# LAND USE PATTERN IN KERALA

*Thesis submitted to The University Of Calicut*

*For The Award Of The Degree of*

**DOCTOR OF PHILOSOPHY IN ECONOMICS**

**Under the Faculty of Humanities**


**By**

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**November 2021**

# Certificate

I hereby certify that this is the revised version of the thesis entitled **" Land use pattern in Kerala"** submitted by Smt. SHIJITHA M under my guidance after incorporating the necessary corrections/ suggestions made by the adjudicators

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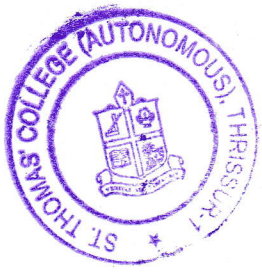

# Certificate

This is to certify that the Thesis entitled **" Land use pattern in Kerala"** being submitted by Smt SHIJITHA M, for the award of the degree of Doctor of Philosophy in Economics to the University of Calicut, is a record of bonafide research work carried out by her under our guidance and supervision at the Research and Post Graduate Department of Economics, St. Thomas' College(Autonomous), Thrissur. The contents of this Thesis, in full or in part, have not been submitted and will not be submitted to any other institute or University for the award of any degree or diploma. Plagiarism is checked and found within the permitted limits.

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# Declaration

I, Shijitha M, do hereby affirm that the written account entitled **"Land Use Pattern in Kerala"** is a bonafide record of research done by me under the Guidance of Dr.K.M.Francis, Associate Professor (Retd), and the Co-Guidance of Dr.Sabu P.J., Assistant Professor and Head of Department, Research and Post Graduate Department of Economics, St. Thomas College(Autonomous), Thrissur. I also declare that the Thesis has not been submitted by me earlier for the award of any degree, diploma, fellowship or any other similar title.

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# Acknowledgement

*I would like to express my immense gratitude to my Guide **Dr K.M.Francis**, Associate Professor(Retd), Research and Post Graduate Department of Economics, St.Thomas College(Autonomous), Thrissur. Throughout my research study, I have been fortunate enough in seeking and obtaining the persistent and enlightened guidance to enter into deeper core of my subject through my respected guide. I am indebted to him for his valuable guidance, encouragement, valuable criticism and devotion to my work.*

*I would like to place on record my sincere gratitude to my Co-Guide **Dr.Sabu P.J.** His valuable suggestions and support towards completion of the research work are praiseworthy.*

*I extent my sincere thanks to **Dr Joy K L**, Principal, St.Thomas College (Autonomous), Thrissur for all the help and support provided to me during my research period. I would also like to express my special thanks to **Dr Jenson P.O** and **Dr Ignatius Antony** former Principal for their great support and encouragement to complete the research work.*

*Just a few words of thanks will not be enough to express my gratitude to **Dr Joby Thomas Kakkassery**, Vice Principal and Research Co-ordinator, St.Thomas College(Autonomous), Thrissur for his constant encouragement, sustained interest and generous assistance at every stage of the work.*

*I express my special thanks to **Dr K.C Francis**, Former Head of Research Department of Economics, St.Thomas College(Autonomous), Thrissur for his constructive suggestions and support. I also extent my sincere thanks to the teachers of Research and Post Graduate Department of Economics, Thrissur for their constant support and assistance.*

*I also express my thankfulness to **Dr Sanjo,** Librarian, St.Thomas College(Autonomous), Thrissur for the help and support provided to me in my research activities. I also express my gratitude to librarians of Dr John Mathai Centre, Thrissur, Kerala Agricultural University, Mannuthy and Centre for Development studies, Thiruvanathapuram for their sincere help and support for the references related to the subject.*

*I would like to place on record my sincere thanks to the officials of Krishi Bhavan (Thrissur), Land Use Board (Thrissur), Directorate of Economics and Statistics (Thrissur), members of Padasekharasamitis of Venkitangu, Pazhayannur and the*

*respondents from Venkitangu, Pazhayannur, Agali, Kuzhalmannam and Kodassery who gave me valid information relating the land use in selected area. My heartfelt thanks to all those people who helped me in collecting information related to the study and primary data from the respondents.*

*I express my gratitude to my friend,* ***Dr T.D Simon****, Assistant Professor, Department of Economics, Sree Keralavarma College and* ***Dr Zabeena P****, Assistant Professor and Head of Department, Dr John Mathai Centre, Aranattukara, Thrissur who helped me in knowing the basic lessons of SPSS and application of statistical tools in the study.*

*I also express my gratitude to* ***Smt Anila C****, my collegue and intimate friend who made me courageous to face and overcome the hurdles in the research procedure. I also express my gratitude towards Dr Sindhu M, Dr Pradeep P, Dr Vidhya I V, Rajasekharan Sir, Dr Savithri Aruna Tr, Dhanya Shankar, Dhanya, Liji Dominic, Nisha, Sasi, Jeena, Sajesh, Balasubramanian and Prema for their constant support. I wish to acknowledge with thanks for the services rendered by Dinops for the neat execution of my computer work.*

*There are no words to express my heartfelt feelings of love and thanks to my Husband,* ***K.M Gopakumar*** *for his immense support and encouragement for successful completion of my work. I am also grateful to my son* ***Gautham K G*** *and my daughter* ***Gayathri K G*** *for bearing with me and for extending their co-operation, love and adjustments without which it would have been difficult for me to complete the research work.*

*I am thankful to my parents* ***Sri M. Prajnabhooshanan*** *and* ***Smt K Vijayakumari,*** *my brother* ***Jithesh M*** *and my sister* ***Shibitha M*** *for the support and inspiration they have given to complete the work. I am also thankful to my Father-in-law,* ***K Madhavan (Late)*** *who gave me inspiration and awareness about agriculture and cultivation procedures. I am also grateful to the aged people and relatives in Chelakkara who gave me direct information relating to cultivation procedures for crops cultivated in different seasons.*

*Above all, I am blessed with "My Lord", the Giver of all Wisdom and Power, who has sustained me and given me strength to carry out this work.*

*Any omissions in this brief acknowledgement doesnot mean lack of gratitude.*

*Place : Thrissur* ***SHIJITHA M***

*Date : November 2021*

# Abstract

Land refers to the total physical surface area and all the natural resources which are free gifts of nature as well as man-made resources which are the contributions of human beings. The natural resources includes soil, natural water reservoirs such as rivers and oceans, hills and mountains, heat of sun and climate, forests and all the resources which are gifted by nature. Land use pattern in Kerala is relevant as 53 percent of total Geographical area is utilised as Net Area Sown and is the main source of income for farmers through production of Food- Crops as well as Non- Food Crops. Provision of Food Crops is a direct way towards creation of food security in order to build up a strong and healthy younger generation. Land use with proper development plans for the future will be helpful for the proper utilisation of the land with preference to Sustainable Development which is important in Minimum Attainable Goals.

Division of the Total Geographical Area into three climatically distinct and parallel physiographic zones such as Lowlands, Midlands and Highlands is necessary to know about variations in the land use especially the Net Area Sown in Kerala. Net Area Sown has the highest Mean Value in all decades followed by Area under Forest and are the main components of Land Use in Kerala during the whole period of 1956-2017. The Net Area Sown under Food Crops and Non- Food Crops during the period 2005-2017 is reflected in two different ways - the area under Food crops is decreasing at an increasing rate, while that of Non- Food crops are decreasing at a decreasing rate which reflects the probability for the occurance of food shortage in the future time periods. Kerala is proving to be a model for other states due to existence of the crop diversification which reduces the risk and uncertainty in agricultural production and provides guidance to agriculturists to bravely face the possibility of occurrence of an agricultural crisis and be risk averters in agricultural sector.

The Compound Growth rate of Land Use Categories in different Periods is estimated by Loglin Semilog Model which help to identify the trend and pattern of Land Use in Kerala. The Herfindal- Hirschman's Index of Crop Diversification is applied to analyse the Crop Diversification and Magnitude of Crop Diversification in Kerala and Multiple Regression Analysis is used for interpreting the relationship between Net Area Sown and its determinants. Net Area Sown is also influenced by the lagged values of price, revenue and cost of the crops cultivated.

# CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# CHAPTER I
# DESIGN OF THE STUDY

## 1.1 Background of the Study

Land is the solid part of the celestial Earth on which all the living beings survive. It includes the physical surface area and all the natural resources which are free gifts of nature as well as man-made resources which are the contributions of human beings. The natural resources includes soil, natural water reservoirs such as rivers and oceans, hills and mountains, heat of sun and climate, forests and all the resources which are gifted by nature. The nature itself creates a natural cradle for human beings, but the beautiful cradle lasts forever with the full brightness when it is properly and honestly utilised in a truthful manner. Land, the survival platform for human beings is a distinguishable limited resource among the four factors of production which creates the base for every economic activity. According to Marshall, "By land is meant……not merely land in the strict sense of land, but whole of materials and forces which nature gives freely for man's aid in land, water, air, light and heat" (Marshall, 1890). It consists of a) upper surface of the soil, its fertility and forests and herb existing on b) Mountains, oceans, rivers, lakes, ponds and all animals and creatures living there on c) all minerals under the surface- iron, gold, coal etc d) Climate, air, sunshine, heat and light etc. L.M.Fraser defined land as "Land stands for all natural resources which yield an income or which have exchange value. It represents those natural resources which are useful and scarce, actually and potentially" (Fraser, 1937). Human beings use land and modify the land resources to meet their material, social and cultural needs often with detrimental impacts on the environment and human well being (Helen Briassoulis, 2000). The sustainable use of agricultural land is essential to economic growth, human well being, social equity and a well built ecosystem (Hamidov et.al). Land cover and land use changes are acknowledged to environmental factors including climate change in complex ways ( Dale 1997, Lepus et.al,2005). Decisions about land use have a significant impact on biodiversity, societal welfare, supply of agricultural commodities, ecosystem services and environment conditions (Classen and Tegene, 1999).

OECD distinguishes three types of agricultural area : land at the urban fringe, agricultural zone and extensive margin. The pressure of agricultural conversion is highest in the urban fringe and extensive margin while within the agricultural sector, the farmers follow conventional model of Von Thunen with high value(high transportation cost and Green House Framing) and low value agriculture with arable farming in rural areas. The

low value agriculture in rural areas is cultivated mainly by traditional farmers with an extensive experience in farming (OECD, 2009).

The area under foodgrains in India showed a negative growth along with increasing growth rate inproduction and productivity while in case of vegetables and fruits, the area, production and productivity showed an increasing trend with area effect higher than yield effect( Prisulla Laishram et.al, 2017).

Unparalleled agricultural land use changes in Kerala during the past fifty years is marked by an initial increase in total cropped area (26 percent between 1960 and 1969) followed by a drop in rice area by 60 percent between 1975 and 2003 supplemented by an increase in coconut, rubber, arecanut and banana between 1955 and 2000 ( Bimal Kumar, 2005). Drastic decline in area used for rice cultivation, conversion of area under rice cultivation to seasonal and perennial crops and also to non- agricultural uses in Kerala indicates changes created by population pressure, labour shortages (Monish Jose 2015, George P.S. et.al 2001), infrastructural development and neighbourhood changes. The primary reason for conversion is unprofitable nature of rice cultivation. (George P.S. et.al, 2001). Agricultural stagnation, large scale commercialization and instability reflected in agricultural sector of Kerala (Durga and Kumar, 2013). An increase of foodgrains productivity is reflected in past fifty years in National Level, while in Kerala, the area of food crops to total cropped area is showing a serious declining trend (Shakeel A, 2014).

A rational assessment of scientific utilisation of land is done only by studying the complexity in land use, by taking into account the local, physical and socio-economic conditions (Ali Mohammed, 1978). The study of Land Use is necessary to know about the optimum utilisation of land by making sure the maximum profit, attainment of food security through provision of food availability to all people, provision of raw materials to industries, through that attainment of rural development, economic growth and economic development.

Given such a collection of information in the existing literature, the present paper is an attempt to examine the land use pattern especially the agricultural land utilised by farmer households in the three physiological zones of Kerala. In view of wide variations in physical settings of land use, useful in-depth field studies are required to know about the physiological conditions and how the topographical conditions influence the land use pattern of Kerala.

Since land is the primary factor of production which creates a base for all the economic activities which contribute to the production process, the demand for land is too high and it will lead to intensive use of land itself. With the restricted supply of land, the human beings have to utilise it in the most possible manner to equalize it with the demand for it.

Land includes all the area which is suitable for the human beings to live their life by properly utilizing the natural resources and through it, leading to the sustainable development of the whole world. It is the basis of all life support systems and through the production of bio-mass can provide food, fodder, fuel, timber, that is, all the biotic and abiotic materials for human use. According to Cairncross, "All gifts of nature that yield income i.e. agricultural land, residential land, mines, fisheries etc are included in land". Land is defined as the total natural and cultural environment within which production takes place. It includes the flora and fauna i.e plant and animal kingdom on the earth and the factors governing the productivity of land. The factors governing the productivity above the earth surface include climate and rainfall while the factors below the earth surface include the properties of soil and underground water. Land has the prominent characteristics such as free gift of nature, fixed quantity which is a unique feature, inelasticity, permanent, original and indestructible nature, primary and passive factor of production, immovable, differences in fertility and has a number of uses. The most important characteristic is the externality of land use which states that the use of a parcel of land affects the use and value of land in the surroundings which requires government intervention.

The Food and Agricultural Organisation of the United Nations defines land as – " Land is an area of the earth's surface, the characteristics of which embrace all reasonably stable or predictable cyclic, attributes of the biosphere vertically, above and below this area including those of the atmosphere, the soil and undergoing geology, the hydrology, the plant and animal populations, the results of the past and present human activities, to the extent that these attributes exert a significant influence on present and future uses of the land by man(FAO, 1976)

Land is a distinct limited resource which holds all human needs and activities. It provides three- fourth of the food needed for the people, timber, natural sources, urban agglomerations, corridors for transportation, recreation facilities and the base for energy sources. The land that is not used by human beings is covered by natural eco-systems

which are helpful in controlling soil erosion, restricting pollutions, preserving quality and quantity of water. In precise, Land use refers to the expression of management of eco-systems in order to produce some of his needs (Karpagam M, 1999). The land can be used for a number of purposes which will be helpful for the survival of human beings and for economic development. The proper utilization of land is the basis of achieving food security by concentrating upon the agricultural sector, achieving industrial development by concentrating upon the building and other facilities needed for industries. And achieving the social as well as economic development through concentrating upon the components of tertiary sector. The land thus contributes indirectly to economic development by acting as a passive factor of production.

Land use refers to the process of how the human beings are utilizing the land for the betterment of their own living and for other human beings as well as other living beings. It involves the proper management and modification of natural or built-up environment such as settlements and semi- natural habitats such as arable fields, pastures and forests. It is the surface utilization of a vacant or developed land for a clear purpose at a given time. The economic value of a particular region is determined by the purpose for which the land is used. It can be used for agricultural, industrial, residential, business, forestry and other natural resources. The type of land use is determined by location, availability of water, type of soil, climate and proximity to other human activities. Land used for agricultural purposes creates an in-depth relation between man and environment. It contributes to attain the proper food security through which a healthy younger generation can be created and which will be helpful for economic development. Agriculture is the main source of income of the rural households and contributes to the rural income as well as savings which is further circulated in the economy, creates a circular flow of income and expenditure. The land used for agriculture is defined by the extent of gross cropped area which is cultivated in the region.

Kerala, with an area of 38862 square kilometers lies between $8^0 18^1$ and $12^0 48^1$ north latitude and $74^0 52^1$ and $77^0 22^1$ east longitude. It has an asymmetrical topography dominated by coastal plains to high mountain ranges as it is located in the Southwestern fringes of Western Ghats. Its altitude ranges from below mean sea level to 2694 metres above sea level. The particular asymmetrical topography creates locational, altitudinal and pedological changes in land, which further leads to changes in agro- ecological utilisation of land. The distinguishable topography is exhibited in classifying total geographical area

of Kerala into three physiological zones such as Lowlands, Midlands and Highlands. The three zones are classified on the basis of altitude, topography, soil and rainfall obtained and may exhibit regional differences in land utilisation which will be reflected in the agricultural land use, cropping pattern and even selection of crops. The regional differences in physiological zones will create a direct impact on the Net Area Sown and Gross Cropped Area.

Perfect knowledge about the peculiarities and utilisation of land especially agricultural land derived from the experience of the forefathers and farmers themselves may be helpful to the farmers in utilizing the land efficiently.

Kerala is an agricultural as well as a environment - sustainable economy since about 60 percent of Total Geographical Area is utilised as Net Area Sown, 30 percent as Forest area and only 10 percent is used for Non- Agricultural purposes. The Net Area Sown together with forest area contributes about 90 percent of the Total Geographical Area. It is an economy with more than half of population dependent upon agriculture and agriculture based economic activities. The physiographic features of Kerala influence the Land Use pattern by creating regional differences in Total Geographical Area. Since major share of Total Geographical Area is occupied by Agricultural Area, it is the most important land use category which is directly influenced by the regional differences.

### 1.2. Research Gap and Research Questions:

Agricultural land occupies about 60 percent of Total Geographical Area in Kerala. Tracing the trend in Land Use Pattern is necessary to know about how the limited land is utilised properly to create the proper food security to the existing population. Provision of food security is also dependent upon the proper utilisation of the Net Area Sown. The utilisation of Agricultural Area is also dependent upon the regional differences which arise from the topography, altitude, rainfall and soil of different horizons as well as on the interest vested in farmers in utilizing the land and protecting the hereditary property which are handed over to them by their forefathers. The difference in crop selection and number of crops cultivated is mainly dependent upon the topography and physiological features of the agricultural area. The variation in price structure of commodities over the periods is also an influencing factor in making variations in the utilisation of agricultural area. The relevance of physiological zones and land use pattern is not much considered by researchers and importance and distribution of Net Area Sown into different categories

based on size of the holding and the crop combinations used as risk adaptation strategies in physiological zones is not given much relevance in the research conducted in the land use pattern.The Land Use Pattern in Physiological Zones, especially the Net Area Sown for which the land is used mainly by majority of people in Kerala are varying within the area and between the area especially in the mode of cultivation and crops cultivated.

The effort of farmers in earning the income from their primary occupation – agriculture is more relevant now-a-days and whether they are earning a reasonable income is also a question to be discussed in recent days.

**Research questions**

1. What is the trend of Temporal and Spatial pattern of Land Use in Kerala?
2. What is the Spatial pattern of Total Agricultural Area which is classified as Utilised and Unutilised Agricultural Area in Kerala?
3. What is the areal proportion of food to non-food crops, the key indicator of food availability and food security in Kerala?
4. How the regional differences influence the Agricultural Area in Physiological Zones of Kerala?
5. How the socio- economic and socio- demographic factors influence the Total Area Owned by farmers in the Physiological Zones?
6. What are the main determinants of changes within the Net Area Sown in Physiological zones of Kerala?
7. What are the adaptation strategies applied by farmers in order to avoid the risk arising from agriculture?

**1.3. Significance of the study:**

India accounts for 2.4 percent of the total world surface and yet it sustains 16.9 per cent of the total population. Kerala comprises only 1.8 per cent of the total geographical area of our country, but 2.76% of the total Indian population. So the pressure of population on land is too high that it is reflected in the variations in the land use pattern. Throughout the years, there is the probability of wide variations in the land use pattern, especially in the distribution of land among the classifications of total land use pattern. Kerala, a state which is bordered by Arabian Sea, 49 rain- fed rivers, small streams, countless

backwaters, 34 lakes and with an annual rainfall of 118 inches is suitable for agricultural purposes along with abundant water supply. The natural irrigation is itself a blessing to the land used for agriculture in Kerala. Attaining the first rank in Human Development Index and 100 percent literacy, the attitude of the population towards agriculture is also relevant for the study.

On the basis of the specific features, the study relating to the trend of agricultural land use is significant and relevant now- a - days. The study is also important, since a relevant study is not conducted on the land use pattern of Kerala recently and diversifications of agricultural land use pattern is of importance now-a-days, especially in the era of urbanisation. Land use pattern in Kerala is relevant as 53 percent of total Geographical area is utilised as Net Area Sown and is the main source of income for farmers through production of Food- Crops as well as Non- Food Crops. Provision of Food Crops is a direct way towards creation of food security in order to build up a strong and healthy younger generation. Land use with proper development plans for the future will be helpful for the proper utilisation of the land with preference to Sustainable Development which is important in Minimum Attainable Goals and favouring a proper ecosystem.

### 1.4. Objectives of the study:

The study is based on certain objectives such as:

- To examine the trend of different land use categories in Kerala during the period from 1956- 2017.
- To discern the areal distribution of crops and crop diversification in the districts of Kerala.
- To interpret the influence of regional variations in Land Use Pattern on Cropping Pattern in selected area in Physiological Zones.
- To analyse the relationship between Size of Agricultural Land Holdings and its determinants in selected area in physiological zones.
- To perceive the Cost and Revenue arising from cultivation of different crops in the selected panchayats in different phases.

### 1.5. Hypothesis of the study:

Hypotheses on which the study proceeds and statistically proven is represented as there exists a significant relationship between current as well as lagged causal variables and Net Area Sown.

### 1.6. Methodology of the study:

Methodology of the study concentrates on Data sources and methods to analyse the relationship between variables which help to make a significant relevance of the variables in the study.

#### 1.6.1. Sources of Data

The study focuses on the Land use pattern in Kerala over the years from 1991 to 2017. The data for the study is to be collected from primary as well as the secondary data sources.

**Secondary Data Source:**

The Secondary Data pertaining to various aspects under study were collected from

- Department of Agriculture and Statistics, Government of Kerala.
- Land Use Board, Government of Kerala.
- Land Use Survey Reports,NSSO.
- Farm Information Bureau, Thiruvananthapuram.
- Department of Town and Country Planning, Government of Kerala.
- Agricultural statistics, Government of Kerala.
- Forest Departments, Government of Kerala.
- Economic Surveys, Government of India.
- Kerala Economic Review, Government of Kerala.
- Journals, Magazines.

**Primary Data Source**

The primary data is collected by conducting interviews with the help of structured questionnaires from 300 sample farmers from five panchayats which were leading in the agricultural area in three physiological zones - two panchayats representing Midlands and Highlands from Palakkad District and three panchayats representing Lowland, Midlands

and Highlands from Thrissur District. Palakkad district occupies the unique feature as a leading producer in variety of crops- Cereals, Pulses and Millets- in Kerala while Thrissur district is familiar for Wetland – Winter (Mundakan) and Summer (Puncha) cultivation. 60 sample households each from Kuzhalmannam belonging to Midlands and Agali belonging to Highlands in Palakkad, Venkitangu, - a Lowland, Pazhayannoor- Midland and Kodassery – Highland from Thrissur District as per the Physiological Climatic Topography is taken into consideration in order to acquire the maximum available information. The crop combinations as well as cropping pattern of the selected panchayats is also considered to know about the risk adaptation strategies adopted by farmers.

### 1.6.2. Sampling Procedure:

In the study, a Multi- Stage Random Sampling method was employed to select the farmer households. In the first stage, Thrissur and Palakkad Districts of Kerala were selected using Purposive Sampling since the districts involve Physiological Zones with diverse economic conditions. Palakkad is the district which occupies first position in Net Area Sown and Thrissur is the district which occupies ninth position in Net Area Sown with I position in Summer and II position in Winter Paddy cultivation especially in wetlands. In the second stage, sampling method is applied by selecting five Panchayats which occupy the largest Net Area Sown in three Physiological Zones. Using the simple random sampling method, 60 farmers each from every panchayat were selected as per the information collected from the particular Panchayat Offices and 300 farmers were interviewed with the help of a structured questionnaire. The sampling procedure in which the samples are collected is given in Table 1.1.

**Table 1.1.**
**Sampling Procedure**

| Sl.No | Districts | Physio- Zone | Blocks | Panchayats | No: of respondents |
|---|---|---|---|---|---|
| 1 | Palakkad | Midland | Kuzhal23mannam | Kuzhalmannam | 60 |
| 2 | | Highland | Attappadi | Agali | 60 |
| 3 | Thrissur | Lowland | Mullassery | Venkitangu | 60 |
| 4 | | Midland | Pazhayannur | Pazhayannur | 60 |
| 5 | | Highland | Irinjalakuda | Kodassery | 60 |

### 1.6.3. Methods for analysis and interpretation

Statistical Methods used for the study provides statistical evidence to the theoretical aspects and relations and the important statistical methods applied in correspondence to the objectives is provided in detail in further explanations.

**1. To analyse the growth rate in Land Use Categories in different time periods**

The Compound Growth rate of Land Use Categories in Period I – 1956-1965, Period II– 1966-1975, Period III-1976-1985, Period IV-1986-1995, Period V-1996-2005 and Period VI -2006-2015 is estimated by LoglinSemilogModel (Gujarati, 1995) which help to identify the trend and pattern of Land Use in Kerala. LoglinSemilog model is a model in which only one variable, the regressand appears in logarithmic form.

$$\text{In } Y_t = \beta_1 + \beta_2 t + u_t$$

$\beta_2$, the slope coefficient measures the constant proportional or relative change in Land Use for a given absolute change in the value of the regressor, time (t). Rate of growth is attained when $\beta_2 > 0$ and when $\beta_2 < 0$, rate of decay or negative growth rate is attained. The trend and pattern of Net Area Sown in Kerala is also analysed with the help of regression and linear trend line.

**2. To analyse the magnitude of Crop Diversification in Districts of Kerala**

The Herfindal- Hirschman's Index of Crop Diversification is applied to analyse the Crop Diversification and Magnitude of Crop Diversification in Kerala. It is calculated by the formula

$$\text{Herfindal Index} = \text{H.I} = \sum_{i=1}^{n} Pi^2 \text{ where Pi} = \frac{Ai}{A}$$

where Ai refers to Net Area Sown in the ith crop and A refers to the Total Net Area Sown

$$\text{Index of Crop Diversification (ICD)} = 1 - \sum_{i=1}^{n} Pi^2 = 1 - \text{H.I}$$

Herfindal Index is an index for crop specialization which ranges from zero to one where onerepresents complete specialization and zero represents perfect diversification (Gupta and Tewari, 1985). An Index of Crop Diversification which is obtained from Herfindal Index also ranges from zero to one where one represents complete diversification and zero represents complete specialization. The Magnitude of Diversification be diversified as

1. Magnitude of High Diversification – 0.80 – 1.00
2. Magnitude of Moderate Diversification – 0.60 – 0.80
3. Magnitude of Low Diversification – < 0.60

**3. To interpret significant relationship between perception of farmers in further investment in land for agriculture and land owned:**

Hypothesis is tested using a Chi-Square test statistic for independence of variables and the attributes used for explaining the dependency are interest for further investment in land, creation of interest by parents in agriculture and interest for investment in agriculture. For the given level of significance α, the sample value of $\chi^2$ is compared with the critical value for the degree of freedom (c – 1) to make a decision.

**4. To interpret the relationship betweenType of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP), Agricultural Income (AI) and Net Area Sown (NAS) by farmers.**

Hypothesis is tested using Multiple Regression analysis explaining the relationship between one dependent variable and more than one independent variable.

$$NAS_i = \alpha + \beta_1 TF + \beta_2 SAL + \beta_3 HP + \beta_4 AI$$

Where$NAS_i$ represents Net Area Sown by i individuals, i=1,2,3,4,……,n, α represents the intercept term, $\beta_1$, $\beta_2$, $\beta_3$ and$\beta_4$ represents the slope coefficients corresponding to the Causal variables such asType of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP)and Agricultural Income (AI) respectively. The Hypothesis may be rejected or accepted depending upon whether the value of the test statistic falls in the rejection region or in the acceptance region.

**5. To identify the variations in Net Area Sown and its determinants such as Price, Yield, Cost and Revenue of crops cultivated.**

Hypothesis is interpreted with the help of Simple Growth rate which is relevant to know about the association between current Net Area Sown and lagged variables influencing Net Area Sown.

**1.7.Chapterisation of the study**:

The present study is categorized into five chapters on the basis of the contents included related to the Hypothesis of the particular study.

- Chapter I -Introductory Chapter which includes Background of the study, Research Gap and Research Questions, Significance, Objectives, Hypothesis, Methodology, Chapterisation and Limitations of the study.
- Chapter II includes Theoretical Background of the study and Review of Literature which is prepared through references from the articles, Working Papers and Books written by eminent personalities.
- Chapter III includes the Temporal and Spatial Pattern of Land use in India and Kerala on the basis of Secondary data Analysis.
- Chapter IV gives importance to the profile of study area related to topography as well as socio- demographic and socio-economic indicators of the respondents from the selected area.
- Chapter V concentrates upon the Land Use Pattern, Ownership and Cropping Pattern, to analyse the significant relationship between the Net Area Sown and its determinants, regional variations in utilisation of land for the agricultural purposes in physiological zones and also to identify the risk adaptation strategies adopted by traditional farmers in each physiological zone.
- Chapter VI focuses on Dynamics of Net Area Sown and the determinants influencing the variations in Net Area Sown in different phases.
- Chapter VII elucidates the Findings, Suggestions and Conclusion of the study.

**1.8.Limitations**:

The time constraint creates the problem of coverage of the particular study and some concepts which are related to the particular topic directly or indirectly may be considered as given or constant in order to focus on the objectives the study has taken. Since sample is a true representation of the whole population, larger the size of sample, more it approaches the population. But the size of sample in the study, though larger is more or less a true representation of the population. Some questions in the structured questionnaire are not answered by the people due to their busy schedule though it is answered by majority of the sample population. But besides these constraints, the study is very much interesting and informative by opening an access into the traditional methods of cultivation and adoption of the methods which are suitable to the regional differences.

# CHAPTER II
# THEORETICAL FOUNDATION
# AND
# REVIEW OF LITERATURE

## 2.1. Introduction

Theories related to Land Use creates a base upon which the particular study can proceed and gives an idea about the thoughts of traditional and modern economists. It provides valid information about the past as well as present circumstances upon which the theory is built.

## 2.2.Theoretical Foundation

The theories related to the land use will help to identify how the land is utilized in the most appropriate way, how rent arises, the determinants of rent for land and all the issues related to land use. The theories create a specific base for the study as it provides an accurate information about the ideas of prominent economists who focused their studies on land which concentrated mainly on the quality of land and the effort taken by man on it in order to make it more and more productive.

### 2.2.1. Theories Related to Land Use:

The organisation of farms varies because of differences in physical, economic and cultural factors though they have something in common as well (Mellor, J.W, 1966). The two prominent factor inputs for agricultural production are land and labour and the farmers have an inclination to increase the size of their farm because they can add to their income more than what they will get by applying more labour to the existing farm and the productivity of labour increases.

Rent not only varies with its fertility, whatever its produce, but with its situation, whatever be its fertility and it is a residually determined distributive share in terms of most common agricultural produce of the country and levels of rent vary with intensities of Land Use and that both rent and land use varied with distance. (Adam Smith, 1776).

Rent is “that portion of the produce of the earth which is paid to the Landlord for the use of the original or indestructible powers of the soil”. The definition clarifies that land possesses original permanent powers which are related to the natural ecosystem with a protection of environment. Rent arises from the extensive, intensive cultivation as well as the regionalisation of the existing land. Each increase in population results in increasing demand for land and necessitates cultivation of progressively inferior quality lands (Ricardo, 1817).

### 2.2.2. Schultz' Theory of Traditional Agriculture:

Traditional agriculture occurs if and only if, the state of art of cultivation remains constant and where the farmers use the same factors of production and same procedure of production that their forefathers were doing. Considering the new factors as well as extended factors as constant or given, the farmers, by their experience, can expect an unchanging pattern of net returns which will encourage production and can attain equilibrium where cost of each factor is equal to marginal returns from each factor. If the art of cultivation and motives and preferences to hold the productive assets remain static, then the disequilibrium, if occurred is only temporary. Any permanent deviation towards disequilibrium cannot make agriculture traditional. If equilibrium is disturbed due to price changes, cost reductions, making changes in the costs or the marginal returns, the particular temporary disequilibrium can be restored after sometime at some other level. With the static art of agriculture, there exists neither misallocation of resources nor the existence of unused resources, especially in agriculture. Since they are utilizing the resources in the proper manner without any misallocation, the farmers can earn their maximum income, but may be a lower or equivalent income when compared with other agriculture progressing countries. The particular concept is called as "Efficient but Poor Hypothesis" by Schultz(Schultz, 1964).

### 2.2.3. Regional Differences and Impact of Population on Land

The model of agricultural land use zones arranged concentrically around a central city on the basis of certain assumptions such as the existence of Isolated State, which is dominated by a single city which provides the sole market for agricultural commodities, an established system of exchange of agricultural for industrial commodities between rural and urban dwellers, location on an isotropic plain, farmers transport their own goods to market on a dense system of routes which converge on the central city (Von Thunen, 1826). Farmers act so as to maximize profit, automatically adjusting output to fluctuations in market demand which is perfectly competitive. The key concept of land use is economic rent and the basis of marginal productivity theory was explained mathematically by giving rent as$R = Y ( P – C ) – Y . F. m$ ;R represents Land rent, Y – Yield per unit of land , C- production expenses per unit of commodity, P- Market price per unit of commodity, F – Frieght rate ( per agricultural unit, per mile), m – Distance to market.

Society is constantly facing a potential land crisis which arises out of the ability and propensity of the human species to reproduce itself rapidly, and to grow at a geometric rate, while the output of agricultural products can only increase at best, arithmetically (Malthus, 1798). The Malthusian Catastrophe is also relevant as it is a prediction that growing population will soon outspace the planet's production capacity of food.

The area of land which is suitable for cultivation will soon be inadequate to feed the increasing population and if the productivity of land (i.e. intensive cultivation) is doubled, the food crisis could be postponed to 15 years further and if it is quadrupled, the food crisis could be postponed to 20 years further. Thus the crisis can be delayed with the application of High Yielding variety of seeds, chemical fertilisers and pesticides. But population will increase swiftly by exhausting the earth's resources and Malthusian checks will come into operation(Club of Rome,1972).

## 2.3.Review of Literature

The viewpoints of economist and researchers are categorised on the basis of the themes under which the research study proceeds. The categorisation of literature review is based on the topic of research and the particular objectives on which the study concentrates. Review of Literature is categorized into three as

- Land Use Pattern in Kerala
- Land use and its determinants
- Land Use Dynamics
- Role of Farmers in Agriculture

### 2.3.1. Land Use Pattern in Kerala

The thoughts of Economists on Land Use is vast and elaborate as the Land is fixed in nature and number of uses for which land is used is more. People demand more and more of the commodity if it is scarce in availability( Alfred Marshall, 1890). Since supply is fixed, higher demand arises and the demand will directly influence price of the commodity. Land has the specific features such as scarcity, high demand, different qualities and so the price of land is also varying due to the factors influencing it. The thoughts and research of economists on Land Use especially the agricultural land use will help to identify the ways and means of utilizing the agricultural land by traditional farmers

and how the farmers at that time cultivated their own land by creating sufficient foodgrains for the existing generation. So the self-sufficiency in food grains production through proper land utilisation without an agricultural crisis is an important objective behind the research activities of the famous economists who studied about the agricultural land use pattern. Not only the food production but also the Non- food production is relevant as substitution is taking place between low valued food crops and high valued non-food crops. Land Utilisation by farmers is dependent upon a number of factors such as Price of the commodity, price of related commodities, income of the farmer, topography of land and irrigation facilities.

Priya et.al (2018) opined that changing land use pattern in Kerala resulted in an increase of area under cultivable waste and a reduction in Net Area Sown as farmers are losing their interest in existing cropping pattern and significant changes occurred in diversification and topographically since coconut and rice can be grown in same condition, the substitutability of coconut for rice is taking place in lowlands.

Deepak Johnson (2018) states that the initial years (1956-75) after formation of Kerala, saw an increase in Net Area Sown and area sown more than once, a reduction in fallow lands and an expansion in cultivation but later it slightly declined as a substitution is taking place from low value crops to high value crops and Kerala attained the first position as the state with the highest per hectare crop income in the country.

Fox A Thomas et.al (2017) analyses that Kerala has a bio- diversity hotspot with a high population density and a long history of complex agricultural land use patterns. The changing land use pattern is mainly due to declining profitability of agriculture in Kerala, labour shortages, unreliable weather, unfamiliar pests and diseases and the Government policies. Agriculture in Kerala is showing a declining trend, other land covers being cleared for roads and new buildings, less diverse agro- forests into paddy wetlands and a reported decrease in the cultivation of 80 percent of Kerala's primary crop species during 2003-2013.

Karunakaran (2013) analyses the trend in growth rates over the period 1960-61 to 2009-10 and the decadal growth rates of area, production and productivity of principal crops of Kerala. A heavy concentration of non – food crops reflects a changing cropping pattern in the agricultural scenario. The predominance of crops which are dependent on world

market conditions and the dominance of perennial crops against annual or seasonal crops are the two main driving forces of changing cropping pattern.

Ahuja, Astha (2006) reveals that agriculture is a state subject according to the entry 14 in List II(State List)of the Seventh Schedule to the Constitution and public investment in agriculture takes place at the level of states and the central government supports the states as catalysts. The Land ownership is a main determinant of Land Use Pattern in Kerala. Before independence, the Zamindari system introduced by Lord Cornwallis exploited the cultivators and land owners lived a luxurious life which led to negative growth in productivity during the British Period.

Kumar B.M. (2005) reveals that agricultural land use changes in Kerala during the past half century were marked by initial increase in total cropped area (26 per cent between 1960 and 1969) followed by dramatic shifts in the coverage of individual crops. Area under Rice production dropped by 6 per cent between 1975 and 2003, while cultivation of coconut, rubber, arecanut and banana plantains increased spectacularly (106, 627, 41 and 96 per cent respectively) between 1955 and 2000. Agricultural expansion coupled with over exploitation of forests has affected the state's forest eco- systems and the primary forests dropped substantially between 1940 and 1970- the average loss of publicly managed forests being 5000 hectares per year.

OmanaCheriyan (2004) opined that area put to non- agricultural purposes increased due to population pressures, area under forest dwindled due to plantation and expansion and rise in cost of cultivation of traditional crops. More land left fallow and used for less labour absorbing crops and overall effect of reduction in wetlands was the reduction of area under paddy.

George et.al (2001) reveals that the location and altitudinal variations in Kerala is endowed with specific and exclusive agro- ecological conditions which distinguishes the state into three distinct elevation zones – lowland, midland and highland regions in which lowland is well known for rice and cococnut cultivation, midland with seasonal, annual and perennial crops and highland with perennial crops.

Sivanandanet.al (1985) investigates the human intervention in the evergreen forests in the high ranges of Kerala, particularly in the Cardomom Hill Reserves. 87% of the region

(Idukki) was covered by forests in 1905, by 1965, the proportion came down to 65% and it again declined to 33.4% by 1973. The large-scale conversion of forest land has affected the micro environment for the agriculture.

Giri (1966) reveals the identification of the variability in land use categories is helpful to create policy measures which will help to recorrect the imbalances and to stimulate changes to the directions which will be effective for the economy. The intense demand for land created a hindrance in the development of land for agricultural purposes and also the extension of land used, towards the forest through direct encroachments. The large increase in net sown area is contributed from utilisation of old fallows and cultivable waste lands which is a direct benefit to the agricultural income of the economy.

### 2.3.2. Land Use and its Determinants

Anjana et.al (2018) reveals that the share of agricultural income to the state income has been declining and the growth rate in current prices was obviously high due to the price factors and its inflationary trends. The districts in Kerala showed positive growth in agricultural income at current prices but recorded a negative growth at constant prices.

Mugula et.al (2018) depicts that the Adopters of Sustainable Agricultural Practices are found to be better off in terms of profit and yield compared to partial / non – adopters suggesting that the farmers should adopt all the principles of SAPs along with the conventional use of fertilisers and inputs if they are to reap all the benefits to their farms regarding output and price. To make it more profitable, Government should intervene in areas of production such as infrastructures, inputs and extension services to make them accessible to smallholder farmers at affordable price.

Adifya et.al (2018) states that land used for agricultural purposes have to be utilised properly and for that the dubbling technique is introduced currently in Karnataka which represents the sowing of seeds of semi- determinant variety with wider spacing, followed by ripping after 40 to 50 days. The correlation of the dependent variable with the independent variables – yield and farm income is analysed with econometric models and the disembodied techniques are low cost techniques in production.

Udemezue et.al (2018) annotates that The Frontier Model, Conservation Model,Urban Industrial Impact Model, Diffusion Model and High Pay-off Input Model is used to

explain the land use intensification, crops and livestock husbandry,labour intensive cropping system, the production and use of organic manures and labour intensive capital formation,geographic variations, empirical observation of substantial differences in land and labour productivity among farmers and regions and application of modern, high pay off inputs.

Priscilla et.al (2017) compiles that with a surplus production in food availability especially in foodgrains, milk, vegetables and fruits, raises the question of why still there exists poverty and hungry though there existed increasing trend in area, production and productivity in India. The yield effect was higher than area effect in case of foodgrains due to increased use of high yielding varieties, but, in case of vegetables and fruits, the yield effect is higher than area effect.

Misra K Ashok et.al(2016) investigates the factors which will affect an individual's decision to enter farming after and / or while participating in an off-farm employment activity. The farmers in older generation find successors to take over their agricultural operations and it's a long standing traditional practice. The operator's age and educational attainment were significant factors in the decision whether they have to work off-farm prior to enter into farming. But the households including an elder member were more likely to enter farming rather than off- farming work to increase the household income.

Rahman, Sanzidur(2016) revealed that increase in rainfall increased the agricultural land use diversity (ALUD). The equivalent wealth or income from the expected utility is composed of net farm earnings from crop production and initial wealth that is exogenous to the crop choices such as farm capital assets and livestock resources carried over from the earlier periods.

Laxmi et.al(2015) revealed that the main determinants of Land use are land availability, type of land and soil type. In case of agriculture, regional specific cropping patterns are followed by farmers. Agricultural land in Dharwad District is declining due to more exhaustive cultivation of land by using excessive chemical fertilizers. To meet food security, forest land has been converted to agricultural land but the exploitation of forest land is dangerous and Farmers should use organic components in agriculture and can bring back their own land to its original status. Cropping intensity, can be increased by growing two or more crops in the particular area.

Brynngelsson et.al (2014) introduced a Conceptual Partial Equilibrium Model of Global Agricultural Land Use based on Heterogeneous Land Quality and Maximisation of land rent at each parcel through choice of crop and input intensity. Two types of costs – cost per unit area of land used (area dependent cost) which is considered as constant and Cost per unit produced of crop (Harvest Dependent Cost) which is a determinant of Profit Maximisation is considered for the analysis. The paper concludes that the crop with the highest area dependent cost is placed as the most productive land.

Shuhaibu et.al (2014) reveals that the land use pattern is also dependent upon the strategies adopted by farmer households such as adjustment in crop varieties, use of resistant crop varieties, diversification of crops, mixed cropping, off-farm activities to cop up with the climate as well as price induced shocks.

Mohammed et.al(2014) reveals the relationship between land use, land price and land value and the variables which affect them are geographical, environmental, social, urban, demographic and political variables. The variables which are affecting the land use may be soil and subsoil condition, groundwater level, freedom from surface floods, freedom from topographic accident hazards, flat land and neighbouring land use.

Chakir Raja (2013) analyses how the introduction of special effects and individual heterogeneity in an aggregated land use share model affects the predictive accuracy of land use models. The net return to each land use and the distribution of land quality were used as explanatory variables in literature based on land use theory. A land quality index acts as a measure of average quality of land while Density of population is considered as another proxy for urban land use.

Kumar Parveen et.al (2013) analyses the strengths- the largest cultivable land with record foodgrains production, weaknesses with low yields, less value addition and food processing and large amount of post-harvest losses. The opportunities can be strengthened further to augment yield and income of the farming community. The rain-fed agriculture, diversification, organic farming, food processing sectors, agri-clinics and agri-business schemes are the choices which can provide further opportunities for the development of agriculture.

Leonard (2013) reveals that the supply of natural resource is scarce in relation to the demand for them and they can be put to several uses. As the time goes on, the area under forest becomes small and shrinks due to large- scale encroachment on land. Large tracts of forest lands are converted into arable land with a view to feed the multitude of population. The supply of natural resources is small and scanty and their quantum starts shrinking, swiftly or slowly.

Narayanamoorthy(2013) reveals that the survival of farmers and further investment in agriculture is the result of the returns which farmers avail from the crop cultivation. The farmers cannot repay their debts if the flow of income from agriculture is irregular and inadequate. The use of spurious inputs which include seeds, fertilizers and pesticide in cultivation, existence of middlemen, inadequate irrigation facilities and lack of institutional credit are some of the major reasons for the crop failure which leads to agrarian crisis in India.

Pratap Singh Amarandraet.al (2013) investigates on Environmental Kuznets Curve(EKC Hypothesis) to state that the technical intervention in agriculture combined with overall economic development should eventually help to spare land from agriculture. The land allocation remains biased in favour of agriculture at lower levels of Per Capita Income, while the allocation of land towards agriculture decreases with increase in Per Capita Income. The study analysed a 'N'shape relationship between agricultural expansion and Net State Domestic Product(NSDP). The technology remained responsible for inducing farmers to bring additional land under agriculture instead of sparing land from agriculture.

Liu Y L et.al (2012) studies the index system of land parcel generalization which is crucial in land use data generalization. Macro indices for land use data generalization include map load, area proportion of different land use types and semantic characteristics. Micro thresholds include minimum parcel area, minimum distance between parcels and minimum bend diameter. Higher land use fragmentation increases the land use area proportion change in generalization and map load at the same scale.

Feichtinger et.al(2011) interprets that the variables which are used to explain the land values are classified as Agricultural Returns- Monetary Variables,Non-Monetary Variables, Government payments, Variables describing the market, Macro economic factors and the Pressure indicators.

Jelili. Olaide Saka (2011) examines the structure of land use intensification in food crop production in Southern Nigeria towards determining its drivers and its relationship with the intensification. Land use intensity will result in continuous depletion of soil fertility, decline in productivity, loss of soil structure, soil erosion and land degradation.

RobertzBednarz (2011) reveals that decision makers always choose to do what is best for them economically. If there exists a number of alternatives, the farmers will be choosing the optimum strategy which will be economically best for them or which provides the best economic return. The farmer's net returns is the difference between the price at which he sells in the market and the costs which they incur to grow the harvest and gets the crops to the market. Economic geographers called the concept as location rent.

ThirapongSantipop (2011) revealed that agricultural land use patterns are affected by farm household characteristics and exogenous factors such as economic, demographic and physical characteristics and the farmer households are shifting from traditional crops to cash crops due to changed in farmer livelihood strategies. Agricultural land use strategies are influenced by distance towards the markets, soil structure, off – farm income possibilities, irrigation facilities and price of the cultivated crops as well as crop substitutes.

Prakasan(2010) provides the theoretical explanation of how Land Use and Land Cover(LULC) is main determinant for changes in Global Environment. Land Use refers to uses which are carried oven on Land and Land Cover refers to Natural Vegetation, rock, soil and artificial cover. Due to extension of human activities, land used for forest as well as cultivation is decreasing and that of built up area is increasing in Kodaikanal. Any process of transformation in agriculture is not due to temperature , but due to heavy dependency on Tourism and reveals the three different transformations: from land used for cultivation of food crops to cash crops and spices, from agriculture to built up land and from forest to agricultural land.

Zhiu, Zhanqianget.al (2010) concentrates upon the Land Use Change Models which interprets the land use changes and the main driving forces for land use change. The logistic regression is designed to estimate the parameters of a multi-variate explanatory model in situations where dependent variable is dichotomous and independent variables are continuous or categorical.

Huang Wenti et.al (2008) analysed land use/ land cover change by remote sensing using multi- temporal images and explains that the population pressure on land would further grow and the farm land areas, open grounds and regions around the highways are likely to become prime targets for urban expansion and the reduction in area used for agriculture.

Liu Yansui et al (2008) states that the arable land has been continuously decreasing with a loss and average decrement per year, land for construction increased, total area of encroachment on arable land for construction created arable land loss by using land for industrial, transportation, rural construction, town construction and influence of Nation's macroscopic land use policies on the fluctuation of the increase of construction land and encroachment on arable land.

Pender John et.al (2008) investigates the land management practices in Highlands of Tigray and identified the factors which have influence on land as population pressure, small landholdings, access to roads, irrigation and extension and credit programmes. Improvements can be made by low external-input investments and practices such as stone terraces, reduced tillage and reduced burnings and these profitable opportunities can increase agricultural production and sustainable land management.

Oyekala(2007) interprets that the Error Correction Model The parameters of the constant term, growth rate of permanent cropland, index of agricultural production, livestock population, human populationwere used as the factors influencing agricultural land expansion in Nigeria.

Hanumantha Rao, C (2004) reveals that the fuller exploitation of water resources, both surface and ground water will bring half the cultivated area of India under irrigation. The Land Reforms which is a major landmark of economic development after independence helped the cultivators to utilise the resources in the proper manner by the feeling of their own land.

Eun So et.al (2002) investigates the relationship between the areas of land in alternative uses and economic and demographic factors influencing land use decisions using econometric land use models. Determinants of land use included in the model are net returns from different uses, land quality and demographic variables such as population density.

Hess, Paul Mitchell et.al (2001) reveals that density and land use are two dominant factors determining land use in transportation research. The measures developed by landscape ecologists to model patterns of land cover provide detailed and spatially explicit ways of measuring land use mix. The use of these techniques requires the researchers to be clear about the resolution of data, the scale of analysis and the extent of area across which analyses are conducted. The paper also discussed how common measures of density and land use mix suffer substantial distortions.

Adesina et.al (2000) interprets that Alley farming was adopted and supported by people as an alternative to slash- burn agriculture which will destroy the soil carbon organic matter. Adoption of the method is lower in areas with high population pressure as farmers have high labour productivity and labour intensive techniques are applied more than capital intensive techniques. The economic, social, institutional, household and village characteristics were used as variables which determine the adoption of alley farming.

Helen Briassoulis (2000), examines that the bio-physical factors which influence the land use are climate and weather, topography, bedrock and soil type, surface water hydrology and groundwater, site specific conditions such as accessibility, landasque capital, regional land use structure as well as by transportation cost, profits, parcel size, competition, costs of production, product prices, public and private financial support, land management practices, land tenure and ownership, societal factors relating to population structure and dynamics, income and affluence, technology, socio- economic organizations, culture, institutions and political system, demand for land, land use patterns and land use change. Considering the demographic traits like age, the old male heads of households exhibit a greater inertia to change, in general than the youngers and single female households have different outlooks and life expectations than the married.

Bishop et.al (1958) examines the alternative uses of resources which will be owned by each owner. He will be deciding which crop he have to cultivate, how he can apply the inputs for the production process in his farm, how much he have to produce, the time of buying and selling and finally, finding a market for buying and selling the product. The producers must produce the commodities which are wanted by the customers. They choose the products on the basis of the expected returns from the products.

Many economists focused on key drivers for conversion of land from agricultural to non- agricultural use as age, gender, education, farm assets, distance to town, tenure system soil fertility(Muluke 2018), (Chandan Kumar et.al, 2012), (Roder, Norbert et.al, 2009), (Helen Briassoulis, 2000), income per month and household size(Mohsin Muhammed et al,2017), (KassaGutahun, 2015),( Lubovski, Ruben N et.al,2006), labour force and climate/ rainfall (MurayaWenjiru et.al, 2017), volatility in agricultural output prices(Boere Esther, 2015), slope and elevation(Jeuck et.al,2014) and profitability analysis by fixed, variable costs and returns over expenses(Deepak Shah, 2017).

### 2.3.3. Land Use Dynamics

The changes occurring in the land use may be due to reasons which will have direct or indirectimpact on the land use as well as the returns from land use for the farmers. The literature review related to land use dynamics provides the information from studies conducted previously on how the changes are occurring on the land use especially the agricultural land use.

Ustaoglu (2017) examines the key drivers of land use change as economic factors in which land rent, the main determinant is determined by the distance from city centre, bio-physical factors which is determined by local climate and weather conditions which is further measured by temperature, rainfall, wind, moisture, topological conditions such as slope and aspect, drainage conditions, soil type, bedrock type and water resources, demographic and social factors which is measured by size of the family, age and education , urbanization, technological factors and spatial policies. The combinations of different drivers are significant with estimated coefficients across different regions in Europe and the regression results for Eastern Europe highlight the strong influence of location based characteristics and climatic factors.

Rahman ( 2016) examines the determinants of land use diversity or area associated to different crops in which wealth or income is composed of net farm earnings from crop production and initial wealth which is exogenous to the crop choices such as farm capital assets and livestock resources. Increase in Rainfall, increasing prices, development of crop varieties and Price Policies will also influence the agricultural land use pattern.

Butt et.al(2015) reveals that the hydrological and eco-processes in the Simly Watershed is determined mainly by the Land Use Change from Watersheds and its proper management. Since water is essential for cultivation, watersheds are also necessary for proper vegetation. But the land used for Water Cover and Vegetation is being transformed to settlements and Agriculture in the area. The detection of LULC is analysed using Maximum Likelihood Algorithm and these transformations created an adverse impact on the Watershed Resources and it shrank by 74.3 percent and 38.2 percent respectively. Proper Management of Watershed Resources is the only solution to bring back the vegetation existed to the initial position.

Jose Monish et al(2015) identifies the causes of changes in land use and cropping patterns with a special focus on paddy and identifies the economic, ecological and social factors aggregating up to 70 percent reduction in the area of paddy. The main drivers for the transformation of paddy fields to other land uses were economic viability, labour shortages and population pressure on land. Changes in land use and agrarian structure reflects the livelihood strategies as well as the unintended policy initiatives. The agricultural system of Wayanad reflects the land transformation from indigenous subsistence farming to a market oriented system.

Lambert et.al(2015) suggests a spatial temporal robust co-variance estimator for a model depicting land use as a first order Markov Process. Land use j shifts to k according to a matrix of Markow Transition probabilities. The parameters determining the transition probabilities are estimated using a system of fractional multinomial logit regressions. The difference between the expected stream of Net Present Returns from different activities is considered for land use allocations. In period t=1, 2,….T and spatial unit i=1,2,….N, agent g=1,2……G, converts land from use j to k, when the expected net returns($v_k$) from use k exceed net returns from j, less the discounted cost of converting from use j to k($C_{jk}$).

Justus E Raja and et.al (2013) reveals that commercialization of agriculture is the intention of farmers and it will lead to increased agricultural productivity and marketable surplus. The lack of soil ph value measurement, non- availability of quality seeds, increasing debt, lack of storage facilities are the other factors which will lead to improper utilization of land. The adverse impact of droughts and floods can be controlled by proper irrigation facilities as well as canaling system. Creating awareness about crop rotation and multiple

cropping will lead to proper use of agricultural land, through which food security can be attained.

Premakumaret.al (2013) makes an attempt to analyses the reasons for declining trend of agricultural land use pattern in India and increasing trend in Karnataka. The reason for increasing trend of Net Area Sown in Karnataka is the focus of state on development of horticulture. While in India, the impact of population pressure which reflected in fragmentation of land, industrialization, energy production, urban development, minings, residential and commercial as well as supporting infrastructure are forcing the conversion of agricultural land use to various non- agricultural purposes.

Man Li and et.al (2013) represents the empirical analysis of major drivers of land use change in China from 1988 to 2005 for which he created an econometric land use model taking into account the spatial interactions between land use decisions and identified the land value and rural income as the main determinants of conversion of farmland to other purposes which are profit oriented.

Rupali P Zope (2013) reveals that the radial growing pattern of land use of the city and the supporting transport systems raises the problem of "ineffective land use pattern" for the sustainable development of the Pune city. The satellite images of the city reflects the increase in built up area and decrease in the agricultural area. Most of the agricultural area at the outer periphery of the city has been converted into the non- agricultural area by real estate developers.

Bhardhan D and Tewari S.K.(2010), focuses on the rapid pace of economic development along with population growth , urbanisation and industrialization exert tremendous pressure on the limited natural resource base of a country. The pressure exerted by India's growing economy on Land and other natural resources has intensified in the post-liberalisation period and will further intensify in the future in the face of the burgeoning population and the demand for the conversion of agricultural lands to non- agricultural uses. Under – utilisation of land in the form of cultivable wastes is mostly concentrated in Gujarat and Rajasthan.

Diago Vasco et.al(2010) learnt about the processes(Urbanisation, Land Abandonment, conversion from nature to agriculture, agricultural intensification and extensification ) and

driving forces (explanatory variables were collected to determine the influence of political, economical, social and natural) of land use change in Portugal between 1990 and 2000. Land use change dynamics were analysed by identifying the substitution patterns,while increasing demand for high valued products is the main reason for conversion of open arable land and pastures into intensive permanent crops such as vineyards and irrigated olive orchards.

Diogo and Koomen (2010) studied the processes of land use change in Portugal from 1990-2000 and analyses which driving forces were responsible for these changes. Land use change patterns are the result of complex interactions between numerous factors operating at different spatial scales. Five driving forces especially, natural, socio-cultural, economic, political and technological forces influence the landscape development. While urbanisation occurred mainly next to urban centres in coastal areas, agriculture abandonment took place in marginal areas with scarce water resources.

Ebanyat( 2010 ) interprets that increase in cultivated area and disappearance of other land use reflects the pressure of population on land. Population density correlated negatively with all other land uses and positively with rice cultivation. Cultivated land negatively correlated with grassland and bushlands. The country was affected by political instability and economic decline, still the model farmers were promoted and agricultural implements and fertilisers were subsidized through agricultural policy measures by Government. The large farmers were benefitted more than the small farmers. The fertility management practices such as organic matter cycling, crop rotation and nutrient conservation were declining in the country for many years, a proper policy management of the land is necessary for a better agriculture and food productivity.

Palyakov Maksym et.al (2010) focuses on the Modelling of Land Use Dynamics as an important component of landscape level analysis of socio- ecological drivers at the urban-rural interface. Land use changes driven by land owners produce negative externalities such as air and water pollution, loss of bio- diversity, increased habit fragmentation and increased flooding. The Model’s parameters measure a combination of spatial and temporal effects and cannot be used for interferences regarding land use change or land change predictions.

Zhu et. al (2009) focus on the evaluation of land- use change and its relationship with its driving factors in the loess hilly region. Two land-use demand scenarios for 1993-2000 and 2001-2005 were studied and two simulated land use patterns were achieved accordingly by the use of conversion of land use which was driven by multiple factors such as slope, elevation, distance to road, soil types, population density etc. The results indicate that the associated Kappa values were decreased from 0.83 in 1993-2000 to 0.27 in the first scenario and 0.23 in second scenario and that the forest land and grassland are the land-use types with highest commission errors, which implies that the conversion of both land use types is the main determinant of change of Kappa values.

XieYichunet.al(2007) examines the temporal and spatial changes in land use as a consequence of rapid urban economic development in the city of Beijing. The study identifies a substantial loss of plain dryland and a phenomenal expansion of urban construction land over the recent decade. A shifting of the urban construction land from the inner city to the outskirts is reflected as a consequence of suburbanization. The uneven distribution of population stands as another factor with significant correlation with the land use change.

Lubowski, Ruben N et.al (2006) examines the relationship between agricultural land use changes, soil productivity and environmental sensitivity. The agricultural programmes such as Federal Crop Insurance subsidies and Conversion Reserve Programmes also help to increase agricultural productivity. Maximisation of Returns depends on the selection of commodities to be cultivated in agricultural land and will lead to proper utilisation of land. Land use change is also due to specific policy initiatives and the policy initiatives could help to improve the effectiveness of future farm programmes.

Lekhi et.al (2004) realizes that Land Utilisation occupies a special attention as it is determined by temperate moisture, topography, soil and physical structure. Land has the characteristics of fixity in supply and scarcity. The Land Classification is a process which assigns each tract of land in an area to its proper class in a system of classes. The classes in the system are defined in terms of qualities or characteristics with which the classification is concerned.

Olson M, Jennifer et.al (2004) explicates that knowing the main causes for land use change is necessary for the policy initiatives to be taken by authorities. Due to lower

productivity, the farmers are keeping their land uncultivable.. The LULCC literature was evolved out of efforts to understand, predict and manage ecologically damaging Land use changes such as deforestation because of their global impact on bio-diversity, carbon storage, atmospheric fluxes and other changes to ecological services and environment resources.

Sen et.al (2002) analyses the implications of land use/ cover changes during 1963-1993 in Pranmati Watershed of Himalayas. Land rights are granted to farmers on cultivated terrace slopes where as all uncultivated land were registered as Government Reserve and protected forests. Area under cash crops, potato and amaranth increased and accompanied by a sharp increase the mean monetary value of crop produce but at the cost of abandoning the traditional crops. Not many encroachments are reported in Reserve forests due to frequent inspection of Government Forest Officials, but encroachments are reported in community and protected forests. The farmers switched from monocropping of traditional crops with poor economic potential to mixed cropping on small plots rather than abandoning the crops altogether.

Elumalai Kannan et.al analysed that the growth performance of crop sector is influenced by use of physical input by farmers, markets, irrigation, credit availability, weather conditions and Government policies. The determinants of aggregate growth of crop output as the National level through Neo- Classical Growth Model can be represented as fertilisers, capital, rainfall as the ratio of actual rainfall to long period average rainfall, ratio of Grossed Cropped Area(GCA) to Net Sown Area(NSA) and Cropping intensity. The area under coarse cereals and pulses were showing a declining trend and intensive cultivation has resulted in salinity and water logging, groundwater depletion, loss of soil nutrients and building up of pests and diseases.

Chetan Agarwal et.al focuses on identifying appropriate models or proposing new modeling requirements and directions for estimating spatial and temporal variations in land cover and forest management practices. Land use is determined by the interaction of space and time of bio- physical factors which include soil, climate and topography as well as the human factors which include population, technology and economic conditions.

### 2.3.4. Role of Farmer in agriculture

Suhasilawane (2019) reveals that the concept of gender is the differentiator of role, responsibilities and traits between men and women since humans exist in earth. The social change can make change in agriculture influenced by region, status, age, education and habits. The role of women as equal partners of men should pay attention to dignity and nature. Women should be given the broadest opportunity to develop themselves and the role of women farmers such as planting, maintaining, harvesting is considered small as compared to role of men. The ownership of land is also a concept which will reduce the gender disparity.

Ranganathan Thiagu( 2018) analyses incomes of farmer households in India based on the data taken from 70$^{th}$ Round of NSSO and interprets that the main source of farmers as the primary occupation by considering agriculture is agricultural income itself, next preference to off-farm income and next preference is given to livestock cultivation and found that the largest land class has high income than lowest land class with less than 0.01 Hectares and inequalities existed in the size of land also

Ravikumar R and et.al (2013) explored that Rice Production stagnated around 10 to 11 lakh tones as Paddy cultivators have been facing various problems as their paddy cultivation did not fetch the reasonable price all over the country. The fall in price will lead to increase in cost of cultivation leading farmers to commit suicide. The study concentrated on the socio- eco background of paddy cultivators in selected villages of Palakkad due to shortage of labour and low prices of paddy and emphasizes group management for improving the economies of paddy cultivation through better management based on low cost technology, improvement in productivity, selective mechanization and cost reduction.

Shoba Arun (2012) explores the gender dimensions of the changing nature of agricultural households in Northern Kerala. Rural households are constructed through differences of gender and class riddled with complex and multiple negotiations and processes increased volatility in crop prices, shortage of rainfall and increased incidence of drought affected crop yields.

Thomas (1994) explores the changes in ownership of land is influenced by land reforms, land market transfers and partitioning. The study focuses on the relative role of social, demographic and economic factors in influencing land transfers among peasant

households through land reforms -conferment of ownership on tenant cultivators and kudikidappukaran to permit their entry in land market and growing commercialization of agriculture led to increased volume of land market transfers and partitioning.

## 2.4.CONCLUSION :

The pattern of land use of a country at any particular time is determined by the combination of economic, institutional, social and environmental frameworks. The land use of any region expresses the interaction of the whole range of environment factors along with a modification by the socio- economic, cultural, climatic and historical elements which will lead to sustainable development with a nature friendly ecosystem. The literature review and theoretical background gives the information related to land use from the earlier studies such as how it is utilised, identification of the main determinants of changing land use, the influencing factors of crop selection and how the regional differences influence the land use. It also gives an idea about the important factors influencing farmers in determining the agricultural land use and the risk adaptation strategies adopted by farmers to face the risk arising from agriculture. The acquired knowledge will be helpful and can be used as a guideline for further analysis as well as for interpretations in the particular study.

# CHAPTER III
# DYNAMICS OF LAND USE IN INDIA AND KERALA

### 3.1. Introduction

Land is a free Gift of Nature to mankind upon which the human beings can utilise the natural as well as the man-made resources available to the existing Living System in the most possible maximum manner. " Land is a delineable area of the Earth's terrestrial surface, encompassing all attributes of the biosphere, immediately above or below this surface, including those of the near surface climate, the soil and terrain forms, the surface hydrology(including shallow lakes, rivers, marshes, swamps), the near surface sedimentary layers and associated groundwater reserve, the plant and animal population, the human settlement pattern and physical results of past and present human activity(terracing, water storage or drainage structures, roads, buildings etc) (FAO, 1995)

Land use pattern refers to the surface utilisation of all developed and vacant land on a specific point at a given time and space (Freeman T.W, 1968). Land use involves the management and modification of natural environment and wilderness to build environment such as fields, pastures and settlements. It also has been defined as "the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it". The United Nations Food and Agricultural Organisation(FAO)Water Development Division explains that "Land use concerns the products and benefits obtained from the use of the land as well as land management actions or activities carried out by humans to produce those products and benefits." 'Land is the stage on which all human activities are being conducted and the source of materials needed for this conduct. Human use of land resources gives rise to 'land use' which varies with the purposes it serves, whether they be food production, provision of shelter, recreation, extraction and processing of materials and so on as well as the bio- physical characteristics of land itself (Helen Briassoulis, 2000). Land is fixed in supply and any change in the supply of land is not possible with changes in demand for land. It has the unique characteristics like non-reproducibility, specificity to location, immobility, and instrumentality. It is the basis for life support systems through creation of biomass, for terrestrial bio- diversity, source and sink of green- house gases, groundwater resources, storehouse for raw materials and the basis for human settlements. As the economy develops, the impact of a transformation of strong preference from primary sector to secondary as well as tertiary sector, agriculture to non- agricultural activities, rural life to urban agglomerations reflects in the changes in land use pattern. The impact of

development increases the proportion of land used for non- agricultural purposes, while on the other hand, it creates a negative impact on land used for the agricultural purposes. But if the land used for agricultural purposes is in the right hands, i.e the skilled and traditional agricultural farmers, the agricultural land can be properly utilised and is profitable for those who are engaged in it with a depth of mind. The pattern of land used for agricultural purposes and the inspiring attitude of the farmers together will result in a golden harvest which will provide sufficient food for the people and through it, the food security to the entire system.

### 3.2 Land and Man on Earth :

Land, the place on which man lives and interacts with other social beings as well as the resources, provides him the space to become the master of earth by utilizing all the available resources- fixed and variable in the efficient manner. The total surface area of Earth is about 510 million $km^2$(197 million sq. km). Out of this, 70.8 percent (361.13 million $km^2$) is covered with water, mostly by oceans and this abundance of water provides the nickname of 'Blue Planet' for Earth. The remaining 29.2 percent consists of land together with lakes and rivers that contribute to hydrosphere.

### 3.3. Land Use Pattern in India and Kerala:

History of Data Construction of Land Use Pattern in India depicts that in 1886, the British Government took an initiative to compile the land use data in order to enhance the revenue collection. Crop forecasting started with a single crop, wheat and later it extended to other crops such as oilseeds, rice, jute, indigo and sugarcane. The recommendations of the Royal Commission on Agriculture (1928) strengthened the statistical system of Land Use in India and during the British Era, the system was based on the Five- fold classification which India followed till 1949-50. The categories of Five- fold classification were:

1) Forests
2) Area not available for cultivation
3) Other uncultivated land, excluding the current fallow
4) Fallow lands
5) Net Area Sown.

In order to tackle the problems of non- compatability and statistical gaps in the existing data collection, the Technical Committee on Co-ordination of Agricultural Statistics (TCCAS) set up in 1948 by the Ministry of Food and Agriculture recommended a nine- fold classification along with the exact definitions for each classification and the standard concepts and definitions each state have to follow and all states except West Bengal which is still following the five - fold classification and Census of India accepted the Nine- fold classification.

### 3.3.1. Classification of Land Use Pattern

All the states in India except West Bengal is following Nine- fold Classification recommended by The Technical Committee on Co-ordination of Agricultural Statistics set up in 1948 by Ministry of Food and Agriculture, by replacing the old- five fold classification.

**Table 3.1**
**The Nine- fold Classification of Land Use Pattern in India and Kerala (ICAR)**

| Sl.No | Classifications | Definitions |
|---|---|---|
| 1. | Forest Area (F) | Forest under any legal enactment or administered as forest, whether state-owned or private |
| 2. | Land put to non-agricultural use (NA) | All land occupied by buildings, settlements, roads, railways, schools, water facilities along with canals, rivers, under water facilities, and all the land put to uses other than agriculture |
| 3. | Barren and Uncultivable land (BU) | Land covered by mountains, deserts, hills etc. Land which cannot be brought under cultivation |
| 4. | Permanent pastures and the grazing land(PG) | Extensively or intensively grazed permanent grasslands with the presence of farm infrastructure |
| 5. | Land under misc. tree crops (T) | Land under casuring trees, thatching grasses, bamboo bushes and other groves for fuel. |
| 6. | CultivableWasteland (CW) | Land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during the last five years or more in succession including the current year |
| 7. | Fallow other than current fallowland (FOCF) | Land, which was taken for cultivation but is temporarily out of cultivation for a period for not less than one year and not more than five years. |
| 8. | Current fallow (CF) | Cropped area which is kept fallow during the current year, that is, the land which is left unsown during the current agricultural year only to regain fertility |
| 9. | Net Area Sown (NAS) | Total area sown with crops and orchards |

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

### 3.3.2. Land Use Pattern for Agriculture and Non- Agriculture Purposes :

Total Reporting or Geographical Area (TGA) is the summation of the area used for the land use classifications and can be expressed as

$$TR = F + NAL + UL + FL + NAS$$

- Non- agricultural area(NAA) which comprises of Forests(F), Land under non-agricultural uses(NA), Barren and uncultivable land (BU) and Permanent pastures(PG).

$$\text{Total Non- agricultural area (NAA)} = F + NA + BU + PG$$

- Agricultural area (AA) which comprises of miscellaneous tree crops (T), Cultivable waste lands (CW), current fallow lands (CF), fallow lands other than current fallows (FOCF) and Net Area Sown(NAS).

Agricultural Area(AA) = T + CW + FOCF+CF + NAS where NAS = TCA – ASMO

The limited availability of land compels each economy to utilise the land resources in the maximum possible manner but still there exists the possibility for the existence of unutilized area. The Utilised and Unutilized agricultural area is calculated by the formula,

$$\text{Utilised AA (UAA)} = NAS + T$$

Unutilised AA (UnAA) = CW + FOCF + CF or AA - Utilised AA or AA – (NAS + T)

In order to know the distinction between Land Use Pattern in India and Kerala, the Percentage proportion of Land Use Pattern is explained with the help of Figure 3.1.

**Figure 3.1.**
**Land Use Categories in India and Kerala (2017-18)**

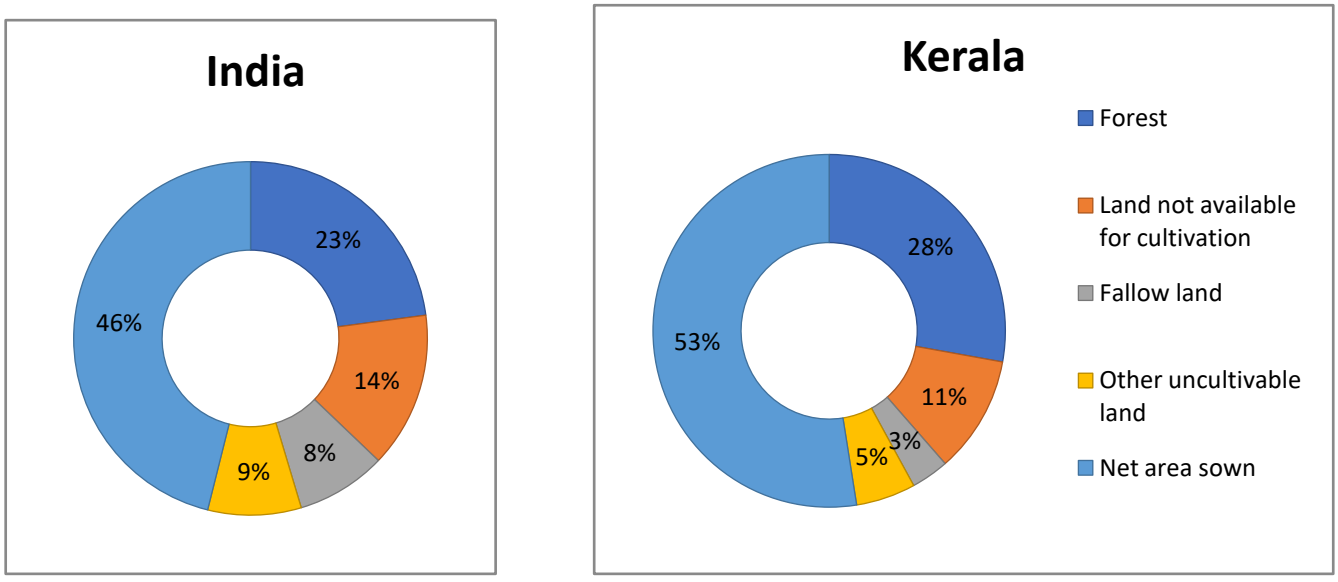


**Table No: 3. 2**

**Land Use Pattern - Proportion to TGA (1950-51 to 2010-11)**

| | KERALA | | | | | | | INDIA | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Land Use** | **1950-51** | **1960-61** | **1970-71** | **1980-81** | **1990-91** | **2000-01** | **2010-11** | **1950-51** | **1960-61** | **1970-71** | **1980-81** | **1990-91** | **2000-01** | **2010-11** |
| F | 25.85 | 27.38 | 27.34 | 27.83 | 27.83 | 27.83 | 27.83 | 14.24 | 18.11 | 21.01 | 22.18 | 22.24 | 22.88 | 23.28 |
| NA | 5.00 | 6.41 | 7.12 | 6.65 | 7.65 | 9.83 | 9.89 | 3.29 | 5.42 | 5.42 | 6.44 | 6.92 | 7.78 | 8.59 |
| BU | 5.28 | 3.92 | 1.85 | 2.01 | 1.50 | 0.75 | 0.50 | 13.42 | 12.03 | 9.26 | 6.56 | 6.36 | 5.73 | 5.59 |
| PG | 1.23 | 1.17 | 0.72 | 0.14 | 0.05 | 0.00 | 0.00 | 2.35 | 4.68 | 4.37 | 3.94 | 3.74 | 3.49 | 3.35 |
| **NAA*** | **37.37** | **38.89** | **37.02** | **36.65** | **37.04** | **38.42** | **38.22** | **33.3** | **40.24** | **40.06** | **39.12** | **39.26** | **39.88** | **40.81** |
| T | 5.40 | 5.30 | 3.34 | 1.69 | 0.88 | 0.40 | 0.09 | 6.97 | 1.49 | 1.44 | 1.18 | 1.25 | 1.13 | 1.04 |
| CW | 4.31 | 3.71 | 2.09 | 3.22 | 2.43 | 1.53 | 2.36 | 8.07 | 6.44 | 5.76 | 5.51 | 4.92 | 4.47 | 4.11 |
| FOCF | 3.87 | 16.15 | 0.58 | 0.71 | 0.68 | 0.87 | 1.34 | 6.14 | 3.75 | 2.87 | 3.2 | 3.17 | 3.36 | 3.36 |
| CF | 1.49 | 1.06 | 0.66 | 1.11 | 1.14 | 2.00 | 1.96 | 3.76 | 3.9 | 3.49 | 4.88 | 4.49 | 4.84 | 4.64 |
| NSA | 47.57 | 30.44 | 56.30 | 56.62 | 57.82 | 56.78 | 53.30 | 41.77 | 44.63 | 46.37 | 46.12 | 46.86 | 46.31 | 46.04 |
| **AA*** | **62.63** | **56.66** | **62.98** | **63.35** | **62.96** | **61.58** | **59.05** | **66.71** | **60.21** | **59.93** | **60.89** | **60.69** | **60.11** | **59.19** |
| **UAA** | **52.96** | **35.73** | **59.65** | **58.31** | **58.71** | **57.18** | **53.40** | **48.74** | **46.12** | **47.81** | **47.3** | **48.11** | **47.44** | **47.08** |
| **UnAA** | **9.67** | **20.92** | **3.33** | **5.04** | **4.25** | **4.40** | **5.65** | **17.97** | **14.09** | **12.12** | **13.59** | **12.58** | **12.67** | **12.11** |

*AA- Agricultural Area,NAA - Non- Agricultural Area, UAA- Utilised Agricultural Area, UnAA- Unutilised Agricultural Area

Data source :1. 1950-51 to 1978-79, Indian Agriculture in Brief, Directorate of Economics and Statistics, Ministry of Agriculture and Irrigation, Government of India

2. Report of National Commission on Agriculture

The five- fold classification of the Land Use Pattern in India and Kerala reveals that India uses 46 percent of its Total geographical area as Net Sown Area while Kerala uses 53 percent for agricultural purposes. In India, the Forest area together with Net Area Sown occupies 69 percent of Total Geographical area (TGA) while it occupies 81 percent in Kerala. The Net Sown Area is an indicator of sufficient food availability and food security to the existing population in Kerala. The Land Use Pattern of Kerala and India during the seven decades is shown in Table 3.2.

In India, the objective of sustainable development was initiated with the extension of forest area, the nature's treasure with a plant diversity is showing a sharp increasing trend in the initial decades and a stagnant growth after 1970s by a negligence towards sustainable development. The people themselves took an initiative in creating a balanced ecological system along with sustainable development to protect as well as recreate the nature for the well- being of its own inhabitants. The area under forest which includes private and state - owned is showing an increasing trend from 40.4 million hectares in 1950-51 to 71.59 million hectares in 2016-17. The area under non- agricultural uses especially for infrastructure development activities showed an increase of 5.3 percent, while the total non- agricultural area showed an increase of 7.51 percent. The area not available for cultivation is showing a small declining trend due to decrease in Barren and Uncultivable land from 38.16 million hectares in 1950-51 to 10.28 million hectares in 2017-18 which was further compensated by a sharp increase in area under non-agricultural uses. Since land used for non- agricultural purposes is an important indicator of economic growth; change in land use pattern of India is reflecting the transformation of land from a developing economy to that of a developed economy. The area under miscellaneous tree crops decreased from 6.97 percent to 1.04 percent reflecting the extinction of the same in the near future. Other uncultivated lands including permanent pastures and grazing lands are fluctuating and becomes highest in 1960-61 with 13.97 million hectares gradually declined to 8.4 million hectares in 2017-18 while the land under miscellaneous tree crops has been decreased at a faster rate which led to the decrease in other uncultivated land excluding fallows. The cultivable wastelands showed a declining trend which is an indicator for growth of utilisation of agricultural area. The area under fallows as well as the current fallows is decreasing which means that land is not kept vacant due to the increasing pressure of population on it (B.M.Kumar, 2005). The decreasing trend of fallow lands other than current fallows, and the stagnancy in the

current fallows enunciates positive attitude towards the agricultural area, while declining trend of the area under miscellaneous tree crops is unfavourable to the agricultural area. Net Sown Area, an indicator of pure agricultural area is about 60 percent and above in all the decades which gives us the strong evidence that India is an agriculture based economy and majority of Indians are dependent upon agriculture for their livelihood.

The Land Use Pattern of Kerala is analysed by classifying the period since the formation of Kerala in 1956 into six decades such as

- Period I – 1956-1965
- Period II–1966-1975
- Period III-1976-1985
- Period IV-1986-1995
- Period V-1996-2005
- Period VI -2006-2015.

Since the utilisation of Land varies over time has a direct influence on the change in Land use and purposes for which it is used, the average area of all Land Use Categories from 1956 to 2015 in decades is given in Table 3.3.

**Table 3.3**

**Average Area of Land Use in Kerala(00' hectares)**

| Period | F | NA | BU | P | T | CW | FOCF | CF | NAS |
|---|---|---|---|---|---|---|---|---|---|
| Period I | 10276.02 | 1482.13 | 2356.43 | 424.38 | 1919.07 | 1272.49 | 521.50 | 496.99 | 20080.01 |
| Period II | 10557.56 | 2709.03 | 751.88 | 246.87 | 1294.65 | 911.64 | 257.46 | 280.69 | 21714.21 |
| Period III | 10815.09 | 2663.52 | 716.17 | 54.31 | 621.96 | 1151.74 | 269.86 | 431.49 | 21982.26 |
| Period IV | 10815.09 | 3000.38 | 550.13 | 19.50 | 349.89 | 912.25 | 274.59 | 467.07 | 22317.92 |
| Period V | 10815.09 | 3690.34 | 310.59 | 4.39 | 158.34 | 647.22 | 348.49 | 704.44 | 22121.38 |
| Period IV | 10815.09 | 4082.00 | 187.98 | 1.42 | 42.27 | 956.53 | 516.91 | 745.95 | 20752.83 |

Source: computed from data of Directorate of Economics and Statistics, Government of Kerala.

The Table depicts that Net Area Sown has the highest Mean Value in all decades followed by Area under Forest and are the main components of Land Use in Kerala during the whole period of 1956-2015. In 1956-65, the third position is occupied by Barren and Uncultivable land which includes mountains and hills while it acquired only the last position which is approximately around zero in 2006-2015. Net Area Sown reached maximum in 1986-95 due to the Second Green Revolution which gave importance to rice, pulses and oilseeds. The Permanent Pastures and Miscellaneous Tree crops also declined at an increasing rate by negatively affecting the whole eco-system. In 1956-65, the cultivable waste is high and declined further in 2006-15 while Fallow other than current fallows remained stagnant. The Average Current fallows increased in 1956-65 while it

showed a declined trend in 1966-75 as the Govt concentrated upon the extension of area in the initial decades as an initiative for agricultural development. The Forest Area increased in the initial decades and remained constant after 1970s.

In order to compare the variability in Land Use Categories, Coefficient of Variation - a measure of relative dispersion is used which is calculated by the formula

$$\text{Coefficient of Variation} = \frac{Standard\ \ Deviation}{Mean} \times 100$$

Coefficient of variation calculated for Land Use Categories in different decadal time periods from 1956 - 2015 in different periods is given in Table 3.4.

**Table 3.4.**

**Land Use Pattern in Kerala -Coefficient of Variation(%)**

| Period | F | NA | BU | P | T | CW | FOCF | CF | NAS |
|---|---|---|---|---|---|---|---|---|---|
| Period I | 3.60 | 21.34 | 9.71 | 11.33 | 8.69 | 35.04 | 53.87 | 19.95 | 6.07 |
| Period II | 0.09 | 2.88 | 10.16 | 31.37 | 18.93 | 14.26 | 25.13 | 16.91 | 1.38 |
| Period III | 0.00 | 2.55 | 6.91 | 25.99 | 21.84 | 8.92 | 3.87 | 5.18 | 0.21 |
| Period IV | 0.00 | 4.19 | 10.42 | 28.32 | 10.47 | 8.20 | 3.99 | 5.86 | 1.02 |
| Period V | 0.00 | 9.98 | 15.52 | 62.46 | 30.70 | 6.17 | 15.03 | 11.89 | 2.07 |
| Period IV | 0.00 | 7.31 | 27.62 | 82.71 | 49.32 | 3.73 | 9.93 | 7.91 | 2.23 |

Source: computed from data of Directorate of Economics and Statistics, Government of Kerala.

Comparing the variability in Land Use Categories, the Coefficient of Variation is higher for Land used for Non- Agricultural purposes in 1956-65. In 1996-2005 i.e. the Post Liberalisation Period, NA, BU, P, T, FOCF and CF has a high variability or is less stable compared to NAS and no variability exists in Forest Area. The Net Area Sown is less variable, more consistent, uniform and homogenous in area utilisation. The current land use with a high variation in BU, P, T is a threat to attain the sustainable eco-system of the Kerala Economy. The statistical evidence proves that the Land Use in Kerala is mainly determined by Net Area Sown which gives relevance to agricultural purposes. The Growth rate of Land Use Categories estimated by LoglinSemilogModel (Gujarati, 1995) help to identify the trend and pattern of Land Use in Kerala in which the slope coefficient measures the constant proportional or relative change in Land Use for a given absolute change in the value of the regressor, time ( t ). The slope coefficient of $\beta_2$ is calculated, subtracted from 1 and multiplying the difference by 100 gives the Compound Growth rate which is expressed in Regression Model

$$\text{In } Y_t = \beta_1 + \beta_2 t + u_t$$

Where $Y_t$represents different Land Use Categories in different time periods, $\beta_2$ the slope coefficient, and t represents time.

$$\beta_2 = \frac{Relative\ \ Change\ \ in\ regressand}{Absolute\ \ change\ \ in\ regressor}$$

Compound Growth Rates for the Land Use Categories in the decadal time periods is represented in Table 3.5.

**Table 3.5**

**Land Use Pattern in Kerala– CGR(%)**

| YEAR | F | NA | BU | P | T | CW | FOCF | CF | NAS |
|---|---|---|---|---|---|---|---|---|---|
| Period I | 1.01 | 3.05 | -6.95 | -3.54 | -2.66 | -16.14 | -9.24 | -6.11 | 1.82 |
| Period II | 0.00 | 0.50 | -2.57 | -10.51 | -6.20 | 1.11 | -6.01 | -1.00 | 0.40 |
| Period III | 0.00 | 0.60 | -1.69 | -8.52 | -6.76 | -2.37 | 0.90 | 1.71 | -0.10 |
| Period IV | 0.00 | 1.31 | -3.34 | -8.70 | -2.96 | -2.47 | 1.11 | 0.50 | 0.30 |
| Period V | 0.00 | 2.84 | -3.44 | -11.04 | -9.70 | 0.60 | 4.60 | 2.84 | -0.70 |
| Period VI | 0.00 | 0.00 | -8.33 | -45.17 | -12.01 | 1.01 | 2.74 | -1.69 | -0.50 |
| Pre- Reform | 0.20 | 0.70 | -3.15 | -10.06 | -5.73 | -0.40 | -1.49 | -0.05 | 0.40 |
| Post-Reform | 0.00 | 1.41 | -5.73 | -21.42 | -11.22 | 1.31 | 3.05 | 1.31 | -0.50 |
| Whole Period | 0.20 | 0.70 | -3.92 | -13.93 | -7.23 | -1.09 | 0.90 | 0.90 | 0.60 |

Source: Computed from data of Directorate of Economics and Statistics, Govt of Kerala.

The Compound Growth Rate (CGR) of Land Use - Forest, Non-Agricultural Land, Fallow Other than Current Fallow, Current Fallow, Net Area Sown is positive while that of Barren and Uncultivated Land, Permanent Pastures, T, Cultivable Waste, shows rate of decay during the whole period 1956-2018. The Compound Growth Rate show an increasing growth in F, NA, NAS and a decayed growth in BU, P, T, CW, FOCF, CF in initial periods among which the declining trend in CW, FOCF and CF is a symbol of favourable Land Use Pattern. The Pre- Reform period of 40 years reflects positive trend in F, NA, NAS with decayed growth in BU, P, T, CW, FOCF, CF out of which the negative values of CW, FOCF and CF is still favourable to the state. But in the Post Reform Period, F = 0, sharp decay in BU, P, T, sharp increase in CW, FOCF, CF is unfavourable to the state as well as to the environment. The Net Area Sown which provides the food security is almost stagnant throughout the 63 years which proves that utilisation of the area is not much affected by changes in the economy.

The Utilised Agricultural Area is a symbol of agricultural stability for an economy and depicts the proper utilisation of the land which is a fixed and limited factor especially for agricultural purposes. The Utilised Agricultural Area is calculated as a summation of Net Area Sown and area under cultivation of Miscellaneous Tree Crops while Unutilised Agricultural Area as a summation of Cultivable Wastelands, Fallow other than Current Fallows and Current Fallows. The Utilised and UnutilisedAgricultural Area in Kerala gives a clear-cut picture of whether the agricultural area is utilised or kept as fallow is depicted in Table 3.6.

**Table 3.6.**

**Agriculture(Utilised and UnutilisedArea)– A comparison**

| Year | Kerala | | | India | | |
|---|---|---|---|---|---|---|
| | AA | UAA | UnAA | AA | UAA | UnAA |
| 1950-51 | 62.63 | 52.96 | 9.67 | 66.71 | 48.74 | 17.97 |
| 1960-61 | 56.66 | 35.73 | 20.92 | 60.21 | 46.12 | 14.09 |
| 1970-71 | 62.98 | 59.65 | 3.33 | 59.93 | 47.81 | 12.12 |
| 1980-81 | 63.35 | 58.31 | 5.04 | 60.89 | 47.3 | 13.59 |
| 1990-91 | 62.96 | 58.71 | 4.25 | 60.69 | 48.11 | 12.58 |
| 2000-01 | 61.58 | 57.18 | 4.40 | 60.11 | 47.44 | 12.67 |
| 2010-11 | 59.05 | 53.40 | 5.65 | 59.19 | 47.08 | 12.11 |
| 2017-18 | 57.79 | 52.15 | 5.64 | 59.09 | 46.01 | 13.08 |

Source: Directorate of Economics and Statistics, Government of Kerala.

In 1960-61, the agricultural area under cultivation showed a declining trend and reached the minimum due to agrarian crisis and Food shortage. It led to New Agricultural Strategy (Green Revolution) initiated by M S Swaminathan by the application of HYV seeds and chemical fertilisers along with heavy irrigation. After the initiatives, the production as well as productivity of agriculture started increasing in State and National level. Though the initiatives were taken to improve agriculture, still a proportion of Agricultural Area is kept as unutilized which may be due to price fluctuations or personal attitude of the farmers towards agriculture. In 1960-61, about 20 percent of Total Agricultural Area is kept as unutilized in Kerala which is far higher than 14.09 percent at the National level. But after that Kerala recouped from the crisis by reducing the unutilized area and it remained stagnant at around 5 percent from 1970 onwards which is lesser than 12 percent at National level interpreting that Kerala is successful in utilizing

the land resources especially the agricultural area and is helpful to provide a better food security to the living population.

The District –wise distribution of Nine-fold classification is necessary to know about the Land Use Pattern in Kerala, especially the proportion of agricultural and non-agricultural area to the Total Geographical Area of Kerala. Land Use Pattern in all Districts of Kerala including Thiruvananthapuram (TV), Kollam (KL), Pathanamthitta (PT), Alappuzha (AL), Kottayam (KT), Idukki (ID), Ernakulam (ER), Thrissur (TS), Palakkad (PL), Malappuram (MA), Kozhikode (KZ), Wayanad (WN) , Kannur (KN) and Kasargode (KS). Whether the thin flat stretch of land is utilised properly is answered with the available information from Directorate of Economics and Statistics and Land Use Board of Kerala is given in the Table 3.7.

**Table 3.7**

**District- wise Land-Use Pattern in Kerala (2017-18) (%)**

| No | Districts | F* | NA | B | P | TNA | T | CW | FOCF | CF | NAS | AA | UAA | UNAA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | **TV** | 1.28 | 0.83 | 0.00 | 0 | 2.12 | 0.00 | 0.01 | 0.02 | 0.07 | 3.33 | 3.44 | 3.34 | 0.11 |
| **2** | **KL** | 2.10 | 0.72 | 0.00 | 0 | 2.82 | 0.00 | 0.07 | 0.05 | 0.06 | 3.20 | 3.39 | 3.21 | 0.18 |
| **3** | **PT** | 3.99 | 0.50 | 0.00 | 0 | 4.49 | 0.00 | 0.06 | 0.05 | 0.09 | 2.06 | 2.27 | 2.06 | 0.21 |
| **4** | **AL** | 0.00 | 0.65 | 0.00 | 0 | 0.65 | 0.00 | 0.38 | 0.06 | 0.05 | 2.15 | 2.65 | 2.16 | 0.49 |
| **5** | **KT** | 0.21 | 0.75 | 0.03 | 0 | 0.98 | 0.00 | 0.17 | 0.06 | 0.11 | 4.18 | 4.52 | 4.19 | 0.33 |
| **6** | **ID** | 5.11 | 0.37 | 0.04 | 0 | 5.51 | 0.00 | 0.05 | 0.03 | 0.04 | 5.29 | 5.42 | 5.29 | 0.13 |
| **7** | **ER** | 1.82 | 1.16 | 0.01 | 0 | 2.99 | 0.00 | 0.39 | 0.17 | 0.21 | 3.82 | 4.58 | 3.82 | 0.76 |
| **8** | **TS** | 2.67 | 1.02 | 0.00 | 0 | 3.69 | 0.01 | 0.24 | 0.16 | 0.21 | 3.35 | 3.96 | 3.36 | 0.61 |
| **9** | **PL** | 3.51 | 1.21 | 0.04 | 0 | 4.75 | 0.02 | 0.48 | 0.33 | 0.22 | 5.32 | 6.36 | 5.34 | 1.02 |
| **10** | **MA** | 2.66 | 1.36 | 0.02 | 0 | 4.04 | 0.00 | 0.15 | 0.15 | 0.16 | 4.47 | 4.94 | 4.48 | 0.46 |
| **11** | **KZ** | 1.06 | 0.85 | 0.01 | 0 | 1.93 | 0.00 | 0.06 | 0.02 | 0.05 | 3.82 | 3.95 | 3.82 | 0.13 |
| **12** | **WA** | 2.03 | 0.30 | 0.00 | 0 | 2.33 | 0.00 | 0.03 | 0.03 | 0.06 | 2.92 | 3.04 | 2.92 | 0.12 |
| **13** | **KN** | 1.25 | 1.00 | 0.03 | 0 | 2.29 | 0.01 | 0.17 | 0.08 | 0.10 | 4.82 | 5.18 | 4.83 | 0.35 |
| **14** | **KS** | 0.14 | 0.74 | 0.08 | 0 | 0.97 | 0.01 | 0.18 | 0.05 | 0.05 | 3.76 | 4.04 | 3.76 | 0.28 |
| **15** | **Total** | 27.83 | 11.40 | 0.28 | 0 | 39.51 | 0.06 | 2.48 | 1.27 | 1.48 | 52.50 | 57.80 | 52.56 | 5.24 |

Source : Directorate of Economics and Statistics,Government of Kerala.

*F- Forest, NA – Land for Non-Agricultural Purposes, B – Barren Land, P- Permanent Pastures, TNA – Total Non-Agricultural Land, T – Miscellaneous Tree Crops, CW – Cultivable Waste, FOCF – Fallow other than Current Fallows, CF – Current Fallow, NAS – Net Area Sown, AA –Agricultural Area, UAA – Utilised Agricultural Area, UNAA – Unutilised Agricultural Area

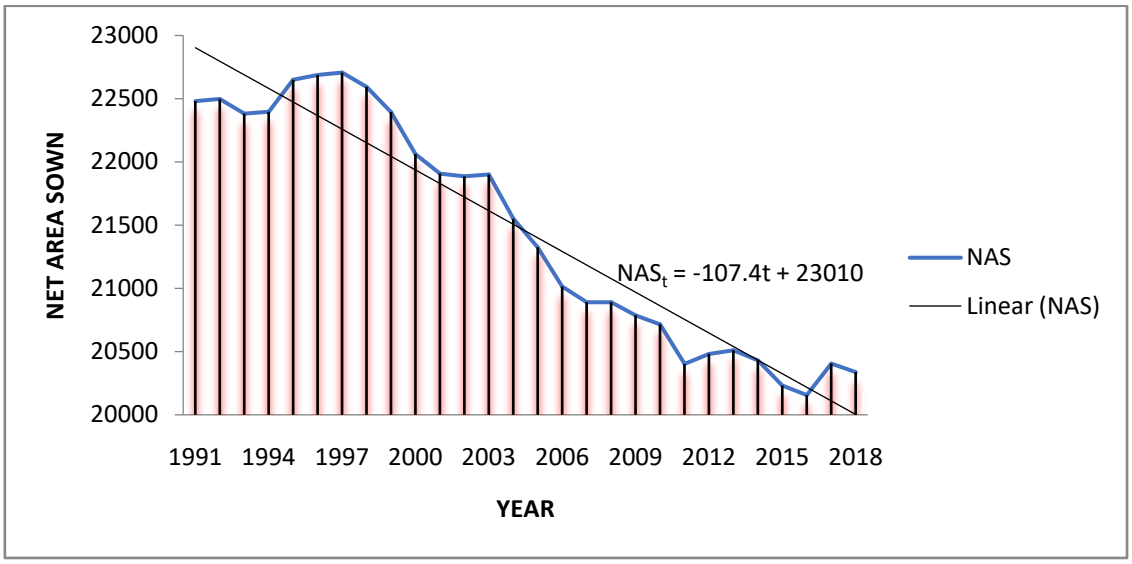
Kerala, the God's Own Country proves that every district contributes about 60 percent of the total area to agriculture and 40 percent to non- agricultural purposes. Palakkad District occupies the first position in Net Area Sown as well as in Total Agricultural Area. The districts such as Pathanamthitta, Idukki, Palakkad, Malappuram have a higher proportion in total non-agricultural area due to the existence of high proportion of forest area and not due to increase in area used for non- agricultural purposes. So a comparative analysis of Area used for agricultural purposes and non- agricultural purposes proves that the Net Area Sown is far above the proportion of land for non-agricultural purposes reflecting the sustainable and ecological utilisation of land giving preference to Millenium Goals. This is the result of a long run perspective of our forefathers who created a strong ecological base for the proper utilisation of land. The agriculture in Kerala is dependent upon the climate, temperature, rainfall, altitude (together called as topography) and the differences in agriculture which is expressed through methods of production, selection of crops, crop diversification and cropping intensity are dependent upon the regional differences based upon which Kerala is classified into Physiological Climatic Zones which is purely based upon rainfall, soil type, topography and altitude.

## 3.4. NAS - A PROXY VARIABLE FOR AREA UNDER AGRICULTURAL PURPOSES:

In the Nine- fold classification, the main contributing factor is the Net Area Sown which is a proxy variable for land used for agricultural purposes. Agriculture, the key concept of Primary sector among the three dominant sectors which contribute to Gross Domestic Product(GDP) is the largest rural livelihood provider in India and the main contributor for food security, healthy nutrients and creates a healthy younger generation through whom the economy can attain rural employment, economic growth, increasing Gross Domestic Product, increasing standard of living and through that economicdevelopment. Since a healthy food intake is necessary for creating a healthy younger generation, agriculture promotes the development of not only the existing generation, but also the coming generations for which availability of healthy food through agricultural development is necessary and vital. A recent clear-cut picture of the Net Area Sown is given with the application of a linear trend line in the Figure 3.2.

**Figure 3.2.**

**Net Area Sown in Kerala (1991- 2018)**




The figure shows a declining trend in the Net Area Sown during the period of 1991 to 2018 – the Post-Liberalisation Period but still the variations are occurring within the limits of 200 million hectares to 230 million hectares. Since $\beta_2$ (= -107.46) < 0 indicating rate of decay(Gujarati, 1995) in Net Area Sown, the linear trend line is downward sloping from left to right.

Agricultural crops in Kerala can be classified as

i. Food and Non- Food Crops.

ii. Seasonal, Annual and Perennial Crops.

**Food and Non- Food Crops** include food crops such as cereals, pulses and millets, sugar crops, spices and condiments, fresh fruits, vegetables etc and non-food crops such as rubber, betel leaves, lemon grass, teak etc. Food crops are crops that form a major proportion of the daily diet in relatively large quantities as a source of energy(cereals, tubers), proteins(pulses and beans), vitamins ( Fruits and vegetables) and minerals. Cereals provide 50 percent calories and half of proteins consumed by human population. The area under food and non-food crops and the Food to Non-food Crop Ratio in Kerala is given in Table 3.8.

**Table 3.8**

**Area Under Food and Non- Food Crops in Kerala (000' Hectares)**

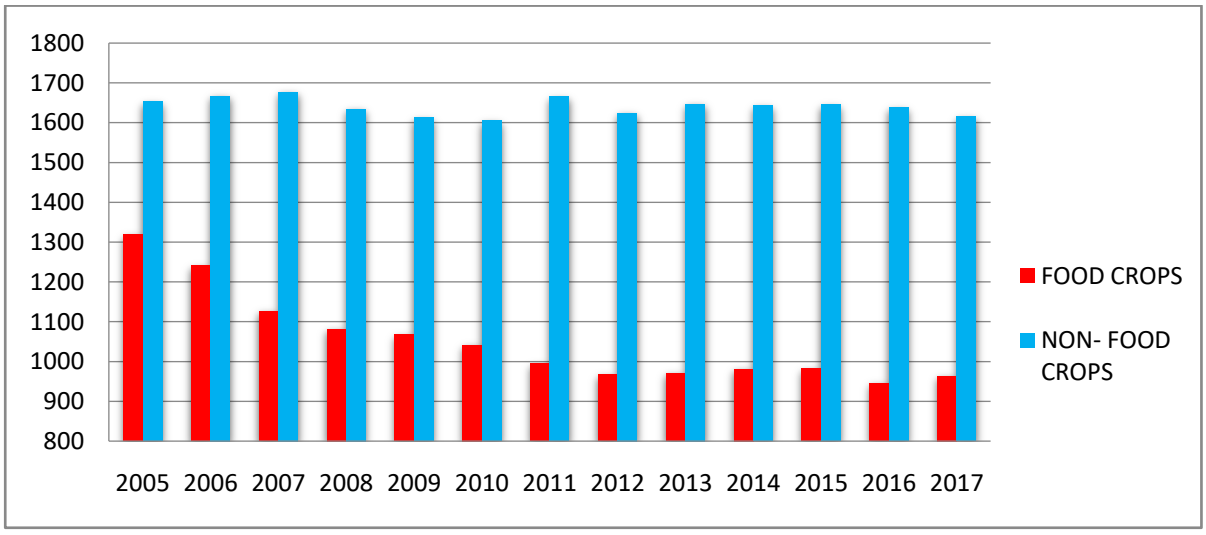
| YEAR | FOOD CROPS | NON- FOOD CROPS | FD/NON FD C-RATIO |
|---|---|---|---|
| 2005 | 1318.644 | 1653.319 | 0.80 |
| 2006 | 1240.582 | 1667.083 | 0.74 |
| 2007 | 1126.495 | 1676.959 | 0.67 |
| 2008 | 1081.873 | 1634.599 | 0.66 |
| 2009 | 1067.468 | 1613.07 | 0.66 |
| 2010 | 1041.54 | 1605.921 | 0.65 |
| 2011 | 995.669 | 1666.088 | 0.60 |
| 2012 | 966.954 | 1624.78 | 0.60 |
| 2013 | 970.703 | 1646.567 | 0.59 |
| 2014 | 981.72 | 1642.904 | 0.60 |
| 2015 | 982.302 | 1645.275 | 0.60 |
| 2016 | 945.608 | 1638.400 | 0.58 |
| 2017 | 963.397 | 1616.302 | 0.60 |
| % Variation | -26.9403 | -2.23895 | |

Source: Directorate of Economics and Statistics,Government of Kerala.

The Net Area Sown under Food Crops and Non- Food Crops is reflected in two different ways - the area under Food crops is decreasing at an increasing rate with a variation of -26.94 percent, while that of Non- Food crops are decreasing at a decreasing rate with a variation of -2.24 percent which reflects the probability for the occurance of food shortage in the future time periods. The Area under food crops and Non- Food Crops in Kerala in the past 12 years is given in Figure 3.3

**Figure 3.3**

**Area under Food and Non-Food Crops in Kerala (2005-17)**



The decreasing areal distribution of food crops is a dangerous indicator of the food insecurity in Kerala which will result in either famines or dependency on other states instead of self- sufficiency in foodgrains. In Kerala, decreasing proportion of food to non-food crop ratio is a threat to economy and Government have to take initiatives to improve the ratio by increasing the cultivation of Food Crops. The Figure shows that the ratio is decreasing due to decreasing trend of Food Crops and Increasing trend of Non- Food Crops. Finding a solution to the problem is necessary as Keralites have to realize the present situation and a diversion back to the cultivation of Food Crops is necessary. The study is relevant as it is focusing upon the farmers who are experienced and learnt about cultivation from their forefathers.

**Seasonal, Annual and Perennial Crops** which includes

a) Seasonal crops – Paddy, Pulses, Tapioca, Vegetables, Sweet Potato, Tubers, Groundnut, Ginger, Turmeric, Cotton, Tobacco, Onion, Tur etc
b) Annual Crops – Sugarcane, Banana, Plantain, Pineapple, Betel leaves etc
c) Perennial Crops – Coconut, Arecanut, Cashew, Mango, Jackfruit, Tamarind, Pepper, Rubber, Tea, Coffee, Cardomom, Cloves, Nutmeg, Cinnamon, Cocoa, Papaya etc

Paddy, the leading crop in Kerala is cultivated in all the three seasons – Autumn (July –October), Winter (November – March) and Summer (April – June) except in Wayanad where there exists no paddy cultivation in Autumn Season. The upland cultivation in paddy is a new change in the cropping pattern of Kerala which is preferred due to the climatic fluctuations. The first position and third position in Paddy Cultivation is occupied by Palakkad and Thrissur Districts respectively. Palakkad also occupies the first position in cultivation of Pulses, Palmyrah, Turmeric, Fresh fruits, Mango, Banana, Groundnut and Millets. Idukki and Wayanad leads in the production of Pepper, Ginger, Cardamom, Tea, Coffee, Malappuram for Arecanut, Ernakulam for Pineapple, Tapioca (tubers), Colocasia, Yam for Kollam, Coconut for Kozhikode and Rubber for Kottayam. The percentage variation in Area and Production of the Principal Crops in Kerala is represented in Table 3.9

**Table 3.9**

**Percentage Variation in Area, Production and Productivity of Principal Crops in Kerala**

| | | Area | | | Production | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Crops | Type* | 1961-62 | 2017-18 | Variation | 1961-62 | 2017-18 | Variation | 1961-62 | 2017-18 | Variation |
| Paddy | S | 753009 | 198026 | -73.70 | 988150 | 578256 | -41.48 | 1312 | 2920 | -123 |
| Arecanut | P | 56764 | 95739 | 68.66 | 8091 | 99925 | 1135.01 | 143 | 1044 | -632 |
| Turmeric | S | 4867 | 2484 | -48.96 | 4267 | 6694 | 56.88 | 877 | 2695 | -207 |
| Cashew | P | 55051 | 38781 | -29.55 | 84449 | 15635 | -81.49 | 1534 | 403 | 74 |
| Tapioca | S | 236776 | 61874 | -73.87 | 1618713 | 2325007 | 43.63 | 6836 | 37576 | -450 |
| Banana | A | 42693 | 52868 | 23.83 | 55443 | 424048 | 664.84 | 1299 | 8021 | -518 |
| Coconut | P | 505035 | 760946 | 50.67 | 32476516 | 5231758 | 63.20 | 6431 | 6878 | -69 |
| Ginger | S | 12050 | 3275 | -72.82 | 11185 | 15124 | 35.22 | 928 | 4618 | -398 |
| Pepper | P | 99887 | 82761 | -17.15 | 26550 | 362183 | 1264.15 | 266 | 4376 | -1546 |
| Sesamum | P | 11953 | 197 | -98.35 | 2539 | 1543 | -39.23 | 212 | 7832 | -3587 |
| Rubber | P | 133133 | 551115 | 313.96 | 24589 | 540775 | 2099.26 | 185 | 981 | -431 |
| Coffee | P | 18807 | 84976 | 351.83 | 8145 | 64676 | 694.06 | 433 | 761 | -76 |
| Tea | P | 37426 | 36473 | -2.55 | 37428 | 60760 | 62.34 | 1000 | 1666 | -67 |

Source : Department of Economics and Statistics, Government of Kerala

*Type of crops - S – Seasonal crop, P – Perennial crop, A – Annual crop

The Table depicts that Seasonal Crops such as Paddy, Turmeric and Ginger are showing a declining trend while the Perennial and Annual Crops are showing a sharp increasing trend in Area and Production in Kerala. High positive variations are reflected in three crops – Rubber, Arecanut and Banana – the crops which have cost effectiveness and high market prices while negative variations occurred in paddy and tapioca, the main staple food crops of Kerala. The highest areal and crop- wise variation occurred in the cultivation of Rubber from 188.07 Hundred Hectares to 853.59 Hundred Hectares while the production increased at a peak rate from 24589 Million Tonnes to 798940 Million Tonnes.

Productivity refers to the physical relationship between the quantity produced (Output) and the quantity of resources used in the production process. Agricultural productivity is equal to the ratio of Total Agricultural Crop Production to Total Land Area used for cultivation which refers to the amount of crop production in per hectare land. High productivity reflects decreasing cost of production and increasing profitability which will help the farmer to increase the living standards and increasing exports. It will be also helpful for farmers to provide the agricultural commodities at a lower cost to the customers. The table focuses upon the changes in area, production and productivity of thirteen principal crops which depicts that productivity of Tapioca, Banana, Ginger and Rubber sharply escalated while that of pepper, coffee and paddy increased very slowly. The productivity of Coconut is remaining stagnant in Kerala in the areawise distribution. Planting coconut seedlings in doughs is an indicator reflecting the first step of land conversion from paddy and other cereals cultivation to the usage of land for other purposes or substitution of low valued crops to high valued crops. Though The Kerala Conservation of Paddy land and Wetland Act 2008 was initiated and implemented, the area under land used for paddy cultivation has been declined while that of coconut has been increased without much increase in productivity. In 1961-62, paddy occupied the leading position in area under cultivation followed by coconut and tapioca. In 2017-18, the situation changed as area under paddy showed a declining trend while area under coconut showed an increasing trend.

### 3.4.1. Crop Diversification

Crop Diversification refers to a shift of crop or area under crop to another crop or area under another crop. The Diversification is preferred by farmers to tackle with the

physiological as well as economic problems faced by them and the problems arising from one crop will be independent from the other crops if a number of crops are cultivated. It will be helpful to the farmer in maintaining the stagnant or increased income though one crop is less profitable. So the farmer can prefer multiple cropping, high valued crops and less water consuming crops instead of monocropping, less valued crops and high water consuming crops.

The Herfindal- Hirschman's Index of Crop Diversification is applied to analyse the Crop Diversification and Magnitude of Crop Diversification in Kerala. It is calculated by the formula

$$\text{Herfindal Index} = \text{H.I} = \sum_{i=1}^{n} Pi^2 \text{ where Pi} = \frac{Ai}{A}$$

where Ai refers to Net Area Sown in the ith crop and A refers to the Total Net Area Sown

$$\text{Index of Crop Diversification (ICD)} = 1 - \sum_{i=1}^{n} Pi^2 = 1 - \text{H.I}$$

Herfindal Index is an index for crop specialization which ranges from zero to one where onerepresents complete specialization and zero represents perfect diversification(Gupta and Tewari, 1985). An Index of Crop Diversification which is obtained from Herfindal Index also ranges from zero to one where one represents complete diversification and zero represents complete specialization. The Magnitude of Diversification be diversified as

1. Magnitude of High Diversification – 0.80 – 1.00
2. Magnitude of Moderate Diversification – 0.60 – 0.80
3. Magnitude of Low Diversification – < 0.60

**Table 3.10.**

**Area –wise Index and Magnitude of Crop Diversification in Kerala (2017-18)**

| STATES | HI | ICD | Magnitude | Topography |
|---|---|---|---|---|
| **TV** | 0.25 | 0.75 | Moderate | Red Loam Lands |
| **KL** | 0.22 | 0.78 | Moderate | Midlands |
| **PT** | 0.26 | 0.74 | Moderate | Malayoram |
| **AL** | 0.27 | 0.73 | Moderate | Lowland |
| **KT** | 0.33 | 0.67 | Moderate | Malayoram |
| **ID** | 0.19 | 0.81 | High | Highland |
| **ER** | 0.26 | 0.74 | Moderate | Coastal Sandy Lands |
| **TS** | 0.25 | 0.75 | Moderate | Midlands, Coastal Sandy Lands |
| **PL** | 0.25 | 0.75 | Moderate | Coastal Plains, Black Soils |
| **MA** | 0.26 | 0.74 | Moderate | Malappuram Lands |
| **KZ** | 0.37 | 0.63 | Moderate | Malappuram Lands |
| **WA** | 0.17 | 0.83 | High | Highland |
| **KN** | 0.21 | 0.79 | Moderate | Malayoram |
| **KS** | 0.25 | 0.75 | Moderate | Malappuram Lands |

Source: Department of Economics and Statistics, Government of Kerala

Index of Crop Diversification is high and approaches one in almost all the Districts of Kerala indicating perfect diversification. The crop diversification and selection of crops is preferred according to the regional differences in the physiological climatic regions. The number of crops is highest in Highlands with the largest variety of crops cultivated while in all the other physiological regions, there exists moderate or high crop diversification and Kerala is proving to be a model for other states due to existence of the crop diversification which reduces the risk and uncertainty in agricultural productionandprovides a guidance to agriculturists to bravely face the possibility of occurance of an agricultural crisis and be a risk averters in agricultural sector. Idukki and Wayanad are the two districts with a large variety of diversified perennial crops such as Pepper, Cardamom, Arecanut, Banana, Plantains, Tea, Coffee, Rubber, Coconut and Jackfruit.

### 3.4.2. Crop Ranking and Crop Combinations :

The Utilisation of Agricultural Land and Crop Combinations selected by farmers in the land is varying according to changes in the physiological characteristics in Kerala. Kerala may be accepted as a true example for utilizing the land resources according to the existing topography.Topography is one of the parameters used for identifying Agro-Climatic Zones explained by ENVIS Centre, sponsored by Ministry of Environment, Forests and Climate Change, Government of India. The crop combinations of the Districts in Kerala give a picture of the area-wise leading crops in Kerala and the topography as which is given in Table 3.11.

In the areal pattern of leading crops in Kerala, Coconut is the leading crop with first rank in 7 districts and second rank in 4 districts of Kerala, thus making Kerala prestigious with the name itself which derived out of the Malayalam word – ‘Kera’ which means Coconut. The other leading crops in area-wise distribution is Rubber in 3 districts which is related to Malappuram lands, Paddy in Lowlands of Alappuzha, Pepper in Idukki and Coffee in Wayanad. In Kerala, 12 different leading crops with equal to or more than five percent as the ratio to Net Area Sown exists and it implies that Crop Diversification exists in the Districts of Kerala. The traditional Farmers are well planned enough to face the uncertain and risky situations arising from climatological and socio- economic circumstances. The farmers are accepting the crop combinations which are very much suitable or apt for the particular agricultural area.

**Table 3.11.**

**Topography and District-wise Crop Combinations in Kerala**

| Crops | Crop Combinations | Districts | Topography |
|---|---|---|---|
| **One Crop** | Nil | 0 | …… |
| **Two Crops** | Paddy+Coconut (S+ P) | AL | Lowland |
| | Rubber+Tapioca(P+S) | PT | Malayoram |
| | Rubber+Coconut(P+P) | ER | Coastal Sandy Lands |
| **Three Crops** | Coconut+Rubber+Tapioca(P+P+S) | KL | Midlands |
| | Rubber+Coconut+Paddy(P+P+S) | KT | Malayoram |
| | Coconut+Paddy+Rubber(P+S+P) | TS | Midlands & Coastal Sandy Lands |
| | Coconut+Rubber+ Arecanut(P+P+P) | KS,MA | Malappuram Lands |
| | Coconut+Rubber+Cashew(P+P+P) | KN | Malayoram |
| **Four Crops** | Coconut+ Rubber+Tapioca+Plantain(P+P+S+A) | TV | Red Loam Lands |
| | Paddy+Coconut+Rubber+Banana(S+P+P+A) | PL | Palakkad Coastal & Chittoor Black Soils |
| | Coconut+Rubber+Arecanut+ Jackfruit(P+P+P+P) | KZ | Malappuram Lands |
| **Seven Crops** | Pepper+Rubber+Cardamom+Tea+ Jackfruit+Coconut+Coffee | ID | Highland |
| | Coffee+Arecanut+Banana+Pepper+ Coconut+Rubber+Paddy(P+P+A+P+P+P+S) | WA | Highland |

Source :Computed from data of Directorate of Economics and Statistics, Govt of Kerala.

**Conclusion:**

Among the Land use categories, major proportion of land is acquired by Net Area Sown which helps to create food security to the existing population. The Net Area Sown is the most important Land Use in Kerala as it occupies more than sixty percent of Total Geographic Area. The Utilisation Pattern of Net Area Sown is the most predominant than other Land Use Categories and the main participants in the proper utilisation of Net Area Sown is the farmers and the ways and procedures in which they are utilizing the land in the maximum possible manner is to be identified. If an individual is provided an acre of land and if it is utilised properly by people themselves with the assistance of those who are experts in traditional agriculture, they can create golden harvest in their own fields. It can help to create a healthy younger generation and a proper eco-system through a favourable environment.

# CHAPTER IV
# PROFILE OF STUDY AREA

## 4.1. Introduction

Kerala comprises only 1.8 per cent of the total geographical area of our country, but 2.76 per cent of the total Indian population. Kerala, being the 'Spice Garden of India' gives priority to the agricultural sector and Out of the total geographical area of 3886257 hectares of Kerala Economy, the forest area together with the net sown area occupies 85 per cent, which is greater than three- forths of the total area. Analyzing the growth trends of the land use pattern, variations can be seen in the land used for non- agricultural purposes, especially in the net sown area. While analyzing the periods from 1995 to 2018, the proportion of land used for non- agricultural purposes are showing a positive upward trend while the proportion of net sown area shows a downward moving negative trend. Changes in land use pattern in Kerala may be due to i) population pressures and emerging lifestyles ii) area under forest dwindled due to expansion of plantations, river valley projects, encroachment of farmers into forest lands etc iii) more land is kept fallow as a consequence of rise in cost of cultivation of traditional crops. Rising cost of cultivation, stagnating rice prices and alternative uses of paddy lands were the main reasons for the declining trend of the cropped area. (OmanaCheriyan, 2004).

## 4.2. Physiological Zones in Kerala

Agriculture is a seasonal economic activity and productivity of crops is dependent upon the climatic and geographic features of particular area. Division of the Total Geographical Area into three climatically distinct and parallel physiographic zones is necessary to know about variations in the land use especially the Net Area Sown in Kerala. For the particular purpose, Kerala is divided into the physiological zones which include

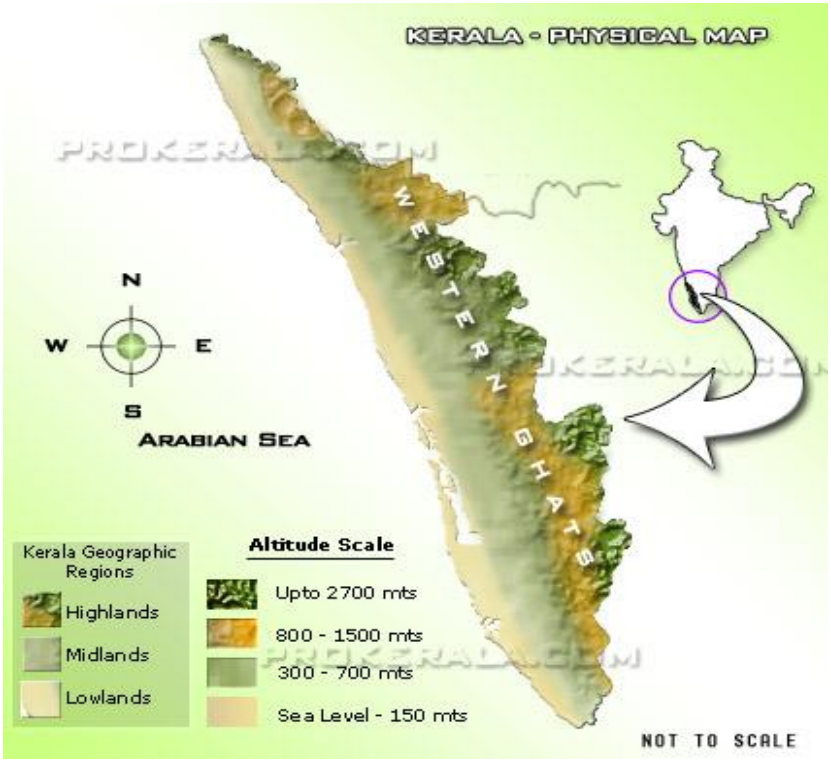
i) Eastern Highlands( Rugged and cool mountainous terrain) include the steeply sloping areas with 41 out of 44 rivers flowing from Western Ghats enriching Kerala and providing proper and natural irrigation.

ii) The Central Midlands(Rolling Hills) include not much steep hills and wide rivers along with ribbon valleys. The ribbon valleys with laterite terrains are suitable for paddy cultivation and hill tops are suitable for plantain and cash crops.

iii) Western Lowlands(also called as Coastal Area or Wetlands) with sandy stretches is suitable for extensive paddy fields , thick groves of coconut trees along backwaters crisscrossed with a network of canals and rivers. Area under Kole land paddy cultivation lies below sea level in the region.

**Figure 4.1**

**Physiological Climatic Zones of Kerala**




Source: Resource Atlas, Centre for Earth Science Studies, TVM.

**Table 4.1**

**Physiological zones in Kerala**

| Zones | Altitude(m) | Total Area (km) | Area(%) | Soil | Temperature | Rainfall |
|---|---|---|---|---|---|---|
| Lowland | 0-7.5 | 3979.3 | 10.24 | Coastal Alluvium | $30^0$ | 1250 mm |
| Midland | 7.5 - 75 | 16231.2 | 41.76 | Laterite/ Red soil | $32^0$ | 3000 mm |
| Highland | >75 m | 18653.5 | 48 | Forest Loam | $20^0$ | 5000mm |

Source: Ministry of Agriculture, Government of Kerala

Classification of Total Geographical Area of Kerala specifies that about 10.24 percent belongs to Lowland which is identified as alluvial plains ( Kole lands) and sandy stretches with extensive paddy fields and coconut trees, 41.76 percent belongs to midland with paddy, coconut, arecanut, vegetables, plantains while 48 percent is Highlands which

includes forest area along with plantation crops. The altitude and slope of the land which is a determinant of topography is also a main factor for determining the selection of crops suitable for cultivation. The locational and altitudinal variations in Kerala is endowed with the specific and exclusive agro-ecological conditions (George P.S, 2001)

### 4.3. Profile of Study Area

The sample area for study is selected with the specification of Categorisation of Land Use Pattern and identifying the categorization for which major proportion of land is used. Identification of Net Area Sown as the important and major land use, the Districts with specific topographical features were identified and selected for the purpose. Palakkad was selected as the state occupying the leading position in Net Area Sown and the Number and Variety of crops cultivated especially millets and pulses. It also occupies a specific feature of Palakkad gap which makes it unique when compared to other districts. Thrissur District has leading position in productivity in the summer cultivation especially paddy cultivation which is done in lowlands or wetlands while occupies the second leading position in area utilised under summer paddy cultivation. Three Panchayats representing the largest Net Area Sown from each physiological zones in Thrissur District were selected – Venkitangu for Lowlands, Pazhayannur for Midlands, Kodassery for Highlands and two Panchayats representing the largest Net Area Sown from each physiological zones in Palakkad District were selected- Kuzhalmannam for Midlands, Agali for Highlands. The brief description of the selected area is necessary to understand the relevance of the particular study.

#### 4.3.1. Palakkad:

Palakkad District locates between North Latitude10’’20’ and 11’’14’’ and East Longitude 76’’02’ and 76’’54’ and is bounded by Malappuram and Nilgiri Districts on the North, Coimbatore district in the East, Thrissur District on the South and Malappuram and Thrissur Districts on the West. It was called as ‘Gateway of Kerala’ as the district opens the gateway to the rest of the country through Palakkad Gap , the natural gap in 960 kms long Western Ghats on either side by Nilgiris and Anamalais which is the most influencing factor for its unique characteristics such as climate. The district enjoys both the climates of North- East and South-West Monsoon due to blowing of North East Wind.

#### 4.3.1.1. Kuzhalmannam:

The word, ‘Kuzhalmannam” is derived from Kuzhal represents flute and mannam represents slow. The panchayat is the Land of Black Palms and Paddy Fields which is the main cultivation of rural population. The soil is Black Cotton Soil which is suitable for cultivation and major portion of the area belongs to Midlands. Upto 1956, the cultivation was purely dependent upon rainfalls while from 1956 onwards, the Malampuzha Dam Left Bank Canal is the main source of irrigation for agricultural purposes. The main cultivations are Paddy, Coconut, Tapioca, Banana, Rubber and Pepper are the main crops cultivated while Cowpea and Vegetables are also cultivated in the region.

#### 4.3.1.2. Agali:

Attappady lies between two ranges of Western Ghats which has the general slope towards the North East Area. From Mukkali to Anakkatty towards east, the elevation is between 500 m and 575 m which represents the features of Highland. The two major rivers, Bhavani and Siruvani which combine to form Cauveri river is the main source of irrigation for agricultural activities. Attappadi is classified into three panchayats for a better decentralized planning as Agali, Pudur and Sholayur. Around 51% of Attappady has an elevation between 600 m to 1000 m and 71.6% of the area has a slope between 15 to 30 degrees and receives much lower monsoon rainfall since it is located in the rain shadow as the mountain ranges separating valley from Mannarkad obstruct much of the rain bearing clouds, while the slopes facing the west and east receive heavy rainfall. The average rainfall varies from 794.87 mm at Agali to 794.98 mm at Pudur and a very high rainfall varying from 1574 mm at Sholayur to 2289.6 mm at Mukkali. The population consists of tribals who belong to three groups, Irulas, Mudugas and Kurumbas (Muraleedharan and Sankar 1991), all belong to broad group of Dravidians. Kurumbas exist only in Pudur, Irulas in Sholayur and in Agali, Irulas and Mudugas together contribute 50 hamlets. Irulas, the dominant tribe of Agali, are of Tamil Origin who was migrated due to great water scarcity from Coimbatore by the end of $16^{th}$ century or the beginning of $17^{th}$ century. Originally, they were doing shifting cultivation, but due to encroachments, they shifted to settled and plough cultivation. They cultivated millets such as makkacholam or maize(zea mays), ragi or fingure millet(Eleusine Coracana) and chama or little millet(Panicum

Miliaceum), pulses(like thuvara or red gram) and oil seeds(like groundnut or castor seed)(SanathananVelluva, 2006).

### 4.3.2. Thrissur

Thrissur District, the cultural capital of Kerala was formed on 1st July 1949, with headquarters ar Thrissur city. Paddy cultivation is the largest agricultural practice pursued by majority of the agricultural population. Tapioca, Coconut, Arecanut, Rubber, Cashew, Banana are other leading crops in the District. Tapioca, the second leading crop is cultivated due to high demand which arises from its calorific value. The low lying kole lands in Thrissur belongs to coastal wetlands which are protected and listed in Ramsar Site in 2002 as per Convention on Wetlands signed in Ramsar, Iran in 1971. It is a part of the largest wetland system which concentrates only on paddy cultivation in South-West Coast of Vembanad Kole with a network of natural channels and network canals.

#### 4.3.2.1. Venkitangu

Venkitangu Panchayat is formed with area of 20.47 sq.km with largest Net Sown Area under kole cultivation in lowlands in Thrissur District. The method of cultivation followed by farmers is the same as that of kuttanad region. As a precaution for cultivation in high water levels, the farmers used seeds such as white pokkali and kuttadan for cultivation. White pokkali is the unique salt resistant variety which is suitable to grow in saltwater. Though October to May is the period of cultivation for paddy, some farmers are doing aquaculture in the high water levels upto October which is called as ‘one fish, one rice’ cultivation.

#### 4.3.2.2. Pazhayannur:

Pazhayannur panchayat, formed in 1954 is located in Talappilly Tehsil of Thrissur District with 59.03 sq. kms. It has the unique feature of being the Special Agricultural Development Zone (SAZ) for Vegetables. Paddy, Cowpea, Tapioca, Yam, Turmeric, Ginger, Pepper, Plantain, Banana (Chengalikkodan) are the main crops cultivated in the area and a conversion is also seen from paddy and coconut to rubber cultivation.

**4.3.2.3. Kodassery:** Kodassery is a highland area with 9 mts above Sea Level in Mukundapuram Tehsil in Thrissur District, focuses mainly on agriculture and related activities and one of the leading producers of paddy cultivation in Kerala which is now in

a stage of negligence towards paddy cultivation. It is the only village in Kerala as well as India with 100 percent reservation for women. The highlands have a diversification in crops due to the regional differences and concentrated upon a number of crops than wetlands. The classification of selected panchayats into physiological and agro- ecological zones is represented in Table 4.2.

**Table 4.2**

**Profile of the Study Area**

| Sl.No | Districts | Physio- Zone | Blocks | Panchayats | Agro-Eco Zones |
|---|---|---|---|---|---|
| 1 | Palakkad | Midland | Kuzhalmannam | Kuzhalmannam | Palakkad Plains |
| 2 | | Highland | Attappadi | Agali | High ranges |
| 3 | Thrissur | Lowland | Mullassery | Venkitangu | Central Midlands |
| 4 | | Midland | Pazhayannur | Pazhayannur | Malayoram |
| 5 | | Highland | Irinjalakuda | Kodassery | Malayoram |

Source :Kissan Kerala, Government of Kerala

The physiological features of the study area is relevant for the study as the land use as well as the cropping pattern is dependent upon the exclusive topology of land. Regional differences occur as the study area is distinguishable on the basis of Altitude, Rainfall, Soil type and Topology. The Agro- Ecological Zones representing the selected Panchayats are Palakkad Plains for Kuzhalmannam, Highranges for Agali, Central Midlands for Venkitangu, Malayoram for Pazhayannur and Kodassery on the basis of the Physiological features of the five sample panchayats which is given in Table 4.3.

**Table 4.3.**

**The physiological features of Study area**

| Panchayats | Altitude | Rainfall | Soil Type | Topology |
|---|---|---|---|---|
| Kuzhalmannam | Type I* | Pattern II* | Red Loam | Model IIa* |
| Agali | Type II* | Pattern I & II | Red Loam | Model III* |
| Venkitangu | Type I | Pattern I & II | Laterite | Model II a* |
| Pazhayannur | Type I | Pattern I* | Lateritewithout B horizon (NH*) | Model III |
| Kodassery | Type I | Pattern I | Laterite without B horizon (NH) | Model III |

Source :Kissan Kerala, Government of Kerala.

Note : * NH – Natural Highlands

Where *Type I – Altitude upto 500 m above MSL(Low altitude Zone, Hot Humid Tropics), Type II – More than 500 m above MSL, Pattern I – Both the South-West and

North- East Monsoon are active and moderately distributed South West Monsoon with June Maximum (Pazhayannur, Kodassery), Pattern II- Poorly distributed rainfall; Southwest Monsoon with July Maximum and concentrated in 3-4 months in North East Monsoon relatively weak(North of 110 N Latitude)(Kuzhalmannam), while both the monsoons are available in Agali and Venkitangu. Model II a- Less Extensive Valleys, Hills with moderate gradients, Slopes with mild gradients, Model III - Narrow valleys, Hills with steep gradients, Steep slopes. 90 percent of precipitation is during two monsoons – with 60 percent annual rainfall in June-Aug (Southwest) and 30 percent in Oct-Nov (Northeast). The main soil-type is Laterite and its variations especially with B horizon present and in Western Ghats with B horizon absent.

The Land Use Pattern in the study area revalidates the area under different purposes such as Wetlands, Drylands and other classifications which is represented in Table 4.4.

**Table 4.4**

**Land Use Pattern in Study Area (Acres) - 2017-18**

| Land Use | Lowland | Proportion to TGA | Midland | Proportion to TGA | Highland | Proportion to TGA |
|---|---|---|---|---|---|---|
| Wetlands | 2612.68 | 51.63 | 7762.6 | 35.25 | 2350.62 | 5.13 |
| Drylands | 2447.28 | 48.36 | 7558.83 | 34.32 | 36973.5 | 80.74 |
| Puramboke | 0 | 0 | 16.19 | 0.07 | 772.54 | 1.69 |
| Forest | 0 | 0 | 3035.45 | 13.78 | 5632.26 | 12.30 |
| Fallow lands | 0 | 0 | 0 | 0.00 | 61.82 | 0.14 |
| Plantations | 0 | 0 | 3648.79 | 16.57 | 0 | 0.00 |
| Total Area | 5059.96 | 100 | 22021.9 | 100.00 | 45790.8 | 100.00 |

Source: Directorate of Economics and Statistics, Govt of Kerala.

The Table depicts that in lowland, Wetlands contribute about 51.63 percent of Total Geographical Area while there exists no forest, fallow and plantations in the area. The Midlands which is a combination of Pazhayannur and Kuzhalmannam contain all the categories except fallow lands. Highlands of Agali and Kodassery together occupy 80.74 percent Drylands and only 5.13 percent wetlands. The important point to be highlighted is that all the lands have very little area kept as fallow lands reflecting the maximum utilisation of land. The size of land is larger in Highlands especially drylands than in Lowlands and Midlands. The Forest Area is also larger in Highlands than in other two physiological zones. Wetlands and Drylands occupy the major proportion of Total Geographical Area in Lowlands and Midlands. In Midlands, wetlands and drylands are

followed by Plantations and Forest Area while the Drylands occupy the major proportion of Total Geographical Area in Highlands with 80.74 percent, followed by Forests with 12.30 percent and so irrigation is necessary for Highlands which include Kodassery and Agali.

### 4.4. Profile of Sample Respondents

Direct assessment as well as observation of the study area is required in order to verify the details of secondary data which is an exact and appropriate design for the Field Survey and it may be conducted with the help of Primary Data collection from the specific survey. As a first-hand information, a pilot survey was conducted from farmers in different zones and open discussions were held with the officials of Land Use Board, Krishi Bhavan, Panchayat Offices and with the members of Padasekharasamitis and Karshakakoottayma. The particular discussions helped in selecting the sample respondents from the selected area in physiological zones.

The Panchayats were selected on the basis of Simple Random Sampling method with the largest Net Area Sown as the key indicator of Land Use in Kerala because Net Area Sown is the major land use in all the physiological zones in Kerala. The Sample farmer respondents were selected from the five panchayats, one Panchayat – Venkitangu represented as Lowlands, two panchayats - Pazhayannur, Kuzhalmannam together represented as Midlands and two Panchayats- Kodassery, Agali together represented as Highlands in further analysis. According to NSSO 70$^{th}$ Round Situation Assessment Survey of Agricultural Households in India, "Farmer is a person who possesses some land and is engaged in some agricultural activities on that land during last 365 days preceding the date of survey"(NSSO, 2013). The study area along with sample population from physiological zones is depicted in Table 4.5.

**Table 4.5.**

**Selected Sample Panchayats, Population and Type of Land**

| Land Use | Panchayats | Frequency | Percent |
|---|---|---|---|
| Lowland | Venkitangu | 60 | 20.0 |
| Midland | Pazhayannur, Kuzhalmannam | 120 | 40.0 |
| Highland | Kodassery, Agali | 120 | 40.0 |
| Total | | 300 | 100.0 |

Source : Primary Field Survey

The table depicts that 20 percent respondents are selected from Lowlands, 40 percent from Midlands and 40 percent from Highlands corresponding to the Total Geographical area in Physiological zones in Kerala. The particular study identifies the factors influencing Agricultural Land Use on the basis of perception of 300 farmers selected from the sample area and engaged in agricultural activities.

The size distribution of land owned is necessary to know about temporal as well as spatial variations in land used by farmer respondents. The 7th Survey on Land and Livestock holdings which was conducted as a part of NSSO 70th Round during January – December 2013 distributed the size of land owned into different categories. The percentage distribution of area owned by farmers is expressed by categorizing on the basis of size of land owned into five categories as given in Table 4.6.

**Table 4.6.**

**Distribution of Owned Land holdings**

| Category of owned land holding | Size of Holding |
|---|---|
| Marginal | More than 0.002 hectare and less than 1 hectares |
| Small | More than 1 hectare and less than 2 hectares |
| Semi-Medium | More than 2 hectare and less than 4 hectares |
| Medium | More than 4 hectare and less than 10 hectares |
| Large | More than 10 hectares |

Source: NSSO, Land and Livestock Holdings Survey Report, 2013.

The farmers who own the land based on five categories of size of holdings is classified as – Marginal, Small, Semi-Medium, Medium and Large land in the study as it will be helpful for further comparisons. Land with a land size in between 0.002 and 1 Hectares are categorized as Marginal land while a land size of greater than 10 is categorized as Large Sized Land. The particular study is giving relevance to the categorization and since the study focuses on the persons who occupy land, the landless category as per NSSO with a land size of 0.00 to 0.002 Hectares is not taken into consideration. Ownership of land refers to a plot of land which was considered as owned by the household, if permanent heritable possession, with or without the right to transfer the title was vested in the member or members of the household(NSSO, 70th Round, 2013). The Distribution of Owned Land Holdings of sample respondents and the number of respondents who belong to each category is given in Table 4.7.

**Table 4.7.**

**Distribution of Owned land Holdings of sample respondents**

| Category of owned land holding | Size of land | Frequency | Percent |
|---|---|---|---|
| Marginal | <1.00 | 173 | 57.6 |
| Small | 1.01-2.00 | 56 | 18.7 |
| Semi-Medium | 2.01-4.00 | 42 | 14.0 |
| Medium | 4.01- 10.00 | 29 | 9.7 |
| Large | > 10.01 | 0 | 0 |
| Total | | 300 | 100 |

Source: Primary field survey

The distribution of the land occupied by the respondents as on the basis of categorization by NSSO reveals that 57.6 percent of the respondents own Marginal Land , 18.7 percent occupies Small Land while only 14.0 percent own Semi- Medium Land, 9.7 percent own Medium sized Lands and no respondent owned Large size lands. The number of respondents who own Medium land is far lesser than that of Marginal land. Increased number of respondents in the Marginal Lands and absence of respondents in Large size lands reflect the fact that farmers with Large size lands are lesser in selected area within the Physiological Zones. Since the study is also focused on Physiological Zones such as Lowland, Highland and Midland, the distribution of land on the basis of land holdings in the zones is also relevant as shown in Table 4.8.

**Table 4.8.**

**Size of Owned Land Holdings in Physiological Zones**

| Category of owned land holding | Type of land | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Lowland | | Midland | | Highland | | | |
| Marginal | 40 | (66.7) | 85 | (70.8) | 48 | (40) | 173 | (57.6) |
| Small | 9 | (15.0) | 32 | (26.7) | 15 | (12.5) | 56 | (18.7) |
| Semi-Medium | 8 | (13.3) | 3 | (2.5) | 31 | (25.8) | 42 | (14.0) |
| Medium | 3 | (5.0) | 0 | (0) | 26 | (21.7) | 29 | (9.7) |

Source: Primary Field Survey.

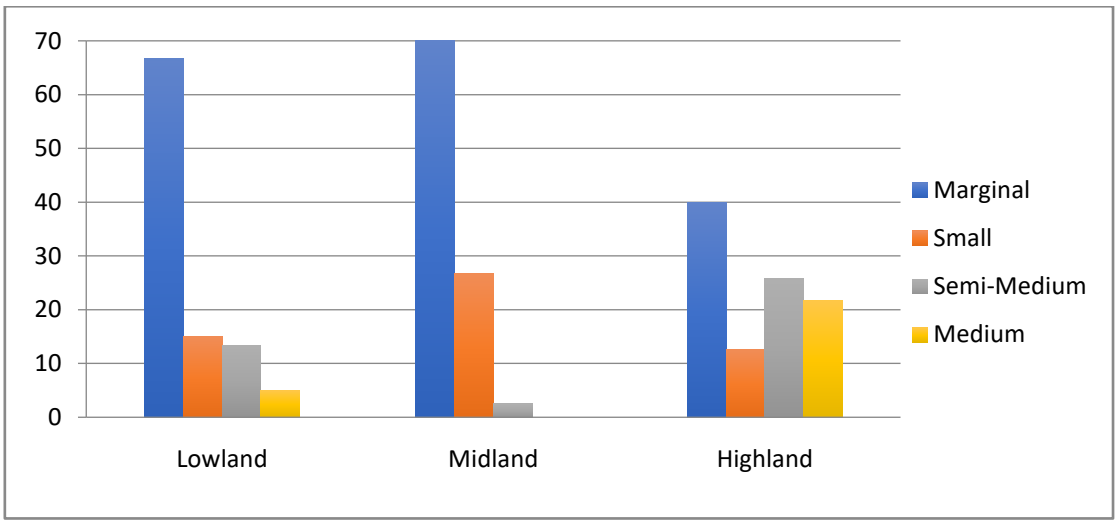
**Note:** Figures in Parentheses represent percentages to respective total

In all physiological zones, 57.6 percent of respondents own Marginal Lands with size in between 0.002 and 1 Hectare, 18.7 percent own small sized land holdings with a size in between 1.01 and 2 Hectares, only 14.0 percent owned Semi- Medium sized lands in between 2 to 4 Hectares and only 9.7 percent owned Medium sized lands with area between 4 and 10 Hectares. The respondents who own Marginal Land Holdings are

sharply higher than other landholdings. Within the Lowland itself, 66.7 percent, 15.0 percent, 13.3 percent and 5 percent respondents own Marginal, Small, Semi-Medium and Medium sized lands respectively. Within Highlands 40 percent owned Marginal Holdings, and within Midland, 70.8 percent owned Marginal Lands. Medium lands are comparatively high in Highlands with 21.7 percent while within the Highlands, Marginal Holdings are higher than other categories. The graphical representation of categorization of owned land holdings is given in Figure 4.2.

**Figure 4.2**

**Category of Size of Owned Land Holdings in Physiological Zones**




The figure depicts that the number of respondents who owned Marginal land is high in every land size categories giving an evidence that 57.6 percent of farmers owned lands with less than 1 Hectare. About 66.7 percent of landholdings within Lowlands are Marginal lands while only 33.3 percent belong to other categories. In Highlands, 52.5 percent have land size less than 4 Hectares while 47.5 percent have land size greater than 4 Hectares. A proportional distribution of all land size exists in Highlands with high proportion of Medium land as respondents in Highlands of Agali Panchayat, Palakkad own 21.7 Medium sized lands.

### 4.5. Socio – Demographic Profile of Study Area

Demographic features of the sample respondents are necessary for the study as it helps to know about the age, social group, marital status, gender, education of farmer households and to identify the relationship between the variables and agricultural land use. All the variables incorporated may be directly or indirectly influencing the size of owned

land holding. The Socio - Demographic profile of farmer respondents related to the economic variables and attributes are given in Table 4.9.

**Table 4.9.**

**Socio - Demographic profile of farmer respondents**

| Economic Variables | Attributes | Marginal | | Small | | Semi-Medium | | Medium | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Physiological Zones | Lowland | 40 | (23.1) | 9 | (16.1) | 8 | (19.0) | 3 | (10.3) | 60 | (20) |
| | Midland | 85 | (49.1) | 32 | (57.1) | 3 | (7.1) | 0 | (0) | 120 | (40) |
| | Highland | 48 | (27.7) | 15 | (26.8) | 31 | (73.8) | 26 | (89.7) | 120 | (40) |
| Age | <30 | 0 | (0) | 0 | (0) | 1 | (2.4) | 0 | (0) | 1 | (0.3) |
| | 31-60 | 112 | (64.7) | 30 | (53.6) | 18 | (42.9) | 6 | (20.7) | 166 | (55.3) |
| | >61 | 61 | (35.3) | 26 | (46.4) | 23 | (54.8) | 23 | (79.3) | 133 | (44.3) |
| Social Group | ST | 0 | (0.0) | 4 | (7.1) | 30 | (71.4) | 26 | (89.7) | 60 | (20) |
| | SC | 20 | (11.6) | 4 | (7.1) | 0 | (0) | 0 | (0) | 24 | (8.0) |
| | OBC | 76 | (43.9) | 18 | (32.1) | 2 | (4.8) | 2 | (6.9) | 98 | (32.7) |
| | Others | 77 | (44.5) | 30 | (53.6) | 10 | (23.8) | 1 | (3.4) | 118 | (39.3) |
| Marital Status | Unmarried | 1 | (0.6) | 1 | (1.8) | 0 | (0.0) | 0 | (0.0) | 2 | (0.7) |
| | Married | 164 | (94.8) | 51 | (91.1) | 40 | (95.2) | 28 | (96.6) | 283 | (94.3) |
| | Widower | 8 | (4.6) | 4 | (7.1) | 2 | (4.8) | 1 | (3.4) | 15 | (5.0) |
| Gender | Male | 148 | (85.5) | 45 | (80.4) | 38 | (90.5) | 29 | (100) | 260 | (86.7) |
| | Female | 25 | (14.5) | 11 | (19.6) | 4 | (9.5) | 0 | (0.0) | 40 | (13.3) |
| Education Qualification | Lower Primary | 21 | (12.1) | 12 | (21.4) | 33 | (78.6) | 28 | (96.6) | 94 | (31.3) |
| | Upper Primary | 4 | (2.3) | 2 | (3.6) | 1 | (2.4) | 0 | (0.0) | 7 | (2.3) |
| | Secondary | 89 | (51.4) | 25 | (44.6) | 4 | (9.5) | 1 | (3.4) | 119 | (39.7) |
| | Senior secondary | 35 | (20.2) | 12 | (21.4) | 0 | (0.0) | 0 | (0.0) | 47 | (15.7) |
| | Higher | 24 | (13.9) | 5 | (8.9) | 4 | (9.5) | 0 | (0.0) | 33 | (11.0) |
| Total | | 173 | (100) | 56 | (100) | 42 | (100) | 29 | (100) | 300 | (100) |

Source: Primary Field Survey

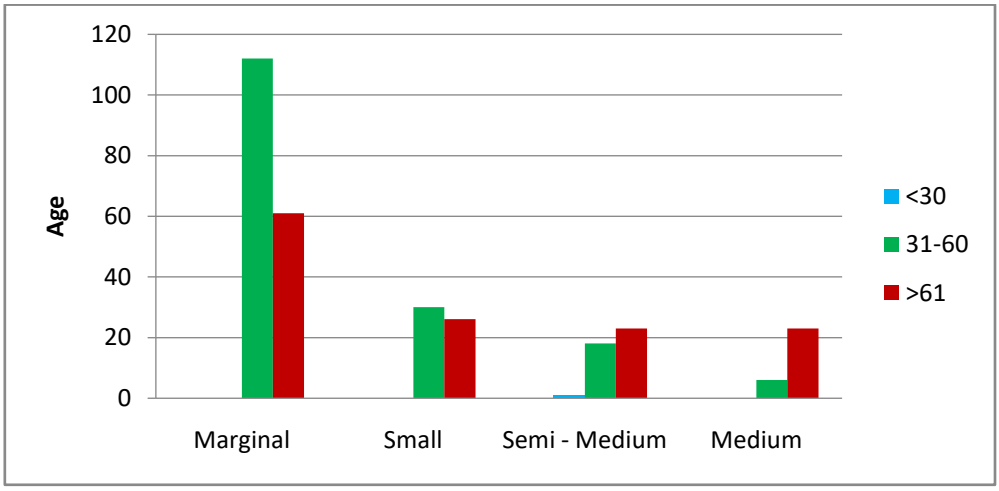
Note: Figures in Parentheses represent percentages to respective total.

Age is classified into three inclusive groups which rectifies that 55.3 percent of the respondents belong to the age group of 31 to 60 and one of the reason for the high frequency is the participation of pensioners in agricultural activities after retirement. 44.3 percent of total respondents are of 61+ age and only 0.3 percent belong the age of less than 30. The study gives the true evidence that those who are involved in agricultural activities are aged people who are interested in agriculture with an attitude of protection of nature

and considering agriculture as the primary source of income. Rather than these, they are very much attached to the land handed over to them by forefathers as the responsibility of protecting land is vested in them. The Figure 4.3 gives pictoral illustration of age and land owned in the selected area.

**Figure 4.3.**

**Age and Land Owned**




Considering the age of farmers, only one respondent belong to the age group of less than 30 (0.3 percent) which gives the clear evidence that younger generations are not involved in agricultural activities along with a land ownership while it may be highlighted that among 79.3 percent of respondents belonging to age - group of 61+ within Highlands, majority are Irulas of Scheduled Tribe Community of Agali Panchayat who are healthy enough to engage in agriculture keeping in consideration an in-depth relationship between nature and man.

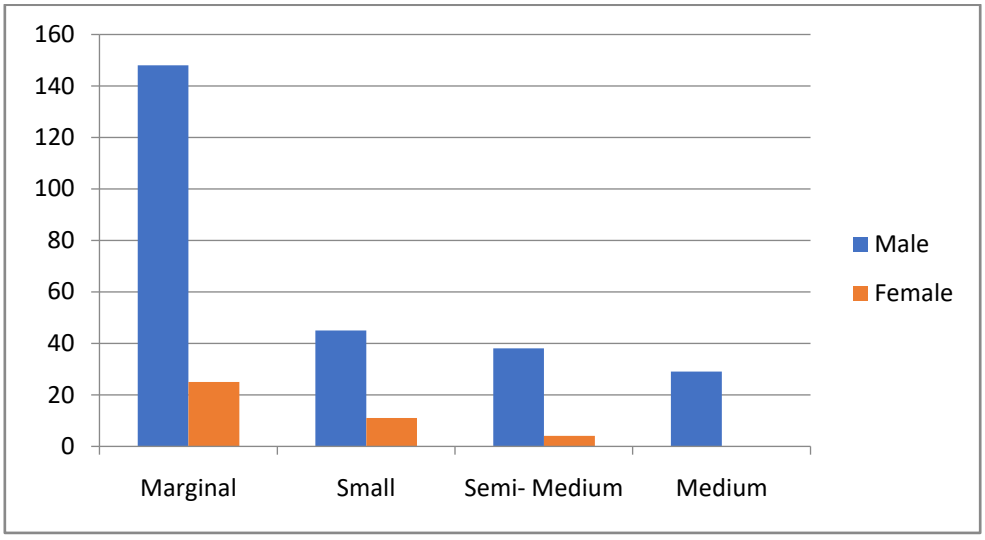
Among the categorization of Social Group, 20 percent respondents belong to Scheduled Tribe especially Irulas, 8 percent belongs to Scheduled Caste, 32.7 percent belongs to Other Backward Communites and 39.3 percent belongs to Other Categories. Within the Semi-Medium and Medium categories, 71.4 percent and 89.7 percent is holded by ST Category while there exists no land ownership for SC Category. Irula community occupied land hereditarily from their forefathers by converting Primary forests to Agricultural land. The categorization of social group in the land owned is important as the distribution and ownership of land varies according to social group. Very rarely, some of the categories in social group gives importance to maternal hereditary hand over of land rather than patriarchal system. In the social groups, Others category includes the Nair Caste in which females owned the land and handed over to female hiers due to the

existence of Marumakkathayam, the system of matrilineal inheritance in which succession to the property was traced through females and females in Christians also owned some land of their own.

Considering the Marital status, 94.3 percent is married while unmarried and divorced respondents together occupy only 5.7 percent. Gender categorisation in the study area is given by the explanation that 86.7 percent respondents belong to Male category while only 13.3 percent belong to Female Category. A gender discrimination exists in the study area in the ownership pattern of land in which male respondents owned majority of land than that of female respondents and is represented in Table 4.4.

**Figure 4.4.**

**Gender and Land Owned**



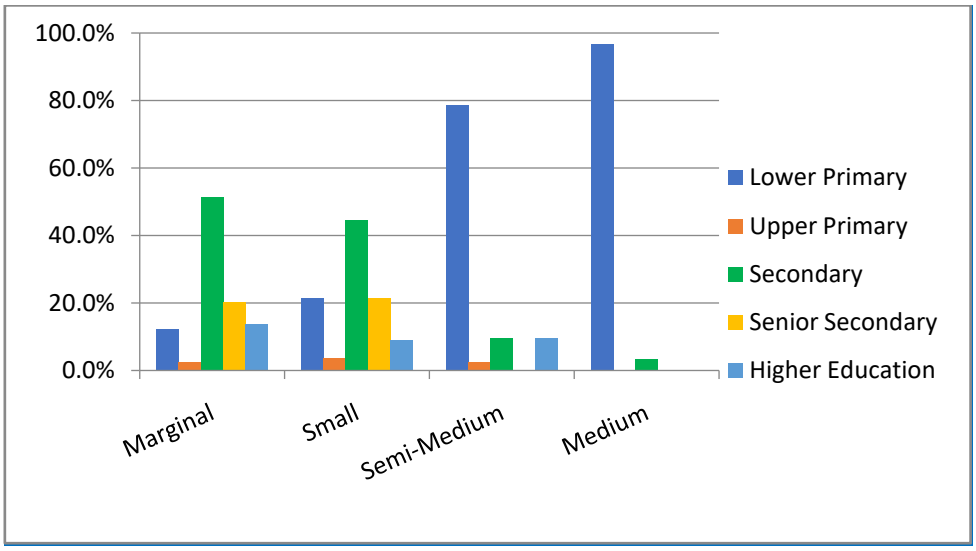

In Lowlands, 85.5 percent are male respondents, 14.5 percent are female respondents, in Midlands, 80.4 percent are male respondents, 19.6 percent are females, while within Highlands, 100 percent belong to male category in ownership of land. This gives the evidence that ownership of land is vested in hands of male respondents rather than female respondents.

Considering the Education Category, among the total respondents, 39.7 percent has Secondary Education while only 26.7 percent of respondents have education above Senior secondary and 33.6 percent has education below Secondary Education which gives the evidence of lesser participation of educated individuals in farming activities. Within the Marginal and Small sized lands, majority of the farmers have Secondary Education while

in Semi-Medium and Medium sized lands, majority of the respondents have the Lower Primary Education. The data reveals that in the Semi-Medium and Medium Lands, the land is owned by less literate farmers than the Small and Marginal lands.

**Figure 4.5.**

**Education and land owned**




The participation of educated individuals in agriculture activities is to be promoted in order to implement the modern possibilities in agriculture and attain a better availability of agricultural commodities for better health. The awareness of innovative technologies, application of fertlisers, new marketing facilities will be more acceptable and always an educated farmer can motivate other educated people to involve and participate in agriculture.

### 4.6. Socio- Economic Characteristics of Respondents

The Socio- Economic characteristics of respondents is necessary to pertain further interpretations of the data. The socio- economic profile gives preference to the variables such as, Poverty level, Type of Family, Years of Experience as farmers, Occupation of Parents, Family size, Number of Dependents, Number of Earning Members, Number of farmers and size of owned land holdings among the sample respondents. The Table gives relevance to the relation between the particular variables and the size of owned land holding. Poverty level is measured by two categories – APL and BPL representing Above Poverty Line and Below Poverty Line respectively based on which the minimum standards of living are defined. Type of family is categorized as Nuclear and Joint family and Years

of experience is given by the years of involvement in farming activities by profession and earn income which is depicted in Table 4.10.

**Table 4.10.**

**Socio- Economic Status of farmer respondents**

| Economic Variables | Attributes | Marginal | | Small | | Semi-Medium | | Medium | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Poverty Level | APL | 149 | (86.1) | 52 | (92.9) | 12 | (28.6) | 3 | (10.3) | 216 | (72.0) |
| | BPL | 24 | (13.9) | 4 | (7.1) | 30 | (71.4) | 26 | (89.7) | 84 | (28.0) |
| Type of Family | Nuclear | 133 | (76.9) | 27 | (48.2) | 9 | (21.4) | 2 | (6.9) | 171 | (57.0) |
| | Joint | 40 | (23.1) | 29 | (51.8) | 33 | (78.6) | 27 | (93.1) | 129 | (43.0) |
| Years of Experience | 0-20 | 71 | (41.0) | 15 | (26.8) | 7 | (16.7) | 1 | (3.4) | 94 | (31.3) |
| | 21-40 | 88 | (50.9) | 31 | (55.4) | 26 | (61.9) | 20 | (69.0) | 165 | (55.0) |
| | >41 | 14 | (8.1) | 10 | (17.9) | 9 | (21.4) | 8 | (27.6) | 41 | (13.7) |
| Occupation of Parents | Agriculture | 129 | (74.6) | 55 | (98.2) | 41 | (97.6) | 29 | (10.0) | 254 | (84.7) |
| | Non-agriculture | 44 | (25.4) | 1 | (1.8) | 1 | (2.4) | 0 | (0.0) | 46 | (15.3) |
| Family Size | 1-2 | 1 | (0.6) | 0 | (0.0) | 0 | (0.0) | 0 | (0.0) | 1 | (0.3) |
| | 3-4 | 44 | (25.4) | 10 | (17.9) | 11 | (26.2) | 1 | (3.4) | 66 | (22.0) |
| | 5-6 | 103 | (59.5) | 28 | (50.0) | 15 | (35.7) | 14 | (48.3) | 160 | (53.3) |
| | 7-8 | 23 | (13.3) | 16 | (28.6) | 6 | (14.3) | 6 | (20.7) | 51 | (17.0) |
| | 9-10 | 1 | (0.6) | 2 | (3.6) | 10 | (23.8) | 6 | (20.7) | 19 | (6.3) |
| | 11-12 | 1 | (0.6) | 0 | (0.0) | 0 | (0.0) | 2 | (6.9) | 3 | (1.0) |
| Number of Dependents | 1-2 | 71 | (41.0) | 20 | (35.7) | 17 | (40.5) | 9 | (31.0) | 117 | (39.0) |
| | 3-4 | 89 | (51.4) | 26 | (46.4) | 16 | (38.1) | 10 | (34.5) | 141 | (47.0) |
| | 5-6 | 6 | (3.5) | 8 | (14.3) | 1 | (2.4) | 10 | (34.5) | 15 | (5.0) |
| | 7-8 | 1 | (0.6) | 0 | (0.0) | 0 | (0.0) | 0 | (0.0) | 1 | (0.3) |
| | Nil | 6 | (3.5) | 2 | (3.6) | 2 | (19.0) | 10 | (34.5) | 26 | (8.7) |
| Number of Earning Members | 1-2 | 74 | (42.8) | 18 | (32.1) | 10 | (23.8) | 2 | (6.9) | 104 | (34.7) |
| | 3-4 | 95 | (54.9) | 34 | (60.7) | 15 | (35.7) | 5 | (17.2) | 149 | (49.7) |
| | 5-6 | 4 | (2.3) | 3 | (5.4) | 11 | (26.2) | 17 | (58.6) | 35 | (11.7) |
| | 7-8 | 0 | (0.0) | 1 | (1.8) | 6 | (14.3) | 5 | (17.2) | 12 | (4.0) |
| Farmers within family | 1-3 | 173 | (100) | 53 | (92.9) | 25 | (59.5) | 7 | (24.1) | 258 | (86.0) |
| | 4-6 | 0 | (0.0) | 3 | (5.4) | 17 | (40.5) | 22 | (75.9) | 42 | (14.0) |
| Total | | 173 | (100) | 56 | (100) | 42 | (100) | 79 | (100) | 300 | (100) |

Source: Primary Field Survey

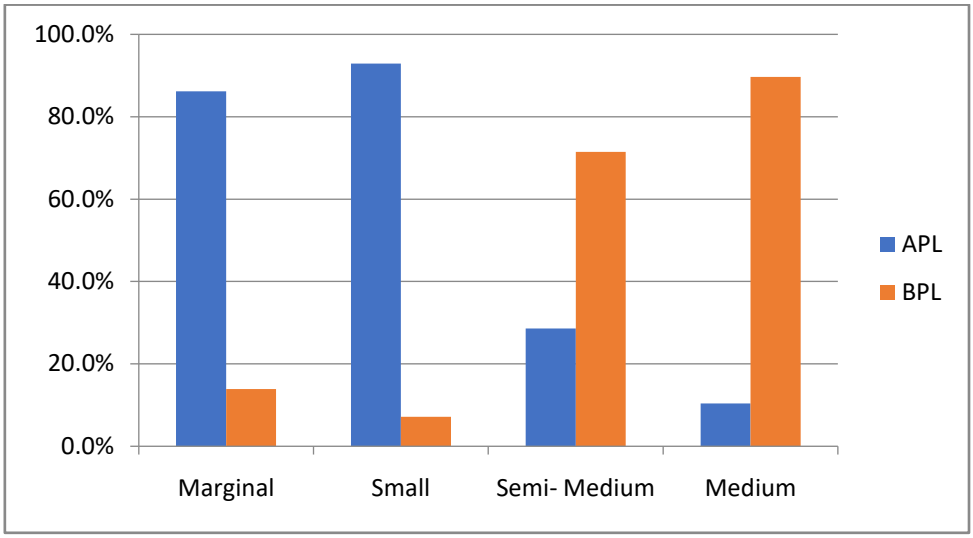
**Note:** Figures in Parentheses represent percentages to respective total.

Among the respondents, 72 percent farmers belong to APL Category and 28 percent to BPL Category giving the evidence that majority of farmer respondents are above Poverty line. Among the respondents within the Marginal lands, 86.1 percent belong to APL Category and 13.9 percent belong to BPL Category, among Small lands - 92.9 percent belong to APL Category, and 7.1 percent belong to BPL Category, among

Semi-Medium Lands - 28.6 percent belong to APL Category and 71.4 percent belong to BPL Category and among Highlands, 10.3 percent belong to APL Category and 89.7 percent belong to BPL Category. The poverty level of respondents is represented in Figure 4.6.

**Figure 4.6.**

**Poverty Level of Respondents**




Majority of farmers in Marginal lands belong to APL Category and major proportion of farmers in Semi-Medium and Medium lands belong to BPL Category which gives the evidence that the primitive tribal communities (Priority Household Ration Card-PPH) is automatically included in BPL Category in order to avail the benefits of Public Distribution system.

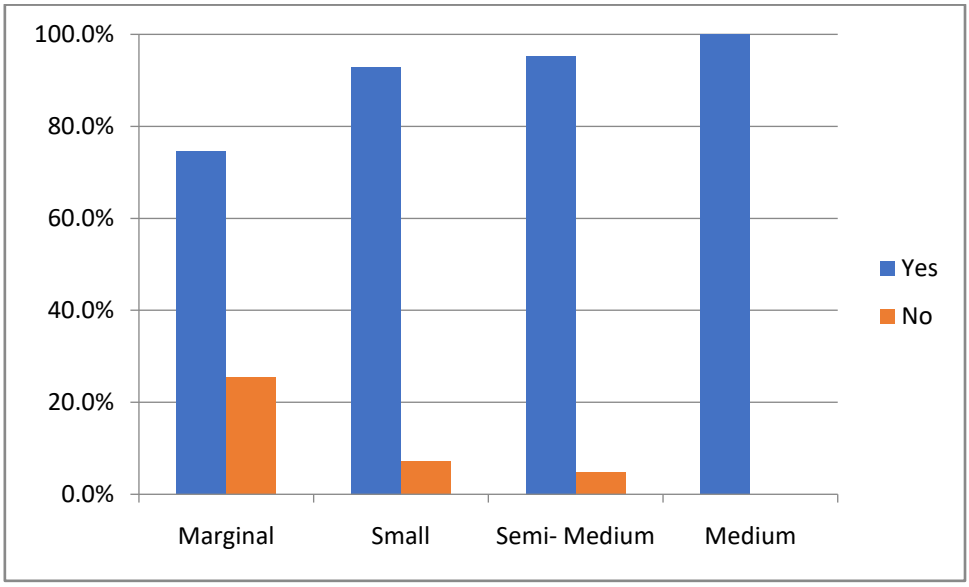
Among the respondents, 57 percent of respondents have Nuclear family (two parents along with their children) while 28 percent have Joint Family with a large number of members. Within the Marginal land category, 76.9 percent has Nuclear family and 23.1 percent has Joint family while 93.1 percent of respondents within the medium land size have joint family in the study.

The farmers are experienced in doing farming activities with 55 percent having the maximum years of experience in the range of 21-40 years, 31.3 percent have an experience of less than 20 years while 13.7 percent are experienced with more than 41 years. The maximum experienced respondents opined the strong bounded intimate relationship with nature and soil that attained hereditarily. Majority of Respondents have

an inborn efficiency in farming activities as they had a hierarchal history of farming within the family itself. 84 percent of respondents have a history of farming in themselves because their parents were engaged in agricultural activities as the main source of their livelihood and the parents handed over the lessons of farming to the next generation.

**Figure 4.7**

**Creation of Interest by parents**




Since the respondents are a part of rural population, 77.7 percent have a large family size in between 5 and 12 while only 22.3 percent have the family size in between 1 and 4. While making a comparison between the categories, the frequency is maximum in the family size group of 3-4. The number of dependents is maximum with 47.0 percent in between 3-4 and maximum with 51.4 percent in the same category within the Marginal lands. Only 0.3 percent of total respondents have more than 7 individuals depending upon the farmer household for their livelihood. 8.7 percent of the respondents have no dependents because the individuals themselves are earning members in the category. Earning members within the family is also maximum with 49.7 percent in the same category and a maximum with 54.9 percent within the Marginal lands. 86 percent of respondents have less than 3 farmers in their family while 14 percent have farmers in between 4 and 6 in the family itself. The number of farmers is maximum in 1-3 category with 100 percent within the marginal lands while there exists no farmers in the family within in the category of 4-6 in Marginal Lands. Within Highlands, 75.9 percent of respondents have large number of farmers ranging from 4 to 6 as majority of family

members are engaging in agricultural activities in Highlands as their main source of Livelihood is agriculture itself.

Each respondent has a recognition in one of the Social groups, which is classified into four as ST, SC, OBC and Others. Distribution as well as ownership of land varies with every Social Group and gender categories of the respondents. The Gender wise distribution of Owned Land Holdings is necessary to know about the disparity in land ownership of the holdings. The relation between Social Group, Gender and Ownership of land is given in Table 4.11.

**Table 4.11.**

**Social Group, Gender and Ownership of land**

| Social Group | Gender | Type of Ownership | | | | Total | |
|---|---|---|---|---|---|---|---|
| | | Individual ownership | | Joint ownership | | | |
| | Male | 9 | (100) | 50 | (98.0) | 59 | (98.3) |
| | Female | 0 | (0.0) | 1 | (2.0) | 1 | (1.7) |
| ST | Total | 9 | (100) | 51 | 100 | 60 | 100 |
| | Male | 23 | (95.8) | 0 | (0.0) | 23 | (95.8) |
| | Female | 1 | (4.2) | 0 | (0.0) | 1 | (4.2) |
| SC | Total | 24 | (100) | 0 | (0.0) | 24 | (100) |
| | Male | 95 | (96.9) | 0 | (0.0) | 95 | (96.9) |
| | Female | 3 | (3.1) | 0 | (0.0) | 3 | (3.1) |
| OBC | Total | 98 | (100) | 0 | (0.0) | 98 | (100) |
| | Male | 82 | (70.1) | 1 | (100) | 83 | (70.3) |
| | Female | 35 | (29.9) | 0 | (0.0) | 35 | (29.7) |
| Others | Total | 117 | (100) | 1 | (100) | 118 | (100) |
| | Male | 209 | (84.3) | 51 | (98.1) | 260 | (86.7) |
| Total | Female | 39 | (15.7) | 1 | (1.9) | 40 | (13.3) |
| | Total | 248 | (100) | 52 | (100) | 300 | (100) |

Source: Primary Field Survey

**Note:** Figures in Parentheses represent percentages to respective total.

While considering the Social Group, gender and ownership of respondents, joint ownership exists only in ST Category of Highlands depicting the inclusion of siblings in ownership and not the better half. Among the total respondents, Male respondents have 84.3 percent of individual ownership while Female respondents have 15.7 percent of Individual Ownership. But 98.1 percent of Joint Ownership is held by male head of the family while only 1.9 percent is held by women respondents. Among the 'Others' category, Nair and Christian widows are leading in individual female ownership of land.

The Nair caste carries matrilinial system of land ownership in which the ownership is vested in female members of the family.

### 4.7. Socio Demographic Characteristics within Physiological Zones

The Demographic features of the sample respondents are necessary for the study as it helps to know about the age, social group, marital status, gender, education of farmer households and to identify the relationship between the variables and Physiological Zones such as Lowlands, Highlands and Midlands. All the variables incorporated may be directly or indirectly influenced by the topography of Physiological Zones. The Socio - Demographic profile of farmer respondents related to the economic variables and attributes are given in Table 4.12.

**Table 4.12.**

**Socio demographic characteristics within the Physiological Zones**

| DemographicVariables | Attributes | Lowlands | | Midlands | | Highlands | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| Age | <30 | 0 | (0.0) | 0 | (0.0) | 1 | (0.8) | 1 | (0.3) |
| | 31-60 | 41 | (68.3) | 78 | (65.0) | 47 | (39.2) | 166 | (55.3) |
| | >61 | 19 | (31.7) | 42 | (35.0) | 72 | (60.0) | 133 | (44.3) |
| Social Group | ST | 0 | (0.0) | 0 | (0.0) | 60 | (50.0) | 60 | (20.0) |
| | SC | 8 | (13.3) | 8 | (13.3) | 0 | (0.0) | 24 | (8.0) |
| | OBC | 28 | (46.7) | 28 | (46.7) | 25 | (20.8) | 98 | (32.7) |
| | Others | 24 | (40.0) | 24 | (40.0) | 35 | (29.2) | 118 | (39.3) |
| Marital Status | Unmarried | 0 | (0.0) | 1 | (0.8) | 1 | (0.8) | 2 | (0.7) |
| | Married | 52 | (86.7) | 117 | (97.5) | 114 | (95.0) | 283 | (94.3) |
| | Widower | 8 | (13.3) | 2 | (1.7) | 5 | (4.2) | 15 | (5.0) |
| Gender | Male | 54 | (90.0) | 94 | (78.3) | 112 | (93.3) | 260 | (86.7) |
| | Female | 6 | (10.0) | 26 | (21.7) | 8 | (6.7) | 40 | (13.3) |
| Education Qualification | Lower Primary | 13 | (21.7) | 8 | (6.7) | 73 | (60.8) | 94 | (31.3) |
| | Upper Primary | 1 | (1.7) | 0 | (0.0) | 6 | (5.0) | 7 | (2.3) |
| | Secondary | 38 | (63.3) | 57 | (47.5) | 24 | (20.0) | 119 | (39.7) |
| | Senior secondary | 4 | (6.7) | 33 | (27.5) | 10 | (8.3) | 47 | (15.7) |
| | Higher | 4 | (6.7) | 22 | (18.3) | 7 | (5.8) | 33 | (11.0) |

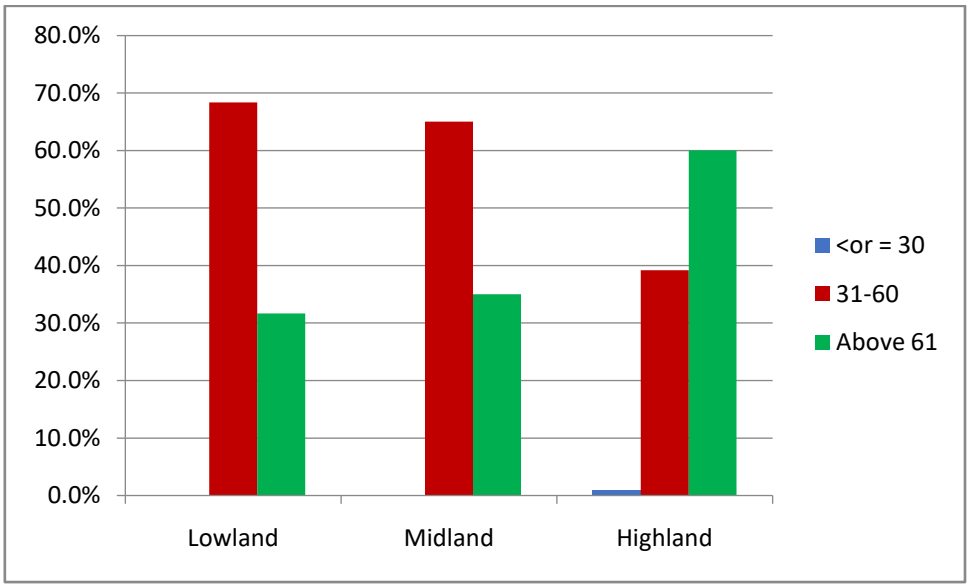
Source : Primary Field Survey

Among the total respondents, only a single respondent belongs to the age of less than 30, 55.3 percent belongs to the age group of 31-60 and 44.3 percent belongs to the age group of greater than 61. Within the Lowlands, no farmer respondent has an age of less than 30 is included, 68.3 percent belongs to age group of 31-60 while 31.7 percent belongs

to the age group of greater than 61. The graphical representation of the age group within the Physiological Zones is given in Figure 4.8

**Figure 4.8.**

**Age group within the Physiological Zones**



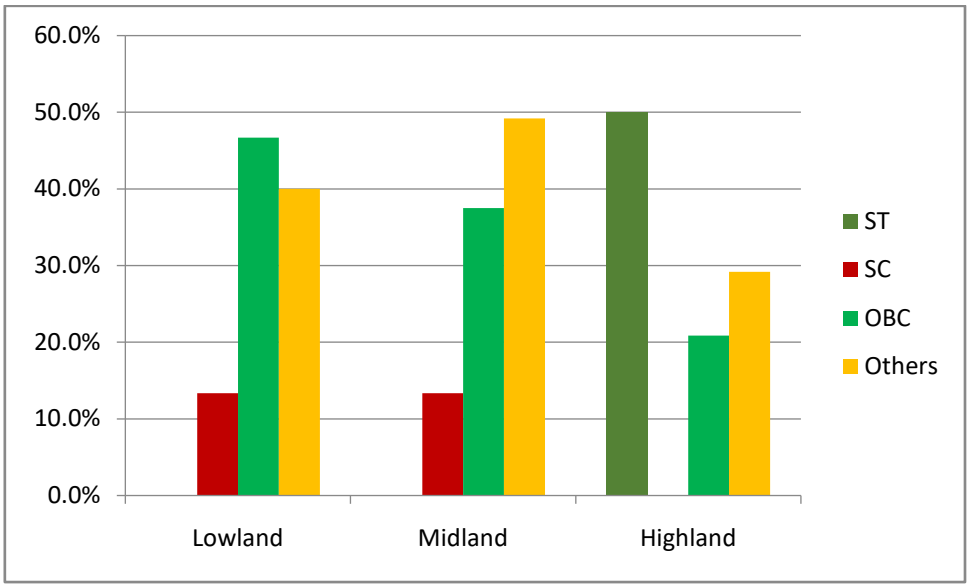

Within the Midlands, no respondent has the age of less than 30, 65.0 percent belongs to the age group of 31- 60 and 35 percent belongs to the age of greater than 61. Within Highlands, one respondent belongs to the age of less than 30 with 0.8 percent, 39.2 percent respondents belongs to the age group of 31-60 and 60 percent respondents belong to the age with equal to or greater than 61. Within the age group, the maximum number of total respondents belong to the age group of 31-60, while within Lowlands and Midlands, the maximum number of total respondents belong to the age group of 31-60 but within the Highlands the farmers mainly have an age of greater than or equal to 61. So the most aged farmers are engaged in agriculture in Highlands rather than in Lowlands and Midlands.

Among the total respondents within the Social Group, 20 percent belongs to ST, 0.8 percent belongs to SC Group, 32.7 percent belongs to OBC and 39.3 percent belongs to Others among whom the Nair Caste is the Dominant one followed by Christians. Within Lowlands and Midlands, no respondents belong to the ST group, while within Lowlands, 13.3 percent belongs to SC, 46.7 percent to OBC group and 40 percent belongs to Others. Within Midlands, 13.3 percent respondents belong to SC group, 46.7 percent to Other Backward Community, and 40 percent belongs to Others Category. The Graphical

representation of categorization of Social Group within the Physiological Zones is given in Figure 4.9.

**Figure 4.9.**

**Social group within Physiological Zones**



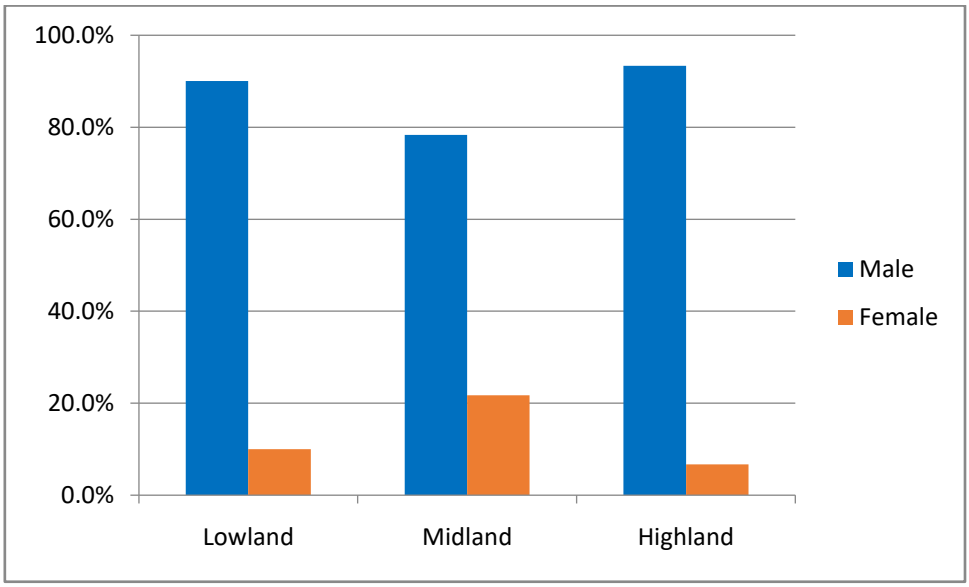

Within Highlands, 50.0 percent respondents belong to ST Category especially Irulas, 0.0 percent to SC Category, 20.8 percent to Other Backward Community, and 29.2 percent belongs to Others Category. Within the Social Groups, Others category included the maximum number of respondents, while within Lowlands, OBC category included the maximum number of respondents while in Highlands, the highlighted fact is that ST category included the maximum number of respondents followed by Others category and OBC Category within the particular study.

Considering the Marital Status, among the total respondents, 0.7 percent respondents are unmarried, 94.3 percent are married and 5.0 percent are widowers. Within the Lowlands, 0.0 percent respondents are unmarried, 86.7 percent are married and 13.3 percent are widowers.Within the Midlands, 0.8 percent respondents are unmarried, 97.5 percent are married and 1.7 percent are widowers who lived a single life. Within the Highlands, 0.8 percent respondents are unmarried, 95.0 percent are married and 4.2 percent are widowers. Within the total respondents from Physiological Zones, the maximum number of respondents are married and within all the Physiological Zones, maximum number of respondents have marital status rather than unmarried and widower status.

Among the total respondents within the Physiological Zones, considering the gender status, 86.7 percent are male respondents while only 13.3 percent are female respondents. Within the Lowlands, 90.0 percent are male respondents while only 10.0 percent are female respondents, within the Midlands, 78.3 percent are male respondents while only 21.7 percent are female respondents.

**Figure 4.10.**

**Gender within Physiological Zones**



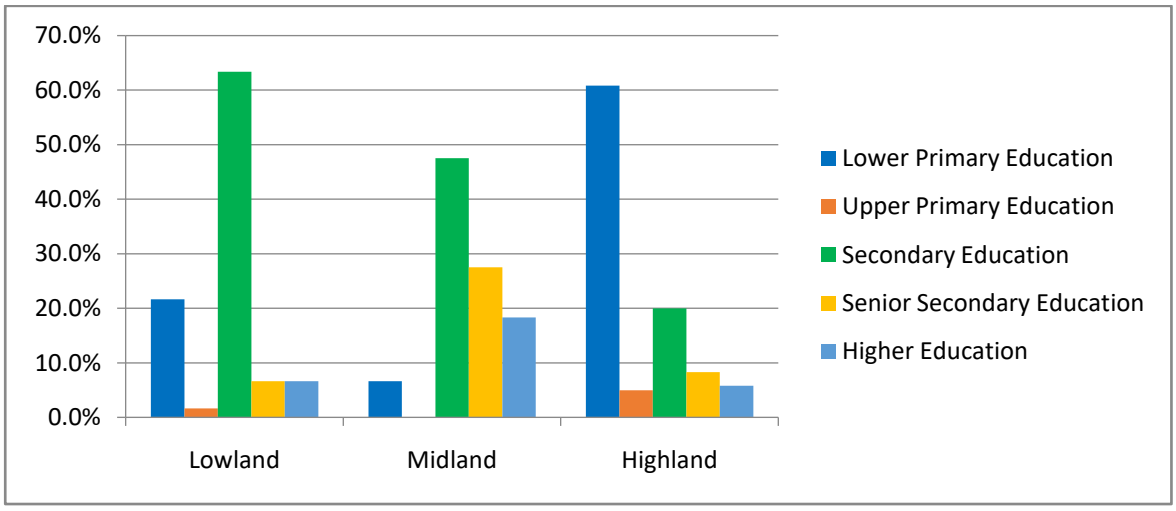

Within the Highlands, 93.3 percent are male respondents while only 6.7 percent are female respondents. Among the total respondents in the study, number of male respondents who owned land used for agricultural purposes is higher than the number of female respondents.

Among the total respondents, 31.3 percent farmers have Lower Primary education, 2.3 percent have Upper Primary Education, 39.7 percent have secondary education, 15.7 percent have Senior Secondary Education and 11.0 percent have Higher Education. Within the Lowlands, 21.7 percent have Lower Primary education, 1.7 percent have Upper Primary Education, 63.3 percent have secondary education, 6.7 percent have Senior Secondary Education and 6.7 percent have Higher Education. Within Midlands, 6.7 percent have Lower Primary education, 0.0 percent have Upper Primary Education, 47.5 percent have secondary education, 27.5 percent have Senior Secondary Education and 18.3 percent have Higher Education. Within the Highlands, 60.8 percent have Lower Primary education, 5.0 percent have Upper Primary Education, 20.0 percent have

secondary education, 8.3 percent have Senior Secondary Education and 5.8 percent have Higher Education.

**Figure 4.11.**

**Education of farmers within the Physiological Zones**




Within the selected area, among the total respondents, majority have education qualification with Secondary Education followed by Lower Primary Education and Senior Secondary Education. Within the Lowlands, majority of respondents have education qualification with Secondary Education followed by Lower Primary Education and Secondary as well as Senior Secondary Education.Within the Midlands, majority of respondents have education qualification with Secondary Education followed by Secondary Education and Senior Secondary Education.Within the Highlands, majority of respondents have education qualification with Lower Primary Education followed by Senior Secondary Education. A fact to be noted is that in Midlands and Lowlands, majority of the farmers have Secondary Education which is a good indicator for participation of educated people in agriculture. In Highlands, very less educated farmers are mainly involved in agricultural activities. The Government must take initiatives to encourage the highly educated youth towards the agricultural purposes and diversification in employment by giving preference to agricultural sector need to be relevant. The attitude that high education qualification is a yardstick for white collar jobs have to be changed and the state must give relevance for agriculture based activities along with the secondary and tertiary activities.

**4.8 Socio- Economic Characteristics of respondents within Physiological Zones :**The Socio- Economic characteristics of respondents within Physiological Zones is necessary to pertain further interpretations of the data. The socio- economic profile gives preference to the variables such as Poverty level, Type of Family, Years of Experience as farmers, Occupation of Parents, Family size, Number of Dependents, Number of Earning Members, Number of farmers and size of owned land holdings among the sample respondents. depicted in Table 4.13.

**Table 4.13.**
**Socio- Economic Characteristics of farmers within Physiological Zones**

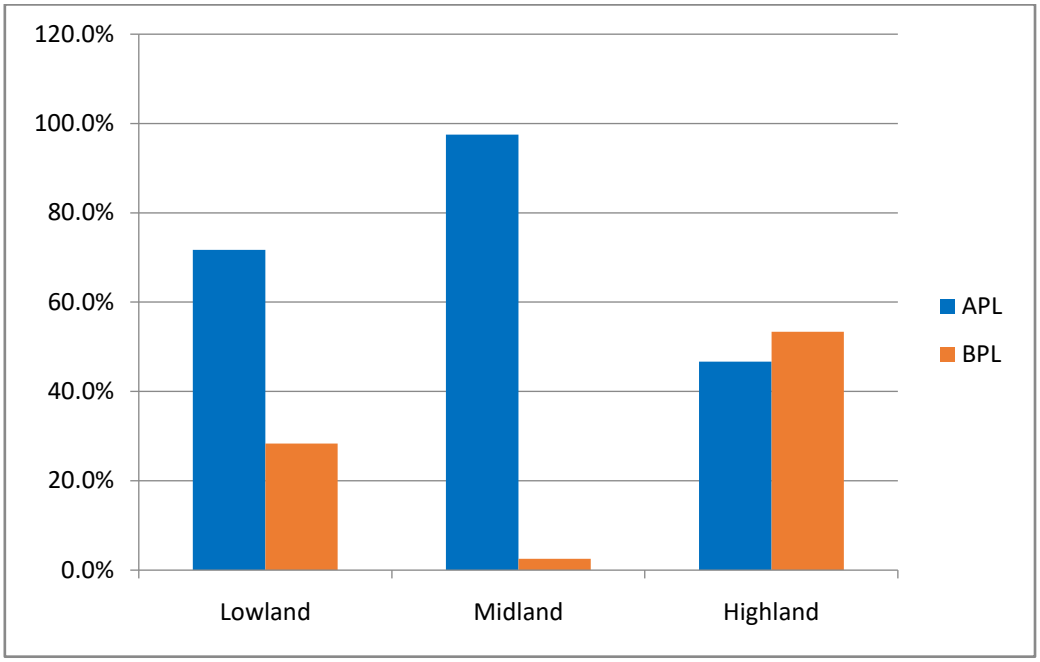
| Eco Variables | Attributes | Lowlands | | Midlands | | Highlands | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| Poverty Level | APL | 43 | (71.7) | 117 | (97.5) | 56 | (46.7) | 216 | (72.0) |
| | BPL | 17 | (28.3) | 3 | (2.5) | 64 | (53.3) | 84 | (28.0) |
| Type of Family | Nuclear | 47 | (78.3) | 77 | (54.2) | 47 | (39.2) | 171 | (57.0) |
| | Joint | 13 | (21.7) | 43 | (35.8) | 73 | (60.8) | 129 | (43.0) |
| Years of Experience | 0-20 | 30 | (50.0) | 41 | (34.2) | 23 | (19.2) | 94 | (31.3) |
| | 21-40 | 24 | (40.0) | 70 | (58.3) | 71 | (59.2) | 165 | (55.0) |
| | >41 | 6 | (10.0) | 9 | (7.5) | 26 | (21.7) | 41 | (13.7) |
| Occupation of Parents | Agriculture | 40 | (66.7) | 102 | (85.0) | 112 | (93.3) | 254 | (84.7) |
| | Non-Agriculture | 20 | (33.3) | 18 | (15.0) | 8 | (6.7) | 46 | (15.3) |
| Family Size | 1-2 | 0 | (0.0) | 0 | (0.0) | 1 | (0.8) | 1 | (0.3) |
| | 3-4 | 17 | (28.3) | 22 | (18.3) | 27 | (22.5) | 66 | (22.0) |
| | 5-6 | 40 | (66.7) | 68 | (56.7) | 52 | (43.3) | 160 | (53.3) |
| | 7-8 | 2 | (3.3) | 28 | (23.3) | 21 | (17.5) | 51 | (17.0) |
| | 9-10 | 1 | (1.7) | 1 | (0.8) | 17 | (14.2) | 19 | (6.3) |
| | 11-12 | 0 | (0.0) | 1 | (0.8) | 2 | (1.7) | 3 | (1.0) |
| Number of Dependents | 1-2 | 28 | (46.7) | 43 | (35.8) | 46 | (38.3) | 117 | (39.0) |
| | 3-4 | 30 | (50.0) | 62 | (51.7) | 49 | (40.8) | 141 | (47.0) |
| | 5-6 | 1 | (1.7) | 11 | (9.2) | 3 | (2.5) | 15 | (5.0) |
| | 7-8 | 0 | (0.0) | 1 | (0.8) | 0 | (0.0) | 1 | (0.3) |
| | 9-10 | 1 | (0.7) | 3 | (2.5) | 22 | (18.3) | 26 | (8.7) |
| Number of Earning Members | 1-2 | 25 | (41.7) | 48 | (40.0) | 31 | (25.8) | 104 | (34.7) |
| | 3-4 | 34 | (56.7) | 69 | (57.5) | 46 | (38.3) | 149 | (49.7) |
| | 5-6 | 1 | (1.7) | 3 | (2.5) | 31 | (25.8) | 35 | (11.7) |
| | 7-8 | 0 | (0.0) | 0 | (0.0) | 12 | (10.0) | 12 | (4.0) |
| Farmers within family | 1-3 | 60 | (100) | 120 | (100) | 78 | (65.0) | 258 | (86.0) |
| | 4-6 | 0 | (0.0) | 0 | (0.0) | 42 | (35.0) | 42 | (14.0) |
| Total | | 60 | (100) | 120 | (100) | 120 | (100) | 300 | (100) |

Source : Primary Field Survey

Within the study area, 72.0 percent belonged to APL Category, 28.0 percent belonged to BPL Category but within Lowlands, 71.7 percent belonged to APL Category and 28.3 percent belonged to BPL Category which is represented in Table 4.12.

**Figure 4.12**

**Poverty Level of farmers within Physiological Zones**

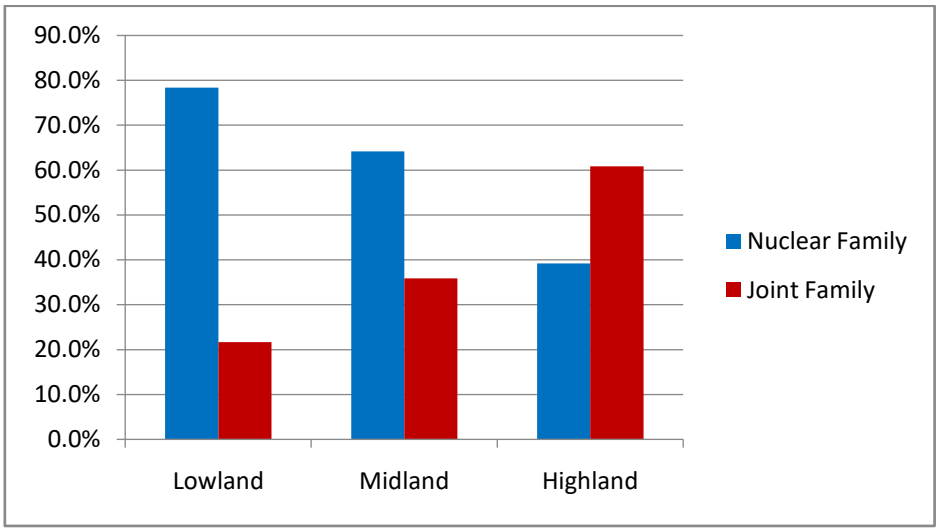



Within Midlands, 97.5 percent belonged to APL Category and 2.5 percent belonged to BPL Category.Within Highlands, 46.7 percent belonged to APL Category and 53.3 percent belonged to BPL Category. It can be concluded that in the study, among the total respondents, majority of farmers belong to APL Category, while an exception exists in Highlands with half of the respondents within the area belongs to BPL Category.

Among the total respondents, type of family which can be categorized as Nuclear and Joint family is given and 57.0 percent have Nuclear family which includes husband, wife and children while 43.0 percent have Joint Family which includes husband, wife and children along with father, mother.

**Figure 4.13**

**Type of Family within the Physiological Zones**

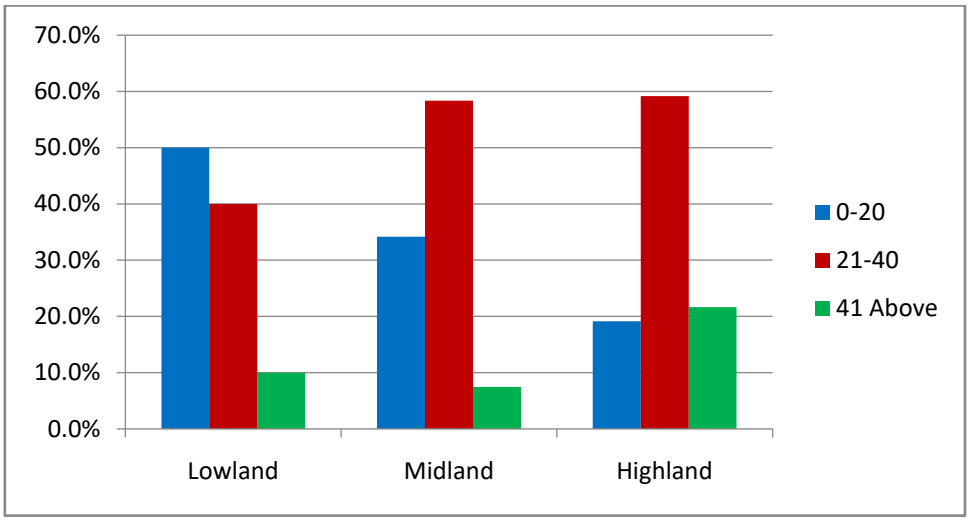



In Lowlands, 78.3 percent have Nuclear family while 21.7 percent have Joint Family, In Midlands, 54.2 percent have Nuclear family while 35.8 percent have Joint Family,In Highlands, 39.2 percent have Nuclear family while 60.8 percent have Joint Family. Since the agricultural activities are mainly conducted in rural areas, features of rural population is reflected in the study area in which one most important factor is the increasing number of members within the family itself and the existence of joint family. The particular feature is also reflected in the study area. Number of family members are high in Highlands when compared to Lowlands and Midlands.

The years of experience is categorized into 0-20, 21-40 and greater than 41 among which 31.3 percent respondents have farming experience of less than 20 years, 55.0 percent experienced for 21- 40 years and 13.7 percent have farming experience of greater than 41 years. In Lowlands, 50 percent of respondents have farming experience of less than 20 years, 40 percent have farming experience of 21- 40 years and 10 percent have farming experience of greater than 41 years. In Midlands, 34.2 percent of respondents have farming experience of less than 20 years, 58.3 percent have farming experience of 21- 40 years and 7.5 percent have farming experience of greater than 41 years. In Highlands, 19.2 percent of respondents have farming experience of less than 20 years, 59.2 percent have farming experience of 21- 40 years and 21.7 percent have farming experience of greater than 41 years.

**Figure 4.14.**

**Years of farming experience within Physiological Zones**

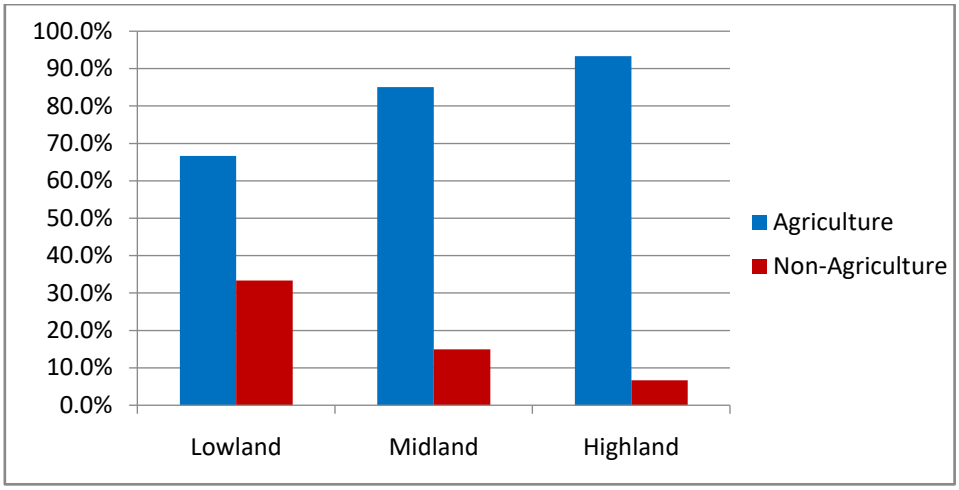



Among the total respondents from the study area, majority of farmers have farming experience for 21-40 years while within the Lowlands majority of respondents have farming experience of less than 20 years, within Midlands and Highlands, majority of respondents have farming experience in between 21 to 40 years, and farmers from Highlands have the maximum years of farming experience with greater than 41 years. Being engaged in farming activities, they are building up a healthy posture for better living without any lifestyle diseases. So they are healthy enough without any age bar in farming activities and they are willing with a whole hearted mind to do the farming activities.

Occupation of parents is an important factor influencing the farmers to stay back in the agricultural activity itself. Occupation of parents in agriculture or non- agriculture is very relevant in influencing their children and promoting them towards agricultural activities. The existing farmers learned the basic lessons of traditional methods of cultivation such as sowing and harvesting in different seasons such as mundakan, virippu and puncha from their parents. With the income earned out of their primary source, agriculture, they learnt how to distribute the agricultural products by keeping a part for themselves as their own food and the rest of the agricultural products for an earning for the future by selling in the market. So the left out agricultural products after self consumption is the main determinant of their income and through that their standard of living. The occupation of parents of the farmer household is given as a graph in Figure 4.15

**Figure 4.15**

**Occupation of parents of farmers in Physiological zones**




Among the total respondents, 84.7 percent have a history of agriculture within them as their parent's main occupation is agriculture itself while 15.3 percent have non- agriculture as their main occupation. A hereditary handing over from one occupation to another is also reflected in agricultural activities.

## 4.9. CONCLUSION

The chapter discusses the secondary information related to the profile area and physiological zones, how the socio- demographic and economic variables are related and expresses the proportion of economic variables within different groups, especially within the different categories of owned land holdings of farmer respondents. The ownership of land with special reference to the gender gives a picture of how the existing system of ownership creates a gender discrepancy and the system have to find a fruitful solution for the problems within each category.

# CHAPTER V
# LAND USE, OWNERSHIP AND CROPPING PATTERN IN PHYSIOLOGICAL ZONES

## 5.1. Introduction

Land, the fixed factor is a scarce limited resource which has to be properly utilised by the people in order to attain the needs properly. The Utilisation of Land is to be efficiently done by each and every person as it is the responsibility of people to behold a resource which is the basic factor of production upon which everything is built. Since a physical platform is necessary for every economic activity, the Land always plays a vital role in the whole economy. For all the sectors, a common base is land itself upon which the Human beings can build their skyscrapers, make a provision for attaining the necessity of food availability and provide a better environment for the sustainable development of economy. Thus Land is a necessity for every economic activity. The Land is used for a number of purposes which varies according to the person who is utilizing as well as owning the land as a factor of production. The land utilisation depends on the current economic and development situations in the economy – if the economy is moving towards development, it is reflected in the urbanization and a transformation from the agricultural land to land used for non- agricultural purposes. While if it is in the hands of the people who are keeping a deep intimate relation with nature and who acquired the land from their forefathers, they will be utilising it with a due respect to them and to the nature, the mother Earth. The land which is used by the nature loving persons with a respect to forefathers will be intimately attached to the Mother Nature.

## 5.2. Land Use Pattern

The Land Use Pattern of farmers who possess certain land and engaged in agricultural activities in the Study Area is relevant to know about the categories under which land owned is utilised, to know about whether land is kept as fallow or whether it is properly utilised or not. The main purposes for which the land is utilised by the farmers are for Built-up or Residential Area(BA), Land used for Government Infrastructure(GI), Net Area Sown or the Cultivated land(NAS), Area Sown More than Once(ASMO), Current Fallow(CF)- the land which is kept fallow during the current year, Fallows other than Current Fallow(FOCF) – the land which is kept fallow for more than one year and less than five years, Water Bodies(WB) which is used for irrigation purposes, Utilised Agricultural Area (UAA), Unutilised Agricultural Area(UnAA) and Gross Cropped Area(GCA), which is the summation of NAS and ASMO. The classification of Land Use

Pattern based on the purposes for which Land is used is taken into consideration for the study area which is based on the Physiological Zones and is represented in Table 5.1.

**Table 5.1.**

**Spatial Land Use Pattern in Physiological Zones (Ha)**

| Physiological-Zones | Lowland | | Midland | | Highland | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| BA | 0.015 | 0.007 | 0.016 | 0.006 | 0.019 | 0.009 | 0.017 | 0.008 |
| GI | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 |
| NAS | 1.883 | 1.043 | 1.292 | 0.475 | 2.283 | 1.204 | 1.807 | 1.039 |
| ASMO | 0.000 | 0.000 | 0.356 | 0.469 | 0.001 | 0.146 | 0.143 | 0.343 |
| CF | 0.000 | 0.000 | 0.004 | 0.026 | 0.000 | 0.000 | 0.002 | 0.016 |
| FOCF | 0.000 | 0.000 | 0.002 | 0.018 | 0.015 | 0.073 | 0.007 | 0.048 |
| WB | 0.000 | 0.000 | 0.001 | 0.003 | 0.012 | 0.112 | 0.005 | 0.071 |
| UAA | 1.50 | 1.407 | 1.077 | 0.737 | 2.201 | 1.947 | 1.612 | 1.540 |
| UNAA | 0.000 | 0.000 | 0.006 | 0.031 | 0.015 | 0.073 | 0.008 | 0.051 |
| GCA | 1.502 | 1.407 | 1.077 | 0.737 | 2.201 | 1.947 | 1.612 | 1.540 |

Source – Primary Field Survey

The mean size of land owned as Built-up area in Lowland is 0.015 Hectares while the Net Area Sown is the highest with average size of 1.583 Hectares. In Lowlands, no area is kept as Area Sown More than Once because only mono-crop cultivation can only be preferred after the rainy season with the draining out of excess water from the land. The average size of utilised agricultural area is 1.50 Hectares and the Gross Cropped Area is 1.502 Hectares. While in Midland, Average Built-Up Area is around 0.016 Hectares, Average Net Area Sown is highest with 1.292 Hectares while Area Sown More than Once is 0.356 as the paddy is cultivated twice in an agricultural year. In Highlands, the maximum average size of land owned in Net Area Sown is the highest with 2.283 Hectares. The Utilised and Unutilised Agricultural Area as well as the Gross Cropped Area is High in Highlands. Among the different categories, the Land Owned by farmers is mainly used as Net Area Sown in the Physiological Zones. The standard Deviation measures the variability of Land Use Pattern, greater the variability, greater the Standard Deviation, that is, greater is the magnitude of variability of deviations from the mean size of the land. A small standard deviation, which is a representation of high degree of uniformity as well as homogeneity of the landsize is reflected in Built-up Area in all the three Physiological Zones since the land used for residential purposes in the rural areas is almost similar in size. While considering the Total land owned, land area is almost

uniform in Current Fallows, Fallows other than current fallows, Water Bodies and Unutilised Agricultural Area with a less deviation from Mean size of land. Deviations from Mean land size is very high in Highlands while it is low in Midlands. Net Area Sown is the most important determinant of Land Use Pattern as it is the main purpose for which the rural land owned is utilised.

### 5.3 Ownership Pattern of farmer households

The best economic benefit for all can usually be accomplished when individuals act in their own self interest – which refers to individual actions and behaviours that provoke positive personal benefits.Individuals own most of the resources available (e.g., labor, land, and capital) and use voluntary decisions, made in their own self-interest, to achieve the greatest personal benefit from marketplace activities and transactions..(Adam Smith, 1776). Ownership of the Land is essential for the utilisation of land resources as owning land creates an inspiration for  further economic activities and self interest. A Plot of land was considered as owned by the Household if, permanent heritable possession, with or without the right to transfer the title was vested in the member or members of the Household (NSSO, 70$^{th}$ Round). The Ownership of Land is derived through Mode of Acquisition of Land - Self Acquisition by farmers themselves and Hereditary Acquisition through forefathers as hereditary Property.

**Table 5.2**

**Mode of Land Acquisition by farmers**

| Type of Land | Self-Acquired Land | | Hereditary Property | |
|---|---|---|---|---|
| | Mean( Hectares) | SD(%) | Mean( Hectares) | SD(%) |
| Lowland | 0.034 | 0.261 | 0.963 | 0.960 |
| Midland | 0.031 | 0.091 | 0.732 | 0.394 |
| Highland | 0.013 | 0.060 | 2.204 | 1.959 |
| Total | 0.025 | 0.135 | 1.367 | 1.49 |

Source : Primary Field Survey

The study reveals that only 0.034 Average Hectares of Land is owned by self-acquisition while 0.963 Hectares is owned Hereditarily in the Lowlands and the deviation from Mean is high in Lowlands. The Mean size of Self Acquired Land is 0.031 Hectares and 0.732 is Hereditarily acquired while the deviations from Mean reflects a uniformity in the land size in the Self Acquired Land but a little more variation is seen in Hereditary

Land when compared with Self- Acquired land. The Average Self Acquired Land is very low in size in Highlands but the average size as well as variations is too high for hereditarily acquired land in Highlands. Thus in Highlands, the land owned hereditarily is very high comparing to Self- acquired land. But the ownership of land is mainly vested in Male respondents in the selected area creating a gender disparity.

### 5.3.1 Preferences of Farmers in further utilisation of Land

The study relating to farmers is more relevant by knowing the preferences regarding further investment in land, interest in investment in agriculture and creation of interest by parents. Investment in land by farmers is dependent on the preferences for investment in agriculture and how the interest for agriculture is created in them. Preference of agriculture for land as per the interest created by parents is relevant as majority of the farmers are utilizing the hereditary land provided to them by parents or grandparents. The relationship between the Total Area Owned and preferences for further investment is depicted in Table 5.3.

**Table 5.3**

**Preference of Farmers in further utilisation of Land**

| Area owned | Interest in further investment in land | Interest in investment in agriculture | Interest created by parents in agriculture |
|---|---|---|---|
| Marginal | 56.1 | 55.5. | 74.6 |
| Small | 66.1 | 66.1 | 92.9 |
| Semi-Medium | 92.9 | 92.9 | 95.2 |
| Medium | 96.6 | 100 | 100 |
| Total | 67.0 | 67 | 83.3 |

Source: Primary Field Survey

Among the respondents, 67.0 percent interested in further investment in land, 67.0 percent interested to invest in agriculture while 83.3 percent were interested by the influence of creation of interest in agriculture by parents. Majority were interested in agriculture due to the influence of parents. Though only 56.1 percent farmers who hold Marginal land and 66.1 percent who owned Small sized lands are interested in further investment in land, 55.5 and 66.1 percent are interested in further investment in agriculture, 74.6 and 92.9 percent are highly influenced by their parents in involving in agriculture. Among the respondents, 96.6 percent farmers owning Medium sized land in

Highlands are highly interested in further investment in land with, 100 percent interested in further investment in agriculture and 100 percent is influenced by parents in preferring agriculture. The relationship between preferences of farmers in different land sizes owned by farmers is analysed with Chi-Square test and the Hypothesis is given by

$H_0$: Perception of farmers for further investment in land and Area Owned is independent.

$H_1$: Perception of farmers for further investment in land and Area Owned is dependent.

The existence of relationship between attributes and Area owned is analysed with the help of statistical method - Chi-square test and testing significance level by comparing the estimated value with the critical value. The relationship between Perception of farmers preferring the attributes in total land owned is given in Table 5.4.

**Table 5.4**

**Perception of farmers preferring the attributes**

| Attributes | Chi-Square | df | Significance level |
|---|---|---|---|
| Interest in further investment in land | 33.525 | 3 | 0.000 |
| Creation of interest by parents in agriculture | 37.369 | 3 | 0.000 |
| Interest for investment in agriculture | 23.316 | 3 | 0.000 |

Source : Computed from Primary Field Survey data

The computed Chi-Square value is highly significant with 3 degrees of freedom at the significance level of 5 percent as the p-value is below 0.05, the assumed level of significance. Since the Chi-Square value is significant, the null hypothesis is rejected which gives the clear evidence to conclude that the three attributes such as interest in further investment in land, Creation of interest by parents in agriculture and the interest for investment in agriculture are dependent upon the area owned by farmers. Interest created by parents is an attribute which is relevant in the whole life of a farmer in utilizing the land owned.

### 5.3.2. Distribution of Land Owned

The land owned may be distributed as fragmented, subdivided or consolidated and Subdivided land refers to the distributed land of an ancestor among his successors, Fragmented land refers to the scattered land owned by an individual in different places while Consolidated land creates an opportunity for efficiency and economy in the agricultural sector by consolidating the scattered land into one compact block in order to

get the benefits of large scale farming. The reason for Subdivision and Fragmentation is also relevant in the study to know about how the land is distributed by farmers in the study area and is represented in Table 5.5.

**Table 5.5**

**Distribution of Land**

| Area owned | Fragmented | Subdivided | Consolidated | Reason for Sub-division and fragmentation | |
|---|---|---|---|---|---|
| | | | | Inheritance | Other Reasons |
| Marginal | 37.0 | 10.4 | 52.6 | 44.5 | 55.5 |
| Small | 46.4 | 12.5 | 41.1 | 53.6 | 46.4 |
| Semi-Medium | 23.8 | 33.3 | 42.9 | 57.1 | 42.9 |
| Medium | 34.5 | 55.2 | 10.3 | 89.7 | 10.3 |
| Total | 36.7 | 18.3 | 45.0 | 52.3 | 47.7 |

Source : Primary Field Survey

Among the respondents, 45.0 percent used consolidated land, 36.7 percent used fragmented land while 18.3 percent used subdivided land for cultivation. The Marginal sized land is mainly used as a Compound Block as major portion of the Marginal Land is Lowland and the cultivated area is consolidated by the farmers themselves as an initiative for creating efficient and cost effective agriculture. The agricultural area is cultivated as consolidated farm by Padasekharasamiti in Lowlands and the people are satisfied with the work effort of Padasekharasamiti in Venkitangu Panchayat. Among the respondents, 52.6 percent have consolidated land, while only 10.4 percent have subdivided land and 37.0 percent have fragmented land. While in Medium sized lands, only 10.3 percent of respondents have consolidated land, while 55.2 percent have subdivided land, 34.5 percent have Fragmented land and 89.7 percent of the respondents have subdivided and fragmented land due to inheritance while 55.5 percent of the respondents have the subdivided and fragmented land due to some other reasons like debts, loss or sale of owned plots.

### 5.4. Regional Differences in Net Area Sown

The physical features such as topography, soil and climates of land may be varying in creating regional differences in land use pattern, especially Net Area Sown which is an important purpose for which land is used by the farmers in selected area. The Socio-Demographic factors such as Age, Social Group, marital status, Gender, Education and

Socio- Economic factors such as Poverty level, Type of family, Years of Experience as farmers, Occupation of Parents, Family Size, Number of Dependents, Earning Members, Number of Farmers within the family are considered as the variables which will have an influence on the land utilised as Net Area Sown and owned by the farmers in the study area. Since a major proportion of Total land owned is utilised as Net Area Sown, Net Area Sown is the most important land use in Land Use Pattern in the study Area.

**Table 5.6.**

**Regional differences in Net Area Sown**

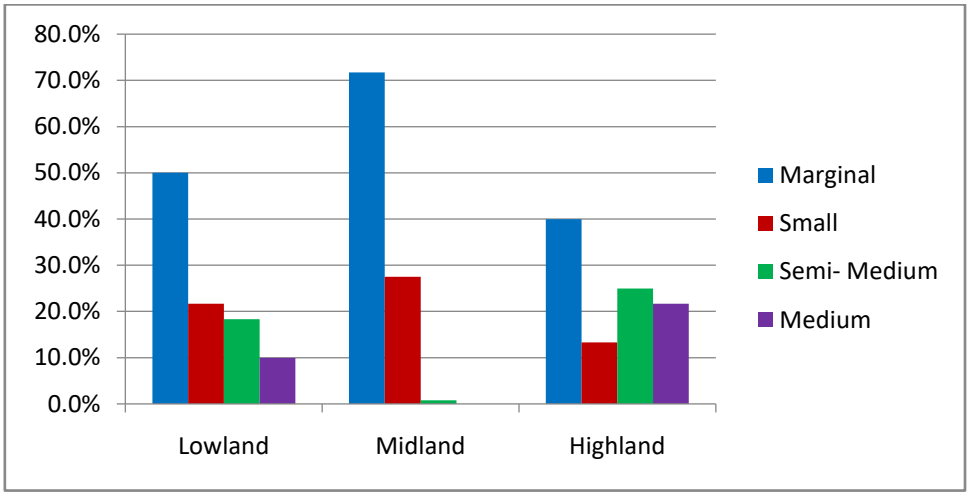
| Net Area Sown | Lowland | | Midland | | Highland | | Total | |
|---|---|---|---|---|---|---|---|---|
| Marginal | 30 | (50.0) | 86 | (71.7) | 48 | (40.0) | 164 | (54.7) |
| Small | 13 | (21.7) | 33 | (27.5) | 16 | (13.3) | 62 | (20.7) |
| Semi-Medium | 11 | (18.3) | 1 | (0.8) | 30 | (25.0) | 42 | (14.0) |
| Medium | 6 | (10.0) | 0 | (0.0) | 26 | (21.7) | 32 | (10.7) |
| Total | 60 | (100) | 120 | (100) | 120 | (100) | 300 | (100) |

Source: Primary Field Survey

Among the respondents, 54.7 percent have Marginal Net Area Sown with less than 1 Hectare, 20.7 percent have Small Net Area Sown within 1 to 2 Hectares, 14.0 percent have Semi-Medium Net Area Sown within 2 to 4 Hectares, 10.7 percent owned Medium Net Area Sown with more than 4 Hectares. In Lowlands and Highlands, Medium-sized Net Area Sown is very less compared to Highland while Highlands have a proportional distribution of different land sizes.

**Figure 5.1**

**Regional differences in Net Area Sown**



The Medium Net Area Sown which includes the land size with greater than 4 Hectares is cultivated mainly by 21.7 percent respondents from Highlands. In Lowlands, only 10 percent of respondents cultivated in Medium Sized Land while no respondents have Net Area Sown cultivated in Medium Sized Land in Midlands. In Lowlands, 50.0 percent occupied Marginal lands, 21.7 percent occupied Small lands, 18.3 percent cultivated in Semi-Medium lands, 10 percent cultivated in Medium lands, Within Midlands, 71.7 percent cultivated in Marginal lands, 27.5 percent in Small lands, 0.8 percent in Semi-Medium lands and within Highlands, 40.0 percent cultivated in Marginal lands, 13.3 percent in Small lands, 25 percent in Semi-Medium lands and 21.7 percent in Medium lands. From the data, it is evident that in all the Physiological Zones, the size of Net Area Sown is in the descending order from Marginal, Small, Semi-medium, Medium while no farmer owned large sized Net Area Sown in the study area. The benefits of large sized lands may not be available to the farmers in the selected area

### 5.5. Distribution of Land Possessed

The Land possessed is considered as the summation of Land leased in, Land leased out, Land held by household as encroached land but neither owned or leased in. The 'Leased in' land is the land taken by household on rent or free without any right of permanent or heritable possession. The 'Leased out' land is the land given to others on rent or free by owner of land without surrendering the right of permanent heritable title (NSSO 70$^{th}$ Round, Report on Household Ownership and Operational Holdings in India). The distribution of Land Possessed by the farmers in the study area is represented in Table 5.7.

**Table 5.7.**

**Distribution of Land possessed**

| Net Area Sown | Area leased in | | Area leased out | | Area Possessed | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| Marginal | 0.037 | 0.197 | 0.001 | 0.016 | 0.587 | 0.369 |
| Small | 0.143 | 0.389 | 0.000 | 0.000 | 1.299 | 0.384 |
| Semi-Medium | 0.236 | 0.689 | 0.000 | 0.000 | 2.729 | 0.581 |
| Medium | 0.329 | 1.269 | 0.000 | 0.000 | 5.039 | 1.339 |
| Total | 0.118 | 0.543 | 0.001 | 0.012 | 1.509 | 1.535 |

Source: Primary Field Survey

The land is possessed by respondents as a summation of Area leased in and Area leased out as the encroachments do not exist in their opinion. The average size of land held by farmers as Area Leased inand Standard Deviation reflecting deviations from Mean is high compared to the Area leased out. The Mean size of land owned and possessed in the study area is 0.587 Hectares in Marginal lands, 1.299 Hectares in Small lands, 2.729 Hectares in Semi-Medium lands and 5.039 Hectares in Medium lands. But Average land size as well as Standard Deviation of Total land possessed is very high when compared with Land leased in and Land leased out. Area leased in as well as area possessed is high in Medium lands than in other categories of land

**5.6. Factors influencing Net Area Sown**

The study focuses on identifying the important variables which influence the Net Area Sown of farmers. The important factors influencing the Net Area Sown of farmers are considered as Type of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP)and Agricultural Income (AI). Net Area Sown is the Dependent variable which has relation with the the other variables. Agricultural income is defined under section 2(1A) of the Income Tax Act, 1961 as "Any rent or revenue derived from land which is situated in India and is used for agricultural purposes". Testing the significance of the regression coefficients with the help of t statistic in the Multiple Regression Analysis will help to identify the dependence between the dependent and the causal variables and decide whether the Hypothesis will be accepted or not. The Hypothesis related to the variables is given as

$H_1$ :There exists significant relationship between the variables such as Type of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP),Agricultural Income (AI) and Net Area Sown (NAS) by farmers .

**Table 5.8**
**Significance level of Net Area Sown and Causal Variables**

| Model | Unstandardised Coefficients | | Standardised Coefficients | t | Sig. | R Square | F |
|---|---|---|---|---|---|---|---|
| | B | S.Error | Beta | | | | |
| (Constant) | - 0.096 | 0.092 | --- | - 1.046 | 0.297 | 0.851 | 420.915 (0.00) |
| Type of Family | 0.182 | 0.085 | 0.058 | 2.144 | 0.033 | | |
| Area of Self Acquired Land | 0.790 | 0.260 | 0.069 | 3.040 | 0.003 | | |
| Area of Hereditary Property | 0.864 | 0.035 | 0.836 | 24.503 | 0.000 | | |
| Agricultural Income | 0.001 | 0.000 | 0.149 | 4.290 | 0.000 | | |

a. Dependent Variable : Net Area Sown (Hectares)
b. Predictors: (Constant), Creation of Interest by Parents, Total Area Owned, Agricultural Income

The value of $R^2$ equals 0.851 indicating that 85.1 percent of the variations in Net Area Sown are explained by the causal variables -Type of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP)and Agricultural Income (AI). Multiple Regression Analysis shows that variables such as Type of Family, Area of Self-Acquired Land, Area of Hereditary Property and Agricultural Income have influenced the Net Area Sown. The Model can be represented as

$$NAS_i = - 0.096 + 0.182\ TF + 0.790\ SAL + 0.864\ HP + 0.001\ AI$$

t value = (-1.046) (2.144)** (3.040)** (24.503)* (4.290)*

* Significant at 1 percent

** Significant at 5 percent

The results indicate that the variables - Type of Family, Area of Self-Acquired Land, Area of Hereditary Property,and Agricultural Income positively influence the Net Area Sown. This is evident from the positive signs of the estimated coefficients of the corresponding variables. This means that if Type of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP)and Agricultural Income (AI) increase, there exists an increase in Net Area Sown. Area of Hereditary Property is found to be most important variable in influencing Net Area Sown followed by Self-Acquired Land, Type of Family and Agricultural Income.The significance of $R^2$ as tested by F statistic indicates that the regression equation is significant 1 percent level (0.000). The results indicate that Hypothesis of existence of significant relationship between the variables such as Type of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP)and Agricultural Income (AI) and Net Area Sown (NAS) by farmers holds true.

### 5.7. Risk adaptation strategies - Cropping Pattern and Crop Combinations in Physiological Zones

Cropping Pattern refers to proportion of area under different crops at a point of time. Cropping Pattern varies in the three Physiological zones such as Lowlands, Midlands and Highlands. The Crop Categories are classified by including Paddy in Cereals, Arecanut, Pepper, Vanilla, Nutmeg in Spices and Condiments, Plantain (Chengalikkodan) in Fresh Fruits, Tapioca in tubers, Cowpea, Bitter Guard, Snake Guard, Ash Guard, Pumpkin in Vegetables, Cholam, Ragi, Gram, Kadala, Vanpayar, Tur, Thina, Chama, Amara, Red Gram, Bajra, Veragu, Muthira, Groundnut, Green Beans in Pulses, Sugarcane in Sugar crops, Coconut and Groundnut in Oilseed and Cocoa, Rubber in

Plantation Crops. Lowlands are very fertile lands bestowed with a network of lagoons, natural lakes, rivers and canals in which paddy and coconut is preferred for cultivation by farmers. Due to the deposits of sediments as a result of natural drainage system, not much expenses is required for adding fertilisers in order to increase the yield. Midlands are irrigated with numerous streams which will help for further production and Highlands slope down from Western Ghats and are used for cultivation of plantation crops.The crop categories cultivated in physiological zones is given in Table 5.9.

**Table 5.9**

**Crop Categories in Physiological Zones (percentage)**

| Crop Categories | Lowlands | Midlands | Highlands | Total |
|---|---|---|---|---|
| Cereals | 100 | 31.0 | 0 | 20.6 |
| Spices and Condiments | 0 | 20.5 | 12.3 | 14.4 |
| Fresh Fruits | 0 | 15.3 | 18.3 | 15.6 |
| Tubers | 0 | 0 | 2.7 | 1.4 |
| Vegetables | 0 | 13.4 | 0.8 | 5.6 |
| Pulses | 0 | 0 | 47.5 | 25.1 |
| Sugar Crops | 0 | 0 | 0.5 | 0.3 |
| Oilseeds | 0 | 19.0 | 15.0 | 15.3 |
| Plantation Crops | 0 | 0.7 | 2.7 | 1.7 |

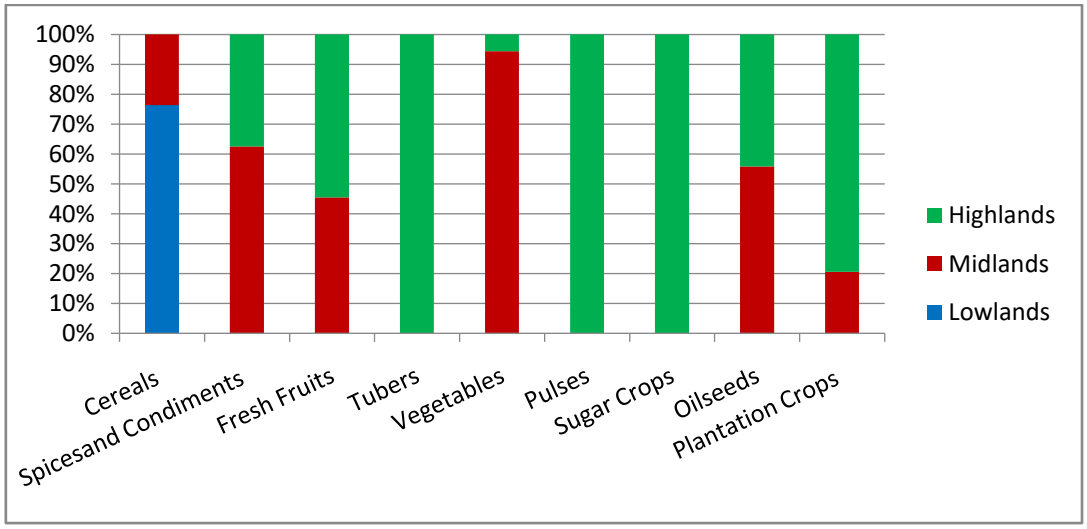
Source : Primary Field Survey

The table 5.9 interprets that among the total agricultural production, the proportion of specific agricultural products in ascending order is 25.1 percent is pulses, 20.6 percent is cereals 15.6 percent is Fresh Fruits, 15.3 percent is Oilseeds and 14.4 percent is pepper. It is evident that in the study area, the farmers are mainly concentrating upon the food crops rather than non-food crops and it is an indicator of food security to the whole state. Within Lowlands, 100 percent cultivation is cereals with exclusive paddy cultivation, within Midlands, maximum proportion of Net Area Sown is used for Paddy Cultivation with 31.0 percent , along with Spices and Condiments which occupy 20.5 percent, Oilseeds especially Coconut, Fresh Fruits and Vegetables, while in Highlands, Pulses occupies the first position followed by Fresh Fruits especially plantain, Oilseeds and Spices and Condiments. Plantation crops donot exist in Agali panchayat in Highlands while Kodassery in Highlands concentrates on Pepper and Plantain crops. Land in each and every zone is utilised in the way it is suitable for by preferring paddy cultivation only

in Lowlands, preferring a variety of crops in Midlands and Highlands. In Highlands, farmers adopt different crop diversification strategies by cultivating a large number of crops which vary according to price, yield, cost and profit. The Regional differences in Cropping Pattern and agricultural crops cultivated is given in Figure 5.2

**Figure 5.2**

**Regional Differences in Cropping Pattern**




The Figure gives the clear explanation of cultivation of cereals in Lowlands and Midlands, the uniqueness of Sugarcrops, Pulses and Tubers in Highlands, Vegetables, Oilseeds and Spices in Midlands. The Highlands is enriched with the cultivation of different varieties of crops except cereals. About 90 percent of vegetables is produced in Midlands especially Pazhayannur.

Crop Combinations provide a basis for agricultural regionalization as crops are generally grown in Combinations. It is very rare to see a monocrop in isolation in a given areal unit at a given point of time as the farmers in the region may be interested in cultivating more than one crop and most probably the existence of monocrop cultivation may be due to the physiological factors rather than the interest of farmers. In Lowlands of Venkitangu and Kuzhalmannam, Paddy – a Monocrop is preferred for cultivation as the watershed land can be used only for the cultivation of rice as rice requires more wetland for cultivation. The availability of water is necessary for paddy which is naturally available in Lowlands with a natural water drainage and irrigation faciltites with natural manmade canals. The Midlands prefer paddy, vegetables, oilseeds, arecanut, pepper with a combination of about eight varieties of crops while Highlands with Kodassery and Agali

together contribute 25 varieties of agricultural crops which is an agricultural asset to Kerala. Agali has a uniqueness in the production of Pulses and can be called as the Pulse Bowl of Kerala. People of Agali considered Pulses as the staple food which provides sufficient Nutrients and Proteins to the inhabitants especially Tribal people. Crop Combinations provides the information related to the number of crops cultivated in the selected area and reveal whether the crop combinations vary in the physiological zones which is given in Table 5.10.

**Table 5.10**

**Crop Combinations in Study Area**

| Physio-Zones | Selected Panchayats | All Phases | | No:of Crops | Total No:of Crops |
|---|---|---|---|---|---|
| | | Type | Crops | | |
| Lowland | Venkitangu | S | Paddy (Monocrop) | 1 | 1 |
| Midland | Kuzhalmannam | S | Paddy (Monocrop) | 1 | 1 |
| | Pazhayannur | S | Paddy+Vegetables | 2 | 8 |
| | | A | Plantain | 1 | |
| | | P | Coconut+Arecanut+Pepper, Rubber+Nutmeg | 5 | |
| Highland | Kodassery | S | Paddy+Tapioca+Vegetables | 3 | 7 |
| | | A | Plantain | 1 | |
| | | P | Coconut+Rubber+Nutmeg | 3 | |
| | Agali | S | Cholam+Ragi+Gram+Kadala+Vanpayar+Tur + Thina+Chama+Amara+Red Gram+ Bajra+Veragu+Muthira+Groundnut +Green Beans | 15 | 20 |
| | | A | Plantain+Sugarcane | 2 | |
| | | P | Coconut+Rubber+ Nutmeg | 3 | |

Source: Primary Field Survey

S – Seasonal Crops, A – Annual Crops, P – Perennial Crops

The Highlands in Physiological Zones takes a very remarkable position in the production of Pulses such as Kodomillets(Veragu), Foxtail Millets (Thina), Amaranthus, Sorghum which are protein rich, nutritious, superfoods, minerals like iron, magnesium, phosphorous and potassium, Eleusine coracana( Ragi),Chama(Panicum Miliaceum). Rice (Summer Rice) is cultivated during Rabi Season , sown in months of September / October and harvested during to January / February. In Venkitangu, only two High Yielding Hybrid Dwarf Varieties of rice – Jyothi and Uma is cultivated which are Hybrid seeds

developed by transferring dwarf genes to high yielding indigeneous varieties of Kerala. In Kuzhalmannam, Paddy – a monocrop with different varieties are cultivated as represented in Table 5.11

**Table 5.11.**

**Varieties of Paddy cultivated in Venkitangu and Kuzhalmannam**

| Varieties of Paddy | Variety | Duration | Time period |
|---|---|---|---|
| Jyothi | HYV | Short | 85-105 |
| Uma | HYV | Medium | 115-120 |
| Rohini | HYV | Short | 85-105 |
| Ponni | HYV | Medium | 140-145 |
| Swetha | HYV | Short | 85-105 |
| Matta Thriveni | HYV | Short | 85-105 |
| Ponni IR-8 | HYV | Medium | 115-120 |

Source : Primary Field Survey

A number of paddy varieties are cultivated in Venkitangu and Kuzhalmannam such as Jyothi, Uma, Rohini, Ponni, Swetha, Matta Thriveni, Ponni IR-8 of which HYV seeds are water and insect resistant, tolerant to salinity are used to attain more productivity. The water and saline resistant High Yielding Dwarf Varieties with Short and Medium Duration for harvesting is used for cultivation in the two panchayats- Venkitangu and Kuzhalmannam. The varieties of paddy cultivation reflects the important role played by farmers in creating food security through availability of cereals for the entire population.

**Conclusion :**

The Land Use Pattern in the Physiological Zones reflects the relevance of Net Area Sown which is the major purpose for which land is used. The study reveals that the Land is Utilised properly as the Agrcultural Area, the main component is utilised properly without Current Fallows and Uncultivable wastelands. The farmers are playing an important role in the utilisation of land due to their personal interest and interest created by Parents in agricultural activities. The Ownership and Cropping Pattern is also important in the Land Use Pattern. Though a gender disparity exists in the Ownership Pattern, the farmers are utilizing the Agricultural Area as Risk Averters by choosing Crop Combinations which are suitable to the topography of the Physiological Zones.

# CHAPTER VI
# DYNAMICS OF NET AREA SOWN
# AND
# FACTORS AFFECTING NET AREA SOWN

## 6.1. Introduction

Net Area Sown represents the extent of cultivable land which is used for raising crops and actually sown once during an agricultural year. The area which is cultivated twice in the case of paddy is considered as Area Sown More than Once and is added to Net Area Sown in order to obtain the Gross Cropped Area. The Utilisation of Net Area Sown is very important as Net Area Sown is the land base for cultivation of crops. The variations in Net Area Sown utilised for cultivation of different crops is relevant to know about the dimensions or diversions of cultivation.

## 6.2. Dynamics of Cropping Pattern in Net Area Sown in Physiological Zones

Dynamics of Cropping Pattern is analysed by considering the Decadal changes in Cropping Pattern in Physiological Zones in three different Phases.

- Phase I – 1991 to 2000
- Phase II – 2001 to 2010
- Phase III – 2011 to2019

The Crops cultivated in the study area is categorized into Food and Non Food Crops to know about the food availability created by farmers. Food Crops are the crops which are grown for the sole use of human consumption. Non-food crops are used for attaining profit rather than for consumption. The Change in cultivation of Food Crops and Non-Food Crops in Physiological Zones in three phases is given in Table 6.1.

**Table 6.1.**

**Dynamics in Cultivation of Food and Non- Food Crops in Physiological Zones**

| Physiological Zones | Food Crops | | | Growth Rate | | | Non –Food Crops | | | Growth Rate | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | I -II | II - III | I -III | I | II | III | I -II | II - III | I -III |
| Lowland | 100 | 100 | 100 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Midland | 80.2 | 78.8 | 80.2 | -1.7 | 1.8 | 0.0 | 19.8 | 21.2 | 19.8 | 7.07 | -6.60 | 0.00 |
| Highland | 84.6 | 83.7 | 83.7 | -1.1 | 0.0 | -1.1 | 15.4 | 16.3 | 16.9 | 5.84 | 3.68 | 9.74 |

Source : Primary Field Survey

In Lowlands, only Food Crops are cultivated in the three different phases from 1991 to 2019. Since the topography is suitable only for the cultivation of Paddy, the

farmers preferred the production of Food Crops only, that is Paddy cultivation in the area. In Phase I, in Midlands, 80.2 percent of Net Area Sown is used for production of Food Crops and only 19.8 percent for Non- Food Crops. In Phase II, 78.8 percent of Net Area Sown is used for production of Food Crops while only 21.2 percent is used for Non- Food Crops. A very slight variation can be seen in Food Crops as well as Non-Food Crops and thus creating a agricultural stagnancy in the Net Area Sown. In Highlands, area under Food Crops decreased from 84.6 to 83.7 percent showing a very low declining trend while area under Non- Food crops increased by 1.5 percent which is a very low increasing trend. Since the farmers have a personal interest in cultivation and the Area owned is a hereditary property, they are interested in continuing the agricultural system that their forefathers have implemented. The study area reveals the relevance of the attitude of farmers towards the cultivation of Food Crops and making the family and economy secured in food availability.

Paddy is the main Food Crop that is cultivated in the study area and Net Area Sown under paddy is varying in different categories of land in the selected Panchayats. The Cross – Section data revealing the size of Net Area Sown under Paddy in the Panchayats is given in Table 6.2

**Table 6.2.**

**Dynamics of Net Area Sown under Cereals - Paddy**

| NAS | Paddy | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Marginal | | | Small | | | Semi-Medium | | | Medium | | | Total | | |
| | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III |
| I | 19.6 | 5.0 | 0.0 | 6.5 | 3.4 | 0.0 | 7.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.4 | 4.2 | 0.0 |
| II | 19.6 | 26.1 | 31.6 | 41.9 | 44.8 | 46.4 | 84.6 | 91.7 | 91.7 | 100 | 100 | 100 | 29.0 | 36.4 | 42.0 |
| III | 32.9 | 31.9 | 23.5 | 3.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.6 | 23.0 | 16.1 |
| IV | 27.8 | 37.0 | 44.9 | 48.4 | 51.7 | 53.6 | 7.7 | 8.3 | 8.3 | 0.0 | 0.0 | 0.0 | 29.0 | 36.4 | 42.0 |
| V | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Source : Primary Field Survey

Row wise - I – Kodassery, II – Venkitangu, III – Pazhayannur, IV – Kuzhalmannam, IV – Agali.

Column-wise– I – Phase I, II – Phase II,III– Phase III.

The Table elucidates that in Kodassery, the Net Area Sown under paddy has been decreased from 16.4 percent in Phase I to 0 percent in Phase III. In Venkitangu, the Net Area Sown under paddy has been increased from 29.0 percent in Phase I to 42.0 percent in Phase III.In Pazhayannur, the Net Area Sown under paddy has been decreased from 25.6 percent in Phase I to 16.1 percent in Phase III. In Kuzhalmannam, the Net Area Sown under paddy has been increased from 29.0 percent in Phase I to 42.0 percent in Phase III. In Phase I, the Net Area Sown was proportionally distributed between the four panchayats except Agali where no paddy cultivation exists. In Phase III, the Net Area Sown under Paddy doesnot exist in Kodassery and Agali and decreased further in Pazhayannur giving a negative indicator for cereals production especially the Staple Food of Kerala. Net Area Sown is now absent in Kodassery and Agali while that of Pazhayannur is also decreasing. But still there exists a positive indicator of development in production of cereals in Venkitangu and Kuzhalmannam where the farmers cannot change the utilisation pattern due to the specific features of Physiological Zones and Zoning Regulations Act in agriculture through the Wetland and Paddy Conservation Act. Among the selected Panchayats, Venkitangu and Kuzhalmannam leads in the production of Paddy Cultivation.

In Kodassery (I), the Net Area Sown have been declined from 19.6 percent in Phase I to 0 percent Phase II in Marginal Lands, from 6.5 percent to 0.0 percent in Small Sized area, from 7.7 perecnt to 0.0 percent in Semi- Medium lands. In Venkitangu(II), Net Area Sown under Paddy increased from 19.6 to 31.6 in Marginal lands, 41.9 to 46.4 percent in Small sized lands, 84.6 to 91.7 percent in Semi-Medium lands and 100 percent in the Medium lands. In Kuzhalmannam (IV) also, Net Area Sown increased from 27.8 to 44.9 percent in Marginal lands, 48.4 to 53.6 percent in Small sized lands, 7.7 to 8.3 percent in Semi-Medium sized lands while no Medium sized land with greater than 4 Hectares exists in the area.

As history says, State Kerala is derived from Kera which means Coconut and 'Alam' meaning Coconut Tree which means "Land of Coconut Trees". Kerala has the largest area under Coconut Cultivation but has third largest position in production. In the three Phases, Coconut, the leading cultivation in Kerala have to be analysed as Coconut is one of the leading cultivations in Kerala. In the past decades, Coconut was considered as main source of income to the farmers of Midlands and Highlands. Since cultivation of other crops is not suitable for Lowlands, Coconut is not cultivated in the specific area. But

in some areas, planting Coconut in domes in the land is considered as the first step of conversion of agricultural land to land that can be used for other purposes.

**Table 6.3.**

**Dynamics of Net Area Sown underOilseeds - Coconut**

| Physiological Zones | Panchayats | Marginal | | | Small | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | I | II | III | I | II | III |
| Highlands | Kodassery | 42.7 | 34.1 | 35.2 | 50.0 | 85.7 | 70.0 | 41.0 | 36.4 | 36.9 |
| | Agali | 8.0 | 9.1 | 6.8 | 50.0 | 14.3 | 30.0 | 14.5 | 13.1 | 13.6 |
| Midlands | Pazhayannur | 49.3 | 56.8 | 58.0 | 0.0 | 0.0 | 0.0 | 44.6 | 50.5 | 49.5 |

Source : Primary Field Survey

Within the total Net Area Sown used for coconut cultivation, 44.6 percent is cultivated in Pazhayannur, 41 percent in Kodassery and 14.5 percent in Agali in Phase I, 50.5 percent in Pazhayannur, 36.4 in Kodassery, 13.1 percent in Agali in Phase II and 13.6 percent in Agali, 36.9 percent in Kodassery and 49.5 percent in Pazhayannur in Phase III. Area under Coconut cultivation is almost stagnant in Agali with 14 percent while Net Area Sown in Pazhayannur is highest and increasing from 44.6 percent in Phase I to 49.5 percent in Phase III while that of Kodassery is showing a declining trend from 41.0 to 36.9 percent. Within the Marginal lands, Pazhayannur leads in all phases along with an increasing trend from 49.3 percent to 58.0 percent while no cultivation exists in Small, Semi-Medium and Medium sized lands.

Spices and Condiments includes agricultural products such as arecanut, pepper, nutmeg, vanilla and is mainly cultivated in Pazhayannur in Midlands and Kodassery, Agali in Highlands.

**Table 6.4.**

**Dynamics of Net Area Sown underSpices and Condiments**

| Physiological Zones | Spices and Condiments | Panchayats | Marginal | | |
|---|---|---|---|---|---|
| | | | I | II | III |
| Midlands | Arecanut | Pazhayannur | 93.1 | 94.6 | 100 |
| Highlands | Arecanut | Agali | 6.9 | 5.4 | 0 |
| Midlands | Pepper | Pazhayannur | 100 | 100 | 100 |
| Midlands | Nutmeg | Pazhayannur | 5.6 | 14.0 | 22.7 |
| Highlands | Nutmeg | Kodassery | 94.4 | 86.0 | 77.3 |
| Midlands | Vanilla | Pazhayannur | 0.0 | 0.0 | 100 |

Source : Primary Field Survey

Arecanut, Pepper and Vanilla is produced mainly in Pazhayannur in Midlands while Kodassery in Highlands leads in the production of Nutmeg with 77.3 percent. Comparing the three Phases, area under production of Arecanut is increasing in Pazhayannur, while area is decreasing in Agali. Area under Pepper cultivation remained constant and is exclusive in Pazhayannur. The cultivation of Nutmeg is preferred by farmers in Kodassery as the price of Nutmeg is increasing. But area under cultivation of Nutmeg is decreasing in the corresponding Phases due to plant diseases.

Food crops including Fresh Fruits, Tapioca, Vegetables are also cultivated in Midlands and Highlands. Fresh Fruits includes Plantain, Tubers like Tapioca, Vegetables and Pulses which are rich in vitamins are also included in agricultural production in the selected area.

**Table 6.5.**

**Dynamics of Net Area Sown underOther Food Crops, Pulses and Non-Food Crops**

| Physiological Zones | Other Crops | Panchayats | Marginal | | | Small | | | Semi-Medium | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | I | II | III | I | II | III | I | II | III |
| Highlands | Fresh Fruits – Plantain | Kodassery | 36.4 | 32.8 | 28.8 | 14.3 | 17.4 | 25.9 | 0.0 | 0.0 | 0.0 |
| | | Agali | 50.0 | 25.0 | 9.1 | 85.7 | 82.6 | 74.1 | 100 | 100 | 100 |
| Midlands | | Pazhayannur | 13.6 | 42.2 | 62.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Highlands | Tapioca | Kodassery | 100 | 100 | 100 | 100 | 100 | 100 | 0.0 | 0.0 | 0.0 |
| Highlands | Vegetables | Kodassery | 0.0 | 4.5 | 7.7 | 100 | 100 | 100 | 0.0 | 0.0 | 0.0 |
| Midlands | | Pazhayannur | 100 | 95.5 | 92.3 | 100 | 100 | 100 | 0.0 | 0.0 | 0.0 |
| Highlands | Pulses | Agali | 69.9 | 76.0 | 83.3. | 85.7 | 75.9 | 72.8 | 76.2 | 72.2 | 66.7 |
| **Non-Food Crops – Plantation Crops** | | | | | | | | | | | |
| Midlands | Rubber | Pazhayannur | 92.3 | 90.0 | 80.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Highlands | | Kodassery | 7.7 | 10.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Highlands | Cocoa | Kodassery | 0.0 | 0.0 | 100 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Source : Primary Field Survey

Other Crops and Pulses which are included as Food Crops are cultivated in the study area especially in Midlands and Highlands. Area under cultivation of Vegetables and Plantain is leading in Pazhayannur especially Chengalikkodan, while that of Pulses is leading in Agali. Plantain cultivation in Pazhayannur is increasing at a faster rate in three phases while in Kodassery, Plantain cultivation is showing a declining trend, while Tapioca is cultivated mainly in Kodassery. In Pazhayannur, Plantain cultivation is done mainly In Marginal lands and in Kodassery, Plantain cultivated in Small sized lands showed an increasing trend while in Agali, Plantain cultivation is showing a decreasing

trend due to destruction of agricultural land by animals especially bananas. In Kodassery, the proportion of Net Area Sown for plantain cultivation is decreasing from 36.4 percent in Phase I to 28.8 percent in Phase III. In Agali, areal plantain cultivation in Marginal lands decreased from 50.0 to 9.1 percent. The farmers who use Semi-Medium lands is fully utilizing area for Plantain cultivation. Pazhayannur is the leading producer of vegetables and Kodassery is showing an increasing trend in the production of vegetables. Pulses are produced by farmers of Agali in Highlands and the proportion of Net Area Sown increased from 69.9 percent in Phase I to 83.3 percent in Phase II in Marginal lands, while showed a decreasing trend from 85.7 percent in Phase I to 72.8 percent in Phase III in Small sized lands and 76.2 percent in Phase I to 66.7 percent in Phase III in Semi-Medium sized lands. Non Food Crops which include Rubber and Cocoa was cultivated mainly in Pazhayannur in Midlands and Kodassery in Highlands. No farmer in Agaliprefered to cultivate Non Food Crops in the owned Net Area Sown. Area – wise cultivation of Rubber increased in Kodassery from 7.7 percent in Phase I to 20.0 percent in Phase III in Marginal lands and Cocoa is produced in Kodassery.

### 6.3. Utilisation Pattern of Net Area Sown in selected Panchayats

Net Area Sown in Kodassery is utilised by cultivating Food Crops – Paddy, Coconut, Plantain, Nutmeg, Tapioca, Vegetables and Non – Food Crops – Rubber, Cocoa in Marginal and Small sized lands and the utilisation pattern of Net Area Sown is represented in Table 6.6.

**Table 6.6.**

**Utilisation of Net Area Sown – Kodassery( Highland)**

| Crop Category | Crops | Marginal | | | Small | | | Total | | | Growth |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | I | II | III | I | II | III | I to II |
| Food Crop | Paddy | 24.6 | 5.5 | 0 | 18.2 | 5.3 | 0 | 24.6 | 5.4 | 0.0 | -100.00 |
| | Coconut | 25.4 | 27.5 | 29.5 | 18.2 | 31.6 | 28.0 | 24.6 | 27.9 | 29.2 | 18.70 |
| | Plantain | 12.7 | 19.3 | 18.1 | 18.2 | 21.1 | 28.0 | 13.0 | 20.2 | 20 | 53.85 |
| | Nutmeg | 27.0 | 33.9 | 32.4 | 27.3 | 36.8 | 36.0 | 26.8 | 34.1 | 33.1 | 23.51 |
| | Tapioca | 0.8 | 3.7 | 7.6 | 9.1 | 5.3 | 8.0 | 1.4 | 3.9 | 7.7 | 450.00 |
| | Vegetables | 0.0 | 0.9 | 2.9 | 9.1 | 0.0 | 0.0 | 1 | 0.8 | 2.3 | 130.00 |
| Non-Food Crop | Rubber | 9.5 | 8.3 | 7.6 | 0.0 | 0.0 | 0.0 | 8.7 | 7.0 | 6.2 | -28.74 |
| | Cocoa | 0 | 0.9 | 1.9 | 0 | 0.0 | 0.0 | 0.0 | 0.8 | 1.5 | --- |

Source : Primary Field Survey

The table reveals that Paddy cultivation decreased sharply from 24.6 percent in Phase I to 0.0 percent in Phase II and Paddy cultivation is completely absent in the Phase III. Cultivation of Coconut, Plantain, Nutmeg, Tapioca, Vegetables showed an increasing trend with growth rate of 18.70, 53.85, 23.51, 450.50 and 130.00 percent respectively while Rubber and Paddy showed a declining trend with a negative growth rate of -100 and – 28.74 percent respectively in Kodassery. Coconut and Plantain cultivation in Net Area Sown in Small sized land is showing a higher increasing trend than in Marginal sized lands.

Net Area Sown is influenced by determinants such as Price, Yield per Hectare, Cost of Production, Total Revenue and Profit obtained from the crops cultivated in the area. The Profit analysis of crops cultivated gives a clear illustration of the reasons for change in Net Area Sown under different crops in different phases. The spatial areal pattern under different crops varies according to changes in the determinants especially the price of the same crop produced. Price of a commodity and yield per hectare were the most important determinants for change in cropping pattern and profit is calculated by the difference between Total Revenue and Total Cost. The variables such as Price, Yield per Hectare, Cost of Production, Total Revenue and Profit in Three Phases were considered for explaining the variations in crop cultivated in the Net Area Sown which is represented in Table 6.7.

**Table 6.7**

**Profit Analysis of Crops Cultivated - Kodassery**

| Crops | Phases | Price | Yield/Hect | Total Cost | Total Revenue | Profit/ Hect | Reasons |
|---|---|---|---|---|---|---|---|
| Paddy | Phase I | 7.76 | 918.40 | 1892.78 | 7423.41 | 5530.63 | Climate vulnerable, irrigation, Neighbourhood change, increasing cost of labour, Rise in price of other crops |
| | Phase II | 12.29 | 873.64 | 6017.14 | 10668.86 | 4651.71 | |
| | Phase III | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | Growth rate | -100.00 | -100.00 | -100.00 | -100.00 | -100.00 | |
| Coconut | Phase I | 6.18 | 1956.98 | 5139.93 | 12084.96 | 6945.04 | Increasing prices Less irrigation |
| | Phase II | 11.72 | 1960.76 | 7426.13 | 22989.15 | 15563.03 | |
| | Phase III | 15.03 | 1968.62 | 14957.29 | 29581.41 | 14624.12 | |
| | Growth Rate | 143.28 | 0.59 | 191.00 | 144.78 | 110.57 | |
| Plantain | Phase I | 20.00 | 2427.75 | 6007.50 | 48555.00 | 42547.50 | Increasing Prices Climate vulnerable Lack of irrigation |
| | Phase II | 30.38 | 2417.54 | 8444.09 | 73336.15 | 64892.06 | |
| | Phase III | 40.50 | 2152.73 | 14875.96 | 87162.23 | 72286.27 | |
| | Growth Rate | 102.50 | -11.33 | 147.62 | 79.51 | 69.90 | |
| Rubber | Phase I | 225.00 | 651.38 | 28350.00 | 146559.38 | 118209.38 | Decreasing Prices |
| | Phase II | 175.00 | 684.00 | 39600.00 | 119700.00 | 80100.00 | |
| | Phase III | 153.13 | 708.24 | 46828.13 | 112336.88 | 65508.75 | |

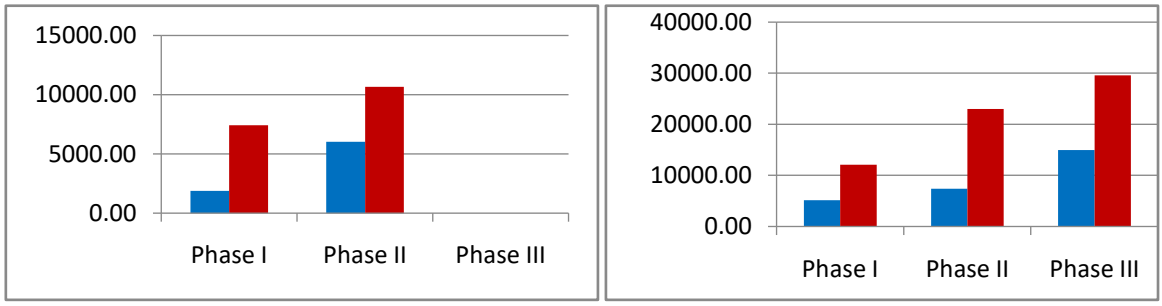
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Growth Rate | -31.94 | 8.73 | 65.18 | -23.35 | -44.58 | |
| Nutmeg | Phase I | 100.00 | 804.53 | 6414.32 | 80452.70 | 74038.38 | Increasing Prices<br>Plant diseases |
| | Phase II | 232.50 | 815.61 | 7695.00 | 189632.97 | 181937.97 | |
| | Phase III | 336.74 | 814.05 | 13327.33 | 274185.94 | 260858.62 | |
| | Growth Rate | 236.74 | 1.18 | 107.77 | 240.80 | 252.33 | |
| Tapioca | Phase I | 6.00 | 4050.00 | 6075.00 | 24300.00 | 18225.00 | Increasing Production<br>Increasing prices |
| | Phase II | 12.60 | 3888.00 | 10125.00 | 48600.00 | 38475.00 | |
| | Phase III | 15.00 | 4058.10 | 14175.00 | 60871.50 | 46696.50 | |
| | Growth Rate | 150.00 | 0.20 | 133.33 | 150.50 | 156.22 | |
| Vegetables | Phase I | 10.00 | 2794.50 | 6075.00 | 27945.00 | 21870.00 | Increasing Production<br>Increasing prices |
| | Phase II | 20.00 | 2835.00 | 12150.00 | 56700.00 | 44550.00 | |
| | Phase III | 30.00 | 2835.00 | 17550.00 | 56700.00 | 44550.00 | |
| | Growth Rate | 200.00 | 1.45 | 188.89 | 102.90 | 103.70 | |
| Cocoa | Phase II | 180.00 | 1012.50 | 10125.00 | 182250.00 | 172125.00 | Increasing Prices |
| | Phase III | 240.00 | 1012.50 | 20250.00 | 243000.00 | 222750.00 | |
| | Growth Rate | ----- | ------- | ------ | ------- | ------- | |

Source : Primary Field Survey

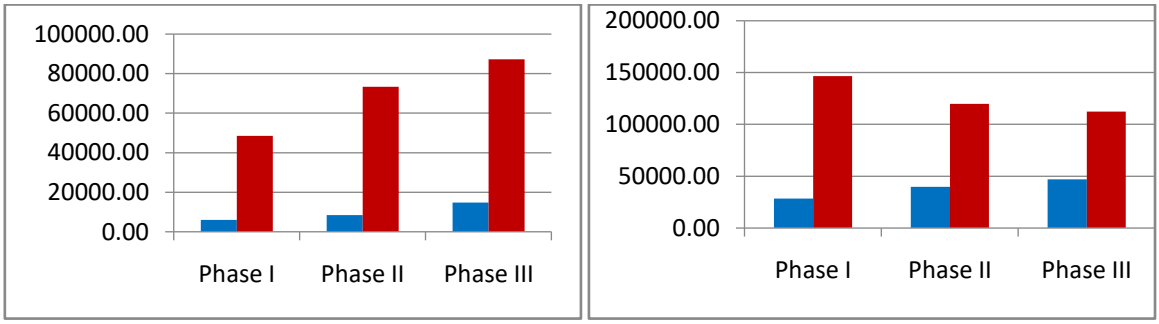
In Kodassery, the main crops cultivated are Paddy, Coconut, Plantain, Rubber, Nutmeg, Tapioca, Vegetables, Cocoa and Paddy cultivation in Kodassery declined and not existed in the Phase III. The reasons identified for the declining trend is not the falling prices but climate vulnerability, increasing cost of production, Conversion of Neighbourhood land and blocking of irrigation facilities through canaling system. The farmers in the area were also influenced by the relative prices of crops such as nutmeg, vegetables, tapioca and coconut. Coconut cultivation was profitable due to increasing prices but the yield is almost constant throughout the three phases. Increase in profit is the result of increasing prices while the yield per hectare remained almost stagnant in first two phases and decreased in III phase in Coconut cultivation. Yield became negative due to climate vulnerability which occurred due to heavy rain and fast blowing wind. In the case of Rubber cultivation, decreasing price reflecting a growth rate of 31.94 percent led to decreasing revenue and the farmers are converting land to other cultivations. Nutmeg cultivation is promoted by the farmers of the area as price is increasing while the yield per hectare remained constant as plant infectious diseases affected the cultivation. Tapioca, vegetables and cocoa showed an increasing trend in price and a stagnancy in quantity produced. But still the cultivation of crops except paddy and rubber is profitable for the farmers. The declining trend of paddy is a threat to create food security in the area. Variations in Cost and Revenue of different crops in three phases is represented graphically as in Figure 6.1.

**Figure 6.1.**

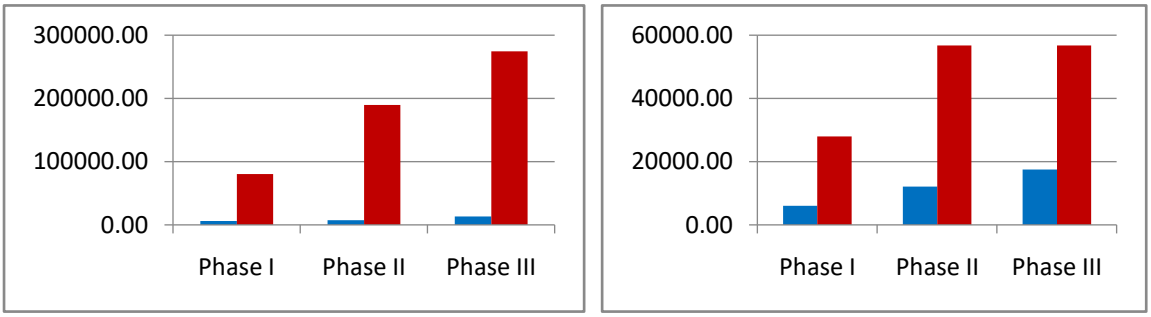
**Cost and Revenue of Paddy and coconut cultivation**




**Plantain and Rubber cultivation**




**Nutmeg and Tapioca cultivation**




Food Crops cultivated in Net Area Sown includes Paddy, Coconut, Plantain, Nutmeg, Tapioca and Vegetables while Non-Food Crops include Rubber and Cocoa cultivation. Among the food crops, main staple food – Paddy shows a declining trend which is considered as a serious problem as the shortage of rice create the deficiency of carbohydrate in people which result in the existence of an unhealthy population as well as young generation which adversely affect the economic growth of the state.

The Utilisation pattern of Net Area Sown in Pazhayannur reflected the crops preferred in the land with different size in different Phases. The cropping pattern in Net Area Sown is given in Table 6.8

**Table 6.8.**

**Utilisation of Net Area Sown - Pazhayannur**

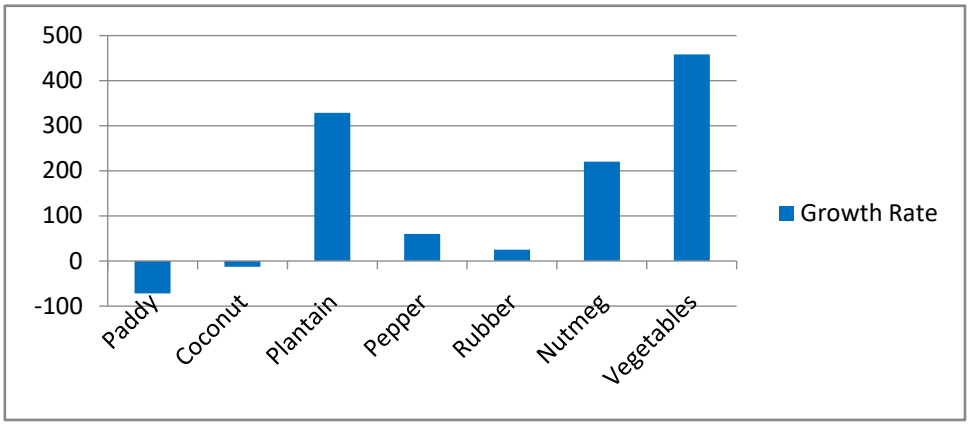
| Crops | Marginal | | | Growth Rate |
|---|---|---|---|---|
| | I | II | III | |
| Paddy | 39.7 | 21 | 11.1 | -72.04 |
| Coconut | 28.2 | 27.6 | 24.5 | -13.12 |
| Plantain | 4.6 | 14.9 | 19.7 | 328.26 |
| Pepper | 1.5 | 1.7 | 2.4 | 60.00 |
| Rubber | 0.8 | 0.6 | 1 | 25.00 |
| Nutmeg | 1.5 | 3.3 | 4.8 | 220.00 |
| Vegetables | 3.1 | 11.6 | 17.3 | 458.06 |
| Cocoa | 0 | 0 | 0.5 | …… |

Source : Primary Field Survey

Net Area Sown under different crops exists only in Marginal lands in Pazhayannur which meant that area under cultivation is of the size less than 1 Hectares. Net Area Sown under Paddy Cultivation declined in Pazhayannur from 39.7 percent in Phase I to 11.1 percent in Phase III and the Growth Rate is -72.04 which depicted that the Net Area Sown is showing a negative trend. The area under Coconut also showed a decreasing trend from 28.2 percent in Phase I to 24.5 percent in Phase III showing a decreasing growth rate of -13.12 percent. The cultivation of Plantain increased sharply from 4.6 to 19.7 percent with a growth rate of 328.26 percent Growth rate of different crops cultivated in Pazhayannur is given in Figure 6.2

**Figure 6.2**

**Growth rate of crops in Pazhayannur**




The Cost and Revenue analysis of different crops cultivated in three phases in Pazhayannur is given in Table 6.9.

**Table 6.9**

**Cost and Revenue analysis of Net Area Sown in Pazhayannur**

| Crops | Phases | Price | Yield/Hect | Total Cost | Total Revenue | Profit/ Hect | Reasons |
|---|---|---|---|---|---|---|---|
| Paddy | Phase I | 8.06 | 898.64 | 1620.00 | 7239.57 | 5619.57 | Decreased Yield |
| | Phase II | 9.34 | 942.16 | 3645.00 | 8840.72 | 5195.72 | |
| | Phase III | 25.04 | 959.67 | 7395.65 | 24328.17 | 16932.52 | |
| | Growth rate | 210.84 | 6.79 | 356.52 | 236.04 | 201.31 | |
| Coconut | Phase I | 6.16 | 1985.59 | 5626.22 | 12235.38 | 6609.16 | Decreased Yield |
| | Phase II | 12.00 | 1983.69 | 6885.00 | 23804.28 | 16919.28 | |
| | Phase III | 15.06 | 1984.50 | 19440.00 | 29884.24 | 10444.24 | |
| | Growth rate | 144.38 | -0.06 | 245.53 | 144.24 | 58.03 | |
| Arecanut | Phase I | 148.15 | 810.00 | 4860.00 | 120000.00 | 115140.00 | Decreased Yield |
| | Phase II | 294.29 | 810.00 | 8100.00 | 238371.43 | 230271.43 | |
| | Phase III | 339.87 | 805.85 | 11163.46 | 273998.08 | 262834.62 | |
| | Growth rate | 129.41 | -0.51 | 129.70 | 128.33 | 128.27 | |
| Plantain | Phase I | 20.00 | 2430.00 | 6075.00 | 48600.00 | 42525.00 | Increased Yield |
| | Phase II | 29.63 | 2430.00 | 19755.00 | 72000.00 | 52245.00 | |
| | Phase III | 40.00 | 2430.00 | 20941.46 | 97200.00 | 76258.54 | |
| | Growth rate | 100.00 | 0.00 | 244.72 | 100.00 | 79.33 | |
| Pepper | Phase I | 90.00 | 668.25 | 6277.50 | 60142.50 | 53865.00 | Increased Yield |
| | Phase II | 106.67 | 729.00 | 6075.00 | 77625.00 | 71550.00 | |
| | Phase III | 135.00 | 777.60 | 10530.00 | 104976.00 | 94446.00 | |
| | Growth rate | 50.00 | 16.36 | 67.74 | 74.55 | 75.34 | |
| Rubber | Phase I | 225.00 | 648.00 | 28350.00 | 145800.00 | 117450.00 | Decreased Yield |
| | Phase II | 175.00 | 648.00 | 36450.00 | 113400.00 | 76950.00 | |
| | Phase III | 125.00 | 607.50 | 60750.00 | 75937.50 | 15187.50 | |
| | Growth rate | -44.44 | -6.25 | 114.29 | -47.92 | -87.07 | |
| Nutmeg | Phase I | 100.00 | 810.00 | 6480.00 | 81000.00 | 74520.00 | Increased Yield |
| | Phase II | 230.00 | 850.50 | 8100.00 | 195615.00 | 187515.00 | |
| | Phase III | 345.00 | 846.45 | 17212.50 | 292025.25 | 274812.75 | |
| | Growth rate | 245.00 | 4.50 | 165.63 | 260.53 | 268.78 | |
| Vegetables | Phase I | 10.00 | 2227.50 | 6075.00 | 22275.00 | 16200.00 | Increased Yield |
| | Phase II | 20.00 | 2835.00 | 24300.00 | 56700.00 | 32400.00 | |
| | Phase III | 30.00 | 2823.75 | 16425.00 | 84712.50 | 68287.50 | |
| | Growth rate | 200.00 | 26.77 | 170.37 | 280.30 | 321.53 | |
| Vanilla | Phase III | 50.00 | 2835.00 | 16200.00 | 141750.00 | 125550.00 | ---- |
| | Growth rate | ---- | ---- | ---- | ---- | ---- | |

Source : Primary Field Survey

Cultivation of all except Paddy and Rubber crops showed an increasing trend and Net Area Sown under vegetable cultivation increased at an increasing rate. Since Pazhayannur is considered as a Special Agricultural Zone for vegetables and vegetable cultivation is promoted through agricultural institutions such as Kerala Agricultural

University through provision of seeds, seedlings, micro irrigation facilities and productivity enhancement programmes.

The Land Utilisation pattern of Venkitangu (Lowlands) and Kuzhalmannam (Midlands) is extremely different from the cropping pattern of Kodassery, Pazhayannur and Agali as Diversification is not possible due to the existing topography and paddy is an exclusive crop in the area which is represented in Table 6.10

**Table 6.10.**

**Utilisation of Net Area Sown – Venkitangu and Kuzhalmannam**

| Panchayat | Crops | Marginal | Small | Semi-Medium | Medium |
|---|---|---|---|---|---|
| Venkitangu | Paddy | 51.7 | 21.7 | 18.3 | 8.3 |
| Kuzhalmannam | Paddy | 73.7 | 25.0 | 1.7 | 0.0 |

Source : Primary Field Survey

Since Venkitangu is a lowland, no transformation or conversion exists in the land as no other crop can be preferred due to the existence of characteristics of wetland. No other crops except paddy can be cultivated in the Net Area Sown in Lowlands. 51.7 percent land is Marginal with less than 1 Hectares, 21.7 percent Small sized, 18.3 percent Semi-Medium and 8.3 percent Net Area Sown is Medium sized land.

No variations exist in Net Area Sown in three different phases in Venkitangu. In Kuzhalmannam which belongs to Midlands, 73.7 percent of Net Area Sown under Paddy Cultivation is Marginal land, 25.0 percent is Small and 1.7 percent is Semi- Medium land. The main crop cultivated is paddy with different varieties of paddy itself such as Jyothi, Uma, Rohini, Ponni, Swetha, Matta Thriveni and Ponni IR-8. All the crops are different High Yielding Dwarf Varieties of paddy which were genetically created out of the traditional seeds. All the seeds take the Medium or Short Term Duration for production ranging from around 100 to 120 days and moderately tolerant to Brown Plant Hoppers in which Uma and Jyothi is special for Kole lands. Uma is also special for cultivation of additional crop season of Kolelands.

The cost and revenue analysis of crops cultivated especially paddy cultivation in three phases in Venkitangu is given in Table 6.11.

**Table 6.11**

**Cost and Revenue analysis of Paddy Cultivation- Venkitangu**

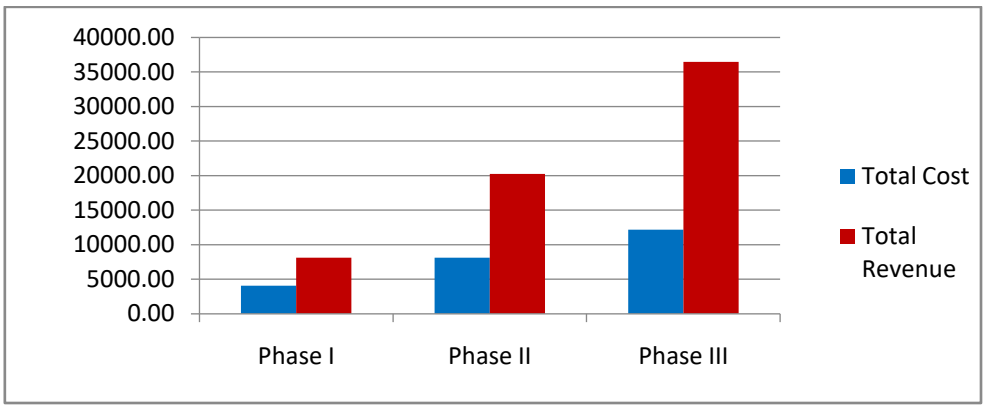
| Phases | Price | Yield/ Hectare | Total Cost | Total Revenue | Profit/ Hectare |
|---|---|---|---|---|---|
| Phase I | 10.00 | 810.00 | 4050.00 | 8100.00 | 4050.00 |
| Phase II | 20.00 | 1012.50 | 8100.00 | 20250.00 | 12150.00 |
| Phase III | 30.00 | 1215.00 | 12150.00 | 36450.00 | 24300.00 |
| Growth Rate | 200.00 | 50.00 | 200.00 | 350.00 | 500.00 |

Source : Primary Field Survey

In Venkitangu, the cost and revenue of paddy in three phases reflects the fact that price of paddy is increasing, cost is increasing at a faster rate while the yield per hectare has been increased due to application of fertilisers – both bio and permitted chemical fertilisers with the help and co-ordination of Padasekharasamiti. Total Cost of production also increased due to increased labour cost, increased cost of machinery and cost of marketing facilities. Whatever is left out as profit after meeting the expenses is also attractive and the main incentive to continue in the agricultural production is that the farmers have no effort or require no labour effort to cultivate in the land as the Net Area Sown is completely cultivated with the guidance of Padasekharasamitis. No conversion is possible in the Net Area Sown due to Kerala Conservation of Paddy and Wetland Act, 2008 which was later amended – Kerala Conservation of Paddy and Wetland Bill 2011. Cost and Revenue of Paddy Cultivation in Venkitangu Panchayat is given in Figure 6.3

**Figure 6.3.**

**Cost and Revenue analysis of Paddy Cultivation - Venkitangu**




Agali in Highlands concentrated mainly in production of pulses and the utilisation pattern of Net Area Sown in Agali is distinguishable with the cultivation of a number of crops such as coconut, Arecanut, Plantain, Cholam, Ragi, Kadala, Vanpayar, Thuvara,

Thina, Chama, Muthira, Veragu, Bajra, Green Beans, Gorundnut and Sugarcane which is represented in Table 6.12.

**Table 6.12**

**Utilisation of Net Area Sown- Agali**

| Crops | Marginal | | | Small | | | Semi-Medium | | | Medium | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | I | II | III | I | II | III | I | II | III |
| Coconut | 5.2 | 6.4 | 7.7 | 2.00 | 1.1 | 2.9 | 0.0 | 0.0 | 2.0 | 100 | 100 | 0.0 |
| Arecanut | 1.7 | 1.6 | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Plantain | 19.1 | 12.8 | 7.7 | 12.2 | 21.8 | 19.4 | 23.8 | 27.8 | 29.4 | 0.0 | 0.0 | 0.0 |
| Cholam | 13.0 | 14.4 | 16.7 | 18.4 | 17.2 | 14.6 | 9.5 | 5.6 | 13.7 | 0.0 | 0.0 | 0.0 |
| Ragi | 17.4 | 19.2 | 16.7 | 16.3 | 13.8 | 16.5 | 14.3 | 16.7 | 17.6 | 0.0 | 0.0 | 0.0 |
| Kadala | 1.7 | 5.6 | 3.8 | 4.1 | 0.0 | 1.9 | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| Vanpayar | 5.2 | 2.4 | 2.6 | 2.0 | 5.7 | 6.8 | 0.0 | 5.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| Thuvara | 7.0 | 8.8 | 11.5 | 7.1 | 4.6 | 5.8 | 4.8 | 11.1 | 3.9 | 0.0 | 0.0 | 0.0 |
| Thina | 7.8 | 9.6 | 6.4 | 10.2 | 8.0 | 8.7 | 14.3 | 5.6 | 11.8 | 0.0 | 0.0 | 0.0 |
| Chama | 9.6 | 42.3 | 15.4 | 13.3 | 46.2 | 7.8 | 9.5 | 11.5 | 11.8 | 0.0 | 0.0 | 0.0 |
| Amara | 0.9 | 0.0 | 0.0 | 2.0 | 3.4 | 2.9 | 9.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Muthira | 3.5 | 4.0 | 3.8 | 7.1 | 3.4 | 8.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Veragu | 2.6 | 3.2 | 1.3 | 4.1 | 5.7 | 7.8 | 0.0 | 5.6 | 5.9 | 0.0 | 0.0 | 0.0 |
| Bajra | 0.9 | 0.0 | 0.0 | 1.0 | 0.0 | 1.0 | 0.0 | 5.6 | 5.6 | 0.0 | 0.0 | 0.0 |
| Green Beans | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.6 | 5.7 | 0.0 | 0.0 | 0.0 |
| Groundnut | 2.6 | 2.4 | 0.0 | 0.0 | 0.0 | 2.9 | 4.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Sugarcane | 1.7 | 0.8 | 0.0 | 0.0 | 1.1 | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Source : Primary Field Survey

In Phase I, a major proportion of land was used for production of Plantain, followed by Ragi, Cholam, Chama, Thina, and Thuvara and almost the same cropping pattern with same crops were cultivated in the Net Area Sown in Phase II and Phase III. The farmers who cultivated coconut owned Medium sized land and the land under coconut decreased due to the attack of Malabar Giant Squirrel. The areal-wise cultivation of Plantain increased due to increasing prices but the cultivators always faced the problem of

attack of wild animals. The farmers of Agali mainly concentrated upon the production of pulses as pulses was the staple food of Agali at a time and have been diverting towards rice which is obtained through Public Distribution System.

**Table 6.13**

**Cost and Revenue analysis of Pulses – Agali**

| Crops | Phases | Price | Yield/ Hectare | Total Cost | Total Revenue | Profit/ Hectare | Reasons |
|---|---|---|---|---|---|---|---|
| Pulses | Phase I | 8.97 | 1252.94 | 2233.80 | 10552.73 | 8318.93 | Destruction by wild animals Increasing irrigation cost |
| | Phase II | 19.34 | 1087.58 | 6853.34 | 20312.31 | 13458.96 | |
| | Phase III | 30.49 | 1114.25 | 9196.29 | 32657.93 | 23461.64 | |
| | Growth Rate | 240.08 | -11.07 | 311.69 | 209.47 | 182.03 | |
| Plantain | Phase I | 20.00 | 2419.62 | 8100.00 | 47976.92 | 39876.92 | |
| | Phase II | 29.63 | 2073.09 | 18569.25 | 61180.31 | 42611.06 | |
| | Phase III | 39.63 | 2134.84 | 25287.80 | 84410.89 | 59123.09 | |
| | Growth rate | 98.17 | -11.77 | 212.20 | 75.94 | 48.26 | |

Source : Primary Field Survey

In Agali, price of Pulses and Plantain increased while the yield per hectare decreased due to destruction by wild animals and increased cost of irrigation. Though Bhavani river is flowing through Agali as the main source of irrigation, variations in altitude in the area is itself a bottleneck for production due to increased irrigation cost which mainly arises from cost of motor pumpsets for irrigation. By the traditional system of cultivation, tribals have to keep mandatorily a portion of their harvest for animals and birds and a certain proportion for the relatives. Though the two traditional customs are going on, the tribals faced attack of the Net Area Sown by Wild animals especially, herd of elephants, Boars and Bisons. The growth rate of price for pulses is 240.08 percent which is acceptable by farmers while the yield per hectare decreased by 11.07 percent, total cost also increased, Total Revenue and Profit also increased to 311.69 percent, 209.47 percent and 182.03 percent respectively out of which increase in cost is the highest growth rate. The same is in the production of plantain also with highest growth rate in cost of production with 212.20 percent and lowest in yield per hectare with -11.77 percent, growth rate in profit also exists low when compared to other concepts. The price fluctuations in the crops cultivated is necessary while considering the net area sown in different phases. Price of some crops showed an increased trend while some showed a decreasing trend. The Price fluctuations in three Phases I, II and III is given in Table 6.14.

**Table 6.14**

**Price Fluctuations in crops cultivated in Three Phases**

| | CROPS | Phase I | Phase II | Phase III | Phase I to Phase II | Phase II to Phase III |
|---|---|---|---|---|---|---|
| 1 | Paddy | 9.21 | 16.52 | 27.94 | 79.43 | 69.14 |
| 2 | Coconut | 6.16 | 12.17 | 15.58 | 97.70 | 28.02 |
| 3 | Arecanut | 138.97 | 289.19 | 333.05 | 108.10 | 15.17 |
| 4 | Plantain | 20.00 | 29.84 | 39.98 | 49.19 | 33.99 |
| 5 | Pepper | 90.00 | 106.67 | 135.00 | 18.52 | 26.56 |
| 6 | Rubber | 225.00 | 175.00 | 147.50 | -22.22 | -15.71 |
| 7 | Nutmeg | 100.00 | 232.20 | 338.30 | 132.20 | 45.69 |
| 8 | Tapioca | 6.00 | 12.60 | 15.00 | 110.00 | 19.05 |
| 9 | Vegetables | 10.00 | 20.00 | 30.00 | 100.00 | 50.00 |
| 10 | Cholam | 11.80 | 180.00 | 240.00 | 1425.42 | 33.33 |
| 11 | Ragi | 5.46 | 15.29 | 50.00 | 180.03 | 226.92 |
| 12 | Kadala | 15.00 | 20.18 | 30.69 | 34.53 | 52.06 |
| 13 | Vanpayar | 10.00 | 20.00 | 27.03 | 100.00 | 35.13 |
| 14 | Thuvara | 8.00 | 15.00 | 30.00 | 87.50 | 100.00 |
| 15 | Thina | 8.00 | 20.00 | 21.22 | 150.00 | 6.11 |
| 16 | Chama | 9.73 | 17.15 | 30.00 | 76.24 | 74.93 |
| 17 | Amara | 8.00 | 19.81 | 23.60 | 147.60 | 19.15 |
| 18 | Muthira | 9.82 | 15.00 | 39.69 | 52.78 | 164.62 |
| 19 | Veragu | 10.00 | 40.00 | 25.00 | 300.00 | -37.50 |
| 20 | Groundnut | 5.33 | 20.00 | 40.00 | 275.00 | 100.00 |
| 21 | Sugarcane | 10.00 | 10.00 | 36.80 | 0.00 | 268.00 |
| 22 | Bajra | 6.50 | 15.00 | 20.00 | 130.77 | 33.33 |
| 23 | Green Beans | 8.00 | 21.00 | 20.00 | 162.50 | -4.76 |

Source : Primary Field Survey

Except the pulses, the price of paddy showed the highest increase in three phases, followed by vegetables, nutmeg and coconut in second, third and fourth positions. The growth rate of price is negative for rubber in both Phase I and Phase II with -22.22 and -15.71 respectively. The Cropping Pattern by farmers in the physiological zones with preference to the different categories of Net Area Sown is given in Table 6.15

**Table 6.15.**

**Cropping Pattern by farmers in Physiological Zones.**

| Sl.No | Crops | Lowland | | Midland | | Highland | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Paddy | 60 | (100.0) | 83 | (31.0) | 0 | (0.0) | 143 | (20.6) |
| 2 | Coconut | 0 | (0.0) | 51 | (19.0) | 48 | (13.1) | 99 | (14.2) |
| 3 | Arecanut | 0 | (0.0) | 39 | (14.6) | 2 | (0.5) | 41 | (5.9) |
| 4 | Plantain | 0 | (0.0) | 41 | (15.3) | 67 | (18.3) | 108 | (15.5 |
| 5 | Pepper | 0 | (0.0) | 5 | (1.9) | 0 | (0.0) | 5 | (0.7) |
| 6 | Rubber | 0 | (0.0) | 2 | (0.7) | 7 | (1.9) | 9 | (1.3) |
| 7 | Nutmeg | 0 | (0.0) | 10 | (3.7) | 45 | (12.3) | 55 | (7.9) |
| 8 | Tapioca | 0 | (0.0) | 0 | (0.0) | 10 | (2.7) | 10 | (1.4) |
| 9 | Vegetables | 0 | (0.0) | 36 | (13.4) | 3 | (0.8) | 39 | (5.6) |
| 10 | Cocoa | 0 | (0.0) | 0 | (0.0) | 2 | (0.5) | 2 | (0.3) |
| 11 | Vanilla | 0 | (0.0) | 1 | (0.4) | 0 | (0.0) | 1 | (0.1) |
| 12 | Cholam | 0 | (0.0) | 0 | (0.0) | 35 | (9.5) | 35 | (5.0) |
| 13 | Ragi | 0 | (0.0) | 0 | (0.0) | 41 | (11.2) | 41 | (5.9) |
| 14 | Kadala | 0 | (0.0) | 0 | (0.0) | 6 | (1.6) | 6 | (0.9) |
| 15 | Vanpayar | 0 | (0.0) | 0 | (0.0) | 10 | (2.7) | 10 | (1.4) |
| 16 | Thuvara | 0 | (0.0) | 0 | (0.0) | 18 | (4.9) | 18 | (2.6) |
| 17 | Thina | 0 | (0.0) | 0 | (0.0) | 20 | (5.4) | 20 | (2.9) |
| 18 | Chama | 0 | (0.0) | 0 | (0.0) | 27 | (7.4) | 27 | (3.9) |
| 19 | Amara | 0 | (0.0) | 0 | (0.0) | 3 | (0.8) | 3 | (0.4) |
| 20 | Muthira | 0 | (0.0) | 0 | (0.0) | 8 | (2.2) | 8 | (1.2) |
| 21 | Veragu | 0 | (0.0) | 0 | (0.0) | 9 | (2.5) | 9 | (1.3) |
| 22 | Groundnut | 0 | (0.0) | 0 | (0.0) | 3 | (0.8) | 3 | (0.4) |
| 23 | Sugarcane | 0 | (0.0) | 0 | (0.0) | 2 | (0.5) | 2 | (0.3) |
| 24 | Green Beans | 0 | (0.0) | 0 | (0.0) | 1 | (0.3) | 1 | (0.1) |

Source : Primary Field Survey

The type of farming preferred by farmers in the study area can be categorized mainly as Crop rotation, Multiple farming and Single farming systems. Crop rotation refers to cultivation of different types of crops in the sequence of growing seasons without keeping the land fallow throughout the agricultural year. It lessens the plant diseases and strengthens the soil health. Multiple Cropping refers to cultivating more than one crop in the same land in a single growing season. Single farming refers to growing a single crop in the area in the growing season. The three systems along with the preference of livestock farming in different categories of Net Area Sown is given in Table 6.16

**Table 6.16**

**Type of Farming preferred by Farmers**

| Net Area Sown | Crop Rotation | Multiple Farming | Single Farming | Livestock Farming |
|---|---|---|---|---|
| Marginal | 53.0 | 76.2 | 28.7 | 34.8 |
| Small | 61.3 | 74.2 | 25.8 | 45.2 |
| Semi-Medium | 73.8 | 73.8 | 26.2 | 78.6 |
| Medium | 81.2 | 81.2 | 18.8 | 84.4 |
| Total | 60.7 | 76.0 | 26.7 | 48.3 |

Source : Primary Field Survey

The Multiple farming system is prefered by majority of farmers followed by crop rotation and Single farming system with 76.2 percent, 53.0 percent and 28.7 percent respectively. Single farming system is preferred by farmers of Lowlands, while farmers in Midlands and Highlands preferred Crop rotation and Multiple farming. Compared to Marginal sized lands, Crop rotation and Multiple farming is preferred by Semi- Medium and Medium sized land owned farmers. Since crop rotation and multiple farming is largely preferred in large sized farms, the income derived is also high in the categories. The size of farm is very much dependent upon the cropping system and small sized farms have its own limitations in application of Crop rotation and Multiple farming.

### 6.4. Other factors influencing Net Area Sown

Socio - Demographic and Socio- Economic factors are influencing the Net Area Sown directly and has a direct impact on the Net Area Sown. The factors other than Demographic and Economic factors which are influencing the Net Area Sown used by farmers in the selected area are considered as the Neighbourhood and Social factors.

The Neighbourhood factors are the factors which are influencing the Net Area Sown from the neighbourhood land and the purposes for which the neighbourhood land is used while the Social Factors are the factors which arise from the society itself and influence the Net Area Sown used by farmers in the study area.

Neighbourhood factors are considered as one of the most important driving forces influencing the Net Area Sown. Neighbourhood Factors that will be influencing Net Area

Sown were identified as Agricultural land itself, Construction of Villas, Construction of homes for entire family within a particular area, Construction of Roads, Co-operative farming and Consolidation of Holdings. in the opinion of farmers. The farmers who owned different categories of Net Area Sown opined in different ways regarding the Neighbourhood factors as is represented in Table 6.17.

**Table 6.17**

**Neighbourhood Factors affecting Net Area Sown**

| Neighbourhood Factors | Marginal | | Small | | Semi-Medium | | Medium | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural Land Itself | 152 | (92.7) | 61 | (98.4) | 42 | (100) | 32 | (100) | 287 | (95.7) |
| Construction of Villas | 16 | (9.8) | 9 | (14.5) | 29 | (69.0) | 26 | (81.2) | 80 | (26.7) |
| Construction of homes for entire family within a particular area | 16 | (9.8) | 9 | (14.5) | 30 | (71.4) | 26 | (81.2) | 81 | (27.0) |
| Construction of Roads | 11 | (6.7) | 2 | (3.2) | 0 | (0.0) | 0 | (0.0) | 13 | (4.3) |
| Co-operative farming | 30 | (18.3) | 17 | (27.4) | 41 | (97.6) | 32 | (100) | 120 | (40.0) |
| Consolidation of Holdings | 30 | (18.3) | 17 | (27.4) | 41 | (97.6) | 32 | (100) | 120 | (40.0) |

Source : Primary Field Survey

The most important neighbourhood factor which influenced the farmers in utilisation of Net Area Sown is the agricultural land itself. The neighbouring agricultural land influenced the farmers in conversion of land as well as in substitution of land for other high valued, cost effective, less water- sensitive and less climate vulnerable crops. In Kodassery, the main reason for conversion of crops from paddy to other crops is the neighborhood agricultural land itself, the slippery sand which is not suitable for application of machinery such as Sowing and Harvesting Machines and increasing labour cost. As the neighbouring Net Area Sown was converted, irrigation facilities were also blocked in the area. In Venkitangu, the co-operative farming and consolidation of holdings were helpful to earn a reasonable income with application of Sowing and Harvesting machines for large scale farming. All the neighbourhood factors more or less are influencing the Net Area Sown and the significance level of Neighbourhood factors on Net Area Sown is tested with the application of Chi- square test. The Hypothesis to analyse the association between Neighbourhood factors and Net Area Sown is given as

$H_1$:There exists association between Neighbourhood factors and Net Area Sown.

The association between Neighbourhood factors and Net Area Sown is tested and significance level is given in Table 6.18.

**Table 6.18**

**Significance of Neighbourhood Factors on Net Area Sown**

| Neighbourhood Factors | Chi-Square value | Df | Significance level |
|---|---|---|---|
| Agricultural Land itself | 7.981 | 3 | 0.04 |
| Construction of Villas | 115.992 | 3 | 0.00 |
| Construction of homes for entire family | 119.488 | 3 | 0.00 |
| Co-operative Farming | 142.387 | 3 | 0.00 |
| Consolidation of Holdings | 142.387 | 3 | 0.00 |

Source : Primary Field Survey

The association between the Neighbourhood factors and Net Area Sown is analysed and interpreted using the Chi-square values and Significance level. The critical value of $\chi^2$ with 3 degrees of freedom at 5 percent level of significance equals 7.981, 115.992, 119.488, 142.387 and 142.387 respectively for the Neighbourhood factors such as Agricultural land itself, Construction of Villas, Construction of homes for entire family within a particular area, Construction of Roads, Co-operative farming and Consolidation of Holdings. Since the sample value of $\chi^2$ is greater than the critical value, the null hypothesis is rejected and there exists significant association between the Neighbourhood factors and Net Area Sown.

The Social factors also influence the Net Area Sown as the land utilised may be influenced by the factors within the society as human beings are social living beings who are linked to the society or a group. The social factors which influence the Net Area Sown is considered as Changes in way of life, Education and Search for white collar jobs, Development of infrastructure, Decreasing size of land, Increasing population, Urbanisation and Changing customs and traditions. The factors are ranked and analysed as given in Table 6.19.

**Table 6.19**

**Influence of Social Factors**

| Social Factors | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Median Rank |
|---|---|---|---|---|---|---|---|---|
| Changes in way of life | 0.6 | 2.3 | 59.1 | 32.3 | 2.3 | 0.3 | 0.3 | I |
| Education and Search for White Collar Jobs | 39.3 | 16.9 | 1.6 | 1.6 | 37.3 | 0.6 | 0.3 | II |
| Development of infrastructure | 58.2 | 16.6 | 1.9 | 1.3 | 19.8 | 1.3 | 0.3 | III |
| Decreasing Size of land | 0.3 | 0.3 | 20.8 | 57.5 | 13.3 | 3.6 | 1.6 | IV |
| Increasing Population | 0.3 | 39.6 | 13.0 | 2.3 | 22.1 | 0.6 | 19.5 | V |
| Urbanisation | 0.3 | 1.9 | 0.6 | 0.6 | 2.3 | 85.7 | 5.5 | VI |
| Changing Customs and Traditions | 0.3 | 19.5 | 0.3 | 1.3 | 0.6 | 5.2 | 69.8 | VII |

Source : Primary Field Survey

Ranks preferred by farmers for factors are consolidated by percentage method and further ranked using Median, a measure of Central Tendency representing the average value of given data. In the opinion of farmers, Changes in way of life ranked first, followed by Education and Search for white collar jobs, Development of infrastructure, Decreasing size of land, Increasing population, Urbanisation and Changing customs and traditions. Most important social factors influencing the Net Area Sown are Changes in way of life and Education and Search for White Collar Jobs. Customs and traditions as a social factor has less influence on the Net Area Sown as many preferred it as the last social factor influencing Net Area Sown. All the factors influenced the farmers who cultivated in the Net Area Sown.

### 6.5. Initiatives taken by Farmers

Farmers perception towards the Net Area Sown is also dependent upon the initiatives taken to improve the organic content of soil. The initiatives taken by farmer is related to the preferences towards Bio – fertilisers, Chemical fertilisers and application of both Fertilisers in the Net Area Sown. The initiatives taken by farmers to improve organic content, how the organic content of the Soil is improved in different land size categories is given in Table 6.20

**Table 6.20**
**Initiatives taken by farmers**

| Net Area Sown | Initiatives to improve organic content | | Initiatives by farmers | | |
|---|---|---|---|---|---|
| | Yes | No | Biofertilisers | Chemical Fertilisers | Both Fertilisers |
| Marginal | 72 | 28.0 | 32.9 | 0.0 | 67.1 |
| Small | 62.9 | 37.1 | 30.6 | 1.7 | 67.7 |
| Semi-Medium | 54.8 | 45.2 | 21.4 | 0.0 | 78.6 |
| Medium | 31.2 | 68.8 | 21.9 | 0.0 | 78.1 |
| Total | 63.3 | 36.7 | 29.7 | 0.3 | 70.0 |

Source : Primary Field Survey

Initiatives were taken by farmers to improve organic content of land in Marginal and Small holdings while less initiatives were taken by farmers who owned Semi- medium and Medium sized Net Area Sown. In the Marginal sized lands, 72 percent farmers took initiatives to improve the organic content in soil, while 62.9 percent, 54.8 percent, 31.2 percent farmers took initiative to improve organic content in soil in Small, Semi-Medium and Medium sized Net Area Sown in the selected area. 21 to 32 percent respondents used Bio- fertilisers and 67 to 78 percent used both fertilisers by restricting the chemical fertilisers to the sanctioned limit. Many of the farmer respondents are not interested in using Chemical fertilisers which is harmful to the human well being and become a helping hand for the people to live a healthy living.

### 6.6. Initiatives taken by Institutions

Institutions belonging to Central Government and State Government are playing an important role in promoting agriculture. Krishi Bhavan, Agricultural University, Paadasekharasamiti and Soil Conservation Board are the institutions through which farmers Krishi Bhavan helps in formulation and implementation of State Government programmes to improve food crop and non- food crop in the Net Area Sown.

Agricultural University is an expertise in the provision of skill, technology, encompassing production activities, education, training and research for the people who are interested in agricultural activities. Paadasekharasamiti was introduced as an intiative for facilitating group farming and enhance production through cost effective techniques. Soil Conservation Board was initiated to make a proper conservation and management of the precious soil and water resources. Farmer respondents attained the benefits and initiatives of institutions as depicted in Table 6.20.

**Table 6.21**

**Initiatives taken by institutions**

| Physiological Zones | Krishi Bhavan | Agricultural University | Padasekharasamiti | Soil Conservation Board |
|---|---|---|---|---|
| Marginal | 40.9 | 45.1 | 36.0 | 31.1 |
| Small | 51.6 | 41.9 | 37.1 | 38.7 |
| Semi-Medium | 59.6 | 42.9 | 26.2 | 42.9 |
| Medium | 59.4 | 40.6 | 18.8 | 40.6 |
| Total | 47.7 | 43.7 | 33.0 | 35.3 |

Source : Primary Field Survey

Among the respondents, 47.7 percent attained benefits from Krishi Bhavan, 43.7 percent from Agricultural University, 33.0 percent from Padasekharasamiti and 35.3 percent from Soil Conservation Board. 59.6 and 59.4 percent farmers who cultivated Semi-Medium and Medium sized land attained the benefits provided by Krishi Bhavan, 45.1 percent farmers who cultivated Marginal sized lands benefited from Agricultural University, 36.0 percent respondents from Marginal sized and 37.1 percent from Small sized lands benefitted by Padasekharasamiti, 42.9 and 40.6 percent benefittedfrom Semi-Medium and Medium sized land. The Padasekharasamiti in Venkitangu and Pazhayannur took initiatives in providing sowing and harvesting machines, power motors for irrigation, warehousing and acts as a marketing agent for wholesale procurement of paddy. Since Net Area Sown in lowlands are consolidated, co-operative farming is possible and all the agricultural activities were done in large scale which is cost effective for the farmer.

**6.7. Government initiatives for protection of Net Area Sown**

The Government policy implementations such as influence of Government policies especially Agricultural Policies, Zoning Regulations Act and Protection of agricultural land affect the Net Area Sown. Agricultural policies aimed at ensuring sufficient income for farmers along with sustainable development, Protection of Ramsar sites which are protected areas under agricultural heritage, protection of farmland and Provision of pumping subsidies. Zoning Regulations were implemented for protection of the land especially through Kerala Conservation of Paddy-land and Wetland Act 2008. Protection of agricultural land is done with group farming through Padasekharasamitis and provision of organic farming. The satisfaction level of farmers towards government intitiatives for protection of agricultural land is given in Table 6.21.

**Table 6.22**

Satisfaction level of farmers towards Government Initiatives for protection of Net Area Sown

| Net Area Sown | Influence of Govt Policies | Zoning Regulations | Protection of Agricultural Land |
|---|---|---|---|
| Marginal | 73.2 | 95.7 | 62.8 |
| Small | 80.6 | 95.2 | 64.5 |
| Semi-Medium | 90.5 | 100 | 59.5 |
| Medium | 65.5 | 100 | 59.4 |
| Total | 76.3 | 96.7 | 62.3 |

Source : Primary Field Survey

Among the respondents, 96.7 percent is satisfied with zoning regulations, 76.3 percent satisfied with Government policies especially agricultural policies and 62.3 percent satisfied with the initiatives taken by Government for protection of agricultural land. Majority of farmers are satisfied with Government initiatives for protection of Net Area Sown. All the respondents are satisfied with zoning regulations which provide restrictions on conversion of paddy land and wetland as zoning regulations mainly took place in Lowlands. The protection of agricultural land in Lowlands became necessary as the Lowlands act as the rice bowls for the state. Since the respondents in Lowlands favoured agriculture as agriculture was considered as the main source of income with certain profit. Actually agriculture was considered as a profitable occupation for the respondents. The 62.8 percent respondents who cultivated marginal lands and 64.5 respondents who cultivated in Small lands demanded protection of agricultural land while 73.2 percent from marginal and 80.6 percent from Small land were satisfied with the influence of Government policies especially the Agricultural policy.

Farmers have many suggestions regarding the initiatives to be taken by Government to support and help them to continue with agricultural activities. The suggestions that were put forward by the farmers were conducting motivation classes for younger generations, provision of subsidies for agricultural products and fertilisers, Issue of Kisan Credit Cards in order to get the benefits without any intermediaries and appointment of Agricultural Co-ordinators to get a perfect awareness about the agricultural situation and benefits through which a perfect knowledge about agriculture is available to them.

**Table 6.23**

**Initiatives to be taken by Government**

| Net Area Sown | Motivation Classes for younger generations | Provision for subsidies | Issue of Kissan Credit Cards | Appointment of Agri.Co-ordinators |
|---|---|---|---|---|
| Marginal | 23.2 | 26.2 | 23.2 | 27.4 |
| Small | 17.7 | 22.6 | 29.0 | 30.6 |
| Semi-Medium | 23.8 | 21.4 | 26.2 | 28.6 |
| Medium | 37.5 | 37.5 | 9.4 | 15.6 |
| Total | 23.7 | 26.0 | 23.3 | 27.0 |

Source : Primary Field Survey

Among the respondents, 27.0 percent favoured appointment of agricultural co-ordinators, 26.0 percent favoured provision of subsidies, 23.7 percent favoured motivational classes and 23.3 favoured suggested issue of Kissan Credit Cards. Kissan Credit cards were favoured in order to avail the subsidies provided by state and central Governments. The farmers who cultivated in all categories of lands were of the opinion that the motivation classes, provision of subsidies, issue of Kissan Credit Cards and appointment of Agricultural Co-ordinators is necessary for the agricultural development. In the family of respondents, young people were not interested in continuing agriculture or work within the fields as the white collar jobs as a result of high educational qualification is available to them and the particular jobs provided a higher income to them without much physical stress and they failed to realize the mental stress out of the white collar jobs. The risk arising out of agriculture due to climatic changes and plant diseases is solved through provision of subsidies though a time lag due to red tapism. The farmers suggested the initiatives to be taken by Government in order to stay back safely in agricultural activities as they cannot think of any other job and the respondents are very much attached to the land they owned and cultivated.

**6.8. Conclusion**

Dynamics of Net Area Sown in different phases is analysed on the basis of area, price, cost, yield and revenue of the crops cultivated. Land use pattern in Net Area Sown gives the true picture of the existing system of agriculture and how the farmers are utilising the land in the most effective manner by cultivating maximum possible number of crops. The farmers are thus adopting risk adaptation strategies of their own and in that way, if one crop is affected by any specific reasons, revenue from other crop will be compensating the variation of income.

# CHAPTER VII
# FINDINGS AND SUGGESTIONS

## 7.1 Introduction

Land which is a fixed factor and scarce in nature always creates the problem of allocation or utilisation in the maximum possible manner. Since the utilisation has to be conducted properly according to the needs and preferences, the human beings who are the inhabitants of Earth have to play an important role in the utilisation. The purpose for which the land is used is based on needs, wants, preferences and choices of the people who are utilizing the land. The human beings are the most important decision makers in dealing with the utilisation of land. Land, the scarce factor is utilised for a number of purposes as land is the base for every economic activity. Without land, nothing is possible now on the land, not even an economic activity such as consumption, production or distribution can be conducted without the base of the fixed factor, land. Since land is fixed, scarce and is used for a number of uses, its value is also increasing at a faster rate especially in areas where it is used for a number of purposes. The use of land is also dependent upon the growth and development of the specific region as the reflections of it can be seen on the purposes for which land is used.

Land use pattern is clearly explained with the help of Nine-fold Classification which is done by Indian Council of Agricultural Research (ICAR) and from the classification, the purposes for which Land is used is identified and the main purpose for which the land in Kerala is used is for agricultural purposes itself which is identified in the categorization as Net Area Sown. The study focuses on the Land Use Pattern and the main categorisation - Net Area Sown in Kerala, the utilisation pattern of Net Area Sown, the main participants in the utilisation of Net Area Sown – farmers and how the farmers are engaged in the Net Area Sown by making a proper utilisation of the area as well as how they can earn living from the Net Area Sown. The findings of the study is relevant to know about the Land Use Pattern and the Net Area Sown, the most important and leading category in the Categorisation of Land Use Pattern.

## 7.2. Major findings of the study

Land use pattern in India and Kerala is favouring a sustainable environment friendly ecosystem by attaining Sustainable Millennium Goals. The important point to be noted is that In India, the area which is favourable to sustainable ecosystem is 69 percent with 46 percent Net Area Sown and 23 percent Forest Area while in Kerala it is 81 percent with 53 percent Net Area Sown and 28 percent Forest Area which gives us the strong

evidence that India and Kerala is an agriculture based economy and majority of Indians and Keralites are dependent upon agriculture for their livelihood. The Net Sown Area a proxy for land used for agricultural purposes is an indicator of sufficient food availability and food security to the existing population in Kerala.The findings of the study related to the objectives is relevant and is given in detail

**To examine the trend of different land use categories in Kerala during the period from 1991- 2017.**

- Net Area Sown has the highest Mean Value in all decades followed by Area under Forest and are the main components of Land Use in Kerala during the whole period of 1956-2015. In 1956-65, the third position is occupied by Barren and Uncultivable land which includes mountains and hills while it acquired only the last position which is approximately around zero in 2006-2017
- The Compound Growth Rate (CGR) of Land Use - Forest, Non-Agricultural Land, Fallow Other than Current Fallow, Current Fallow, Net Area Sown is positive while that of Barren and Uncultivated Land, Permanent Pastures , Miscellaneous Tree Crops, Cultivable Waste, shows rate of decay during the whole period 1956-2018.
- The Compound Growth Rate show an increasing growth in F, NA, NAS and a decayed growth in BU, P, T,CW,FOCF,CF in initial periods among which the decayed CW, FOCF and CF is a symbol of favourable Land Use Pattern.
- In 1960-61, about 20 percent of Total Agricultural Area is kept as unutilized in Kerala which is far higher than 14.09 percent at the National level.
- But after that Kerala recouped from the crisis by reducing the unutilized area and it remained stagnant at around 5 percent from 1970 onwards which is lesser than 12 percent at National level interpreting that Kerala is successful in utilizing the land resources especially the agricultural area and is helpful to provide a better food security to the living population.
- The Net Area Sown which provides the food security is almost stagnant around 60 percent throughout the 63 years which proves that utilisation of the area is not much affected by changes in the economy.
- Comparing the variability in Land Use Categories, the Coefficient of Variation is higher for Land used for Non- Agricultural purposes in 1956-65. In 1996-2005 i.e. the Post Liberalisation Period, NA, BU, P, T, FOCF and CF has a high variability

or is less stable compared to NAS and no variability exists in Forest Area. The Net Area Sown is less variable, more consistent, uniform and homogenous in area utilisation.

- Net Area Sown is far above the proportion of land for non- agricultural purposes reflecting the sustainable and ecological utilisation of land giving preference to Millenium Goals.
- A declining trend in the Net Area Sown during the period of 1991 to 2018 – the Post-Liberalisation Period but still the variations are occurring within the limits of 200 million hectares to 230 million hectares.
- The Net Area Sown under Food Crops and Non- Food Crops during the period 2005-2017 is reflected in two different ways - the area under Food crops is decreasing at an increasing rate with a variation of -26.94 percent, while that of Non- Food crops are decreasing at a decreasing rate with a variation of -2.24 percent which reflects the probability for the occurance of food shortage in the future time periods.
- Seasonal Crops such as Paddy, Turmeric and Ginger are showing a declining trend while the Perennial and Annual Crops are showing a sharp increasing trend in Area and Production in Kerala.
- High positive variations are reflected in three crops – Rubber, Arecanut and Banana – the crops which have cost effectiveness and high market prices while negative variations occurred in paddy and tapioca, the main staple food crops of Kerala

**To analyse the areal distribution of crops and crop diversification in the districts of Kerala.**

- Index of Crop Diversification is high and approaches one in almost all the Districts of Kerala indicating perfect diversification.
- The number of crops is highest in Highlands with the largest variety of crops cultivated while in all the other physiological regions, there exists moderate or high crop diversification and Kerala is proving to be a model for other states due to existence of the crop diversification which reduces the risk and uncertainty in agricultural productionandprovides a guidance to agriculturists to bravely face the

possibility of occurance of an agricultural crisis and be a risk averters in agricultural sector.

- Idukki and Wayanad are the two districts with a large variety of diversified perennial crops such as Pepper, Cardamom, Arecanut, Banana, Plantains, Tea, Coffee, Rubber, Coconut and Jackfruit
- In Kerala, 12 different leading crops with area equal to or more than five percent as the ratio to Net Area Sown exists and it implies that Crop Diversification exists in the Districts of Kerala.

**To interpret the influence of regional variations in Land Use Pattern on Cropping Pattern in selected area in Physiological Zones.**

- 57.6 percent of farmers owned lands with less than 1 Hectare, that is low sized lands, 18.7 percent own small sized land holdings with a size in between 1.01 and 2 Hectares, only 14.0 percent owned Semi- Medium sized lands in between 2 to 4 Hectares and only 9.7 percent owned Medium sized lands with area between 4 and 10 Hectares.
- Majority of farmers owned Marginal sized lands with size of less than 1 Hectare.
- Increased number of respondents in the Marginal Lands and absence of respondents in Large size lands reflect the fact that farmers with Large size lands are lesser in selected area within the Physiological Zones.
- Within the Lowland itself, 66.7 percent, 15.0 percent. 13.3 percent and 5 percent respondents own Marginal, Small, Semi-Medium and Medium sized lands respectively.
- Within Highlands 40 percent owned Marginal Holdings, and within Midland, 70.8 percent owned Marginal Lands. Medium lands are comparatively high in Highlands with 21.7 percentwhile within the Highlands, Marginal Holdings are higher than other categories.
- A proportional distribution of all land size exists in Highlands with high proportion of Medium land as respondents in Highlands of Agali Panchayat, Palakkad own 21.7 Medium sized lands.
- Among the total respondents, only a single respondent belongs to the age of less than 30, 55.3 percent belongs to the age group of 31-60 and 44.3 percent belongs

to the age group of greater than 61. Within the Lowlands, no farmer respondent has an age of less than 30 is included, 68.3 percent belongs to age group of 31-60 while 31.7 percent belongs to the age group of greater than 61.

- Within the Midlands, no respondent has the age of less than 30, 65.0 percent belongs to the age group of 31- 60 and 35 percent belongs to the age of greater than 61.
- Within Highlands, one respondent belongs to the age of less than 30 with 0.8 percent, 39.2 percent respondents belongs to the age group of 31-60 and 60 percent respondents belong to the age with equal to or greater than age - group of 61+ within Highlands, majority are Irulas of Scheduled Tribe Community of Agali Panchayat who are healthy enough to engage in agriculture keeping in consideration an in-depth relationship between nature and man.
- While considering the Social Group, gender and ownership of respondents, joint ownership exists only in ST Category of Highlands depicting the inclusion of siblings in ownership and not the better half.
- Among the total respondents, Male respondents have 84.3 percent of individual ownership while Female respondents have 15.7 percent of Individual Ownership.
- But 98.1 percent of Joint Ownership is held by male head of the family while only 1.9 percent is held by women respondents.
- Among the 'Others' category, Nair and Christian widows are leading in individual female ownership of land. The Nair caste carries matrilinial system of land ownership in which the ownership is vested in female members of the family.
- Among the total respondents, 31.3 percent farmers have Lower Primary education, 2.3 percent have Upper Primary Education, 39.7 percent have secondary education, 15.7 percent have Senior Secondary Education and 11.0 percent have Higher Education.
- In Lowlands, 50 percent of respondents have farming experience of less than 20 years, 40 percent have farming experience of 21- 40 years and 10 percent have farming experience of greater than 41 years.
- In Midlands, 34.2 percent of respondents have farming experience of less than 20 years, 58.3 percent have farming experience of 21- 40 years and 7.5 percent have farming experience of greater than 41 years.

- In Highlands, 19.2 percent of respondents have farming experience of less than 20 years, 59.2 percent have farming experience of 21- 40 years and 21.7 percent have farming experience of greater than 41 years.
- Among the total respondents, 84.7 percent have a history of agriculture within them as their parent's main occupation is agriculture itself while 15.3 percent have non- agriculture as their main occupation.
- In Lowlands, no area is kept as Area Sown More than Once because only mono-crop cultivation can only be preferred after the rainy season with the draining out of excess water from the land.

**To analyse the relationship between Size of Agricultural Land Holdings and its determinants in selected area in physiological zones.**

- The mean size of land owned as Built-up area in Lowland is 0.015 Hectares while the Net Area Sown is the highest with average size of 1.583 Hectares. The average size of utilised agricultural area is 1.50 Hectares and the Gross Cropped Area is 1.502 Hectares. While in Midland, Average Built-Up Area is around 0.016 Hectares, Average Net Area Sown is highest with 1.292 Hectares while Area Sown More than Once is 0.356 as the paddy is cultivated twice in an agricultural year.
- In Highlands, the maximum average size of land owned in Net Area Sown is the highest with 2.283 Hectares. The Utilised and Unutilised Agricultural Area as well as the Gross Cropped Area is High in Highlands.
- While considering the Total land owned, land area is almost uniform in Current Fallows, Fallows other than current fallows, Water Bodies and Unutilised Agricultural Area with a less deviation from Mean size of land.
- Average land size as well as Standard Deviation of Total land possessed is very high when compared with Land leased in and Land leased out. Area leased in as well as area possessed is high in Medium lands than in other categories of land.
- The Multiple Regression Analysis results indicate that the variables - Type of Family, Area of Self-Acquired Land, Area of Hereditary Property, and Agricultural Income positively influence the Net Area Sown. This is evident from the positive signs of the estimated coefficients of the corresponding variables. This means that if Type of Family (TF), Area of Self-Acquired Land (SAL), Area of Hereditary Property (HP)and Agricultural Income (AI) increase, there exists an increase in Net Area Sown.

- Within Lowlands, 100 percent cultivation is cereals with exclusive paddy cultivation, within Midlands, maximum proportion of Net Area Sown is used for Paddy Cultivation with 31.0 percent , along with Spices and Condiments which occupy 20.5 percent, Oilseeds especially Coconut, Fresh Fruits and Vegetables,
- In Highlands, Pulses occupies the first position followed by Fresh Fruits especially plantain, Oilseeds and Spices and Condiments. Plantation crops is also cultivated in Agali panchayat in Highlands
- In Lowlands of Venkitangu and Kuzhalmannam, Paddy – a Monocrop is preferred for cultivation as the watershed land can be used only for the cultivation of rice as rice requires more wetland for cultivation. The availability of water is necessary for paddy which is naturally available in Lowlands with a natural water drainage and irrigation faciltites with natural manmade canals.
- The Midlands prefer paddy, vegetables, oilseeds, arecanut, pepper with a combination of about eight varieties of crops while Highlands with Kodassery and Agali together contribute 25 varieties of agricultural crops which is an agricultural asset to Kerala. Agali has a uniqueness in the production of Pulses and can be called as the Pulse Bowl of Kerala. People of Agali considered Pulses as the staple food which provides sufficient Nutrients and Proteins to the inhabitants especially Tribal people.
- The Highlands in Physiological Zones takes a very remarkable position in the production of Pulses such as Kodomillets(Veragu), Foxtail Millets (Thina), Amaranthus, Sorghum which are protein rich, nutritious, superfoods, minerals like iron, magnesium, phosphorous and potassium, Eleusine coracana( Ragi),Chama(Panicum Miliaceum).

**To analyse the Cost and Revenue arising from cultivation of different crops in the selected panchayats in different phases.**

- In Lowlands, only Food Crops are cultivated in the three different phases from 1991 to 2019. Since the topography is suitable only for the cultivation of Paddy, the farmers preferred the production of Food Crops only, Paddy in the area.
- In Phase I, in Midlands, 80.2 percent of Net Area Sown is used for production of Food Crops and only 19.8 percent for Non- Food Crops.

- In Phase II, 78.8 percent of Net Area Sown is used for production of Food Crops while only 21.2 percent is used for Non- Food Crops. A very slight variation can be seen in Food Crops as well as Non-Food Crops and thus creating a agricultural stagnancy in the Net Area Sown
- But still there exists a positive indicator of development in cereals in Venkitangu and Kuzhalmannam where the farmers cannot change the utilisation pattern due to the specific features of Physiological Zones.
- Spices and Condiments includes agricultural products such as arecanut, pepper, nutmeg, vanilla and is mainly cultivated in Pazhayannur in Midlands and Kodassery, Agali in Highlands.
- Cultivation of all except Paddy and Rubber crops showed an increasing trend and Net Area Sown under vegetable cultivation increased at an increasing rate. Since Pazhayannur is considered as a Special Agricultural Zone for vegetables and vegetable cultivation is promoted through agricultural institutions such as Kerala Agricultural University through provision of seeds, seedlings, micro irrigation facilities and productivity enhancement programmes.
- In Agali, the areal-wise cultivation of Plantain increased due to increasing prices but the cultivators always faced the problem of attack of wild animals. Though Bhavani river is flowing through Agali as the main source of irrigation, variations in altitude in the area is itself a bottleneck for production due to increased irrigation cost which mainly arises from cost of motor pumpsets for irrigation.
- By the traditional system of cultivation, tribals have to keep mandatorily a portion of their harvest for animals and birds and a certain proportion for the relatives. Though the two traditional customs are going on, the tribals faced attack of the Net Area Sown by Wild animals especially, herd of elephants, Boars and Bisons.
- In Kuzhalmannam which belongs to Midlands, 73.7 percent of Net Area Sown under Paddy Cultivation is Marginal land, 25.0 percent is Small and 1.7 percent is Semi- Medium land. The main crop cultivated is paddy with different varieties of paddy itself such as Jyothi, Uma, Rohini, Ponni, Swetha, Matta Thriveni and Ponni IR-8.
- Except in case of paddy and rubber cultivation, all other crops are profitable to the farmers. Loss in Paddy cultivation is due to climate vulnerability and loss in Rubber cultivation is due to decreasing market prices.

## 7.3. Conclusion

The study reveals that the farmers are really interested in agricultural activities as the land they owned is a Hereditary property which is given to them by their forefathers. The farmers are attached to the land with an affection towards nature and they are concerned about the nature which they have to protect and become a part of sustainable development. The farmers are satisfied with their main occupation or primary source of income though a little hurdles they have to face. Though the declining trend of Paddy cultivation is a threat to the food security to be availed in the economy, it can be corrected by ourselves through motivating the youth as well as through proper consideration and solutions and suggestions are necessary for upliftment of Paddy cultivation in Kerala.

## 7.4. Suggestions and recommendations

Proper Land Utilisation is necessary as land is scarce and the needs and wants have to be identified properly to make a better utilisation knowing the preferences by ordering the needs and choices. Since Net Area Sown is the most important land use in Kerala and a larger community is dependent upon the Net Area Sown, the farmers who are utilizing it for the benefit of themselves as well as for others, the proper utilisation of Net Area Sown through agricultural activities is necessary in Kerala economy. Diversity exists in crop cultivation according to the characteristics of Physiological Zones and farmers are playing their role in the most efficient manner, but some suggestions are required to imrove the existing agricultural situation in the economy. In order to attain a stabilized and sustainable agricultural Growth, the valid suggestions are

❖ **Motivate each and everyone to participate in agricultural activities**

- Creating interest in each and every person through motivational classes in Grama Sabha or Community Programmes
- Make sure the participation of people through proper networking and issuing public notices
- Provide proper information to people about seeds, fertilisers
- Creating Organisations or groups or clusters within which the informations can be circulated
- Application of least expensive or traditional techniques of production

❖ **Proper land utilisation by cultivating the fallow lands**

- Proper coordination and grouping through creation of community gardens
- Creation of Orchads for growing fruits and vegetables
- Group effort of family can be promoted to reduce the increasing cost of cultivation
- Raising Livestock farming
- Provision of Direct Marketing of fresh vegetables through the gardens itself
- Off – grid living – living in farms and orchards to reduce carbon footprint

❖ **A better participation of educated youth in agricultural activities**

- Promote agriculture through farm development organisations in schools like 'Seed'
- Be mandatory to participate in any of the clubs or organisations in schools
- Create a nature loving mind and to conserve the existing nature
- Conservation of nature for future generations
- A better awareness will keep them stick on in agriculture rather than searching white collar jobs

❖ **Provide proper awareness and information to farmers**

- Through Agricultural Universities
- Farm Development Bureaus
- Krishi Bhavan
- Appointment of agricultural co-ordinators to reach every person in village
- Padasekharasamitis
- Moving caravans by universities for sale of fresh vegetables and fruits

❖ **Promoting use of better seeds and bio-fertilisers**

- High yielding seeds generated from traditional seeds
- Promoting livestock cultivation through which bio fertlisers can be made available

❖ **Promotion of Organic and Homestead Farming**

- Organic farming with the help of bio fertlisers
- Less use of chemical fertilisers will reduce the spread of diseases such as cancer

❖ **Through these, a proper sustainable development in Millenium Goals**

### 7.5. Need for better utilisation of Net Area Sown

Better utilisation of Net Area Sown is required to attain a long term stabilized agricultural growth for the creation of food security in the Economy. Attainment food security as a primary goal in Millenium Goals is attainable through a proper utilisation of Net Area Sown

### 7.6. Scope for future research

Since agricultural development is necessary for the whole world, the relevance of continuing in agricultural activities creates scope for further research in agriculture. Each and every person is dependent upon agriculture upto that time for which food intake is necessary for the existence of life on Earth.

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# APPENDIX

**APPENDIX -1**

**INTERVIEW SCHEDULE**

**Based on the topic related to Ph.D Programme**

**"Land Use pattern in Kerala"**

**Schedule Number:** **Date of Survey:**

**I. General Information:**

1. Name of the head of family:

2. Address:

3. Telephone Number:

4. District:

5. Block:

6. Panchayat:

7. The Ward:

8. The Padasekharasamidhi:

9. Type of Area: ☐ 1.Rural 2. Urban

10. Religion:

11. Caste:

12. Nature of the family: ☐ 1. APL 2.BPL

13. Years of Experience as a farmer:

14. Occupation of parents: ☐ 1. Agriculture 2. Non-Agriculture

15. Whether the parents influenced you in creating an interest in agricultural activities: ☐

1.Yes 2. No

16. Details of family members:

| Sl. No | Family Members | Relation with head | Age | Marital Status | Edn | Main occupation | Additional occupation | Main Income | Additional Income | Daily Hours of work |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |

**II Ownership of Land:**

17. Details of ownership of Land:

| Sl. No | Total Land owned | Owner ship | Self Acquired Land | Value of Land at that time | Value of Land now | Details of Loan, if any | Hereditary property | Transfe rred from | Interest in Agriculture | Land Reg- Y/N |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |

1.Individual 2. Joint

18. Are you interested for further investment in land: 1. Yes 2. No

19. If yes, purpose for which it will be used- Agriculture/ Construction/ Others (Specify) ☐

20. Whether you disposed any land owned by you: 1. Yes 2. No If Yes, specify the reason-

21. Total Area disposed –

22. Whether the land is fragmented or Subdivided? ☐ 1. Fragmented 2. Subdivided

23. Distribution of fragmented or Subdivided area –

24. Reasons for Subdivision and Fragmentation

| Sl. No | Reasons | Ranking/ Preference |
|---|---|---|
| 1 | Laws of Inheritance | |
| 2 | Indebtedness | |
| 3 | Decline of Joint Family System | |
| 4 | Occupational Shift | |
| 5 | Urbanisation | |

25. Area of Land Leased in: purpose:

26. Area of Land leased out: purpose:

27. Area of Land possessed: purpose:

**III. Details of cultivation of land:**

28. Type of Cultivation: ☐ Extensive ☐ Intensive ☐ Crop Rotation
☐ Subsistence farming ☐ Multiple Farming ☐ Single Farming
☐ Others

29. Conversion of Crops cultivated:

| I Stage ( 20 Years earlier) | | | | II Stage (10 years earlier) | | | | III Stage (Now) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Crops | Area | Year of conversion | Reason | Crops | Area | Year of Conversion | Reason | Crops | Area | Year of Conversion | Reason |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

30. Particulars about cultivation of Land:

| Crops | Type of Seeds | Area cultivated | | | Yield per acre | | | Cost of Cultivation | | | Price per Kg | | | Income earned | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

1.20 years earlier; 2.10 years earlier; 3.now

31.Livestock Farming if any(Specify the number):

☐ Cattle ☐ Pig ☐ Poultry

☐ Emu ☐ Rabbit ☐ Others (Specify)

32. The interest in Agriculture was created due to

| **Sl. No** | **Reasons** | **Ranking** |
|---|---|---|
| 1 | Influence of Parents | |
| 2 | Personal Interest | |
| 3 | Main Source of Income | |
| 3 | Interest of consuming organic products | |
| 4 | Increasing price of agricultural products in the market | |
| 5 | Other reasons, if any | |

**III. Details of Transformation of Land:** 33. Purpose for which land is used :

| Sl. No | **Purpose of land** | Area used | | | Area converted from agri.land to others | | | Area converted from others to agricultural land | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 20 yrs earlier | 10 yrs Earlier | Now | 20 yrs earlier | 10 yrs earlier | Now | 20 yrs earlier | 10 yrs earlier | Now |
| 1 | Built – up area | | | | | | | | | |
| 2 | Land transferred for Govt infrastructure ( road, school etc) | | | | | | | | | |
| 3 | Drainage facilities | | | | | | | | | |
| 4 | Land used for agricultural purposes | | | | | | | | | |
| 5 | Net area sown | | | | | | | | | |
| 6 | Area sown more than once | | | | | | | | | |
| 7 | Current Fallow land | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Fallows other than current fallows | | | | | | | | | |
| 8 | Permanent Pastures | | | | | | | | | |
| 9 | Miscellaneous Tree crops | | | | | | | | | |
| 10 | Land for water bodies | | | | | | | | | |
| 11 | Land used for livestock farming | | | | | | | | | |
| 12 | Other uses ( Specify) | | | | | | | | | |
| 10 | Total area of land | | | | | | | | | |

## IV. DETERMINANTS OF AGRICULTURAL LAND USE

34. Whether these changes have made any change on your attitude towards agriculture? ☐

1. Yes 2. No

35. i) Whether there exist any quarries nearby? Yes/No.

ii) If yes, is it a threat to the people residing nearby? Yes/No

Reasons for being a threat:

iii) Whether it is permitted by Govt - Yes/No

36. i)Whether there is any chance of landslides or drought in your area: ☐ 1.Yes 2.No

ii) In your opinion, reasons for landslides:

37. If Yes, whether it affect the fertility of the soil: ☐ 1. Yes ☐ 2. No

38. What are the precautions taken to protect your agricultural land from land slides?

39. Whether you have taken any initiatives to improve the organic content of your soil?

1. Yes 2. No

40. If yes, what are the initiatives taken?

1.

2.

41. Details of initiatives taken by various institutions

| Sl.No: | Institutions | Initiatives taken |
|---|---|---|
| 1 | Government | |
| 2 | Krishi Bhavan | |
| 3 | Agricultural University | |
| 4 | Padasekhara Samithi | |
| 5 | Soil Conservation Dept | |
| 6 | Land Use Board | |
| 7 | Other institutions | |

42) How the social factors influenced you in the transformation of Land ?

| Sl.No | Social Fcators | Preference / Ranking | If Yes, specify reasons | | |
|---|---|---|---|---|---|
| | | | I | II | III |
| 1 | Changing Customs and Traditions | | | | |
| 2 | Urbanization | | | | |
| 3 | Education | | | | |
| 4 | Westernization | | | | |
| 5 | Changes in way of life | | | | |
| 6 | Industrialisation | | | | |
| 7 | Development of Infrastructure | | | | |
| 8 | Decreasing Size of Land | | | | |
| 9 | Increasing Population | | | | |

43. Land Use in the neighbourhood had influenced in changing the use of agricultural land

| Sl.No | Characteristics | Yes/No |
|---|---|---|
| 1 | Agricultural Land itself | |
| 2 | Construction of Villas/ Flats | |
| 3 | Constructions of Homes for the entire family within a | |

| | | |
|---|---|---|
| | particular area | |
| 4 | Construction of Roads | |
| 5 | Co- operative Farming | |
| 6 | Consolidation of Holdings | |

44. Do the Government policies influenced you in the land transformation? Yes / No

45. Is the Zoning regulations creating any problems in the usage of land? Yes/No

46. Is it due to these regulations that you made a change in the usage of land? Yes/No

47. Is the Government taking any initiatives to protect the agricultural land? Yes/No

48. Are you satisfied with the initiatives taken by the government in the

1. Protection of Agricultural Land
2. Documentation of Ownership of Land
3. Psychological motivation for promoting agriculture
4. Provision of subsidies

49. What steps would be taken, in your opinion, to improve the current utilization of agricultural land?

1.

2.

3.

4.

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