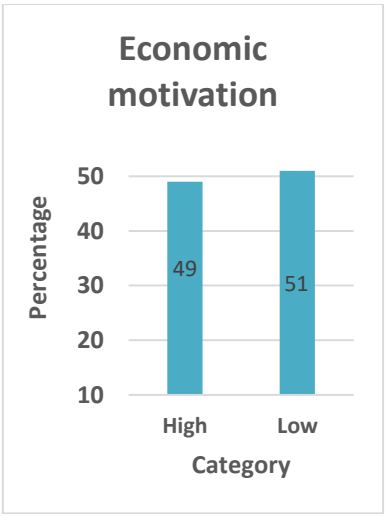

Fig.l. Economic motivation

Fig. 3. Profile characteristics of homegarden respondents

4.2.Delineation of economically important crops in homegardens

The economic dominances of crops were worked out in order to identify the economically dominant crops in homegardens.

Crops	Mean rank score
Coconut	1.59
Banana	1.68
Tapioca	2.94
Pepper	3.33
Vegetables	3.47
Yams and colacasia	4.22
Arecanut	4.56

Table14. Economic dominance of crops in homegardens

The economically dominant crops were identified based on mean score of each crop as ranked by the respondents.

The analyzed data on dominance of crops in homegardens were presented in Table 14. Economic dominance rating clearly depicted that coconut as the most dominant crop in homegarden which is in line with the finding by Jayawardana (2007) followed by banana with a mean score of 1.68, tapioca (2.94) and least dominant as arecanut with mean rank score of 4.56.

Hence it can be inferred from the results that homegarden farmers perceived coconut to be the most economically dominant crop followed by banana, tapioca, pepper, vegetables, yams and colacasia and arecanut.

4.3.Level of adoption of selected KAU plant protection technology by farmers

The level of adoption of KAU plant protection technology by homegarden respondents are presented and described which brought out the percentage of respondents who are high, medium or low level of adopters in these practices.

The adopter categories were worked out according to standard normal curve developed by Rogers (1982).

Table 15.Distribution of respondents based on their adoption of selected plant protection technologies of KAU

N=100

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<14.46	14	14
2	Medium (between mean and standard deviation)	14.46 – 40.75	70	70
3	High (mean + standard deviation)	>40.75	16	16

Mean =27.61 SD = 13.14

The data in Table 15illustrated distribution of homegarden respondents based on the level of adoption of KAU plant protection practices.

Table 15 depicted that majority of the homegarden farmers (70%) were having a medium level of adoption of KAU plant protection practices while 16per cent were having high level of adoption.

The overall adoption curve (Fig. 4) showed the absence of innovator while there were 14per cent early adopters and 45per cent early majority in case of adoption of plant protection practices. The probable reason for the absence of innovators may be due to the extreme values in the minimum mean

and maximum mean values derived through adoption quotient for all the seven crops and the farmers together.

Hence it can be inferred that more than one third of the homegarden farmers were falling under medium level adoption of plant protection practice. This was a fairly good sign of adoption of KAU plant protection practices by homegarden farmers.

4.3.1. Extent of adoption of selected KAU plant protection technologies of economically dominant crop, coconut in homegarden

In Table 16 the level of adoption of KAU plant protection practices by homegarden farmers in coconut are presented and sorted as high, medium and low level of adoption. Adopter categories were also worked out using the adoption curve Fig. 17

Table 16. Distribution of respondents based on their adoption of selected plant protection technologies of KAU in coconut

N=

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<16.36	13	13.54
2	Medium (between mean and standard deviation)	16.36 – 46.30	72	75
3	High (mean + standard deviation)	>46.30	11	11.46

96

Mean = 31.33 SD = 14.97

Table 16 showed that majority of homegarden respondents (75%) had a medium level of adoption of selected plant protection technologies followed by low (13.54%) and high level of adoption (11.46%).

The potential adopter categories consisted of 1per cent innovators, 12 per cent of early adopters, 42 per cent of early majority, 30 per cent of late majority and 11 per cent of laggards. The single percentage in innovator may be due to recent agricultural mechanization in coconut. Hence it can be inferred that the level of adoption of coconut plant protection practices was found to be medium in the homegardens of coconut farmers. The findings are in agreement with the findings of Jayawardana (2007).

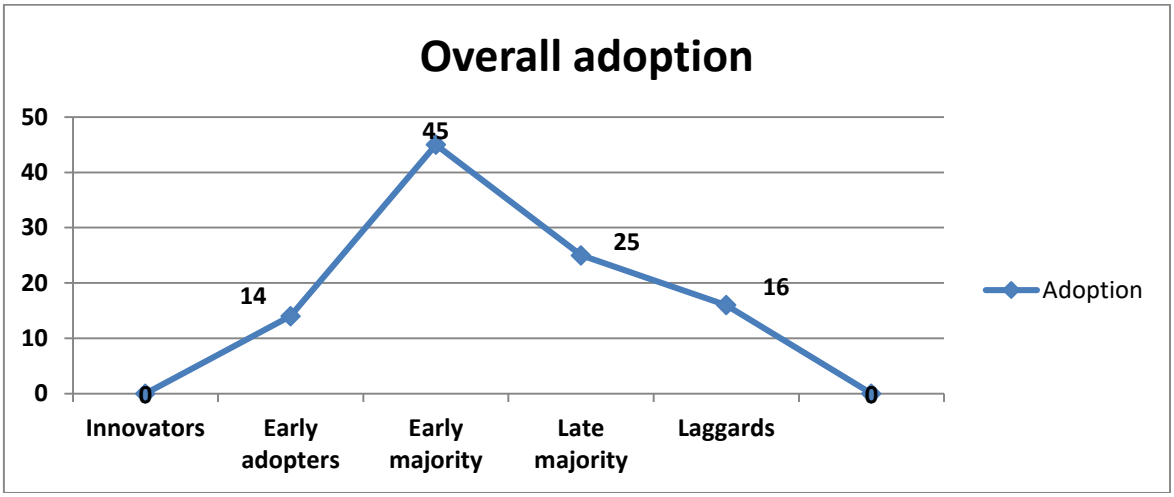

Fig. 4. Overall adoption adopter categorization of respondents

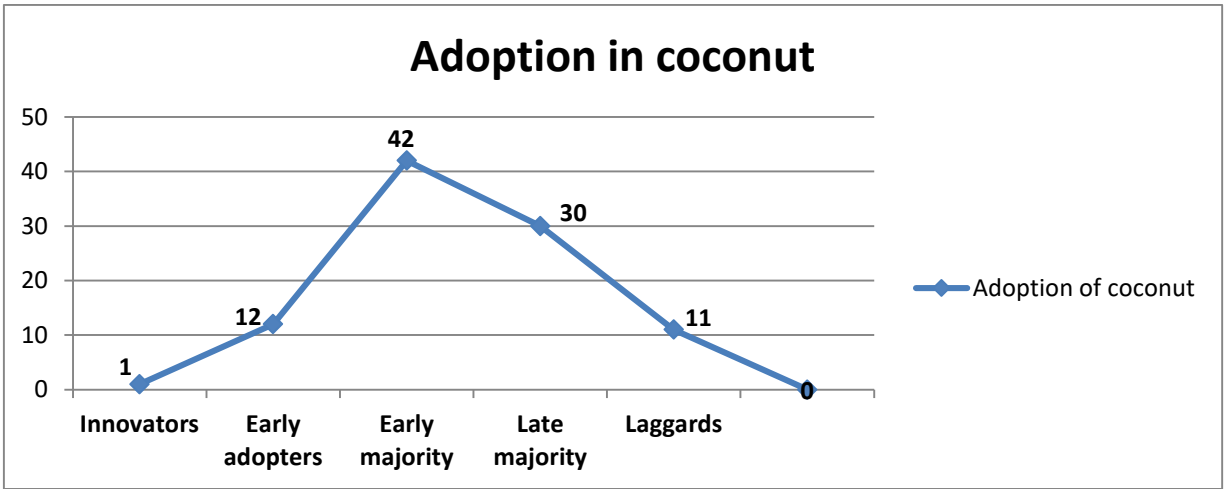

Fig. 5. Adopter categorization of respondents in coconut

4.3.2. Extent of adoption of selected KAU plant protection technologies of the economically dominant crop, banana in homegarden

Banana being the second economically dominant crop in homegarden, the adoption was worked out and classified as high, medium and low category.

Table 17. Distribution of respondents based on their adoption of selected plant protection technologies of KAU in banana

N= 100

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<16.43	25	26.04
2	Medium (between mean and standard deviation)	16.43 – 65.70	56	58.33
3	High (mean + standard deviation)	>65.70	19	19.79

Mean = 41.06 SD = 24.63

Adoption of selected KAU plant protection practices of banana in homegarden is depicted in Table 17.

The result thus obtained highlighted that majority (58.33%) of the homegarden respondents were having a medium level of adoption in banana plant protection technology followed by low level (26.04%).

A critical glance of the Fig.5 revealed that even though there were no respondents as innovators the remaining 21.88 per cent respondents belonged to early adopter category, followed by 32.29 per cent in early majority category, 26.04 per cent in late majority category. With respect to laggards 19.79 per cent of the respondents belonged to this category. This might be because homegarden farmers are reluctant to use chemicals as recommended due to the adverse effect rather they prefer more of organic plant protection practices.

Hence it was inferred that more than half of the homegarden farmers has adopted the KAU plant protection technologies and it is a fairly good sign of adoption. Waman and Wagh (2009) in their study on banana had come up with similar results.

4.3.3Extent of adoption of selected KAU plant protection technologies of economically dominant crop, tapioca in homegarden

Upon analysis of the data, the third economically dominant crop in homegarden was found to be tapioca. The KAU plant protection technology adoption level in tapioca by the homegarden farmers were worked out.

Table 18. Distribution of respondents based on their adoption of selected plant protection technologies of KAU in tapioca

N = 56

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<7.79	3	5.35
2	Medium (between mean and standard deviation)	07.79 – 52.91	44	78.57
3	High (mean + standard deviation)	>52.91	9	16.07

Mean = 30.35 SD = 22.56

A glance on Table 18 showed high, medium and low level category of homegarden respondents who adopt the selected KAU plant protection technology in their respective farming area.

It is evident from the Table 18 that majority (78.57%) of the homegarden respondents had a medium level of adoption of selected KAU plant protection technology while 16.07 per cent had high level of adoption.

The adoption category curve Fig.7 showed that05.35 per cent of respondents were early adopters which was low compared to standard Roger's curve. 51.78per cent were early majority which was fairly high than that of standard Roger's curve hence it could be inferred that KAU practices were adopted by majority of the respondents as there was 57.15 per cent of respondents belonging together in early adopter and early majority category. However there is a need to focus with more meaningful extension progarmmes to improve the level

of adoption so that the percentage of respondents in innovator and early adopter category would be in rise. Twenty six point seven eight per cent late majority and 16.07 per cent respondents were laggards in case of tapioca plant protection practices. Tapioca being less managed crop and less knowledge on the plant protection practices might have resulted in less number of early adopter category.

Hence it can be inferred that tapioca farmer tends to have a good adoption of selected KAU plant protection technologies.

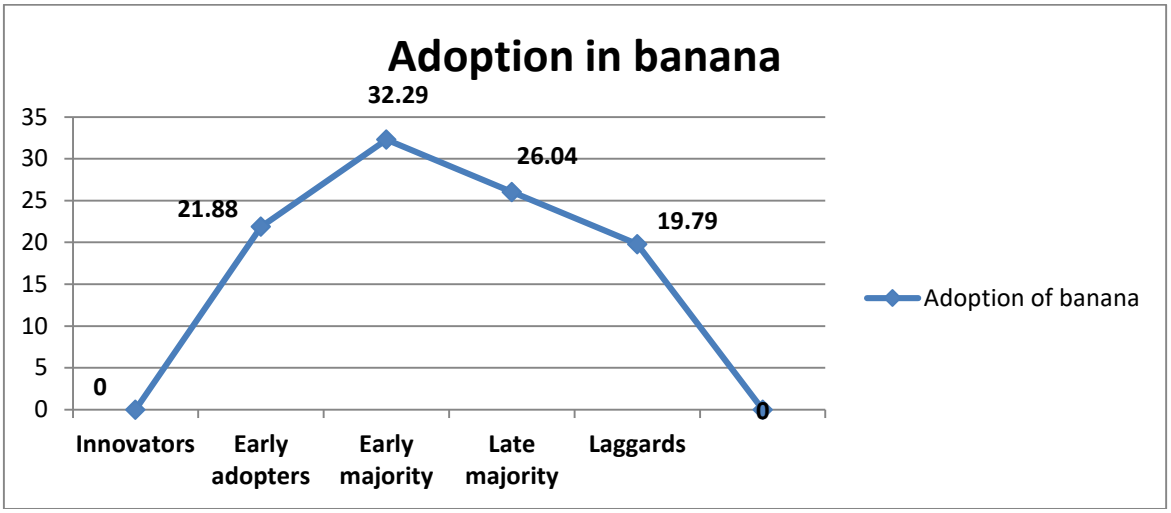

Fig. 6. Adopter categorization of respondents in banana

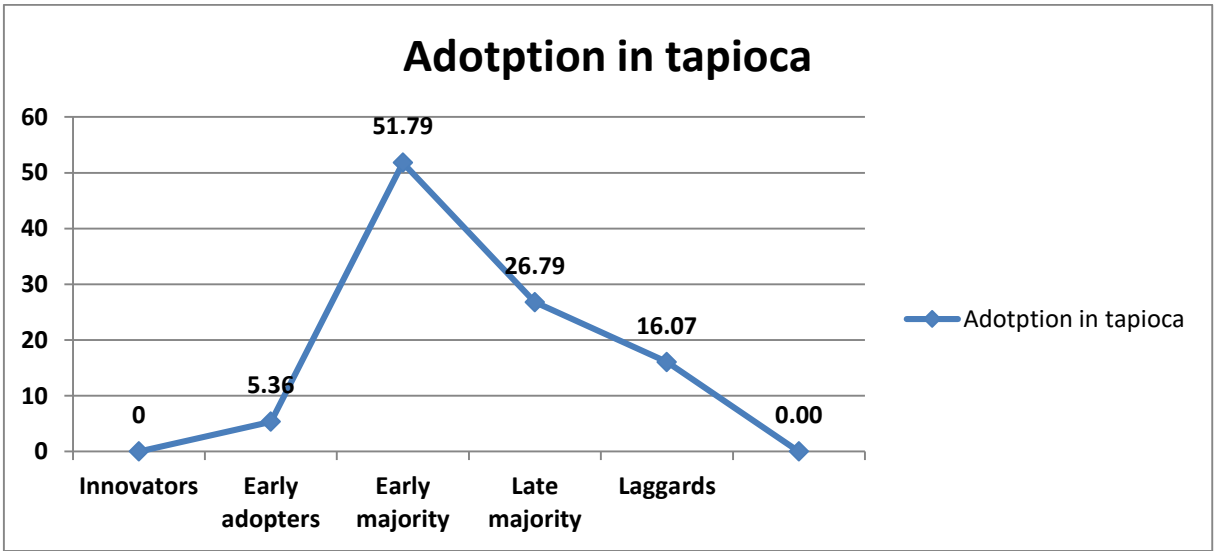

Fig. 7. Adopter categorization of respondents in tapioca

4.3.4. Extent of adoption of selected KAU plant protection technologies of economically dominant crop, pepper in homegardens

Selected KAU plant protection practices adoption level in homegardens having pepper as fourth economically dominant crop, the adoption was worked out and they were categorized as high, medium and low levels.

Table 19. Distribution of respondents based on their adoption of selected plant protection technologies of KAU in pepper

N = 100

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<23.57	28	35.44
2	Medium (between mean and standard deviation)	23.57 – 65.07	59	74.68
3	High (mean + standard deviation)	>65.07	13	16.45

Mean = 44.32 SD = 20.74

Table 19showed that majority (74%) of the homegarden respondents were having a medium level of pepper plant protection technology adoption in their homegardens, followed by 35.44 per cent having a low level adoption and only 16 per cent having high level of adoption.

The adoption curve depicted in Fig. 8revealed that 8.88 per cent of the respondents belonged to early adopter category followed by 50.63 per cent of early majority category, 24.05 per cent of late majority and 16.46 per cent of laggards in adopting plant protection technology as recommended by KAU.

Even though there were enough plant protection technologies in pepper and was adopted by several farmers, it is found that a good number of them are not adopting the technology to the fullest in their homegardens. This may be due to the reason that homegarden farmers are not concentrating on commercial production of pepper but for sustainable production for domestic

consumption. The results are found to be in agreement with the finding of Gangadharan (1993).

4.3.5. Extent of adoption of selected KAU plant protection technologies of economically dominant crop, vegetables in homegarden

The mean adoption scores of the homegarden respondents having vegetables as one of the economically dominant crops in their respective homegarden was worked out in order to find the extent of adoption of selected KAU plant protection practices.

Table 20. Distribution of respondents based on their adoption of selected KAU plant protection technologies in vegetables

N = 89

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<08.45	17	19.10
2	Medium (between mean and standard deviation)	08.45 – 57.93	54	60.67
3	High (mean + standard deviation)	>57.93	18	20.22

Mean = 33.20 SD = 24.73

Observations from Table 20 concluded that 60.67 per cent of the homegarden farmers were of medium level of adoption and 20.22 per cent of respondents belonged to high level of adoption of selected KAU plant protection practices in vegetables.

Figure 9 projected the results as 19.10 per cent of the respondents as early adopters, 35.96 per cent as early majority, 24.72 per cent and 20.22 per cent laggards with respect to the adoption of selected plant protection practices of KAU. The low percentage in early adopters might be due to lack homegarden suited plant protection technologies. In case of adoption of KAU plant protection practices in vegetables 20.22 per cent of respondents belonged to laggard category which was higher than that of standard Roger's curve. This indicates the necessity of more meaningful extension programmes with reference to lot of scientific plant protection practices among the homegarden farming community

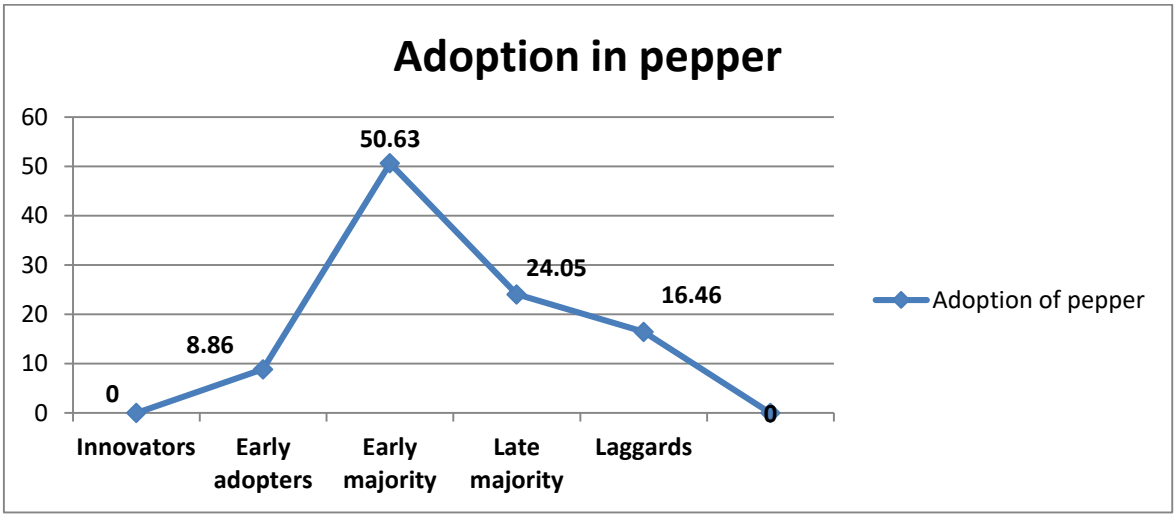

Fig. 8. Adopter categorization of respondents in pepper

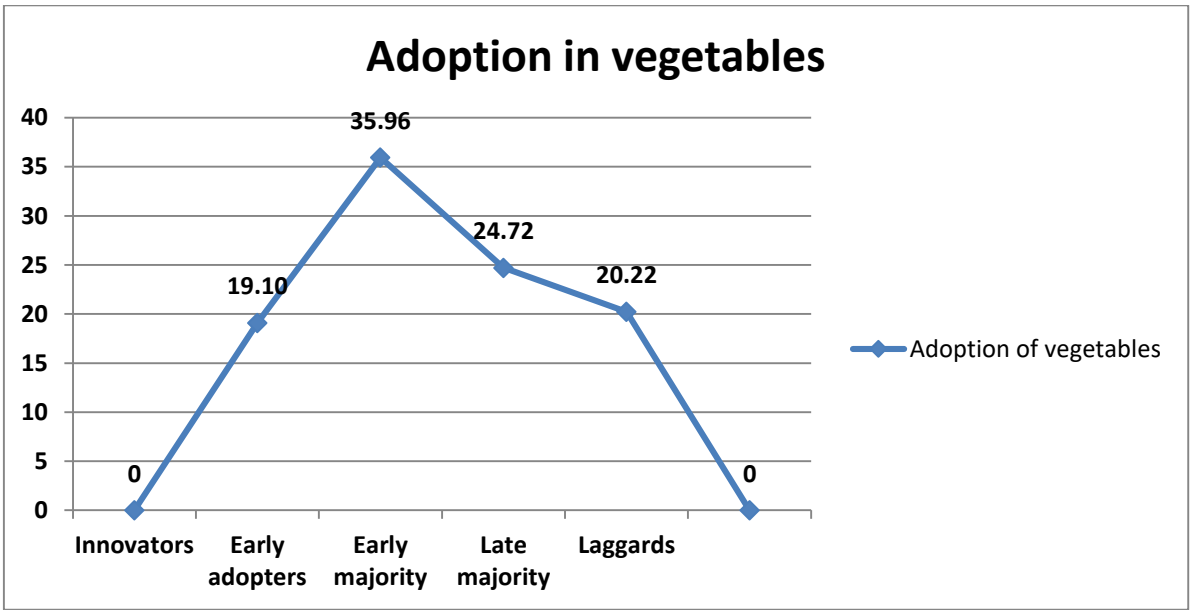

Fig. 9. Adopter categorization of respondents in vegetables

which in turn will help in increasing adoption with focus on reducing percentage of laggards.

Hence it can be inferred that in vegetables the adoption of plant protection practices in homegarden is quite slow in nature. This may be due to the reason that homegarden farmers prefer vegetables that are free from plant protection chemicals and are safe for consumption. The findings were in tune with the findings of Meera (1995), Majjusha (2000 and Jayanathan (2004).

4.3.6. Extent of adoption of selected KAU plant protection technologies of economically dominant crop, yams and colacasia in homegarden

Yams and colacasia yet another economically dominant crop in homegarden which requires less management compared to other crops in general.

Table 21. Distribution of respondents based on their adoption of selected KAU plant protection technologies in yams and colacasia

N = 62

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<08.87	10	16.12
2	Medium (between mean and standard deviation)	08.87 – 69.86	40	64.51
3	High (mean + standard deviation)	>69.86	12	19.35

Mean = 39.35 SD = 30.59

A critical appraisal of Table 21 showed that out of the homegarden respondents having yams and colacasia as one of the economically dominant crop, more than half of the respondents (53.33 per cent) were coming under medium level of adoption.

An attempt was made to analyze the data with the Rogers curve in Fig. 10and it was found that majority of the homegarden respondents (35.48 per cent) were of late majority followed by 29.03 per cent of early majority, 19.35 per cent of laggards and 16.13 per cent of early adopters. In case of adoption of KAU plant protection practices in yams and colacasia revealed that the percentage of respondents that belonged to both late majority and laggards were higher than that

of Roger's curve this was of a matter of concern indicating the need of meaningful extension programmes to reduce percentage of farmers in these categories to help in improving the adoption level of KAU plant protection practices. Hence it can be inferred that homegarden farmers were not keen to adopt plant protection practices for yams and colacasia.

4.3.7. Extent of adoption of selected KAU plant protection technologies of economically dominant crop, arecanut in homegarden

In this study, arecanut was found to be the least economically dominant crop in homegarden.

Table 22. Distribution of respondents based on their adoption of selectedKAU plant protection technologies in arecanut

N = 59

Sl No.	Category	Class limits	No.	%
1	Low (mean – standard deviation)	<11.92	13	22.03
2	Medium (between mean and standard deviation)	11.92 – 74.62	35	59.32
3	High (mean + standard deviation)	>74.62	11	18.64

Mean = 43.27 SD = 31.35

Table 22 showed the distribution of respondents based on their level of adoption of selected plant protection practices in arecanut as recommended by the KAU. The greater part (59.32%) of the homegarden farmers belonged to medium level category in adopting plant protection practices in arecanut. Subsequently 18.64 per cent of homegarden farmers had a high level of adoption in plant protection practices.

In Fig.11 gave a picture that 22.03 per cent of the homegarden farmers fit in early adopter category, 30.51 per cent in early majority, 28.81 per cent in late majority and 18.64per cent in laggard category. In case of adoption of KAU plant protection practices in arecanut 18.64 per cent of respondents belonged to laggard category which was higher than that of standard normal Roger's curve. This indicates the necessity of more meaningful extension

programmes with reference to lot of scientific plant protection practices among the homegarden farming community which in turn will help in bettering adoption with focus on reducing percentage of laggards. Innovators are very low because the economic value is least in the crop and also the plant protection measures were a complex activity, thus the farmers gave less importance to maintain this crop. Hence it can be summarized that even though arecanut is found to be least dominant crop in homegardens the KAU plant protection practices are practiced on an average by the homegarden respondents.

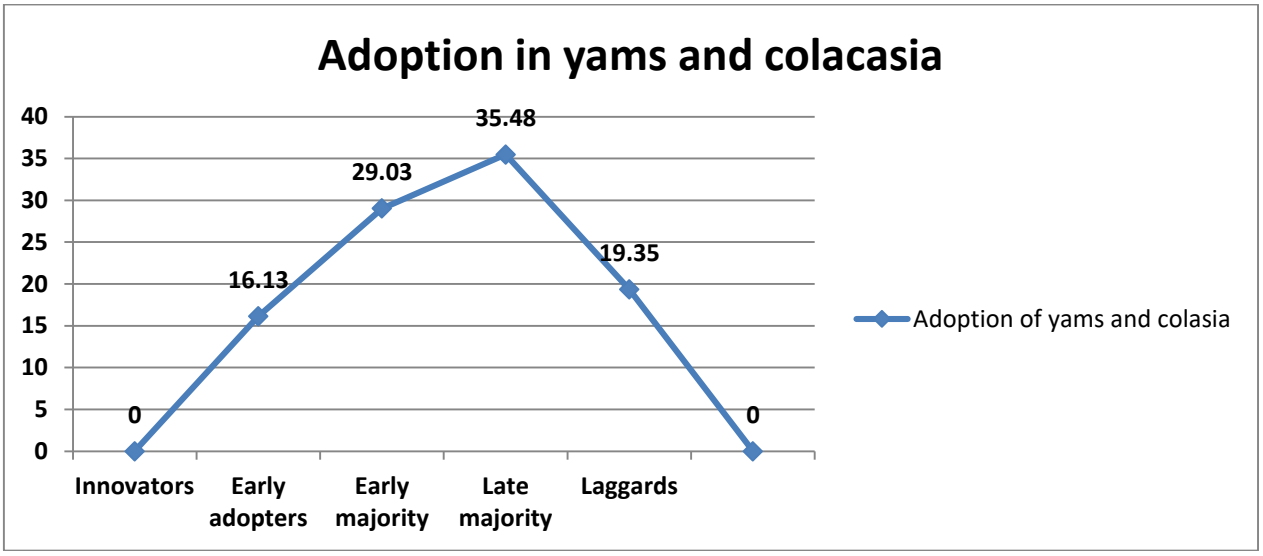

Fig. 10. Adopter categorization of respondents in yams and colacasia

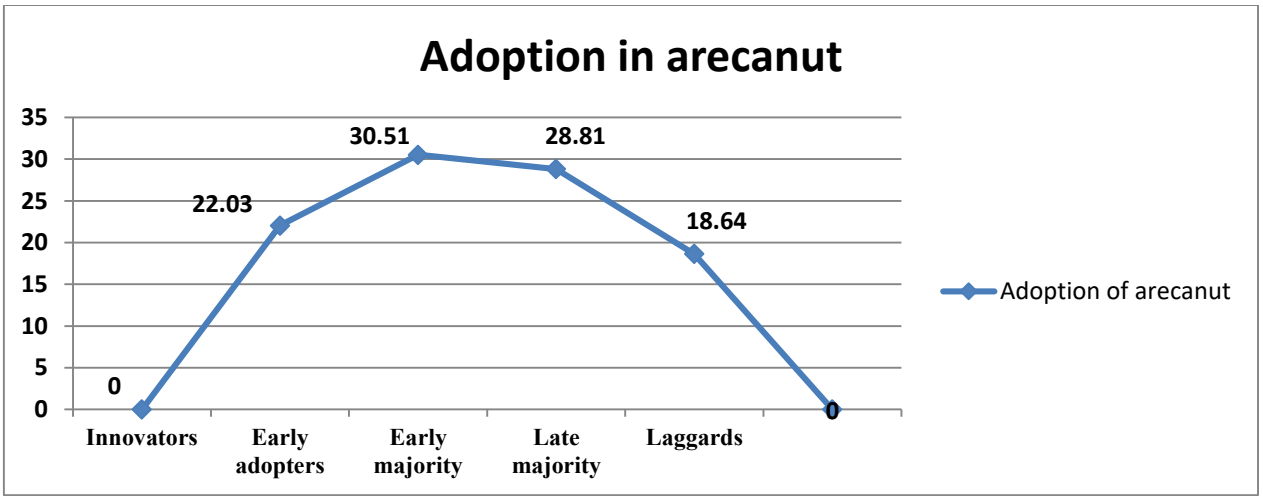

Fig. 11. Adopter categorization of respondents in arecanut

4.3.2. Extent of adoption of selected KAU plant protection practices of economically dominant crops and their relationship with independent variables in homegardens

The influence of 12 independent variables on the extent of adoption of plant protection technologies by homegarden farmers were obtained by simple correlation analysis.

Table 23. Correlation between the independent variables and dependent variable adoption

Variables	Independent variable	r
X_1	Age	0.3151**
X_2	Education	0.0270
X_3	Family size	0.0005
X_4	Occupation	0.1782
X_5	Farming area	-0.0158
X_6	Rational orientation	0.0392
X_7	Information source utilization	0.2763**
X_8	Farming experience	0.1916
X_9	Extension participation	0.2989**
X_{10}	Knowledge on plant protection practices	0.0698
X_{11}	Evaluative perception on sustainability of plant protection practices	0.0066
X_{12}	Economic motivation	0.0454

** - significant at 1% level

Overall data of Table 23 revealed that out of the 12 independent variables age, information source utilization and extension participation were the three variables that were positively and significantly related with the dependent variable adoption. The result also showed that the variables education, family size, occupation, rational orientation, farming experience, knowledge, evaluative perception and economic motivation had no significant relation with the

dependent variable adoption and farming area was found to have a negative but non significant correlation.

A critical appraisal of the correlation analysis showed that the dependent variable age shown positive significant relation with the extent of adoption of selected plant protection practices. As the age of respondent increases they gain more experience in farming and become more exposed to the extension agencies thus resulting in increase of adoption of recommended plant protection practices. Information source utilization was also found to be significantly correlated in this study. This might be due to the fact that the homegarden farmers had utilized the information sources to a great extent since they might have got better opportunity and facilities to utilize the source of information properly. The better utilization of information sources might have also helped farmers to improve their adoption of plant protection practices. This finding was found to be in agreement with the findings of Gangadharan (1993) and Meera (1995). The third independent variable that was found to have a significant correlation with the dependent variable adoption was extension participation of the homegarden farmers. This might be due to the fact that the homegarden respondents who had contact with the extension agency and participated in the extension programmes would have improved their level of knowledge and developed a favourable attitude towards adopting improved and recommended plant protection practices in their homegarden. Similar result have been obtained from the study of Gangadharan (1993)

The variable farming area had a negative and non significant relationship with the dependent variable adoption of selected plant protection practices. This might be because most of the respondent homegarden farmers were found to be small or marginal farmers and they might be cultivating for domestic consumption rather than commercial cultivation which might have hampered their adoption. And also as such we do not have specific plant protection practices for homegardens. The finding was found to be in agreement with the findings of (Prasanan,1987).

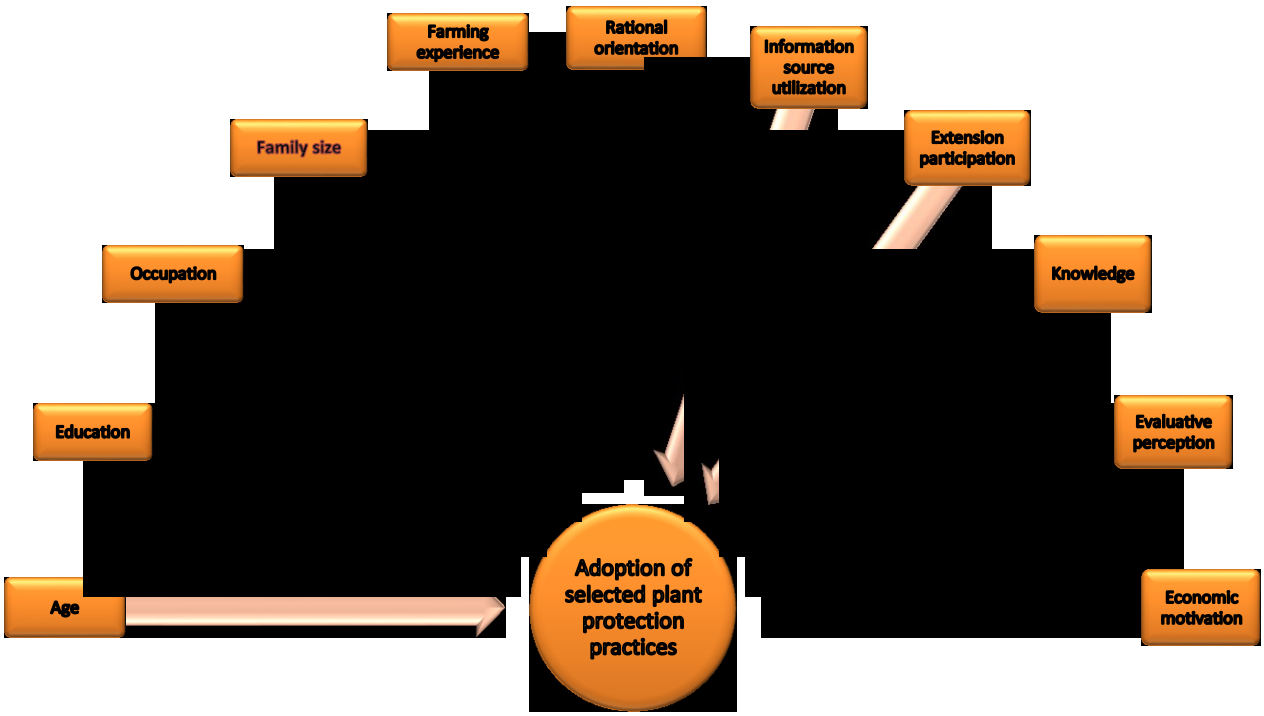

FIG. 25 EMPERICAL MODEL OF THE STUDY

Hence it can be comprehended that age, information source utilization and extension participation had influenced extent of adoption of selected KAU plant protection technology among homegarden farmers.

4.4. Perceived plant protection preferences of homegarden farmers

The farmer's perception on plant protection preference were collected and presented in Table 24, which concluded that among the ten criteria given in the case of coconut (7.09), banana (6.98), tapioca (7.06) and arecanut (8.35) ease in operation was perceived as the most preferred criteria. Coconut and arecanut were perennials as well as due to its long stature it requires more labour for spraying, crown clearing operations and such other plant protection measures. This might be the reason why they preferred ease in operation as the most important criteria. Also in tapioca and banana number of crops per unit area was more thus management becomes difficult. Cost effectiveness was the second preferred criteria in case of banana (6.8), tapioca (6.67), pepper (7.03) and colacasia and yams (6.15) which was logical because farmers always preferred to get maximum profit from their investment. The least preferred criteria were the concept of safe family food in coconut (2.42), tapioca (3.41) and arecanut (1.4). In perennials, the chance of residual toxicity was less and also may be because farmers are not resorting to any chemical control measures in these crops.

Interestingly in the case of vegetables, the most preferred criteria in plant protection was availability of inputs (6.25), followed by family safe food concept (6.2). This was very logical because it is well know that the vegetables available in the market are highly toxic and so the homegarden farmers are giving more importance to ensure toxin free vegetables in the homegarden for family consumption.

Table

mponents	Cost effectiveness	Sustainability	Family safe food concept	Ease in operations	Compatibility with management	Eco-friendliness	Local resource utilization	Safety in handling	Availability of inputs	Immedi of th effec
Coconut	6.0	5.27	2.42	7.09	5.66	3.0	5.02	5.45	6.27	6.63
Banana	6.8	5.07	5.12	6.98	4.05	7.54	6.63	6.34	6.65	3.94
Tapioca	6.67	4.8	3.41	7.06	4.25	6	5.78	5.23	7.12	6.25
Pepper	7.03	6.75	5.3	5.99	1.9	4.25	5.05	3.9	7.33	6.21
ams and olocasia	6.15	4	6.25	6.5	6.25	3.4	3.1	4	5.1	5.55
egetables	2.6	1.2	6.2	4	4.4	4.7	4.75	5.1	6.25	5.1
recanut	2.2	6.25	1.4	8.35	6.35	5.5	6.35	5.4	7.05	2.65

4.5. Perceived usefulness and effectiveness of selected KAU protection technologies for the homegarden systems

Usefulness and effectiveness of the plant protection practices as perceived by the homegarden farmers are presented in the following table.

Table 25. Usefulness of the KAU plant protection practices in homegardens

N= 100

Sl no	Category	Percentage
1	Very useful	30
2	Useful	45
3	Not useful	25

As we can see from Table25 that 45per cent the homegarden respondents perceived the selected KAU plant protection practices to be useful for them while 30per cent felt it to be very useful. Only 25 per cent of them perceived the KAU plant protection practices to be not useful. Since majority of farmers i.e (70%) were falling under medium level of adoption, the result is justified with 75per cent perceiving the plant protection technologies to be either useful or very useful.

These results were quiet a good indication that the plant protection practices of KAU are helpful for the homegarden farmers.

Table 26. Effectiveness of KAU plant protection practices in homegardens

N= 100

Sl no	Category	Percentage
1	Very effective	25
2	Effective	40
3	Not effective	35

The effectiveness of KAU plant protection practices in homegardens as perceived by the homegarden farmers is depicted in Table 26.

The findings revealed that KAU plant protection practices were perceived as very effective by 25per cent of the homegarden respondents while majority (40 per cent) had opined it to be effective. Here also of the 70 per cent who were adopting plant protection measures 65 per cent had perceived it to be either effective or very effective which was a positive observation.

Hence it can be concluded that the KAU plant protection practices are identified as pretty useful and effective in the homegardens.

4.6. Technology needs/gaps in protection practices for the economically dominant homegarden crops as perceived by the homegarden farmers

The results obtained on analyses of plant protection technology gap as perceived by the respondents are presented in Table 27.

Table 27. Plant protection technology gap in homegardens

Sl no	Plant protection practices	Score
1	Botanicals	360

2	Soil solarization	255
3	Seed treatment	220
4	Equipments	195
5	Plant protection chemicals	192
6	Biocontrol agents	190
7	Resistant variety	180
8	Trap crop	150
9	Non insect pest management	120

A critical appraisal of the Table 27 indicated that the plant protection technology in which there existed a maximum gap/need as perceived by the respondents were identified as non insect pest management (120) followed by trap crop (150) and resistant variety (180).

It can be inferred from the results presented above that as perceived by the farmer respondents the maximum need were on generation of technologies for management of non pest, trap crop and evolving resistant varieties.

4.7. ITK practices on plant protection aspects

The Indigenous technical knowledge on plant protection practices were identified from each AEUs and categorized to crop specific/general ITKs. Results are presented in Table 28 below.

Table 28. Cropwise/general ITK practices identified

Sl no.	Crop/general	ITK practices
1	Vegetables	1. Cow's urine is diluted 10 times and sprayed on chilly to reduce pest attack. 2. Tobacco decoction emulsified in soap water is used against many pests in vegetables

		3. Spraying cowdung solution prepared from 200g of fresh cowdung diluted in water against bacterial diseases 4. Spraying of bird's chilly mixed in cow's urine for sucking pest
2	Coconut	1. Mulching of coconut basin with cleodendron leaves to repel rhinoceros beetles 2. Placing of salt and sand inside the second leaf of crown after mixing both in equal ratio to destroy rhinoceros beetle in coconut
3	Banana	1. Inserting bar soap into the bore holes of pseudostem weevil reduces its attack 2. Placing of neem seed powder and bar soap inside the top leaves of banana to kill pseudostem weevil 3. Smearing of cowdung and ash solution on banana suckers during storage and before planting to reduce rhizome weevil attack 4. Application of tobacco decoction against bunchy top of banana
4	Tapioca	1. Erecting coconut peduncle to keep away rats in tapioca field
5	General	1. Attracting snails by keeping small amount of beer in the field 2. Keeping light traps for night pest 3. Hanging polythene cover in the field to scare the birds away 4. Hanging of fish head in the fields to attract ants 5. Use of crow feather as bird scarcer 6. Storage pest can be reduced by keeping neem leaves along with stored seeds

Critical analysis of the Table 28 revealed that of the 17 ITK plant protection practices enumerated four numbers were specific to vegetables and banana each. Two were specific to plant protection of coconut and when it comes to general there were 6 practices of which two were specific to non insect pest bird, one each was on stored pest management, night pest and snail management.

Hence it can be concluded that there are a quiet good number of ITK plant protection practices that were still practiced in homegardens by the farmers from time immemorial.

4.8. Constraints experienced by farmers in adopting selected plant protection technologies in the homegardens

Table 29 gives an idea about the constraints experienced by the homegarden farmers in adopting the KAU plant protection technology in their homegardens.

Table 29. Constraints experienced by farmers in adopting selected KAU plant protection practices

Sl no.	Constraints	Rank over class	Rank over total
A	**Personal constraints**		
1	Lack of motivational factors	3	18
2	Lack of time in homegarden activity	4	20
3	Lack of supervision	2	16
4	Lack of knowledge in plant protection chemicals	1	7
B	**Economic constraints**		
1	Labour cost	2	19
2	High cost of plant protection chemicals	1	14
C	**Technology constraints**		
1	Plant protection chemicals are not effective in their recommended dosages	1	1
2	Difficulty in finding dosage of chemicals	3	6
3	Varieties are less resistant to pest and diseases	2	5
4	Lack of proper information source to deliver the latest plant protection technology	4	8
5	Lack of follow up activities by officials	6	15
6	Lack of suitable technology for homegarden	5	10
D	**Physical constraints**		
1	Non availability of labour on time	4	12
2	Non availability of equipments	5	13
3	Difficulty in finding alternate plant protection methods	2	4
4	Non availability of supply and services Non availability of plant protection chemicals at required	6	17
5	time and amount Lack of proper drainage	1	3

6		3	11
E 1 2	**Others** Wild animal attack Climate change influence on pest and disease intensity	 2 1	 9 2

Table 29 depicted the constraints experienced as perceived by the farmers in adopting the selected KAU plant protection practices. The constraints were ranked accordingly under sub headings of personal constraints, economical constraints, physical constraints, technological constraints and others.

In personal constraints, lack of knowledge in plant protection chemical was ranked one followed by lack of supervision, lack of motivational factors and lack of time in homegarden activities. Due to lack of knowledge the farmers had to depend on extension agencies for many activities relating to plant protection and hence they considered it as one of the major constraints. More of extension intervention can fill these gaps among homegarden farmers. These results are in line with results reported by Meera (1995), Resmy *et al.* (2001) and Balachandaran
(2004).

Among the economic constraints, high cost of plant protection chemicals and high labour cost were ranked one and two respectively. Due to small area of the homegarden and low returns from farming activity farming is not much remunerative and they cannot afford to buy expensive plant protection chemicals. This should be taken into consideration while evolving government policy. Meera (1995), Singh (2004) and Jaganathan (2004) also reported a similar trend.

Major technology constraints perceived by the respondents were plant protection chemicals not effective in their recommended dosages, varieties were less resistant to pests and diseases and difficulty in computing the dosage of chemicals. Respondents felt that the pests and pathogens have become resistant to

the recommended dosages also to the resistant varieties and so they are applying it in the amount or quantity they felt suitable. Most of the farmers were not skilled enough to find out the dosage of chemicals required for their farms as they find it a complex technology of calculations and formulas.

Non availability of plant protection chemicals/agents at the required time and amount, followed by difficulty in finding an alternate plant protection measure and lack of proper drainage were the major constraints identified by the respondents under physical constraints. Homegarden respondents preferred organic inputs/agents for the control of pest and diseases but these were available to them at the required time or amount. Similar results were reported by Muliyar (1989), Jaganathan (2004) and Jayawardana (2007). Improper drainage was found to hinder the timely plant protection operations and also resulted in incidence of some of the major diseases. Similar observations were also made by Sangeetha (1997) and Meera (1995).

Influence of climatic change on pest and disease intensity and wild animal attack were the two constraints that were perceived by the respondents. Due to the climatic variations respondents felt that the pest and disease incidence had increased and also evolved new ones too. Non insect pest management was another constraint faced as they were unable to find any management practices or technology suitable for homegardens. Similar results had been obtained by Shaw (2009), Davis (2009) and Ahmed *et al.* (2013).

Hence in the overall total rank the major constraints perceived by the homegarden respondents in adopting selected plant protection practices as recommended by KAU were plant protection chemicals not effective in their recommended dosages, climatic change influence on pest and disease intensity and non availability of plant protection chemicals/agents at the required time and amount.

4.8. Suggested refinement of the plant protection technologies as perceived by the farmers

Table 30. Contribution of suggestions for refinement of technology as perceived by respondents

Sl no	Suggested refinement of plant protection technologies	%
1	More of eco friendly and organic plant protection practices that are homegarden suited	56
2	Ensure timely availability of plant protection chemicals/biocontrol agents	48
3	More pest/disease resistant varieties	30
4	Reduce the cost or provide subsidies for the plant protection agents	25
5	Conduct plant protection demonstration or classes through Krishi Bhavans	22
6	Technology to keep away non insect pests	20

It can be seen from Table 30 that majority (56%) of the homegarden farmers suggested that they require refinement in plant protection technology that are organic,ecofriendly and are suitable for the homegarden environment. Subsequently came the suggestion to ensure timely availability of plant protection chemicals/biocontrol agents required. This was followed by the suggestion to evolve more resistant varieties, subsidies for plant protection agents, conduct of classes and demonstration on plant protection measures and lastly evolve technology to keep away non insect pests.

Hence it can be inferred that the plant protection technology needs refinement in homegardens so that it become more acceptable and thereby adoptable by homegarden farmers to a great extend thus making the technology a success.

SUMMARY

SUMMARY

Homegardening is a time-tested example of sustainable, multispecies, agroforestry land-use, practiced as a subset of the farming system, predominantly in the different agroclimatic regions of Kerala. The high structural and floristic diversity of tropical homegardens is a reflection of the unique biophysical environment and technology components in the homegarden systems. By promoting increased consumption of the available diversity, nutrition of farming families can be improved. Rural farmers continue to rely on their homegardens to enhance household food security against the risks presented by monocropping systems. In addition to various ITKs farmers follow certain scientific plant protection practices in homegardens. In this backdrop the present study was undertaken with the following specific objectives.

v. To assess the level of adoption of selected plant protection practices of KAU for the economically dominant crops in the homegardens.
vi. To analyse the plant protection preferences of homegarden farmers.
vii. To identify the constraints experienced by farmers in the utilization of plant protection technologies in the homegardens.
viii. Suggestions for refinement of plant protection measures as perceived by the homegarden farmers.

The study was conducted during 2014-2015 in selected homegardens of Thiruvanathapuram district of Kerala State. A total of 100 homegarden farmers were purposively selected with 20 each from five Agroecological units wherein homegardens were having an area more than 0.1 ha and were active and operational.

The independent variables selected for the study were age, education, family size, occupation, effective homegarden area, rational orientation, information source utilization, farming experience, extension participation, knowledge on plant protection practices, evaluative perception on sustainability of plant protection practices and economic motivation while the

dependent variable was adoption of selected plant protection practices of KAU in economically dominant crops.

The data were collected by conducting personal interviews with the homegarden farmers, using a well-structured and pre-tested interview schedule developed for the purpose. Percentage analysis, means and correlation analysis were employed in analysis of the data and interpreting the results. The independent variables were quantified using already existing scales or following established procedures. The economic dominant crops were delineated by taking the mean score obtained for each crop. Rate of adoption of selected plant protection practices were worked out using "Adoption quotient". Correlation between the independent variables and the dependent variable were worked out. Perceived plant protection preferences were identified and ranked on ten point continuum. Level of perceived usefulness and effectiveness of selected KAU plant protection technologies for homegarden were measured on a three point continuum. The technology needs/gaps were assessed using a four point ordinal scale. ITK practices on plant protection aspects were identified and grouped to crop specific/general category. A constraint index was worked out for identifying the constraints experienced by the homegarden farmers in adopting the plant protection technologies. Suggestions for the refinement of the selected plant protection practices as perceived by the homegarden farmers were also analysed.

The major findings of the study are furnished below.

1. More than half of the respondent belonged to old age category.
2. Majority of the farmers were having high school level of education.
3. Agriculture was the primary occupation for 51 per cent of the respondents.
4. More than 80 per cent of the respondents belonged to small family.
5. Almost 50 per cent of the homegarden respondents had effective homegarden area less than 1acre.
6. Half of the respondents were having above 25 years of farming experience.
7. Nearly 50 per cent of the farmers depended on science alone as rationale for taking decisions.

8. More than 80 per cent of the sampled homegarden farmers had high level of information source utilization.
9. More than 50 per cent of the respondents had occasional participation in extension activities.
10. More than 50 per cent of the sampled respondents were having high level of knowledge on plant protection practices.
11. Evaluative perception on sustainability of plant protection in crops was found to be high in 51 per cent of the respondents.
12. More than 50 per cent of the respondents were belonging to low level category in case of economic motivation.
13. Coconut was found to be most dominating crop in homegarden followed by banana, tapioca, pepper, vegetables, yams and colacasia and arecanut.
14. Majority of the respondents (70%) had medium level of adoption of KAU plant protection practices.
15. In coconut, 75 per cent of respondents were having medium level of adoption of selected KAU plant protection practice. Forty two per cent of them belonged to early majority adopter category.
16. In banana, more than 50 per cent on the respondents had medium level of adoption of selected KAU plant protection practices wherein 32.29 per cent were found to be in early majority category.
17. More than 70 per cent of the sampled farmers had medium level of adoption of selected KAU plant protection practices in tapioca and majority (51.79 per cent) belonged to early majority adopter category.
18. In pepper, 74.68 per cent of the respondents had medium level of adoption of selected KAU plant protection practices and more than 50 per cent were found to be under early majority category.
19. In vegetables, majority belonged to medium level (60.67%) of adoption of selected plant protection practices and 35.95 per cent of respondents were of early majority adopter category.

20. More than half (64.51%) of the respondents had medium level of adoption of KAU plant protection technology in yams and colacasia and 35.48 per cent were late majority.
21. In arecanut, more than half of the respondents (59.32%) belonged to the medium level of adoption of selected KAU plant protection technologies and 30.51 per cent were early majority category.
22. Age, information source utilization and extension participation was found to have significant relationship with the dependent variable adoption of selected plant protection practices of KAU.
23. In coconut, banana, tapioca and arecanut ease in operation was perceived as the most preferred and the least preferred plant protection criteria was the concept of safe family food in coconut, tapioca and arecanut in homegardens.
24. Forty five percent of the respondents perceived the selected KAU plant protection practices as useful.
25. Twenty five of the respondents perceived KAU plant protection practices to be very effective and 40 per cent perceived it to be effective.
26. As per the perception of farmers, the areas of technology needs were identified in non insect pest management followed by trap crop and resistant varieties.
27. A total of 17 ITK practices were identified which were in coconut, banana, vegetables, tapioca and general category.
28. The major constraints as perceived by the homegarden respondents in adopting selected plant protection practices as recommended by KAU were plant protection chemicals not effective in their recommended dosages, climatic change influence on pest and disease intensity and non availability of plant protection chemicals/agents at the required time and amount.
29. Suggested refinement of plant protection technology as perceived by the homegarden farmers were generation of ecofriendly and organic plant protection measures that are suitable for homegardens followed by timely

availability of plant protection inputs and generating more pest and disease resistant varieties.

Suggestions for future research

1. This study was conducted in Thiruvanathapuram district alone that too only among 100 homegarden farmer. Hence similar studies shall be undertaken in other agriculturally dominant districts of Kerala state for more generalization.
2. Homegarden is gaining popularity because it is providing the nutritional as well as food needs of the family and also due to the reduction of land available for cultivation. Hence more development plans concentrating on homegarden concept should gain momentum.
3. The dream of safe food for family can be realized only through homegarden cultivation and so strategies need to be developed to stream line homegarden cultivation more scientific. Studies focusing on these aspects should be addressed.
4. The ITKs enumerated in the study should be assessed for its validity and reliability. Focus can be given in future research on more crop related enterprises in the homegardens.

ABSTRACT

TECHNOLOGY ASSESSMENT OF PLANT PROTECTION PRACTICES OF ECONOMICALLY DOMINANT CROPS IN HOMEGARDENS

by

SUJITHA P. S.

(2013-11-119)

ABSTRACT

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KERALA, INDIA

2015

ABSTRACT

The study entitled "Technology assessment of plant protection practices of economically dominant crops in homegardens" conducted in the Thiruvanathapuram district of Kerala state covering 100 homegardens having an area more than 25 cents were selected from five Agroecological units (AEU) *viz*., Southern coastal plains, Southern central laterites, Southern high hills, Southern central foothills and Southern laterites. Twenty operational homegardens from each of the five panchayats belonging to the selected AEUs were chosen making the total sample size to 100 respondents. Delineation of economically dominant crops in homegardens, levels of adoption of selected KAU plant protection practices, technology need assessment, constraints in adoption of plant protection practices and suggestions as perceived by the farmers were the major objectives of the study.

The independent variables selected through judges rating were age, education, occupation, effective homegarden area, family size, farming experience, information source utilization, rational orientation, extension participation, knowledge, evaluative perception on sustainability of plant protection practices and economic motivation. The independent variable selected was adoption of selected KAU plant protection practices.

The economically dominant crops identified were coconut, banana, tapioca, pepper, vegetables, yams and colacasia and arecanut respectively in the homegardens.

The overall level of adoption of selected plant protection practices showed that majority (70%) of the respondents had medium level of adoption followed by 16% having high level and 14% low level of adoption. The adopter category curve delineated for the overall adoption showed that 45% of the respondents fell under early majority followed late majority (21%), laggards (16%), early adopters (14%), with no innovators. Differences in adopter categories were observed for different crops.

Age, information source utilization and extension participation were found to have significant positive relationship with the dependent variable adoption of selected plant protection practices of KAU.

In coconut, banana, tapioca and arecanut ease in operation was perceived as the most preferred plant protection criteria in homegardens.

The result showed that 45% of the farmers found the preferred KAU plant protection practices to be useful however only 40% of the respondents felt it effective.

Of the 17 ITK plant protection practices, four were specific to vegetables and banana each. Two were specific to plant protection of coconut and six of general practices.

Major constraints identified were, plant protection chemicals not effective in their recommended dosage, followed by climatic influence on pest and incidence and non availability of plant protection chemicals. Suggested refinement in plant protection technology as perceived by the homegarden farmers were in generating of ecofriendly and organic plant protection measures that are suitable for homegardens followed by timely availability of plant protection inputs and generation of more pest and disease resistant varieties.

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Appendix

DATA ENUMERATION SCHEDULE

1. Name: ID. No.
   Address:

2. Family Details

Name of Member	Sex	Age	Relationship with head	Education	Occupation		Annual income	
					Primary	Secondary	Daily	Monthly

3. Farming experience:
4. Area (Ha)

Total Area	Total infrastructure area	Effective homegarden area	Rent/ Owned	Leased out land

5. Structure of homegarden : Planned/ Unplanned
6. Tenancy Status: Owner/ Tenant
7. System of farming: Organic/ Inorganic
8. Land status
    a. Type of land

(Area)

i. Wetland:
ii. Garden land:
iii. Hilly :
iv. Valley:
v. Undulating:

    b. Topography :
    c. Type of Soil:

9. Soil analysis (Yes/No)

How?	When?	Where?	Last date	Result	Copy of

					result (Y/N)

10. Type of canopy arrangement (Tiers 1 /2 /3 /4 /5 /6 /7)
11. Fencing type: (Live/wall/wire/mesh netting/mud wall)

    Live fencing crops:
12. Irrigation:
    a. Rainfed/ irrigated:
    b. Frequency of irrigation:
    c. Type of irrigation: (Drip, Spray…etc)
13. Water resource

Type	Y/ N	No./ Area
Well		
Pond		
Pipe		

14. Water accessibility in well

Type of well	Diameter	Depth	Year of digging	Perennial	Non perennial	Drought period

15. Farm machineries/ implements

Production practices	No.	Protection practices	No.	Value addition practices	No.

16. Labour requirement

    a. Family labour/ Wage labour:
    b. Wage:

c. No. of labourers (yearly):

17. Economically dominant crops

Sl No.	Crops	Rank

18. Evaluative perception on sustainability of crops on plant protection

Sl no.	Statements	Evaluative perception			
		VM	M	L	VL
1	Homegarden farming provides adequate provisions for developing aesthetic aspects				
2	Safe products				
3	Multi stored cropping helps in reduced pest and diseases incidence				
4	Help to meet immediate medicare				
5	Provides risk reducing practices				

VM: Very much M: Much L: less VL: very less

19. Economic motivation of homegarden farmers

Sl	Statements	Economic motivation

no		SA	A	DA
1	A farmer should work towards larger yields and economic profit			
2	The most successful farmer is one who makes a maximum profit			
3	A farmer should try new farming idea may earn him more money			
4	It is difficult for the farmer children to make good start unless he provides them with economic assistance.			

SA: Strongly agree A: Agree D: Disagree

20. Livestock component

Item	Breed	Number	Age	Yield	Method of sale	Price/ Unit

Item	Feed	Protection	Consumption		Outlet
			Family	Economic	

Are you satisfied with livestock: Yes/ No

21. Usefulness and effectiveness of plant protection technologies

Sl no	plant protection practice	NU	U	VU	NE	E	VE
1	Use of biopesticides						
2	Crown clearing in coconut						

3	Soil solarization in field						
4	Application of pseudomonas in pepper						
5	Use of resistant variety in tomato against bacterial wilt						

22. Other component:

Component	No.	Site CY/ BY	MR	OR	Source of information

23. ITK

No.	ITK	Probable reason

24. Knowledge on plant protection

Sl no	Statements	Yes	No
1	Name an important pest of coconut		
2	Give a control measure for Rhinoceros beetle		

3	Name an important pest affecting pepper		
4	Name a bio pesticide		
5	Name an important disease of tapioca		
6	Control measure for pseudostem weevil in banana		
7	Name leaf spot resistant variety in banana		
8	Name two biocontrol agents		
9	Name a bacterial wilt resistant variety of tomato		
10	Name a trap crop		

25. Information source utilization

Sl no	Source of information	Frequency		
		Regularly	Often	Not often
1	Newspaper			
2	Television			
3	Radio			
4	Magazines			
5	Mobile Advisory Service			
6	Kiosk			
7	Friends			

26. Plant protection preferences in homegadens

Sl no	criteria	coconut	Banana	Tapioca	Pepper	Yams and colcasia	Vegetables	area nut

1	Cost effectiveness							
2	Sustainability							
3	Family safe food concept							
4	Ease in operation							
5	Compatibility with management practice							
6	Eco friendliness							
7	Local resource utilization							
8	Safety in handling							
9	Availability of inputs							
10	Immediacy of effect							

27. Rational orientation

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

a. Beliefs in starts not in scientific recommendations
b. Beliefs in starts and scientific recommendations
c. Beliefs only in scientific recommendations

28. Extension participation

Sl no	**Agency**	**Frequency of contact**		
		Regularly	Often	Not often
1	Kerala Agricultural University			
2	Krishi bhavan			
3	Commodity Board			
4	Friends and neigbours			

29. Technology need assesment

Sl no	Technology	Technology not available	Technology available but not applicable	Technology available but not sustainable	Technology available, applicable and sustainable
1	Botanicals				
2	Soil solarization				
3	Seed treatment				
4	Equipments				
5	Plant protection chemicals				
6	Biocontrol agents				
7	Resistant variety				
8	Trap crop				
9	Non insect pest management				

30. Constraints analysis

Sl no.	Constraints	Rank over class	Rank over total
A	**Personal constraints**		
1	Lack of motivational factors		
2	Lack of time in homegarden activity		
3	Lack of supervision		
4	Lack of knowledge in plant protection chemicals		
B	**Economic constraints**		
1	Labour cost		
2	High cost of plant protection chemicals		

C 1 2 3 4 5 6	**Technology constraints** Plant protection chemicals are not effective in their recommended dosages Difficulty in finding dosage of chemicals Varieties are less resistant to pest and diseases Lack of proper information source to deliver the latest plant protection technology Lack of follow up activities by officials Lack of suitable technology for homegarden		
D 1 2 3 4 5 6	**Physical constraints** Non availability of labour on time Non availability of equipments Difficulty in finding alternate plant protection methods Non availability of supply and services Non availability of plant protection chemicals at required time and amount Lack of proper drainage		
E 1 2	**Others** Wild animal attack Climate change influence on pest and disease intensity		

No.	**Crop**	**Variety**	**Source of seed**	**No./Area**		**Total**	**Spacing**	**Irrigated/ Rainfed**	**Frequency of irrigation**	**Type of irrigation**
				Bearing	**Non. Bearing**					

Crop	Yield	Family consumption	Economic Consumption	Marketing channel	Market	Price	Transport cost	Middleman (Y/N)	Labour

ROP DETAILS

Crop	Previous crop	Next crop	Organic/ inorganic	Fertilizers	Quantity	Purchased from?	Source of information	Price	Labour (including harvest)

Crop	Organic/ inorganic	Pest/ Disease/ Weeds	PPC used	Quantity	Source of purchase	Source of recommendation	Price of PPC	Labour	Farmer's practice

Appendix II

Relevancy rating of independent variables

OBJECTIVES OF THE STUDY

i. To assess the level of adoption of selected plant protection practices of KAU for the economically dominant crops in the homegardens.
ii. To analyse the plant protection preferences of homegarden farmers.
iii. To identify the constraints experienced by farmers in the utilization of plant protection technologies in the homegardens.
iv. Suggestions for refinement of plant protection measures as perceived by the homegarden farmers.

Sl. No.	Independent variables	Relevancy rating				
		Most R	More R	R	Less R	Least R
1	Age					
2	Education					
3	Occupation					
4	Family size					
5	Information source utilization					
6	Farming experience					
7	Literacy					
8	Irrigation potential					
9	Availability of homegarden inputs					
10	Effective homegarden area					
11	Economic orientation					
12	Rational orientation					
13	Extension participation					
14	Extension contribution					
15	Innovativeness					
16	Social capital					
17	Labour availability					
18	Scientific rationality					
19	Credit availability					
20	Livestock possession					
21	Risk orientation					
22	Annual total income					

23	Knowledge on plant protection practices in homegarden farming.					
24	Evaluative perception on the sustainability of plant protection practices farming systems in homegardens					
25	Economic motivation					
26	Others					

R-relevant

Thanking you

Name & Designation

The variables with their mean relevancy score

Sl. No.	Independent variables	Mean relevancy score
1	Age	**3.65**
2	Education	**4.05**
3	Occupation	**3.65**
4	Family size	**4.15**
5	Information source utilization	**4.10**
6	Farming experience	**3.48**
7	Literacy	1.95
8	Irrigation potential	2.15
9	Availability of homegarden inputs	2.80
10	Effective homegarden area	**3.85**
11	Economic orientation	2.95
12	Rational orientation	**4.25**
13	Extension participation	**3.85**
14	Extension contribution	2.15
15	Innovativeness	3.15
16	Social capital	2.10
17	Labour availability	3.25
18	Scientific rationality	3.15
19	Credit availability	2.85
20	Livestock possession	2.95

21	Risk orientation	2.65
22	Annual total income	2.75
23	Knowledge on plant protection practices in homegarden farming	**4.45**
24	Evaluative perception on the sustainability of plant protection practices in homegardens	**3.85**
25	Economic motivation	**3.48**
	Mean	**3.48**