

# Original Research Article

## Horizontal and Vertical Diversification of Specializations in Homegardens of Kerala

### ABSTRACT

**Aims:** To delineate extent of horizontal cum vertical integrations and to— analyze distribution of specialisations/specializations based on the level of vertical diversification.

**Study design:** —‘Ex-post-facto’ and ‘explorative’ research designs were used for conducting the present study.

**Place and Duration of Study:** The study was conducted in Thruvanathapuram district of Kerala in India

**Methodology:** ‘Ex-post-facto’ and ‘explorative’ research designs were used for conducting this study.

**Results:** Majority of specialized homegardens (60%) do have more than 4 tiers of horizontal diversification whereas 40 percent have less than 4 tiers of diversification. Similarly, distribution of vertical diversification shows that 61.6 per cent have less than 3 levels and 38.3 per cent have more than 3 levels of vertical diversification. Mean vertical diversification was found to be highest for livestock-cow (3.75) and least was for tubers and orchids (1) each. However, 3 levels of vertical diversification was noticed for rubber, animal husbandry, coconut, goat, mushroom and aquaculture.

**Conclusion:** Homegardens are the sustainable production system. If the competent authorities pay attention to the individual specializations of the system and give adequate thrust to the value addition of these/these specializations, then definitely homegardens can turn out to be a remunerative farming system fetching supplementary benefits.

**Keywords:** homegardens, specialized homegardens, horizontal diversification, vertical diversification, sustainable production system

### 1. INTRODUCTION

Traditionally, homegardens constitute the prominent agricultural land-use activity in Kerala, which is sumptuous in agro-biodiversity. The adjoining Western Ghats further facilitates vast agro-biodiversity and picturesque the agricultural lands of Kerala. As compared to other monospecific production system, homegardens are multi storeyed agroforestry systems that are ecologically complex and are structurally and functionally diverse. An infinite number of multiple services are offered by homegardens. Millions of marginal farmers rely on homegardens for their livelihood and nutritional security apart from offering diverse economic and other ecological benefits. The trees in this farmlands ensures multiple functions such as food, fodder, timber, fuel, medicinal plants, pulpwood and other Non Timber Forest Products (NTFPs) (Kumar, 2006) [1]. In addition to the direct benefits, homegardens provide enumerable indirect services such as nutrient cycling, climate moderation and soil fertility improvement (Beer *et al.*, 1998) [2]. Probably, homegardens serve as the potential sources in meeting the Intended Nationally Determined Contributions (INDC) of the country based on the Paris Climate agreement.

Generally, homegarden is defined as the special type of sustainable agricultural production system practiced around the home with or without extended garden, where a multi-species of annual and perennial crops along with /without animal husbandry components and other specialized components like aquaculture, sericulture, apiculture, etc. for the purpose of meeting the fundamental requirements of home and besides generate additional income through the sale of surplus to fulfill the requirements of household (Thomas, 2004) [3].

**Comment [PS1]:** Revise the title as: “Horizontal and Vertical Diversification of Specializations in Homegardens: A case study of Thruvanathapuram district of Kerala”

**Comment [PS2]:** The journal required a unstructured abstract of words. Revise the abstract, as per the guidelines of the abstract,

**Comment [PS3]:** Repetition of the statement. As already provided in the methodology heading.

**Comment [PS4]:** Duration of the study is missing. Specify the year.

**Comment [PS5]:** Need to be revised. As, from the former statement it is obvious.

**Comment [PS6]:** Similarly for the above statement

**Comment [PS7]:** Are you depicting that, till now homegarden are not the remunerative farming system?

**Comment [PS8]:** Th keywords should be different from the title of the manuscript

**Comment [PS9]:** Use only homegarden

**Comment [PS10]:** The major missing in the manuscript is lack of information regarding the horizontal and vertical diversification in home garden in the Introduction section. It will be very hard for new researcher to understand the study.

**Comment [PS11]:** You should some statements regarding the potential of the agroforestry system and then move to the homegarden. Consult from the below mentioned references:

1.Sharma, P., Singh, M. K., Tiwari, P., & Verma, K. (2017). Agroforestry systems: Opportunities and challenges in India. *Journal of Pharmacognosy and Phytochemistry*, 1(sp), 953-957. (...)

**Comment [PS12]:** Instead of infinite use word “diversified”

**Comment [PS13]:** Provide proper reference.

**Comment [PS14]:** Not only trees but the whole system are providing diversified provide such as food, fodder, timber, f (...)

**Comment [PS15]:** Carbon sequestration, water recycling is missing. Add with proper citation

**Comment [PS16]:** These are authors personal views and should be added in conclusion or policy recommendations.

**Comment [PS17]:** Also provide the average size of the home garden in kerala (up to 0.2 ha)

Planners, environmentalists, researchers, and extension personnel often is deprived of the information to identify situation where homegardens can accomplish sustainability in terms of technology, socio-psychologically and economically. To make homegardens more remunerative and as a strategy to mitigate risks, diversification is the best choice. Diversification can meet the price fluctuations and ensure economic stability. The high diversity of crop, tree and livestock species with different uses and production cycles in these systems, allows year-round production of food, wood and a wide range of other products. It also reduces risk of production failure, pests and diseases, increases productivity cum output flexibility and also it improves the microclimate and soil conditions. The presence of different functional groups of crops, trees and livestock in homegarden systems fulfils the dietary and cash requirements of the households, thus enhancing food and livelihood security (Tesfaye,2005) [4].

**Comment [PS18]:** Home gardens are itself provide diversified products. Instead of homegardens, the word monoculture should be used.

As a result of commercialization and decreasing land due to ~~fragmention~~fragmentation, cultivation systems are becoming more specialised. Although, focus on the –dialectical relationship between diversification and specialization is not new, concern about diversification is more underlined because of major developments in the agricultural sector in many developing countries. Agricultural diversification can potentially benefit farmers and consumers by providing a wider range of products, greater production stability, lower risks, and finally more efficient land use systems. The factors leading to specialization are environmental constraints to production, high margins of economic return, narrow technological adaptation, and regulation of prices, inputs or crop size. Considering the potential benefits and technological potential of agricultural diversification, a better understanding of the factors controlling the diversification needs to be defined (Zandstra,1982) [5]. Horizontal diversification reflects the measure of both the cropping intensity and the structure of homegardens. The functional dynamics and the economic entities in the homegarden as a result of value addition or product diversification is shown by means of vertical diversification (Aravind *et al.*, 2004) [6]. Studies reveal that the diversity of crops that results in specialisations with primary homegarden components along with vegetation, livestock, fisheries and other specialised components enables continuous produces/products and reduces the production risks. (Thomas, 2016) [7].

**Comment [PS19]:** It looks like the whole paragraph taken from the one single research paper. Add more references and some informative information.

**Comment [PS20]:** Cropping

**Comment [PS21]:** Proper citation missing

## 2. METHODOLOGY

The study was conducted in the Thiruvananthapuram district comprising five agro ecological units where the specialized homegarden systems are in vogue. The agro ecological units (AEU) were selected in consultation with Kerala Agricultural University and State Planning Board. It includes AEU-1, AEU-8, AEU-9, AEU-12 and AEU-14. A list of panchayats in each AEU's of study was prepared and panchayats with potentially active and operational homegarden units were identified. From each AEU, one panchayat each was selected randomly in consultation with Agricultural Officers. The panchayats include Kazhakkuttam, Pallichal, Nedumangad, Amburi and Aryanad. From each panchayat 12 specialised homegardens were selected using Simple Random Sampling, thus making a total of 60 specialized homegardens.

**Comment [PS22]:** Proper hypothesis and objective of the manuscript are missing.

**Comment [PS23]:** It will be informative, if a study area map will be provided.

Horizontal diversification refers to the addition of more crops to the existing cropping system. The other type of crop diversification is vertical crop diversification, in which various other downstream activities are undertaken. It could be illustrated by using any crop species, which could be refined to manufactured products, such as fruits, which are canned or manufactured into juices or syrups as the case may be. In this study, the horizontal and vertical diversification was measured as given below.

**Comment [PS24]:** This should be part of the introduction but with proper reference

The horizontal diversification was computed based on the number of levels of crop/specialized component observed in each of the specialized homegardens with special reference to the numerical dominance and the results obtained were recorded in terms of average levels of inclusions in each of the specialized homegardens. The result of numeric dominance of crops in ~~specialized~~specialized homegardens as perceived by the respondents were rated on a 7 point continuum scale with rank 1 for the most dominant crop and 7 for the least dominant crop. Mean scale value depicted the extent of dominance of the crops. The scale ranges from 1 to 7 levels to determine the extent of horizontal diversification. Results were categorized as “more than mean” and “less than mean”.

Likewise the vertical diversification was computed based on the number of levels of the entire specialized components subjected to the levels of value addition until it reaches the market. The results were expressed in terms of the mean score obtained for the different specialized components in the homegardens understudy. Vertical diversification was computed based on the mean vertical diversification for each specialization. The scale ranges from 1 to 6 levels to determine the extent of vertical diversification. Results were categorized as “more than mean” and “less than mean”.

**Comment [PS25]:** Statistical analysis part is missing

### 3. RESULTS AND DISCUSSION

#### 3.1 -Dominance profile of homegardens

The numeric dominance for the crops in specialized homegardens was worked out on a seven point scale where a rank of one was assigned to the most dominant crop and a rank of 7 was assigned to the least dominant. Only the first seven dominant crop components were considered for numerical dominance in each specialized homegarden. The results of the numerical dominance arrived in the study area was presented in Table-1.

**Comment [PS26]:** It should be the part of the methodology

**Table 1. Distribution of dominant crops based on numeric dominance**

Crops	Mean scale value	Rank
Coconut	1.89	1
Banana	1.94	2
Rubber	2.32	3
Tapioca	3.45	4
Vegetables	3.67	5
Yams and Colocassia	4.22	6
Arecanut	4.60	7

The Table 1 revealed that the maximum numeric dominance was observed for coconut (1.89) followed by banana (1.94), rubber (2.32), tapioca (3.45), vegetables (3.67), yams and colocassia (4.22) and arecanut (4.60) respectively in order of their mean scale values. Almost 20 crops were identified as dominant ones when rated in a 7 – point scale for numeric dominance of which only top 7 have been selected.

The results are in line with Meerabhai *et al.* (1991) [8], Thomas (2004) [3], and Jacob (2015) [9]. According to them, mostly coconut based farming is being followed in the state especially coastal and mid –land Kerala, where other dominant crops were more included as intercrops, thus reiterating the existing of horizontal diversification in specialized homegardens.

#### 3.2 Type and extent of horizontal diversification in -specialized homegardens

Horizontal diversification refers to the measure of cropping intensity and structure of homegardens. It was computed based on the number of levels of crop/specialized component observed in each of the specialized homegarden with special reference to numeric dominance.

**Comment [PS27]:** The definition should be part of the introduction. Moreover, the method of its estimation is already described in the methodology section.

In this study when the levels were worked out the horizontal diversification ranged from 1-7 levels. However the mean horizontal diversification value was 4.21. Hence results were categorized and distribution of specialized homegardens based on the extent of horizontal diversification under all AEUs in the study area is presented in Table 2.

**Table 2. Distribution of homegardens based on the extent of horizontal diversification**

	AEU-1		AEU-8		AEU -9		AEU-12		AEU-14		Total	
Category	n=12		n=12		n=12		n=12		n=12		N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
High(>4.21)	9	75	6	50	8	66.67	5	41.67	8	66.67	36	60
Low(<4.21)	3	25	6	50	4	33.33	7	58.33	4	33.33	24	40
<b>Mean – 4.21</b>												

The data furnished in the table 2 revealed that majority of specialized homegardens- (60%) do have more than 4 tiers of horizontal diversification whereas 40 percent have less than 4 tiers of diversification.

The overall analysis revealed that in all homegardens except AEU-12 (58.33 %) had more than 4 tiers of diversification. Also, 75 per cent of respondents in AEU-1 have more than 4 tiers of horizontal diversification and 58.33 per cent of AEU-12 were having less than 4 tiers of diversification. Hence it can be inferred that general majority of selected specialized homegardens in Thiruvananthapuram district have more than 4 tiers of horizontal diversification.

This can be attributed to the fact that all the respondents are interested in addition of more components to the existing crop production system. It can be due to the additional economic and social benefits. In Kerala homegardens have the unique nature of growing multiple crops such as trees, shrubs, bushes and with the incorporation of farming components utilizing the available area in homegardens. Similarly, the assured economic gain from the specialisations is another major factor resulting in increased number of specialisations. In some of the selected homegardens, horizontal diversification upto 6 levels were noticed. This was a clear indication that homegardens are transforming with more inclusions leading to horizontal diversification for making homegardens more remunerative. The results are in line with Krishnan (2013) [10].

### 3.3. Extent of vertical diversification of specializations in homegardens .

Vertical diversification reflects more on the economic entities in homegarden as a result of product diversification or value addition. The more level of vertical diversification could be due to the fact that more inclusion of specialisations like rubber, livestock is present where generally value addition is more compared to agricultural crops. In this study when the levels were worked out the vertical diversification ranged from 1-6 levels. However the mean vertical diversification value was 3.41. Results were categorized as “more than mean” and “less than mean.” The results describing levels of vertical diversification were presented in Table 3.

**Table 3. Distribution of respondents based on the levels of vertical diversification**

	AEU-1		AEU-8		AEU -9		AEU-12		AEU-14		Total	
Category	n=12		n=12		n=12		n=12		n=12		N=60	
	No	%	No	%	No	%	No	%	No	%	No	%
High (>3.41)	5	41.67	6	50	4	33.3	5	41.67	3	25	23	38.3

**Comment [PS28]:** How you calculate the tier?????. Specify what do you mean by tier....

Low  
(<3.41)      7      58.33      6      50      8      66.6      7      58.33      9      75      37      61.6

Mean-3.41

The AEU wise total distribution of vertical diversification shows that 61.6 per cent have less than 3 levels and 38.3 per cent have more than 3 levels of vertical diversification.

The result was found almost same in all agro-ecological units. Highest vertical diversification of fifty percent was found in the specialized homegardens of AEU-8. However, 75 per cent in AEU-14 was having less than 3 levels of vertical diversification. At the same time, in AEU-8, 50 per cent of the respondents were having less than and more than 3 levels of vertical diversification. This may be due to the fact that in AEU-8 more specialisations like livestock, rubber etc. was present abundantly than other dominant crop components.

More than sixty per cent of vertical diversification (61.6 %) revealed the need of scaling up of extension by competent authorities to enhance vertical diversification in the homegardens inclusive of specialisations. Thus more avenues and centralized facilities should be made available to the specialized homegardens for better value addition and product diversification. Profit linked value addition should be promoted in the specialized homegardens to make the system more remunerative.

Vertical diversification was computed based on the mean vertical diversification for each specialization. Distribution of specialisations based on the extent of vertical diversification is depicted in Table 4 as follows:

**Table 4. Distribution of specialisations based on the level of vertical diversification**

Specialized component	Levels	Mean vertical diversification	Total levels
Vegetables (8)	Raw / seedlings	1.5	2
Poultry(4)	Unit/egg/manure	2.25	2
Livestock –cow (3)	Milk/Unit/manure/Milk products	3.75	4
Animal Husbandry(6)	Egg products/Unit/manure	3.25	3
Goat(1)	Unit/milk/manure	3	3
Aquaculture/Farm tourism(7)	Unit/dried/fingerlings/ Processed	2.85	3
Banana (6)	Fruits/chips	1.50	2
Coconut (4)	Nuts/copra/oil	2.75	3
Tubers(2)	Raw	1	1
Fruit trees (2)	Fruits/seedlings	2	2
Rubber (3)	Sheet/sap/saplings	2.75	3
Poly house vegetables (4)	Raw/Seedlings	1.75	2
Mushroom (1)	Raw/Processed/Spawn	3	3

**Comment [PS29]:** How this is related to your finding ???

**Comment [PS30]:** No need of this. Already explained in the methodology section

**Comment [PS31]:** Also specify....what these values specify

Terrace garden (3)	Raw/seedlings	1.50	2
Orchids (1)	Seedlings/cut flowers	1	1
Ornamentals (4)	Unit/Seedlings/Flowers	2.25	2
Apiary (1)	Unit/ honey	2	2

The scale ranged from 1 to 3.75. It was evident from the Table 4 that mean vertical diversification was found to be highest for livestock-cow (3.75) and least was for tubers and orchids (1) each. However 3 levels of vertical diversification was noticed for rubber, animal husbandry, coconut, goat, mushroom and aquaculture.

This was due to the fact that incorporating more specialisations fetches additional economic benefits and reduces the risk factors. However considering specialized homegardening as a potential catchment sector, due framework and appropriate technology to enhance vertical diversification should be promoted thus making it remunerative and will hence attract more farmers especially youth to follow specialisations in homegardens.

#### 4. CONCLUSION

Thus, it can be inferred that majority of specialized homegardens (60%) do have more than 4 tiers of horizontal diversification whereas 40 percent have less than 4 tiers of diversification. Similarly, distribution of vertical diversification shows that 61.6 per cent have less than 3 levels and 38.3 per cent have more than 3 levels of vertical diversification. Mean vertical diversification was found to be highest for livestock-cow (3.75) and least was for tubers and orchids (1) each. However 3 levels of vertical diversification was noticed for rubber, animal husbandry, coconut, goat, mushroom and aquaculture. Homegardens are the sustainable production system. If the competent authorities pay attention to the individual specializations of the system and give adequate thrust to the value addition of those specializations, then definitely homegardens can turn out to be more a-remunerative farming system fetching supplementary benefits.

**Comment [PS32]:** Is this your finding. Not....this statement everyone knows.

#### REFERENCES

1. Kumar, M. B. 2006. Agroforestry: The New Old paradigm for Asian Food Security. *Journal of Tropical Agriculture*, 44(4): 1-14.
2. Beer, J., Muschler, R., Kass, D. Somarriba, E. 1998. Shade management in coffee and cacao plantations. *Agroforestry Systems* 38(6): 139-164.
3. Thomas, A. 2004. Technology assessment in the homegarden systems. *Ph.D. thesis* Kerala Agricultural University, Thrissur.
4. Tesfaye, A. 2005. Diversity in homegarden agroforestry systems of southern Ethiopia. Wageningen University, the Netherlands, Tropical Resource Management Paper No. 59: 143p
5. Zanstra, H. G. 1982. On farm research to improve production systems. Paper presented at the workshop on On-farm Experimentation for Farming Systems Research held at IITA, Ibadan, 31 May - 4 June. 233p
6. Aravind, N., Gandharappa, N. R., Ganeshamoorthy, S. and Ibrahim, S. 2004. Homestead agroforestry system. LEIS India. 21p
7. Thomas, A. 2016. Biodiversity Implications of Riparian Home-gardens: The Case of Chalakkudy River Based Agro-Ecosystem in Kerala. *Journal of Extension Education*, Vol.(28); 2456-1282
8. Meerabhai, M., Jayachandran, B.K; Salam, A.M and Kunjamma .P. Mathew, K. 1991. Cooking fuel productivity of coconut trees, *Indian Coconut Journal*. Vol.22(8):67p

9. Jacob, R. 2015. Technology assessment on the production practices of economically dominant crops in Thiruvananthapuram district. Kerala Agricultural University, Thrissur
10. Krishnan, R. 2013. Techno -Socio- economic characterization of specialised homegardens: A dominance diversity approach. M.Sc(Ag) thesis. Kerala Agricultural University, Thrissur

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