

**SUSTAINABILITY OF COMMERCIAL VEGETABLE
CULTIVATION IN THIRUVANANTHAPURAM DISTRICT:
A MULTIDIMENSIONAL ANALYSIS**

by

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(2015-11-071)

THESIS

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2017

DECLARATION

I, hereby declare that this thesis entitled **“SUSTAINABILITY OF COMMERCIAL VEGETABLE CULTIVATION IN THIRUVANANTHAPURAM DISTRICT: A MULTIDIMENSIONAL ANALYSIS”** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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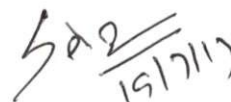
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LIST OF ABBREVIATIONS

| Abbreviations | Full form |
|---------------|---|
| % | Percentage |
| KB | Krishibhavan |
| KVK | Krishi Vigyan Kendra |
| NGO | Non-Governmental Organization |
| No. | Number |
| SMS | Subject Matter Specialist |
| TV | Television |
| VFPC | Vegetable and Fruit Promotion Council of Kerala |

Introduction

1. INTRODUCTION

George Washington once said “Agriculture is the most helpful, most useful, and most noble employment of man”. Agriculture is the backbone of Indian economy. Before independence majority of farmers in India practiced subsistence farming, which means farming for own consumption, i.e. the entire production was largely consumed by the farmers and their family and they did not have any surplus to sell in the market. In this type of farming, farmers possess small and fragmented landholdings, and they adopt primitive and simple cultivation practices. In other words there is a total absence of modern equipment's like tractors and farm inputs like chemical fertilizers, insecticides and pesticides. But after the great green revolution there was a drastic change in the form of farming from subsistence farming to commercial farming. Commercial farming is just the opposite of subsistence farming. In the case of commercial farming, most of the produce is sold in the market for earning money and farmers use inputs like irrigation, chemical fertilizers, insecticides, pesticides and High Yielding Varieties of seeds and other modern technologies. Some of the major commercial crops grown in different parts of India are cotton, jute, sugarcane, groundnut etc. and now a day's vegetables get maximum momentum in commercial cultivation due to their short duration, high yield, nutritional richness and more economic demand. (Course H, 2017). Commercial vegetable cultivation can be defined as the large scale production of vegetables for sale or vegetables grown for market (Wikipedia, 2017)

Vegetables are important constituents of Indian agriculture and nutritional security. India is the second largest producer of fruits and vegetables in the world which account for a total of 6.2 million hectares forming 3% of the total cropped area which is 15% of the world's production. Vegetables are vital sources of proteins, vitamins, minerals, dietary fibers, micronutrients, antioxidants and phytochemicals in our daily diet. Apart from nutrition, vegetables also contain a wide array of potential phyto-chemicals like anti-carcinogenic principles and anti-oxidants. In India, vegetables are treated as valuable biological assets especially

genetic resources and they have been vividly described in the Indian scriptures like 'Vedas' and 'Ramayana'. India is rich in biodiversity of vegetables, because our country is blessed with diverse agro-climates with distinct seasons hence India is the primary/secondary center of origin of many vegetables. (Vanitha *et al.*, 2013).

In Kerala, vegetables are being cultivated as a commercial crop mainly in the recent past. Kerala is blessed with diverse agro climatic condition hence Kerala is a homestead for a variety of fruits and vegetables differing in temperature requirement, cultivation practices and parts used. Due to the absence of distinct winter climate it is ideal for growing summer season vegetables throughout the year in Kerala. The cool season vegetables are grown in cooler parts of the state like Idukki, Wayanad, and high altitude villages of Palakkad. The major market oriented vegetables cultivated in Kerala are bitter gourd, snake gourd, bottle gourd, cucumber, ash gourd, ivy gourd, pumpkin, ridge gourd, cowpea, okra, amaranth, chilli, brinjal, coleus, colocasia and amorphophallus. (Gopalakrishnan, 2007)

Cultivation of vegetables for marketing in Kerala is traditionally confined to rice fallows during summer season, hill slopes and garden lands during rainy season. Riverbed cultivation in the beds of Bharathapuzha river and basins of Pamba and Manimala rivers during December- April is also prevalent.

However sustainability of commercial vegetable cultivation is an unexplored area and hence this study was primarily focusing on sustainability of commercial vegetable cultivation. Sustainability of commercial vegetable cultivation is operationally defined as the ability of commercial vegetable growers to profitably maintain vegetable production over time.

The major objectives of the study were to

- Assess the sustainability of commercial vegetable cultivation in Thiruvananthapuram district
- Measure commercial vegetable cultivators scale of knowledge and rate of adoption of KAU practices in selected vegetables
- Study the perception about the feasibility of commercial organic vegetable cultivation
- Study the constraints faced in commercial vegetable cultivation

1.1. SCOPE AND IMPORTANCE OF THE STUDY

India produces 15 % (146.55 million tonnes) of world's vegetables on 14 % (8.5 million hectares) of world area under vegetables. But in Kerala, due to the certain limiting factors, the state has been depending on its neighbouring states to meet its increasing needs for vegetables. Kerala sources 80% of its vegetables from neighbouring states (Anonymous, Hindustan Times, June 18, 2015).

Vegetables brought from other states has pesticide residue 3-5 times more than the permissible limit, which was noticed during the random visit of these farmlands by a team of Food Safety Officials from Kerala (Anonymous, Hindustan Times, June 18, 2015). Later the Kerala Government has decided to enforce a ban on vegetables and fruits with high level of pesticide residue in them due to the wake of various reports indicating the entry of pesticide sprayed vegetables and fruits in the local markets.

The Government of Kerala is giving more emphasis to 'Food safe to eat' concept. According to the report of Pesticide Residue Testing Laboratory at Vellayani under Kerala Agricultural University the vegetables cultivated in Kerala were found to be safe for consumption in comparison to vegetables from other states. (The Hindu, 2014). Hence commercial vegetable growing in Kerala needs

to be promoted, through a scientific and systematic approach which will minimize the dependency on other states as well as improve the health of people through the production of safe to eat vegetables and to achieve self-sufficiency in vegetable production. This became possible only if the commercial vegetable growers continue to cultivate vegetables in Kerala.

Hence the present study seeks to analyse the sustainability of commercial vegetable cultivation through a multidimensional analysis and to assess the scale of knowledge and rate of adoption of KAU practices in selected vegetables, perception about the feasibility of commercial organic vegetable cultivation and their constraints in commercial vegetable cultivation. Thus, the results of the study will enlighten the various factors that influence on sustainability of farmers in commercial vegetable cultivation, the achievements of KAU in the dissemination of scientific practices of vegetable cultivation and the farmers perception about commercial organic vegetable cultivation. The study will also throw light on the knowledge and adoption of selected practices of commercial vegetable growers which will help to formulate strategies to redeem the short falls in these areas. Moreover the study will help to identify the constraints faced by the commercial vegetable growers which provide information for further research regarding commercial vegetable cultivation.

1.2. LIMITATIONS

The study was conducted in selected four Panchayats of Thiruvananthapuram district having maximum area under commercial vegetable cultivation with 100 farmers from as respondents, and hence the findings of the study have limited scope of generalization. The data collected from the respondents may or may not be free from their personal pre-conceptions and biases. More over the scientific investigation in behavioural science is bounded by the limitations of time and resources. Within these limitations, sincere efforts have been taken to make the study systematic and fruitful and to attain the objectives.

1.3. PRESENTATION OF THE THESIS

The report of the study is spread over five chapters. First chapter is introduction which covers about commercial vegetable cultivation, scope and importance of the study, objectives and limitations of the study. Second chapter is theoretical orientation which deals with review of literature. Methodology is the third chapter which describes the process of investigation and analysis. The fourth chapter covers the result and discussion of the study in detail. The last chapter summarizes the study with implications and suggestions for the future research. The thesis is concluded with the references, appendices and abstracts.

Review of Literature

2. REVIEW OF LITERATURE

The theoretical orientation covers the review of literature. A literature review is the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfil certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed (Hart, 1998)

The review section should show that the proposal is solidly grounded on past work, indicate command of key studies and elucidate the extent to which the proposed research will move the field forward (Krathwohl and Smith, 2005).

The main objective of this chapter is to link the research findings and other observations existing in the area of study with the research problem for giving a proper orientation for the proposed research. This chapter explains the theoretical perspective adapted for the study, and the results of the review are presented under the following headings.

- 2.1. Concept of commercial vegetable cultivation
- 2.2. Concept of sustainability
- 2.3. Sustainability of commercial vegetable cultivation
- 2.4. Variables and their review
- 2.5. Constraints faced by the respondents

2.1. CONCEPT OF COMMERCIAL VEGETABLE CULTIVATION

Vegetables are essential to the diet, contributing minerals and vitamins for growth and development. Vegetables are rich sources of natural antioxidants. They are involved in free radical scavenging. Vegetables are high value crops, which require intensive cultural practices. Hence the labour and financial inputs involved are greater than those required for most staple crops. Vegetables play an important role in income generation and subsistence in Indian agriculture.

Vegetable production currently plays a major role in nutrition and income generation. Vegetables play an important role in the quality of life for millions of humans indirectly (AVRDC, 2003).

Okorji (1988) reported that commercial vegetable production is a male dominated enterprise, 98 percent of commercial vegetable farmers are male and this contrast with the gender of rural producers who are predominantly women.

In the upper slopes of the Manupali watershed, located in the Bukidnon province of north-central Mindanao, the Philippines, commercial vegetable production on sloping land is a major enterprise of at least 14% of the total households (MAO, 1994).

Widespread intensive use of agrochemicals was one of the major characteristic of commercial vegetable production systems. Overuse of agrochemicals poses the greater risk of pesticide contamination of downstream water and risk to human health (Midmore and Poudel, 1996).

A significant and positive correlation was observed between the number of vegetable crops grown in a year and pesticide costs per hectare. This intensification is generally associated with higher levels of pesticide use per hectare which is found same as in lowland vegetable production systems (Jansen *et al.*, 1995).

Demand for vegetables are increased day by day. This is mainly due to population growth, and government import bans and restrictions of selected vegetables in some of the Southeast Asian countries. Finally it resulted in an increased domestic prices for vegetables, which has provided an impetus for the expansion of these crops to ecologically fragile areas (Coxhead *et al.*, 1999).

Poudel *et al.*, (1998) reported that the uplands of Southeast Asia are the important supplier of the fresh vegetables in lowland Asian cities. Commercial vegetable production systems are high-input based production systems. The level of external nutrient like N, P, and K application on vegetable farms is the major factor which differentiate commercial vegetable production systems in this tropical highland site.

In the urban towns and cities of Nigeria, commercial vegetable production is an informal sector activity. The urban centers provide a secure market to producers mainly during the dry season months. And there is little competition from rural production at that time (Ezedinma and Chukuezi, 1999).

The vegetable crops grown for the domestic market in backyard gardens, commercial plots and in the greenhouses are subject to a range of insect pests and diseases (Bok *et al.*, 2006; Munthali *et al.*, 2004).

The vegetable productivity in islands mainly depends on heavy incidence of diseases and pests, unfavourable soil nutrient balance, weather vagaries during cropping, and other management constraints. Many vegetables are temperate in origin and productivity remains low under tropical conditions. But southern states in India with a tropical climate perform better than northern states having subtropical and temperate climates in vegetable production. (NHB, 2011).

Vegetables are grown in the Andaman and Nicobar Island on 5150 ha, producing 31,300 Mt, primarily as a post paddy crop and in post fallow lands and uplands (Anonymous, 2011).

Vanitha *et al.*, (2013) reported that India is the second largest producer of fruits and vegetables in the world. Total area under horticultural crops in India is 21.83 million ha and production is 240.53 mt. Fruits and vegetables together contribute about 92% of the total horticultural production. An efficient production system is necessary to ensure increased production and this efficiency of the production system is important because it determines the producer's income, consumers living costs and facilitates the allocation of productive resources, among alternative uses.

Ninety six percent of the vegetable growers produced vegetables for market and 4% produced for both the market and home consumption under tropical conditions (Abang, 2014).

Vegetable growers must use cultural practices that optimize yields, maximize returns and profit, and minimize environmental impact (Richter *et al.*, 2015).

Vegetable production is a high income generating and employment-generating activity. But it requires high inputs like labour, fertilizers and pesticides. Vegetable production is a costly intervention. But high prices attract growers. Many technological interventions are being made in vegetable production to increase productivity and profitability (Sigh and Singh, 2012).

2.2. CONCEPT OF SUSTAINABILITY

Sustainability means different things to different people.

The Brundtland Commission (WCED, 1987) stated that: "sustainable development is the development which meets the needs of the present generation without compromising the ability of future generations to meet their own needs".

Khosla and Ashok (1987) reported that the major characters of sustainable agriculture include resource conservation, equitable, economically efficient, waste reducing, socially compactable, enjoyment generating, self-reliant and need fulfilling.

The FAO (1989) defined the sustainable development of agriculture as “the management and conservation of the natural resource base, the orientation of technological and institutional change, in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development in various sectors of agriculture conserves land, water, plant and animal genetic resources .It is environmentally non-degrading, technically appropriate, economically viable and socially acceptable”.

Kang *et al.*, (1990) defined sustainability as the production system ability to produce stable yield of a crop(s) over a long period of time while minimizing soil degradation.

A workable definition of ‘sustainable agriculture and rural development (SARD)’ by UN’s Food and Agriculture Organization (FAO) (1991) is ‘sustainability is the management and conservation of the natural resource base, the orientation of technological and institutional change, in such a manner to ensure the attainment and continued satisfaction of present and future generation needs.

Sustainability consist of multidimensional approaches. Ecological, economic and social aspects at an equivalent level. A systemic investigation conceiving not only single factors but also complex functions and processes with various interactions between these elements. Sustainability can also be assessed with regard to a suitable temporal and spatial scale (Dariush *et al.*, 1991).

Asheim and Geir (1994) defined sustainability as a requirement of our generation to manage the resource base, in such a way that the average quality of life we ensure ourselves can potentially be shared by all future generations.

Costanza and Patten (1995) add sustainability as the emphasis shifts to methods to enable us to predict better what configurations will persist in the future.

The European Community (EC) used five indicators that were suggested by UNCSO to inspect the agricultural state. It includes arable land per capita, land use change, energy use in agriculture, use of fertilizers in agriculture, and use of pesticides in agriculture. (Stevenson and Lee, 2001).

The term 'sustainability' is considered as a synonym of sustainable development, as pointed out by Dresner (2002).

Hani *et al.*, (2003) reported that Sustainable Development allows a life in dignity for the present generation without compromising dignity for future generations or to threaten the natural environment and endangering the global ecosystem. It is generally accepted. The three key factors of sustainable development include environmental protection, economic efficiency and solidarity in society.

According to the dietetic internship programme (Brianna, 2010) sustainable agriculture is multidimensional in nature. It include production of food and fiber, protection of the environment, conservation of land and resources, development of rural communities and maintenance of agricultural heritage.

Binder *et al.*, (2010) suggested that the assessment of sustainability of agricultural systems was still in the development stage and it had shortcomings.

Astier *et al.*, (2012) reported that agricultural sustainability analyses are only applied at the regional, national, or global level. The indicators used in these analyses are not sufficiently adapted to initiate changes at the farm level. It lead to the mitigation of the negative impact on natural resources and environment.

Jalilian (2012) points out that farmers' survey, employing a structured questionnaire or/and an in-depth interview is the most commonly-used data source for the evaluation of the farms economic, social and environment sustainability

According to Anilkumar *et al.*, (2014), economic sustainability, environmental sustainability, social sustainability, humane and adaptable sustainability are the criteria and indicators of sustainability

Schader *et al.*, (2014) enumerated that the frame work used for analyzing agricultural and food sector in a comprehensive way is the sustainable development.

Marchand *et al.*, (2014), stated that no tool is there for sustainability assessment which is "one size fits all".

Vitunskiene and Dabkiene (2016) enumerated that the indicator sets for the farm sustainability assessment differ by their scope and purpose.

2.3. SUSTAINABILITY OF COMMERCIAL VEGETABLE CULTIVATION

Jansen *et al.*, (1995) outlined that the application rate of N, P, K and an index of biocide use was identified as the two major sets of sustainability indicators for the sustainability of an agricultural production system in Costa Rica

The sustainability of production systems is constrained by several factors. The major factors are soil erosion, overuse of agrochemicals, siltation of waterways, nutrient losses in runoff water, and poor market infrastructure (Midmore and Poudel, 1996).

Poudel *et al.*, (1998) explained that the factors influencing the sustainability of commercial vegetable production systems in the Manupali watershed can be classified into three groups: they are biophysical, socioeconomic, and institutional.

Poudel *et al.*, (1998) reported that the biophysical factor is represented by nutrients, soil pH, soil erosion, pests and diseases, and agro ecological suitability. The socioeconomic factor are the degree of commercialization, diversification, and opportunity cost of farming and the institutional factor are represented by externalization (input availability and market infrastructure) of vegetable production systems.

Singh *et al.*, (2015) stated that to support the needs of a significant portion of a population in a sustainable manner in the tropical island, systematic analysis of problems and related production management systems for vegetables in this area is desired.

2.4. VARIABLES AND THEIR REVIEW

2.4.1. Age

Sreedaya (2000) reported that age had a non – significant relationship with extent of adoption of recommended practices among vegetable growers of both Intensive Vegetable Development Programme (IVDP) and Vegetable and Fruit Promotion Council of Keralam (VFPCCK).

Kamalakkannan (2003) reported that about 75 per cent of commercial vegetable growers belonged to medium category of age in the eastern Palakkad.

Jaganathan (2004) found that majority of vegetable growers in Thiruvananthapuram district belonged to old age category.

Obopile *et al.*, (2008) in his study of “Assessing vegetable farmer knowledge of diseases and insect pests of vegetable and management practices

under tropical conditions” pointed out that the use of greenhouses was negatively associated with age, which is indicating that most farmers who used greenhouse for vegetable cultivation were relatively young

Abang *et al.*, (2014) reported that 41 per cent of the vegetable farmers belonged to the middle age category.

Anupama (2014) in her study of “Content development for an agricultural expert system on organic vegetable cultivation” reported that more than 50 per cent of organic farmers belonged to old age category and the participation of young people in farming is quite low.

Godswill *et al.*, (2014) stated that a 50 percent of the vegetable growers are women aged between 37- 47 years who depends mainly on agriculture for their livelihoods.

2.4.2. Educational Status

Quazi and Iqbal (1991) pointed out that education was an important determinant of innovation adoption.

Elizabeth and Zira (2009) in their study conducted among vegetable farmers stated that less than 50% of farmers completed at least primary school; fewer completed secondary school. Level of education of farmers was found to impact on awareness and effectiveness of technology transfer.

Pandit and Basak (2013) reported that 45.07 percent of the respondents had primary level of education while about 37% had secondary to above secondary level education.

Boruah *et al.*, (2015) reported that 52.50 per cent of the tribal winter vegetable growers of Jorhat district had medium level of education. 27.50 per cent had low educational level, 13.33 per cent had no education and only 6.67 per cent had high level of education.

Anju (2016) observed that majority of commercial amaranthus cultivators had high school and higher secondary school education and 33.33 per cent of vegetable cowpea growers had education up to high school level.

Thasneem (2016) found that majority of banana growers had medium level of education followed by low level of education.

2.4.3. Knowledge about the KAU Practices in Selected Vegetables

Fayas (2003) reported that 75.60 percent of vegetable growers had medium level of Knowledge in vegetable cultivation.

Jaganathan (2004) reported that 70 percent of the vegetable farmers had medium level of knowledge. There is a positive and significant relationship with education, training attended, innovativeness, risk orientation, self-confidence, environmental orientation and awareness with the knowledge about organic farming practices.

Pandit and Basak (2013) observed that about 56% of the respondents had medium level of knowledge in vegetable production compared to 27.47% had high and 16.90% had low level of knowledge about vegetable production.

Manevska (2013) stated that farmers' knowledge attributes have the potential to influence farm economic performance.

Abang *et al.*, (2014) stated that lack of adequate knowledge of vegetable production and protection from biotic and abiotic constraints could prevent vegetable farm size from increasing.

Noobiya (2016) summerised that majority of the bitter gourd farmers of Thiruvananthapuram district had medium level of knowledge on scientific production practices of bitter gourd.

Anju (2016) revealed that 68.89 % of amaranthus growers and 73.33 % of vegetable cowpea growers of Thiruvananthapuram district had medium level of knowledge about KAU varieties and selected recommended practices.

2.4.4. Adoption of KAU Practices in Selected Vegetables

Rogers (1962) defined adoption as a process of thinking and doing in which an individual passes from first hearing of an innovation to its final adoption.

Chattopadhyay (1963) reported that an individual might make full or partial use of an innovation.

Kamalakkannan (2003) pointed out that 65 % of the commercial vegetable growers had medium level of adoption of recommended technologies followed by 16.25 % with low and 18.75 % with high level of adoption.

Singh and Singh (2012) stated that 86 percent of farmers used improved seed of tomato, cucurbits, okra, chilli, cauliflower, cabbage, cowpea, french bean, and dolichos bean in Andaman and Nicobar Islands. The study also revealed that 90 percent of vegetable growers used protected cultivation in vegetable production on the Andaman and Nicobar Islands.

Noobiya (2016) reported that among 16 recommended practices in bitter melon cultivation, five practices like varieties, weeding and raking, neem based insecticide, cue lure trap, food bait trap were highly adopted by the farmers of Thiruvananthapuram district.

Anju (2016) stated that 60 % of amaranthus growers and 57.78 % of vegetable cowpea growers of Thiruvananthapuram district had medium level of adoption, followed by low level adoption of the KAU varieties and selected recommended practices of amaranthus and vegetable cowpea.

2.4.5. Perception about the Feasibility of Commercial Organic Vegetable Cultivation

Organic farming systems are a key to sustainable agriculture and have captured the interest of many countries throughout the world. Organic cultivation helps to sustain the health of soils, ecosystems and people. It is commercial viable and it may provide solutions to the current problems of unconventional agriculture (John, 2011).

Factors affect farmers perception about organic farming include the characteristics of the new practice in comparison with the existing practice, resource endowments, socio-economic status, demographic characteristics, and access to institutional services like extension, input supply, markets, etc.(Pinthukas, 2015).

Rural Economy Research Centre (RERC) (2008) reported that, under current circumstances, large-scale conversion to organic farming by dry stock farmers within the next five years is uncertain. But 6% of dry stock farmers of the state are interested in going organic. The reason behind this is due to the lack of strong opinion among farmers about organic farming and lack of good level of knowledge about organic farming.

Srivastava *et al.*, (2009) reported that only 25% of the farmers use organic practices for disease and pest management in vegetables in Andaman Islands. Organic manures are common among all farmers. But 70% use chemical fertilizers.

Suresh and Himanshu (2015) revealed that there was a positive and significant relationships between perception about organic farming with age, educational background, farm size, benefits of organic farming, and social factors of the farmers. It shows that the communities will have high rate of adoption regarding innovations in organic farming and other agricultural policies.

Prihtanti (2016) stated that farmer's perception about organic farming concepts were associated with farming experience and membership in farming group.

2.4.6. Annual Income

According to business dictionary (2017) annual income is the total amount of income earned annually.

Pandit and Basak (2013) pointed out that respondents' annual income ranged from 36 thousand to 290 thousand with an average of 86.17 thousand. Fifty percent of the respondents were medium income category followed by high income (30.28%) and low income (19.72%) category.

Most significant factors which influence farmer's income positively in the urban commercial vegetable enterprise were farm size and number of exotic vegetables cultivated. Labour and capital costs have a negative but not significant correlation on farm income. (Ezedinma, 2001).

Fayas (2003) found that 60 % of Self Help Groups in VFPCCK had obtained an income which belongs to the medium category.

Priya (2003) reported that 59.2 % of the vegetable producing Self Help Groups belonged to medium category with respect to annual income.

Boruah *et al.*, (2015) revealed that majority (51.67%) of the tribal winter vegetable farmers of jorhat district of Assam belonged to group with annual income ranging from Rs 25001-50000. It was followed by 25 per cent with annual income between Rs.75001 and above,

Noobiya (2016) reported that 44.44 % of the bitter gourd farmers of Thiruvananthapuram district obtained an income of more than 2 lakh followed by 38.89 % with an income between 1 and 2 lakh.

2.4.7. Farming Experience

Muthazhagan (1990) in his study on “Content Analysis and Readers Perception on Valarum Velanmai and Seithimandal Publications” inferred that majority of the respondents were having more farming experience.

Senthilkumar (2000) found that 40 percent of the farmers were having more than 20 years of experience.

Ezedinma (2001) revealed that the farmers have an average of nine years farming experience. Mainly they are doing on urban farming. Forty percent of the farmers had all their experience in commercial vegetable production.

Jaganathan (2004) reported that 47 percent of the respondents were having medium level of experience in vegetable cultivation.

Zanu *et al.*, (2012) reported that farming experience had a positive and significant relationship with the adoption of improved technologies by the farmers.

Sobha (2014) enumerated that a significant proportion (82.22%) of the farmers were having a rich experience in farming.

Anju (2016) revealed that 42.22 percent of the amaranthus growers and 40 percent of the vegetable cowpea growers were having high level of experience in vegetable cultivation.

2.4.8. Credit Orientation

Nizamudeen (1996) pointed out that credit orientation of Kuttimulla growers lead them towards the successful adoption cultivation practices.

Jayalekshmi (2001) observed that credit orientation and rural women empowerment had negative and significant correlation.

Fayas (2003) suggested that majority (84.4%) of the Self Help Groups in VFPCCK had medium level of credit orientation.

Priya (2003) reported that majority of the respondents had medium level of credit orientation.

Esakkimuthu (2012) reported that 41.1 % farmers had medium level of credit orientation and 33.3 % had high level of credit orientation.

Samuel *et al.*, (2014) pointed out that few farmers accessed credit facilities mainly due to lack of collateral and very strict conditions of accessing credit.

2.4.9. Extension Contact

Arun kumar (2002) pointed out that 48.50 % cassava growers had medium level of contact with extension agency.

Halim (2003) reported that respondents who had more contact with extension media acquired more knowledge on technological aspects which helped them to combat their constraints more efficiently.

More than half of the respondents (55.63%) had medium extension media contact. 40.85% of the respondents had low and only 3.52% had high extension media contact. (Pandit and Basak, 2013).

Abang *et al.*, (2004) reported that most vegetable farmers received extension information from neighbours and had little or no contact with government departments. They also reported that almost all respondents were aware of extension services and its usefulness. But majority of the farmers were never visited by the extension service, which likely resulted in farmers' inability to identify pests and diseases of vegetables, poor pest management skills, and lack of good knowledge of the use of chemical pesticides.

Samuel *et al.*, (2014) revealed that most farmers were not accessing extension services mainly due to unavailability of extension workers and farmers had to travel long distances to access extension advice.

Anju (2016) stated that 60 % of the amaranthus growers and 68.9 % of the vegetable cowpea growers had medium level of contact with extension agency.

Kumar *et al.*, (2009) reported that extension contacts of peri-urban respondents were under medium to high category (71.67 %) while majority of the peri-rural respondents were under medium to low category (70.00%).

2.4.10. Economic Motivation

Gowda (1996) found that a negative and significant relationship between economic motivation and susceptibility of rice farming.

Fayas (2003) revealed that 85 % of SHG respondents had medium level of economic motivation.

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

Priya (2003) pointed out that 92 % of the vegetable growers had medium level of economic motivation.

Revathy (2015) revealed that 23% of the respondent had high level of economic motivation and only 9 % fell under low category.

Namitha (2016) reported that 85 % of the respondents had medium level of economic motivation, 10 % had low level and 5 % had high level of economic motivation.

Noobiya (2016) reported that economic motivation of bitter gourd farmers of Thiruvananthapuram district was high irrespective of the Panchayats in which the farmers belong.

2.4.11. Market Orientation

Marketing is the process whereby in order to fulfil its objectives, an organization accurately identifies and meets its customers' wants and needs (Richter, 1994).

Thomas (2000) opined that knowledge and adoption of medicinal plant cultivation had a significant relation with market orientation.

Jaganathan (2004) stated that market orientation had a positive and significant relationship between respondent's awareness and attitude towards organic farming practices.

Jayakumar *et al.*, (2010) reported that marketing of farm products is affected by certain features of farming. These factors include: seasonality of products, perishability of products, inelastic demand, bulkiness of products, production hazards, changes in market demand, large number of small producers, and geographical specialization of production.

Patel *et al.*, (2013) noted that adoption of eco-friendly management practices of the vegetable growers had no significant association with market orientation.

Chalermphol *et al.*, (2014) reported that appropriate market management is the important aspect in promotion of commercial vegetable cultivation.

Noobiya (2016) revealed that market orientation of bitter gourd farmers of Thiruvananthapuram district was high irrespective of the Panchayat in which they belonged.

2.4.12. Exposure to Mass Media

The mass media is a diversified collection of media technologies that reach a large audience via mass communication (Wikipedia, 2017)

The success of agricultural development programmes in developing countries largely depends on the nature and extent of use of mass media in mobilization of people for development. The planners in developing countries realize that the development of agriculture could be hastened with the effective use of mass media (Purushothaman *et al.*, 2003).

Suthan (2003) revealed that 65.33 % of vegetable growers had high level of mass media exposure.

Sobha (2014) pointed out that majority of the farmers using information kiosk and had medium level of exposure to ICT tools and only 25 % respondents had high exposure to ICT tools.

Shuwa *et al.*, (2014) identified radio communication as the best means of communication in the Borno State (87%) and farmers prefer radio as the best source of information.

Namitha (2016) reported that 85.5 % of the respondents were exposed to TV programmes regularly and 14. 17 % occasionally.

Anju (2016) inferred that 53.33 % of amaranthus growers and 71.11 % of vegetable cowpea growers belonged to medium category with respect to mass media exposure.

2.4.13. Entrepreneurial Behaviour

Entrepreneurship has traditionally been defined as the process of designing, launching and running a new business, which typically begins as a small business, such as a start-up company. Entrepreneurship will offer a product, process or service for sale or hire. The people who do so are called 'entrepreneurs' (Wikipedia, 2017).

Entrepreneurial behaviour is the cumulative outcome of information seeking behaviour, farm decision making, leadership ability, risk taking ability, innovativeness, achievement motivation and market orientation of the respondent farmers. (Vijaykumar, 2001).

Entrepreneurial behaviour is the composite measure of nine components. The components are innovativeness, achievement motivation, decision making ability, risk orientation, coordinating ability, planning ability, information seeking behaviour, cosmopolitaness and self-confidence. (Boruah *et. al.*, 2015).

Pandeti (2005) pointed out that 42.50% of small farmers had low entrepreneurial behaviour. 37.50 per cent of medium farmers and 42.50 per cent of big farmers had medium and high entrepreneurial behaviour

Shailash and Gyanendra (2009) reported that the entrepreneurial characters of vegetable growers comprises of self-confidence (90.83%), management orientation (79.16%), farm decision making (69.16%), leadership ability (57.50%), risk taking ability (76.66%) and innovativeness (68.33%).

Wankhade *et al.*, (2013) revealed that majority of the respondents were found in medium level with respect to the main entrepreneurial attributes of vegetable growers. It indicates the importance and contribution of these entrepreneurial attributes in achieving entrepreneurship especially among vegetable growers.

2.4.14. Risk Orientation

Fayas (2003) pointed out that technology adoption and risk orientation had a positive and significant relationship.

Priya (2003) pointed out that majority of the vegetable producing Self Help Groups in Thiruvananthapuram had medium level of risk orientation.

Jaganathan (2004) reported that 73 % of the respondents had medium level of risk orientation and it had a positive and significant relationship with knowledge of farmers about the organic farming practices in vegetable cultivation.

Jayawarddana (2007) revealed that 66% coconut organic farmers had medium level of risk orientation, followed by 15 % under low and 19 % under high category of risk orientation.

Esakkimuthu (2012) reported that 61.67 % respondents had medium level of risk orientation.

Hanjabum (2013) observed that precision farmers are highly risk oriented and farmers has to take certain level of risk in cultivating vegetables.

Thasneem (2016) reported that majority of the respondents had fairly good orientation towards risk which is desirable for adoption of improved practices in banana cultivation.

2.4.15. Training Undergone in Vegetable Cultivation

Training is teaching, or developing in oneself or others, any skills and knowledge that relate to specific useful competencies. Training has specific goals of improving one's capability, capacity, productivity and performance (Wikipedia, 2017).

The average of trained and non-trained persons is very similar in terms of the area of land owned, household size, and household composition among off season vegetable growers of Bangladesh. But, the two groups show marked differences in the characteristics of the person managing farm operations. The trained persons is younger, literate, better educated and more often a member of a farmers' organization (Pepijn *et al.*, 2016).

Farmers' training is provided at the local level through Krishi Vigyan Kendras, vocational agricultural schools and field demonstrations. These training classes may be conducted on specific topics. Eg: use of urea or vast topics like packages of practice. The new information that farmers gain through these training sessions makes their daily farming activities much easier. It also leads to an increase in productivity and bigger profits in the long run (National portal of India, 2017).

Fayas (2003) reported that 95.6 % of the respondents belonged to the high category of training, and there was a positive relation between the respondents training needs and group formation behaviour and market perception.

Sajeev *et al.*, (2012) reported that farmers of Manipur, India sought maximum trainings on Integrated farming systems, integrated pest and disease management and technologies for soil and water conservation

The Times of India (2016) reported that Himachal Pradesh Farmers got training in vegetable cultivation at PAU. The agriculture scientists of PAU threw light on the scope of vegetable cultivation for crop diversification, cultivation of vegetables in low tunnels, techniques of nursery growing of vegetables, seed production of vegetable crops, management of diseases and insect-pests in vegetable crops, and their post-harvest management, and cultivation of vegetables in net and poly houses,

Training provides an opportunity to the farmers to get awareness of agricultural technologies as well as the shift in agricultural development approach through farming enterprises (Shankara *et al.*, 2014).

2.4.16. Incentives Received in Commercial Vegetable Cultivation

Incentives is a thing that motivates or encourages someone to do something. (Wikipedia, 2017).

Diannacahnn (2015) reported that government incentives make farming a viable option for veterans.

USDA (2017) pointed out that financial support for small farms and farm-related businesses is available from a variety of Federal, state and local agencies and from non-governmental organizations.

Savoie *et al.*, (2016) reported that only fewer individuals reported experiencing food insecurity-related behaviours after receiving incentives. A significantly increased intake was found among selected vegetables.

2.5. CONSTRAINTS FACED BY THE RESPONDENTS

Obopile *et al.*, (2008) reported that most farmers (94.6%) perceived invertebrate pests as the most important constraint in vegetable production. It was followed by vegetable diseases (42.0%), water shortage (11.6%), soil fertility (8.9%), weeds (8.0%) and marketing (7.1%).

Intensive agronomic practices, improper crop rotation, and excessive use of pesticides disrupt the natural balance between pests and their enemies and cause deterioration of water, soil and quality of vegetables (Wang *et al.*, 2008).

Bacterial wilt in solanaceous crops, yellow vein mosaic virus in okra, anthracnose in cucurbits, and yellow mosaic virus in legumes are major constraints to vegetable production on tropical conditions the islands (Jayakumar *et al.*, 2010).

A heavy incidence of diseases and pests, unfavourable soil nutrient balance, weather vagaries during cropping, and other management constraints reduce vegetable productivity in islands ($8.0 \text{ Mt} \cdot \text{ha}^{-1}$), which is lower than the national average ($16.5 \text{ Mt} \cdot \text{ha}^{-1}$) (NHB, 2011).

The constraints faced by the farmers in commercial cultivation of vegetables will have adverse effect on agricultural production. These facts indicate that the desired level of vegetable production will not be achieved if the different constraints faced by the farmers were not solved by the concerned authority. (Pandit and Basak, 2013).

Price fluctuation in the market, no provision of vegetable crop insurance, exploitation by middleman, non-availability of labour at the time of harvesting of vegetable crops, high input cost, inadequate extension services, insufficient electricity, decreasing water table and non-availability of quality planting (seedling) material were the major constraints faced by vegetable growers in management of vegetable farming. (Wankhade *et al.*, 2013).

Singh *et.al.*, (2013) reported that the major issues of vegetable growers were lack of irrigation water, lack of suitable high-yielding and resistant genetic stocks, incidence of disease and pests, lack of labour during the peak season, lack of knowledge of improved technologies, marketing problems, lack of input availability, limited land resources, and socioeconomic constraints.

Improved varieties of vegetables from mainland India produce low yield. This is mainly due to heavy incidence of diseases and pests, poor pollination and fertilization during the rainy season, short cropping period, heavy weed infestation, slightly acidic soils, and physiological stress due to high temperature during the dry season. (Singh *et al.*, 2014).

Issues of vegetable growers were lack of irrigation water, lack of suitable high-yielding and resistant genetic stocks, incidence of disease and pests, lack of labour during the peak season, lack of knowledge of improved technologies, marketing problems, lack of input availability, limited land resources, and socioeconomic constraints. (Singh *et al.*, 2014).

Tiwari *et al.*, (2016) stated that general-illiteracy, poor socioeconomic conditions, lack of technical knowledge and awareness, small landholdings, and underdeveloped physical infrastructures associated with the comparatively high cost of agricultural production are the major problems in vegetable cultivation.

Noobiya (2016) reported that the major constraints perceived by bitter gourd farmers were incidence of pest and disease, flooding due to heavy rain fall, scarce water resources, extremity in weather conditions, labour scarcity, lack of knowledge on management practices, inadequate capital etc.

Methodology

3. METHODOLOGY

The research methodology in accordance with the objectives of the study is presented under the following heads.

- 3.1. Research design
- 3.2. Locale of study
- 3.3. Selection of respondents
- 3.4. Operationalization and measurement of dependent variables
- 3.5. Operationalization and measurement of independent variables
- 3.6. Constraints faced in commercial vegetable cultivation and suggestions
- 3.7. Techniques employed in data collection
- 3.8. Statistical tool used for data analysis

3.1. RESEARCH DESIGN

A research design is a plan, structure and strategy of investigation so conceived as to obtain answers to research questions or problems. The plan is the complete scheme or programme of the research. It includes an outline of what the investigator will do from writing the hypothesis and their operational implications to the final analysis of data (Kerlinger, 1986)

For conducting this study, ex – post facto design was used in which the researcher does not have direct control over the variables. The investigator draw inferences regarding the relationship between the dependent and independent variables and there was no scope for manipulation of any variables under study.

3.2. LOCALE OF STUDY

Thiruvananthapuram district was selected for the study because of the presence of College of Agriculture, Vellayani from where many of the high yielding vegetable varieties are released and distributed to farmers. Also Thiruvananthapuram district is one of the major producers of the major vegetables and these vegetables from the district fetch higher price in the foreign market as per the opinion of the exporting agency.

3.3. SELECTION OF RESPONDENTS

Selection of respondent was through random sampling procedure. From the list of blocks having larger area under commercial vegetable cultivation two blocks were selected, mainly, Pallichal and Neyyattinkara from the eleven blocks of Thiruvananthapuram district. From each block two panchayaths were selected having maximum area under vegetable cultivation. From Pallichal block two panchayaths namely Pallichal and Kalliyoor were selected, Kottukal and Venganoor were the two Panchayath selected from Neyyattinkara block. In the next stage, list of twenty five farmers engaged in commercial vegetable cultivation having at least 20 cents of land under vegetable cultivation and having five years of experience in vegetable cultivation were prepared with the help of respective Krishibhavans, thus making a total of hundred farmers as respondents.

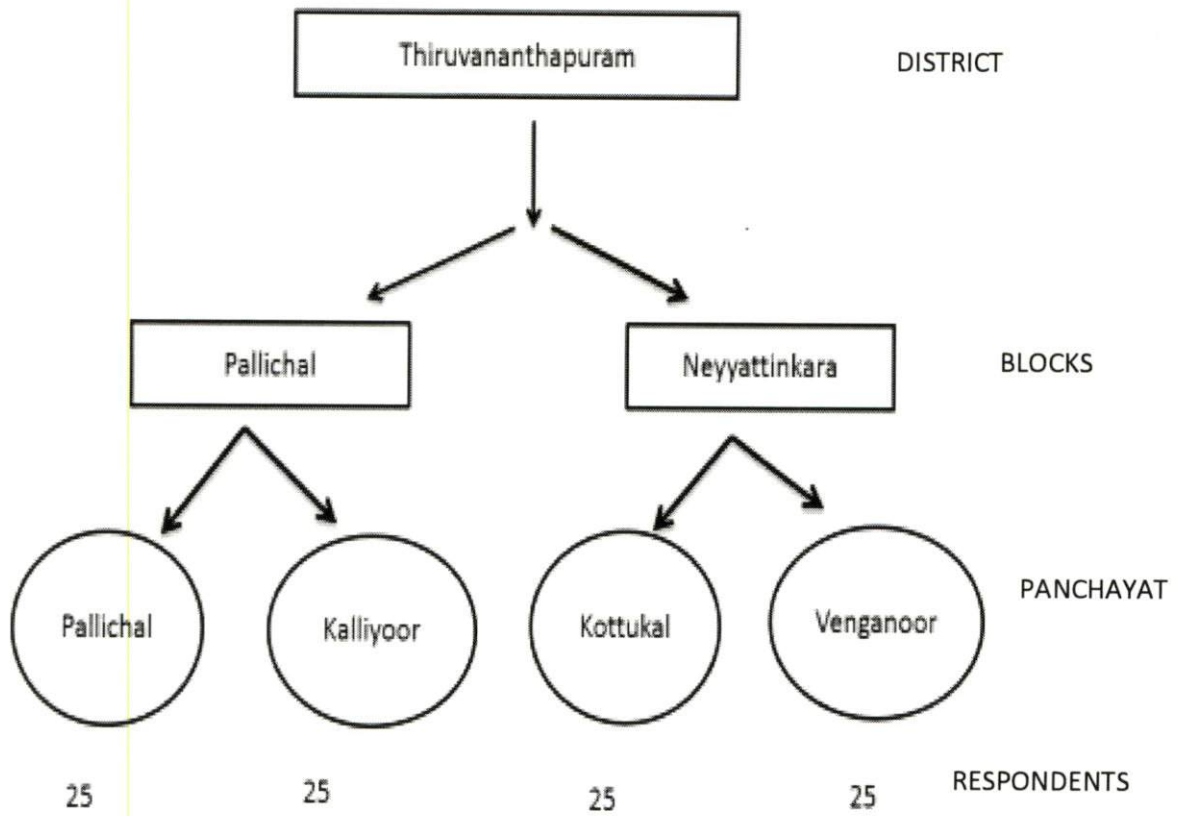


Figure 1: Selection of respondents



Figure 2. Map of the study area – Thiruvananthapuram district

3.4. OPERATIONALISATION AND MEASUREMENT OF DEPENDENT VARIABLES

3.4.1. Sustainability of Commercial Vegetable Cultivation.

The objectives of the study necessitated to select sustainability of commercial vegetable cultivation as the dependent variable for the study.

In this study on commercial vegetable cultivation, sustainability is operationally defined as the ability of commercial vegetable growers to profitably maintain vegetable production over time.

Sustainability composed of various dimensions and the dimensions relevant for the current study was identified based on review of literature and discussion with experts in the respective disciplines. Thus five dimensions namely economic dimension, socio- psychological dimension, environmental dimension, technological and temporal dimensions were selected for the study. The operational definitions for each dimensions and twenty statements contributing to each dimensions of sustainability were prepared based on intensive review of literature and consulting with experts in the respective discipline. Later these five dimensions were subjected to weightage rating in percentage based on the importance and relevance of each dimension in relation to sustainability of commercial vegetable cultivation by experts consisting of scientist in agricultural extension, various agricultural research stations all over Kerala, and officials from the agricultural department. The judges were also asked to indicate the degree of relevance of these twenty statements of each dimensions of sustainability on a three point continuum of most relevant, relevant, and least relevant with score 3, 2, 1 respectively.

The total score of all the judges for each statements were calculated and the mean value was worked out. The overall mean for individual dimensions were also computed. The statements which were having a mean value more than the overall mean were selected. Thus 12 statements in economic dimensions, 6 statements in socio- psychological dimension and 5 statements each from the

remaining three dimensions namely environmental, temporal and technological dimensions were selected for the study (Appendix II)

These five dimensions and the respective statements were included in the interview schedule and the respondents were asked to respond to statements listed on a two point scale of sustainable and not sustainable with score 1 and 0.

The five dimensions were operationalize as follows.

3.4.1.1. Economic Dimension

Defined as the degree of the situation as perceived by the farmer which support an optimum level of production with continuous stable per capita income and efficiency in the eco-friendly use of resources and assured market for his economic wellbeing

3.4.1.2. Socio- Psychological Dimension

Defined as the degree of perceived social situation in which the social processes and structures which help in meeting socio- psychological needs of the farmer which influence his enhanced continuation of commercial vegetable cultivation

3.4.1.3. Environmental Dimension

Defined as the degree to which relevance and importance of environmental conservation and protection are internalized by the farmer in continuing his commercial vegetable cultivation

3.4.1.4. Technological Dimension

Defined as the degree of importance perceived by the farmer about the adoption of new technologies based on its perceived attributes to maintain the continuation of commercial vegetable cultivation

3.4.1.5. Temporal Dimension

Defined as the degree of availability of supplies and services for commercial vegetable cultivation at the right time and the rapidity of returns from commercial vegetable cultivation

3.5. OPERATIONALISATION AND MEASUREMENT OF INDEPENDENT VARIABLES

Based on the objectives, review of literature, discussion with experts and observation made by the researcher, a list of socio- psychological and economic characteristics which have relationship with the selected dependent variable were identified along with their operational definitions. A questionnaire was prepared to collect the responses from the judges in a four point continuum with response pattern “Most relevant”, “Relevant”, “Least relevant”, “Irrelevant” with scores 4,3,2,1 respectively. A copy of questionnaire is furnished in Appendix II.

Copies of the questionnaire with clear instructions for filling up were sent to thirty judges through post and mail. Twenty six judges responded. The score assigned by these judges were added up for each variable and are furnished in appendix III. The variables having higher score were selected as the independent variables for the study.

Table 1. Variables and their measurement

| Variable | Measurement |
|-----------|---|
| Age | Scoring procedure based on census report of GOI (2011). |
| Education | Procedure developed by Singh(1993) |
| Knowledge | A teacher made test developed for the study |
| Adoption | Scoring procedure followed by |

| | |
|--|--|
| | Noobiya (2016) |
| Perception about the feasibility of organic commercial vegetable cultivation | An arbitrary scale was developed |
| Farming experience | Measured by directly asking the respondents |
| Annual farm income | Measured by directly asking the respondents |
| Economic motivation | Scale adopted by Fayas (2003) |
| Credit orientation | Procedure developed by Beal and Sibley (1967) |
| Extension agency contact | Scoring procedure used by Manoj (2000) |
| Market orientation | Method used by Samantha (1977) |
| Exposure to mass media | The scale developed by Lakshmi (2000) |
| Entrepreneurial behaviour | Scale developed by Varma (1996) |
| Risk orientation | Method used by Supe (1969) |
| Trainings undergone for vegetable cultivation | Measured by directly asking to the respondents |
| Incentives received for vegetable cultivation | Measured by directly asking to the respondents |

3.5.1. Age

Age was operationalized as the number of calendar years completed by the respondent at the time of enquiry. This was measured as the total number of years completed by the respondent at the time of interview and was classified based on census report, 2011

| Age category | Years | Score |
|--------------|-----------------|-------|
| Young | Less than 35 | 1 |
| Middle aged | 35-55 | 2 |
| Aged | Greater than 55 | 3 |

3.5.2. Educational Status

Educational status was operationalized as the highest academic qualification possessed by the respondent through formal and informal education. Measured using the scoring pattern adopted by Hanjabum (2013)

| Category | Score |
|-------------------|-------|
| Illiterate | 1 |
| Write and read | 2 |
| Primary school | 3 |
| High school | 4 |
| Higher secondary | 5 |
| College education | 6 |

3.5.3. Knowledge about KAU Practices

Knowledge about KAU practices was defined as the quantum of technical know - how possessed by the respondent about KAU practices on commercial vegetable cultivation of selected vegetables (Amaranthus, Vegetable cowpea, Bitter gourd). The vegetables are selected based on the area under cultivation in Thiruvananthapuram district, where these three crops possess maximum area under cultivation in the district.

In the present study, a teacher made test was developed for measuring the knowledge of the respondents about varieties and recommended practices of amaranthus, vegetable cowpea and bitter gourd. Correct and incorrect answers were given a score of 1 and 0 respectively. The total knowledge score of each respondent was calculated by total number of items correctly answered by him. The knowledge index was calculated for each respondents. The mean of the knowledge index were calculated and respondents were categorized into high, medium and low with respect to knowledge based on mean and standard deviation.

The maximum score that could be obtained by a respondent for the test was ten and minimum zero.

3.5.4. Adoption of KAU Practices.

Adoption was operationalized as the extent to which the various popular practices of vegetable cultivation were put into practice by the respondent

Adoption was measured by using the procedure followed by Noobiya (2016). For measuring the level of adoption of scientific production practices of selected vegetables (Amaranthus, Vegetable cowpea, Bitter gourd) by commercial vegetable growers a package of improved practices in these vegetables were selected after reviewing Package of Practices of Kerala Agricultural University (2011) and other literature related to the subject.

The list consisted of 10 relevant practices and adoption of each practices was given in a three - point continuum with non-adoption, partial adoption, and complete adoption with score 1, 2, 3 respectively. The adoption index was worked out using formula

$$\text{Adoption index} = \frac{\text{Respondents total score}}{\text{Total possible score}} \times 100$$

Respondents total score = Total number of practices adopted by the farmer, multiplied by the respective practice weightage

Total possible score = Total number of practices recommended multiplied by the respective practice weightage.

The maximum score that could be obtained by a respondent was thirty and minimum ten.

3.5.4.1. *Selected KAU practices in Amaranthus*

| Sl no | Vegetable practices – Amaranthus | Adopt (3) | Partially adopt(2) | Non adopt (1) |
|-------|--|-----------|--------------------|---------------|
| 1 | Avoid sowing of red leaved varieties during period of heavy rain | | | |
| 2 | Varieties : Red – Kannara local, Arun, Krishnasree Green – Co1, Co2, Co3, Mohini and Renusree | | | |
| 3 | Seed rate is 1.5 – 2.0 Kg/ ha | | | |
| 4 | Transplanting of 20-30 day old seedlings in shallow trenches | | | |
| 5 | 50 tonnes of FYM per ha as basal dose | | | |

| | | | | |
|----|--|--|--|--|
| 6 | NPK : 50:50:50 Kg/ ha | | | |
| 7 | Top dressing of 50 Kg of N fertilizer at regular interval | | | |
| 8 | Spraying of , 0.1% of Malathion during severe cases of leaf webber incidence | | | |
| 9 | Spraying 1% urea immediately after each harvest for increasing yield | | | |
| 10 | Avoid use of insecticide or fungicide if maximum possible | | | |

3.5.4.2. Selected KAU Practices in Cowpea

| Sl no | Vegetable practices – vegetable cowpea | Adopt (3) | Partially adopt (2) | Non adopt (1) |
|-------|---|-----------|---------------------|---------------|
| 1 | Spacing is 25× 15 cm for dibbling two seeds per hole 30× 15 cm for bush and 2 × 2 m for trailing on pandal@ 3 plants/ pit | | | |
| 2 | Varieties : Bushy- Bhagyalakshmi, Pusa Barsathi, Pusa Komal Semi trailing - Kairali, varun, Anaswara, Kanakamony, Arka Garima Trailing type – Sharika , Malika, KMV-1, Lola, Vyjayanthi, Manjeri Local , Vylathur Local, Kurutholapayar, Vellayani Jyothika | | | |
| 3 | Seed rate is 20-25Kg/ ha for bush cowpea 4-5 Kg/ha for trailing cowpea | | | |
| 4 | Soaking seeds in thiourea (500ppm) solution , followed by two sprays(vegetative stage and flowering stage) | | | |
| 5 | Seed inoculation with <i>Rhizobium</i> and pelleting with lime | | | |
| 6 | Application of 250 Kg/ ha Lime at the time of first plowing | | | |

| | | | | |
|----|---|--|--|--|
| 7 | NPK : 20:30:10 Kg/ha | | | |
| 8 | Half quantity of N, full P and K applied at the time of final ploughing | | | |
| 9 | Irrigation at critical periods- 15 days after sowing and at the time of flowering | | | |
| 10 | Soil drenching with 1% Bordeaux mixture to prevent fungal diseases | | | |

3.5.4.3. Selected KAU Practices in Bitter gourd

| Sl no | Vegetable practices – Bitter gourd | Adopt (3) | Partially adopt(2) | Non adopt (1) |
|-------|--|-----------|--------------------|---------------|
| 1 | Spacing is 2× 2 m | | | |
| 2 | Varieties are Preethi, Priyanka, Priya and Arka Harit | | | |
| 3 | Seed rate is 5-6 Kg/ ha | | | |
| 4 | Retain 3 plants/ pit | | | |
| 5 | Top dressing of N fertilizer in split doses at fortnightly interval | | | |
| 6 | Weeding and raking at the time of fertilizer application | | | |
| 7 | Irrigation at 3- 4 days interval and alternate days during flowering/ fruiting | | | |
| 8 | Carbaryl 10% DP in pit before sowing | | | |
| 9 | Spraying 0.2% Mancozeb against Downey mildew | | | |
| 10 | Vector control of Mosaic by spraying Dimethoate 0.05% | | | |

3.5.5. Perception about Feasibility of Commercial Organic Vegetable Cultivation

Perception about feasibility of commercial organic vegetable cultivation was operationally defined as the farmer's opinion towards the feasibility of commercial organic vegetable cultivation

An arbitrary scale was used to measure the perception of farmers towards commercial organic vegetable cultivation

Scale consist of seven statements which was measured in a five point continuum namely, strongly agree, agree, undecided, disagree and strongly disagree. The maximum score that could be obtained by a respondent was 35 and minimum 7.

| Sl no | Statements | SA (5) | A (4) | UD (3) | DA (2) | SDA (1) |
|-------|--|--------|-------|--------|--------|---------|
| 1 | Adoption of commercial organic vegetable cultivation is profitable | | | | | |
| 2 | Adoption of commercial organic vegetable cultivation is economically viable | | | | | |
| 3 | Organically produced vegetables have high demand in the market and fetch higher price | | | | | |
| 4 | Ample Inputs are available for commercial organic vegetable cultivation and are economical | | | | | |
| 5 | Biological and mechanical pest and disease control methods are practically useful for commercial vegetable cultivation | | | | | |
| 6 | Animal husbandry component in organic farming makes vegetable cultivation more profitable | | | | | |
| 7 | Use of organic manures like FYM, compost are feasible for commercial vegetable cultivation | | | | | |

3.5.6. Farming Experience

Experience in farming referred to the total number of years a respondent had been engaged in commercial vegetable cultivation.

The respondents were asked to indicate the number of years they have been engaged in commercial vegetable cultivation. The scoring was done in the following way.

| Sl no: | Experience (Years) | Score |
|--------|---------------------|-------|
| 1 | 5-10 | 1 |
| 2 | 11-25 | 2 |
| 3 | >25 | 3 |

3.5.7. Annual Farm Income

Refers to the earnings of respondent from the farm per annum

This was obtained by adding income earned by the respondent from land and crops for one year. The variable was measured by directly asking to the respondents.

3.5.8. Economic Motivation

Economic motivation is referred as the extent to which respondent was oriented towards profit maximization and relative value he/she places on monetary gain.

It was measured by using a scale developed by Supe (1969) and the scale consist of 6 statements, fifth and sixth were negative. Each statement is provided with five point continuum from strongly agree (5) to strongly disagree (1) with

scores 5,4,3,2 and 1 for positive statements and 1,2,3,4 and 5 for negative statements. The score ranges from 5-30.

| Statements | SA (5) | A (4) | UD (3) | DA (2) | SDA (1) |
|--|-----------|----------|-----------|-----------|------------|
| A farmer should work towards larger yields and economic returns | | | | | |
| The most successful farmer is the one who makes the most profit | | | | | |
| A farmer should try any new farming idea which may earn him more income | | | | | |
| A farmer should grow cash crops to increased monetary profit in comparison to growing of food crops for home consumption | | | | | |
| It is difficult for the farmers children to make a good start unless he provides them with economic assistance | | | | | |
| A farmer must earn his living, but the most important thing in life cannot be defined in economic terms | | | | | |

3.5.9. Credit Orientation

Refers to the orientation to avail and utilize credit by the respondent for commercial vegetable cultivation.

In this study the procedure developed by Beal and Sibley (1967) was used

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

Yes (2) /no (1)

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

Very difficult (1) /difficult (2) /easy (3) /very easy (4)

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

Very badly (1)/ badly (2)/fairly (3)/very fairly (4)

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

SDA (1) /DA (2) /UD (3) /A (4) /SA (5)

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

Yes (2) / no(1)

The total score is obtained by summing up the scores obtained for all the responses. The respondents were categorized into three, namely low, medium, high based on the quartile method.

3.5.10. Extension Agency Contact

Contact with extension agency was operationalized as the degree to which a farmer used to maintain contact with research and extension agency for the purpose of obtaining information and advices. The quantification of the variable is done based on the regularity of contact with extension agents.

The scoring procedure used by Manoj (2000) was followed in the study. The score ranges from 10-30.

| Sl. No: | Category | Regularly (3) | Occasionally (2) | Rarely (1) |
|---------|------------------------|------------------|---------------------|---------------|
| 1 | Agricultural scientist | | | |
| 2 | Agricultural officer | | | |
| 3 | Agriculture assistant | | | |

| | | | | |
|-----|-----------------------------------|--|--|--|
| 4 | Private extension agencies | | | |
| 5. | Block Technology Manager | | | |
| 6. | Assistant director of agriculture | | | |
| 7. | SMS of KVK | | | |
| 8. | Non-Governmental Organizations | | | |
| 9. | VFPCCK | | | |
| 10. | Any others | | | |

3.5.11. Market Orientation

Defined as the degree to which farmers are oriented towards marketing to obtain reasonable gains from selling the produce

In this study the method used by Samantha (1977) was used to measure the variable. A two point continuum scale of agree and disagree with score 2 and 1 was used. The score ranges from 6-12.

| Sl.No | Statements | Response | |
|-------|---|----------|-------|
| | | A(2) | DA(1) |
| 1 | Market is not useful to farmer | | |
| 2 | A farmer can get good price by eliminating the middle man | | |
| 3 | One should sell his produce to the nearest market irrespective of price | | |
| 4 | One should purchase his inputs from shops where his friends or relatives are purchasing | | |
| 5 | One should grow those crops which have more market demand | | |
| 6 | Co-operatives can help a farmer to get better price for his produce | | |

3.5.12. Exposure to Mass Media

Exposure to mass media referred to the extent to which respondent was using the support of mass media for developing his/her knowledge and skills for the improvement of commercial vegetable cultivation

In this study the scale developed by Lakshmi (2000). The score ranged between 9 and 27.

| Items | Regularly (3) | Occasionally(2) | Never (1) |
|-------------------|---------------|-----------------|-----------|
| Television | | | |
| Radio | | | |
| Newspaper | | | |
| Internet | | | |
| Magazine | | | |
| Bulletin | | | |
| Information Kiosk | | | |
| Mobiles | | | |
| Others | | | |

3.5.13. Entrepreneurial Behaviour

It refers to the ability of the respondent to exploit the opportunities and initiate an enterprise of his/her own for income generation.

Entrepreneurial behaviour was measured by using the scale developed by Varma (1996).

The scale consisted of six statements weighted on a two point continuum of agree and disagree with scores 2 and 1. The scoring pattern was reversed for negative statements. The score ranged between 6 and 12.

| SL.no | Statements | Agree (2) | Disagree (1) |
|-------|--|-----------|--------------|
| 1 | I have enough faith in my own ability | | |
| 2 | I am hesitant about starting / running an enterprise | | |
| 3 | The key points of success should not be divulged to other entrepreneur | | |
| 4 | No one keep information on what others are doing. | | |
| 5 | It is only because of my own effort that I have acquired enough knowledge to start an enterprise | | |
| 6 | I will start an enterprise only if somebody prompt me. | | |

3.5.14. Risk Orientation

Risk orientation referred to the degree to which a farmer was oriented towards risk and uncertainty and had courage to face the problems in farming.

In this study the method used by Supe (1969) was used for measuring the variable. Scale consists of 6 statements, of which 2 are negative. The scoring was on a five point continuum ranging from strongly agree (5) to strongly disagree (1) for positive statements and was reversed in the case of negative statements. The sum of the score of each statement is the score of the risk orientation of the respondent. The score ranges from 6-30.

| Sl. No | Statements | SA (5) | A (4) | UD (3) | DA (2) | SDA (1) |
|--------|---|--------|-------|--------|--------|---------|
| 1 | A farmer should grow a large number of crops to avoid greater risks involved in growing one or two crops | | | | | |
| 2 | A farmer should take more chance in making a big profit than to be content with smaller but less risky profit | | | | | |
| 3 | A farmer who is willing to take greater risk than the average farmer usually does better financially | | | | | |
| 4 | It is good for a farmer to take risk when he knows his chance of success is fairly high | | | | | |
| 5 | It is better for a farmer not to follow commercial vegetable cultivation unless most others in the locality have used it with success | | | | | |
| 6 | Trying an innovative farming technique is beneficial even though an element of failure is involved in it. | | | | | |

3.5.15. Trainings Undergone for Vegetable Cultivation

Training undergone was operationalized as the total number of trainings undergone by the respondents in commercial vegetable cultivation during the last three years. The variable was measured by directly asking to the respondents.

3.5.16. Incentives Received for Vegetable Cultivation

Incentives received for commercial vegetable cultivation was defined as the number of incentives received by the farmer from government and other agencies for promoting commercial vegetable cultivation. The variable was measured by directly asking to the respondents.

3.6. CONSTRAINTS FACED IN COMMERCIAL VEGETABLE CULTIVATION

A pretested list of constraints was developed after conducting pilot survey. Using this pretested list of constraints the constraints were measured by directly asking to the respondents. Frequency of each constraint reported by respondents were noted.

| Sl.No | Constraints | Frequency |
|-------|---|-----------|
| 1 | High cost of cultivation | |
| 2 | Labour scarcity | |
| 3 | Non availability of good quality seeds | |
| 4 | Non availability of inputs in time | |
| 5 | Lack of awareness and knowledge about high yielding varieties | |
| 6 | Lack of awareness and knowledge about improved practices | |
| 7 | Inadequate extension support | |
| 8 | High labour charges | |
| 9 | Inadequacy of capital | |
| 10 | High transportation cost | |
| 11 | Lack of marketing facilities | |
| 12 | High perishability | |
| 13 | Lack of storage facilities | |
| 14 | Price fluctuation | |
| 15 | Prevalence of pest and diseases | |
| 16 | Inadequate facilities for value addition | |
| 17 | Non assurance of premium price for organic products | |
| 18 | Others | |

3.7. METHODS USED FOR DATA COLLECTION

Personnel interview method was employed for collecting data from the farmer respondents. The draft of the interview schedule was pre-tested in a pilot study conducted in a non-sample area and suitable modifications were made accordingly. On the basis of these modifications the final interview schedule was prepared (Appendix III). The respondents were interviewed individually in the local language.

3.8. STATISTICAL TOOL USED

The data collected from the respondents were scored, tabulated and analysed using suitable statistical methods.

3.8.1. *Mean*

The respondents were grouped into categories based on mean values of independent variables. After grouping the categories percentage analysis was worked out.

3.8.2. *Percentage analysis*

Percentage analysis was used in descriptive analysis for making simple comparisons. For calculating the percentage the frequency of the particular cell was multiplied by hundred and divided by the total number of respondents.

3.8.3. *Quartile deviation*

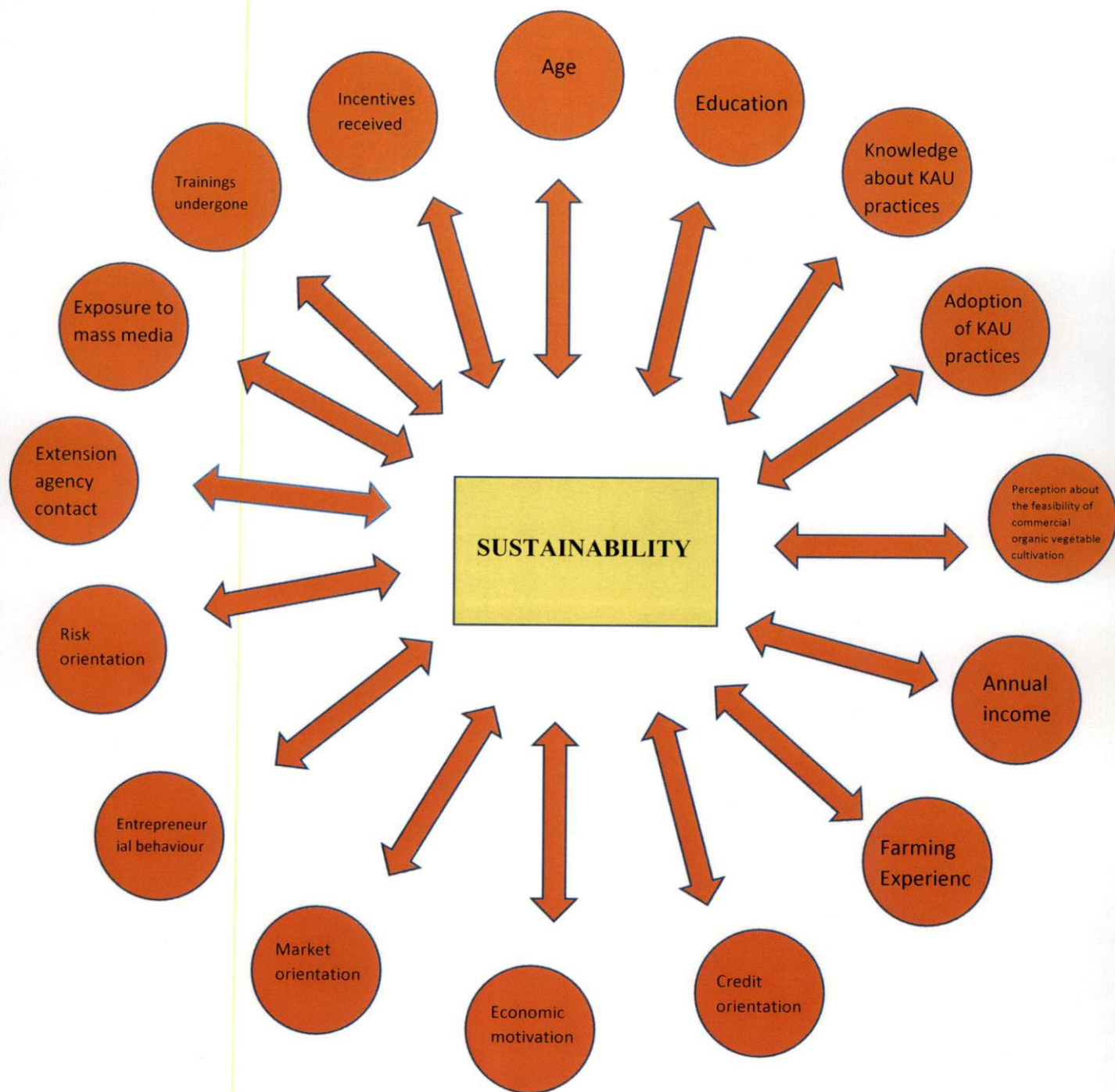
Quartile deviation was used to categorize the respondents based on the lower quartile Q_1 and upper quartile Q_3 . It is a measure of dispersion. Quartile deviation uses the difference of first and third quartile as a measure of dispersion. For a normally distributed data, the first quartile is equal to the 25th percentile of data and third quartile equals to the 75th percentile of data. The observations obtained below Q_1 are taken to be low category and above Q_3 are taken to be higher category. The observations obtained in between first quartile Q_1 and third quartile Q_3 are taken as medium category.

3.8.4. ANOVA

ANOVA (Analysis of Variance) was done to compare the sustainability of the four Panchayat and knowledge about KAU practices in amaranthus, cowpea and bitter gourd.

3.8.5. Correlation analysis

Simple correlation analysis was done to find the degree of relationship between the dependent variables and independent variables.



CONCEPTUAL FRAMEWORK OF THE STUDY

Figure 3. Conceptual framework of the study

Results & Discussion

4. RESULT AND DISCUSSION

This chapter deals with the result and discussion based on the analysis of the data obtained after conducting the survey research. The data obtained were classified, tabulated, and treated with statistical methods to get the results. The result and discussions are presented in the following heading.

- 4.1. Sustainability of commercial vegetable cultivation in Thiruvananthapuram district
- 4.2. Commercial vegetable cultivators scale of knowledge and rate of adoption of KAU practices in selected vegetables.
- 4.3. Perception about the feasibility of commercial organic vegetable cultivation.
- 4.4. Distribution of respondents according to their profile characteristics
- 4.5. Relationship of sustainability of commercial vegetable cultivation with profile characteristics of the respondents.
- 4.6. Constraints faced in commercial vegetable cultivation
- 4.7. Suggestions for overcoming the constraints as perceived by farmers.

4.1. SUSTAINABILITY OF COMMERCIAL VEGETABLE CULTIVATION IN THIRUVANANTHAPURAM DISTRICT

Sustainability is operationally defined as the ability of commercial vegetable growers to profitably maintain vegetable production over time. In the present study we had analysed the five dimensions of sustainability. The five dimensions were economic dimension, socio psychological dimension, environmental dimension, technological dimension and temporal dimension. Economic dimension covers the optimum level of production with continuous stable per capita income and efficiency in the eco-friendly use of resources and assured market for the economic wellbeing of commercial vegetable growers. Socio – psychological dimension explores the area of social processes and structures which help in meeting socio- psychological needs of the farmer which influence the enhanced continuation of commercial vegetable cultivation. Environmental dimension examines the perception of the farmers about the relevance and importance of environmental conservation and protection during commercial cultivation of vegetables. Technological dimension covers the importance perceived by the farmer about the adoption of new technologies and temporal dimension covers the availability of supplies and services for commercial vegetable cultivation at the right time and the rapidity of returns from commercial vegetable cultivation.

For each dimension separate sustainability index namely economic dimension index, socio psychological dimension index, environmental dimension index, technological dimension index and temporal dimension index were calculated. Percentage of each dimension to the total sustainability were also analysed.

Table 2. Distribution of respondents according to sustainability indexes to the total sustainability.

(N = 100)

| Category | Dimensions of sustainability to total sustainability (in percentage) | | | | |
|---------------------|---|-------|-------|-------|-------|
| | ED | SD | END | TCD | TPD |
| Low(<Q1) | 16.00 | 9.00 | 27.00 | 24.00 | 24.00 |
| Medium (Q1 – Q3) | 12.00 | 55.00 | 66.00 | 71.00 | 72.00 |
| High(>Q3) | 72.00 | 36.00 | 7.00 | 5.00 | 4.00 |

Q1 = 16.64, Q3 = 22.90

From table 2, it was clear that, among these five dimension of sustainability, economic dimension (ED) of sustainability contributed seventy two per cent of the total sustainability followed by socio – psychological dimension (SD) (36%), environmental dimension (END) (7%), technological dimension (TCD) (5 %) and temporal dimension (TPD) (4%).

The result depicts that majority(72%) of the respondents had high rate of economic sustainability, which point towards the economic well-being of the commercial vegetable growers with the optimum level of production, efficient and eco -friendly use of resources, assured market and stable per capita income. The result also shows that, a commercial vegetable farmer become sustainable only if he had higher level of economic sustainability. Thirty six per cent of the respondents belonged to the high category with respect to socio – psychological dimension which indicates that the commercial vegetable growers gives importance to the recognition, prestige and status he get from the society. More over the social satisfaction from commercial vegetable cultivation ensures his continuation in commercial vegetable cultivation.

Table 3. Distribution of respondents according to the total sustainability.

(N = 100)

| Category | Frequency | Percentage |
|------------------------|-----------|------------|
| Low ($<Q_1$) | 22 | 22.00 |
| Medium ($Q_1 - Q_3$) | 55 | 55.00 |
| High ($>Q_3$) | 23 | 23.00 |

$$Q_1 = 13.20, Q_3 = 15.47$$

Expected score range = 9 -18, Data score range = 10.66 - 17.28

Table 3 indicates that more than half (55%) of the respondents belonged to medium category in respect to sustainability of commercial vegetable cultivation, whereas it was 23 per cent in high category and 22 per cent in low category. The result depicts that majority of the commercial vegetable cultivators of Thiruvananthapuram district had medium level of sustainability which was due to the higher economic stability, social satisfaction they get from being a commercial vegetable grower.

Table 4. Comparison of four Panchayats with respect to sustainability

| Sl no. | Groups | Average | F | F crit | Inference |
|--------|-----------|---------|------|--------|-----------|
| 1 | Pallichal | 52.32 | 0.39 | 2.69 | NS |
| 2 | Kalliyoor | 51.84 | | | |
| 3 | Kottukal | 52.84 | | | |
| 4 | Venganoor | 50.88 | | | |

When comparing the four Panchayat in terms of sustainability, the result shows that the F value of ANOVA table was 0.39 which is less than F critical

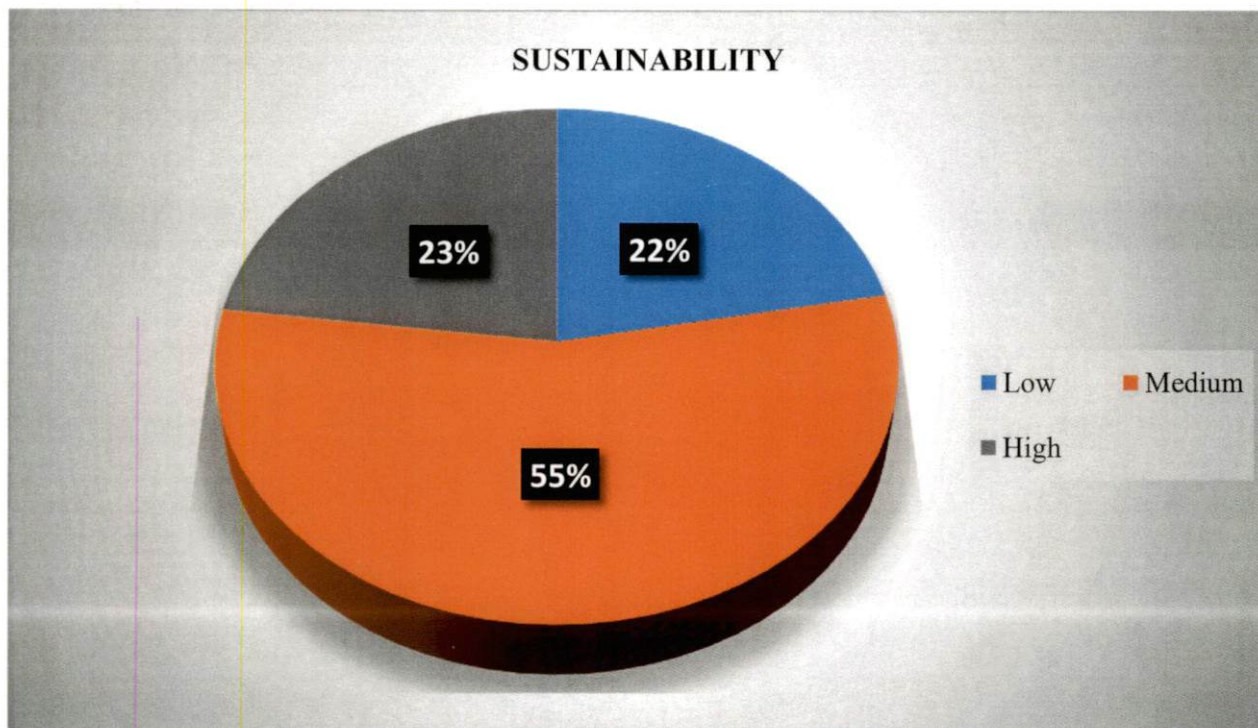


Figure 3. Distribution of respondents based on sustainability

value (2.69), hence there was no significant difference in relation to sustainability of commercial vegetable cultivation in these four Panchayats. This result indicate that, the respondents from the four Panchayat had similar level of economic stability with optimum level of production, stable per capita income, and assured market. Along with that they also possess similar recognition and status from the society as a commercial vegetable grower.

Similar result was reported by Anilkumar *et al.*, (2014). He reported that economic sustainability, environmental sustainability and social sustainability were the criteria and indicators of sustainability

4.2. COMMERCIAL VEGETABLE CULTIVATORS SCALE OF KNOWLEDGE AND RATE OF ADOPTION OF KAU PRACTICES IN SELECTED VEGETABLES.

4.2.1. Commercial Vegetable Cultivators Scale of Knowledge about KAU Practices in Selected Vegetables.

The vegetables selected for the study were amaranthus, cowpea and bitter gourd based on the maximum area under cultivation in Thiruvananthapuram district. The knowledge of respondents about selected KAU practices in amaranthus, cowpea and bitter gourd were categorized into high, medium and low based on the knowledge index and quartile deviation. The selected KAU practices include the knowledge about varieties, recommended cultivation practices and pest and disease management. Separate knowledge index was calculated for each crop and was enlisted in the following tables. Respondents were categorized into high and low category according to their total knowledge by using knowledge index and mean.

Table 5. Distribution of respondents based on knowledge about KAU practices in Amaranthus.

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low (<Q1) | 4 | 16.00 | 3 | 12.00 | 3 | 12.00 | 3 | 12.00 | 13.00 |
| Medium (Q1 – Q3) | 16 | 64.00 | 17 | 68.00 | 16 | 64.00 | 15 | 60.00 | 64.00 |
| High(>Q3) | 5 | 20.00 | 5 | 20.00 | 6 | 24.00 | 7 | 28.00 | 23.00 |

Q1 = 4, Q3 = 7

Expected score range = 0-10, data score range = 2 -10

Table 6. Distribution of respondents based on knowledge about KAU practices in cowpea.

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low (<Q1) | 3 | 12.00 | 2 | 8.00 | 4 | 16.00 | 4 | 16.00 | 13 |
| Medium (Q1 – Q3) | 17 | 68.00 | 18 | 72.00 | 15 | 60.00 | 17 | 68.00 | 67 |
| High(>Q3) | 5 | 20.00 | 5 | 20.00 | 6 | 24.00 | 4 | 16.00 | 20 |

Q1 = 4, Q3 = 7

Expected score range = 0-10, data score range = 2 -10

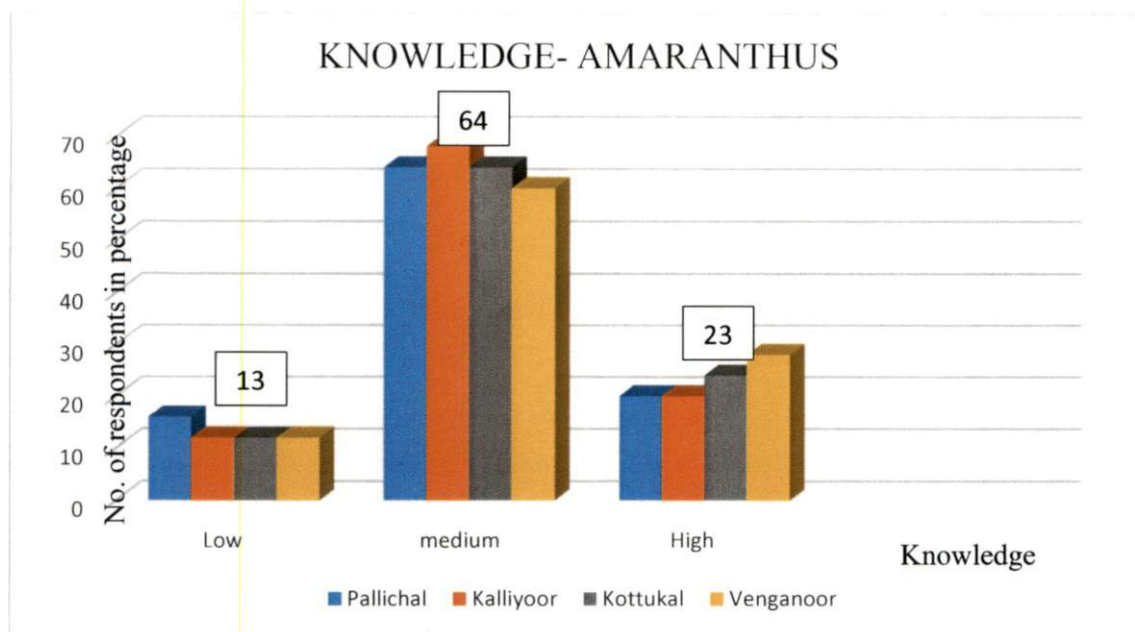


Figure 4. Distribution of respondents according to knowledge about KAU practices in Amaranthus.

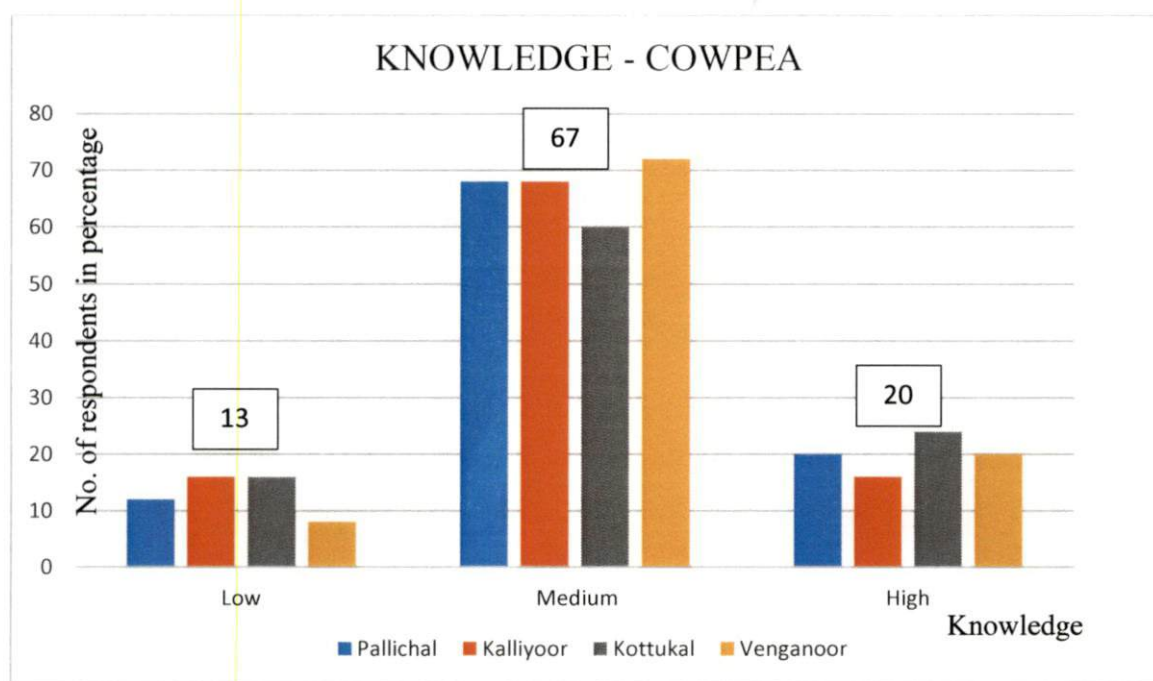


Figure 5. Distribution of respondents according to knowledge about KAU practices in Cowpea.

Table 7. Distribution of respondents based on knowledge about KAU practices in bitter gourd.

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|---------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low (<Q1) | 3 | 12.00 | 3 | 12.00 | 3 | 12.00 | 4 | 16.00 | 13.00 |
| Medium (Q1 – Q3) | 15 | 60.00 | 18 | 72.00 | 16 | 64.00 | 17 | 72.00 | 66.00 |
| High(>Q3) | 7 | 28.00 | 4 | 16.00 | 6 | 24.00 | 4 | 16.00 | 21.00 |

Q1 = 4, Q3 = 7

Expected score range = 0-10, data score range = 2 -10

In the present study, knowledge about KAU practices of amaranthus was operationally defined as the quantum of technical know - how possessed by the respondent about KAU practices on commercial vegetable cultivation of amaranthus, cowpea and bitter gourd.

Table 5, evidences that more than half (64 %) of the respondents had medium knowledge about KAU practices in amaranthus whereas it was 23 per cent in high category and 13 per cent in low category. In the case of Kalliyoor Panchayat , sixty eight per cent of the respondents had medium knowledge about KAU practices where as it is sixty four per cent in Pallichal and Kottukal Panchayat and sixty per cent in Venganoor Panchayat.

In the case of cowpea, 67 percent of the respondents possess medium level of knowledge regarding KAU practices, whereas it was 20 percent in high knowledge category and 13 percent in low knowledge category. More than ninety percent of respondents from Kalliyoor Panchayat had medium level to high knowledge regarding KAU practices in cowpea.

In the case of bitter gourd 66 per cent of the respondents had medium level of knowledge regarding KAU practices. Twenty one per cent of the respondents belonged to high knowledge category where as it was only 13 per cent in the low knowledge category. The result indicates that the respondents from the Kalliyoor Panchayat possess almost on par level of knowledge regarding KAU practices of bitter gourd as in the case of amaranthus and cowpea.

This result directs to the conclusion that the medium to higher knowledge of commercial vegetable growers in the Kalliyoor Panchayat may be due to the fairly good level of support and services from College of Agriculture, Vellayani and from Kalliyoor Krishi Bhavan.

Similar result in amaranthus and cowpea was reported by Anju (2016) and by Noobiya (2016) in bitter gourd

Table 8. Distribution of respondents based on total knowledge regarding KAU practices of amaranthus, cowpea and bitter gourd.

(N = 100)

| Category | Frequency | Percentage |
|------------------------|-----------|------------|
| Low (M -SD) | 11 | 11.00 |
| Medium (M+SD) – (M-SD) | 68 | 68.00 |
| High (M+SD) | 21 | 21.00 |

Mean = 58.7 , Standard Deviation = 17.20

Expected score range = 0-30 , Data score range = 7 - 27

Table 8, point out that 21 per cent of the respondents had high rate of knowledge regarding the KAU practices in amaranthus, cowpea and bitter gourd, whereas 68 per cent of the respondents belonged to medium category and 11 percent belonged to the low knowledge category.

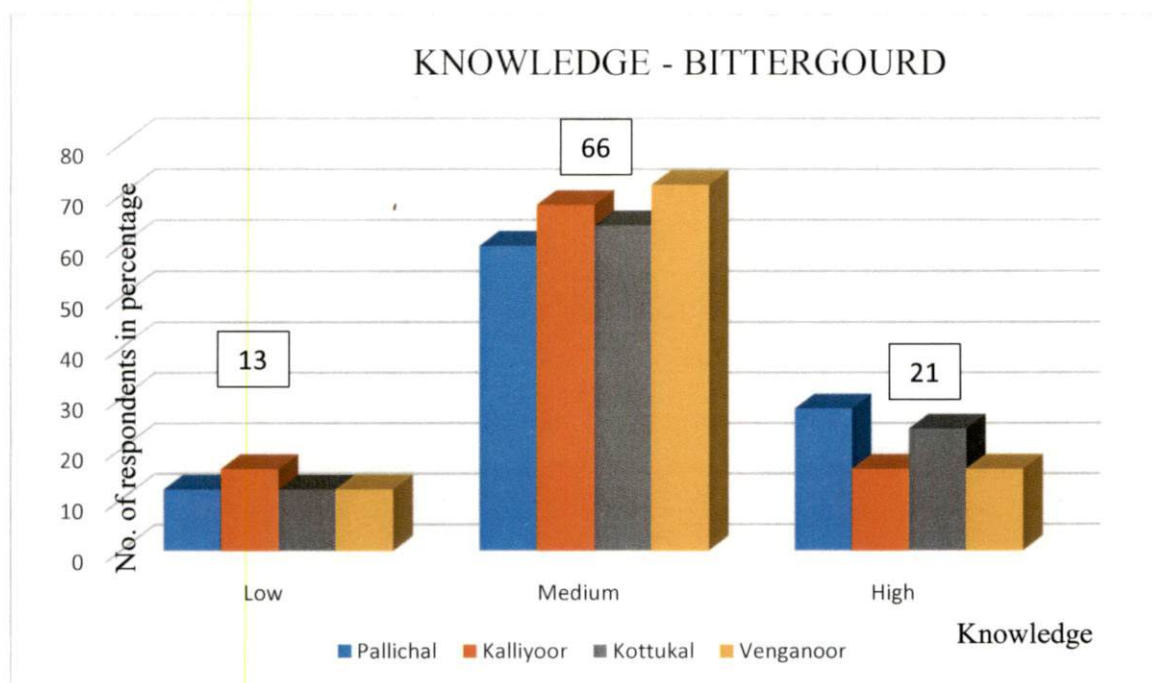


Figure 6. Distribution of respondents according to knowledge about KAU practices in Bitter gourd.

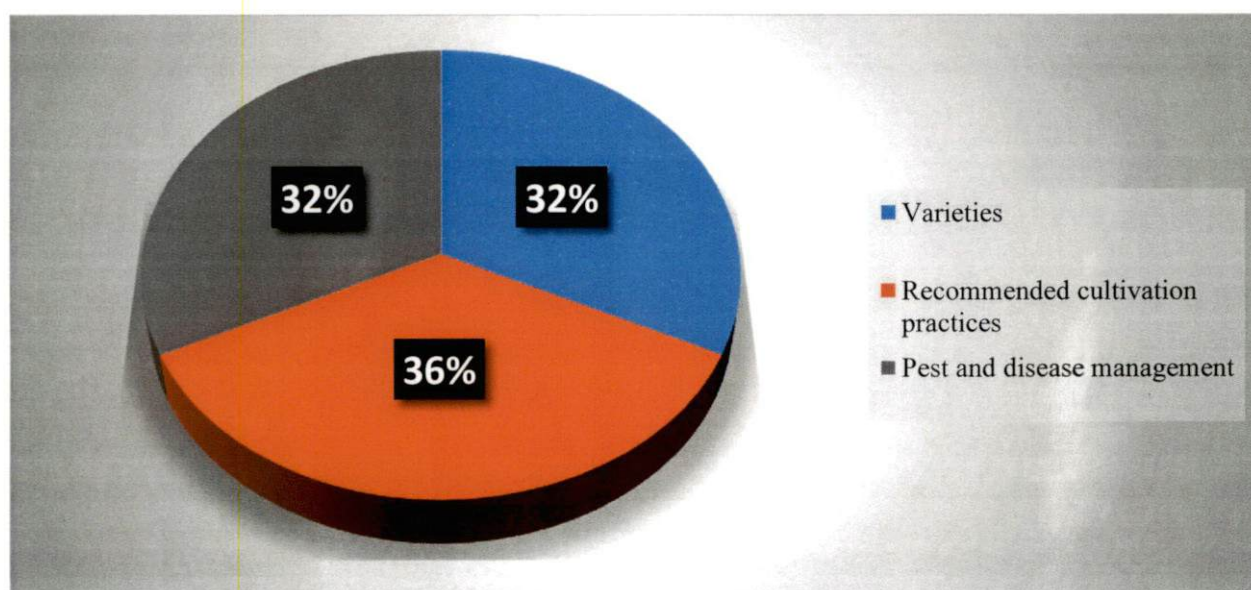


Figure 7. Distribution of respondents based on knowledge about KAU practices.

Table 9. Comparison of respondent's knowledge about the selected practices in amaranthus, cowpea and bitter gourd.

(N = 100)

| Sl. No | Groups | Average | F | F crit | Inference |
|--------|--------------|---------|------|--------|-----------|
| 1 | Amaranthus | 6.02 | 0.43 | 3.02 | NS |
| 2 | Cowpea | 6.20 | | | |
| 3 | Bitter gourd | 5.95 | | | |

When we compare the knowledge about KAU practices in these three vegetables, it was clear that the F value of ANOVA table was less than F critical value, hence there is no significant difference between the knowledge about KAU practices in these three vegetables.

This result indicates that the respondents from all the four Panchayat possess similar level of knowledge regarding KAU practices of amaranthus, cowpea and bitter gourd, which indicates that the farmers give equal importance to all the three vegetables and so efforts are taken to update their knowledge in all these three crops. This may be due to the fairly good extension contact from Krishi Bhavan, VFPC (Vegetable and Fruit Promotion Council of Kerala) and from College of Agriculture, Vellayani. This result also signifies the higher level of education of the respondent, their exposure to various mass media regarding commercial vegetable cultivation and the trainings and incentives they received for commercial vegetable cultivation.

Similar result was reported by Anju (2016) and Noobiya (2016).

4.2.2. Rate of Adoption of KAU Practices in Selected Vegetables.

The adoption of KAU practices in amaranthus, cowpea and bitter gourd were ranked based on the adoption score.

Table 10. Ranking of practices based on adoption - Amaranthus

| Sl no | Vegetable practices - Amaranthus | Adoption score | Rank |
|-------|--|----------------|------|
| 1 | Seed rate is 1.5 – 2.0 Kg/ ha | 280 | 1 |
| 2 | Avoid sowing of red leaved varieties during period of heavy rain | 273 | 2 |
| 3 | Varieties : Red – Kannara local, Arun, Krishnasree Green – Co1, Co2, Co3, Mohini and Renusree | 250 | 3 |
| 4 | Transplanting of 20-30 day old seedlings in shallow trenches | 239 | 4 |
| 5 | Spraying of , 0.1% of Malathion during severe cases of leaf webber incidence | 230 | 5 |
| 6 | Avoid use of insecticide or fungicide if maximum possible | 225 | 6 |
| 7 | Top dressing of 50 Kg of N fertilizer at regular interval | 223 | 7 |
| 8 | NPK : 50:50:50 Kg/ ha | 211 | 8 |
| 9 | 50 tonnes of FYM per ha as basal dose | 191 | 9 |
| 10 | Spraying 1% urea immediately after each harvest for increasing yield | 190 | 10 |

Table 11. Ranking of practices based on adoption – Cowpea

| Sl no | Vegetable practices – vegetable cowpea | Adoption score | Rank |
|-------|---|----------------|------|
| 1 | Varieties : Bushy- Bhagyalakshmi, Pusa Barsathi, Pusa Komal Semi trailing - Kairali, varun, Anaswara, Kanakamony, Arka Garima Trailing type – Sharika , Malika, KMV-1, Lola, Vyjayanthi, Manjeri Local , Vylathur Local, Kurutholapayar, Vellayani Jyothika | 275 | 1 |
| 2 | Seed rate is 20-25Kg/ ha for bush cowpea 4-5 Kg/ha for trailing cowpea | 272 | 2 |
| 3 | Spacing is 25× 15 cm for dibbling two seeds per hole 30× 15 cm for bush and 2 × 2 m for trailing on pandal@ 3 plants/ pit | 268 | 3 |

| | | | |
|----|---|-----|----|
| 4 | Irrigation at critical periods- 15 days after sowing and at the time of flowering | 259 | 4 |
| 5 | Application of 250 Kg/ ha Lime at the time of first ploughing | 251 | 5 |
| 6 | Seed inoculation with Rhizobium and pelleting with lime | 236 | 6 |
| 7 | NPK : 20:30:10 Kg/ha | 221 | 7 |
| 8 | Half quantity of N, full P and K applied at the time of final ploughing | 208 | 8 |
| 9 | Soil drenching with 1% Bordeaux mixture to prevent fungal diseases | 191 | 9 |
| 10 | Soaking seeds in thiourea (500ppm) solution , followed by two sprays(vegetative stage and flowering stage) | 185 | 10 |

Table 12. Ranking of practices based on adoption – Bitter gourd

| Sl no | Vegetable practices – Bitter gourd | Adoption score | Rank |
|-------|--|----------------|------|
| 1 | Seed rate is 5-6 Kg/ ha | 285 | 1 |
| 2 | Weeding and raking at the time of fertilizer application | 276 | 2 |
| 3 | Varieties are Preethi, Priyanka, Priya and Arka Harit | 271 | 3 |
| 4 | Spacing is 2× 2 m | 240 | 4 |
| 5 | Irrigation at 3- 4 days interval and alternate days during flowering/ fruiting | 235 | 5 |
| 6 | Retain 3 plants/ pit | 234 | 6 |
| 7 | Spraying 0.2% Mancozeb against Downey mildew | 220 | 7 |
| 8 | Top dressing of N fertilizer in split doses at fortnightly interval | 212 | 8 |
| 9 | Vector control of Mosaic by spraying Dimethoate 0.05% | 204 | 9 |
| 10 | Carbaryl 10% DP in pit before sowing | 193 | 10 |

In the case of amaranthus, majority of the respondents ranked seed rate as the major practice they adopted followed by avoidance of sowing red leaved varieties during heavy rainy seasons and adoption of varieties. The least adopted practices were recommended NPK application, application of FYM as basal dose and spraying of urea after harvest for increasing the yield.

In the case of cowpea majority of them adopted varieties followed by seed rate and spacing. The least adopted practices were NPK application, soil drenching of Bordeaux mixture and soaking of seeds in thiourea.

In the case of bitter gourd majority of the respondents adopted seed rate followed by weeding and raking at the time of fertilizer application and varieties. Top dressing of N fertilizer in split doses, mosaic vector control by Dimethoate, and application of Carbaryl in pit before sowing.

These results point towards the need of taking necessary extension interventions focusing on the least adopted practices of amaranthus, cowpea and bitter gourd. The adoption of varieties and recommended seed rate of the three crops were found to be almost similar showing the popularity of this practices among commercial vegetable growers.

Similar results was found by Anju (2016) in the case of amaranthus and cowpea and by Noobiya (2016) in bitter gourd.

4.2.2.1. Rate of Adoption of KAU Practices in Selected Vegetables

Table 13. Distribution of respondents according to rate of adoption of KAU practices in selected vegetables.

(N = 100)

| Category | Frequency | Percentage |
|---------------------|-----------|------------|
| Low(Q1) | 19 | 19.00 |
| Medium (Q1 – Q3) | 54 | 54.00 |
| High(>Q3) | 27 | 27.00 |

$$Q_1 = 77.78, Q_3 = 87.78$$

Expected score range = 33.33 – 100, Data score range = 63.33 – 91.11

In the case of adoption of KAU practices in amaranthus, cowpea and bitter gourd fifty four per cent of the respondents belonged to medium category whereas only twenty seven per cent had high rate of adoption.

The medium to high rate of adoption of KAU practices in amaranthus, cowpea and bitter gourd indicates the higher rate of knowledge of respondents regarding commercial vegetable cultivation as well fairly good extension contact and exposure to various mass medias in relation to commercial vegetable cultivation.

4.2.2.2. Adoption Categorization of Respondents According to the Adoption of KAU Practices in Amaranthus, Cowpea and Bitter gourd.

The commercial vegetable growers were categorized into different adopter categories as explained by Rogers (1982). The five adopter categories include innovators, early adopters, early majority, late majority and laggards.

Table 14. Distribution of respondents according to adopter categorization

| Category | Standard Rogers curve | No. | % |
|----------------|-----------------------|-----|--------|
| Innovator | 2.5 | 5 | 5.00 |
| Early adopters | 13.5 | 26 | 26.00 |
| Early majority | 34 | 46 | 46.00 |
| Late majority | 34 | 16 | 16.00 |
| Laggards | 16 | 7 | 7.00 |
| Total | | 100 | 100.00 |

Table 14 enumerated that the percentage of innovators is five which is double the standard Rogers curve. Majority of the respondents fall into the

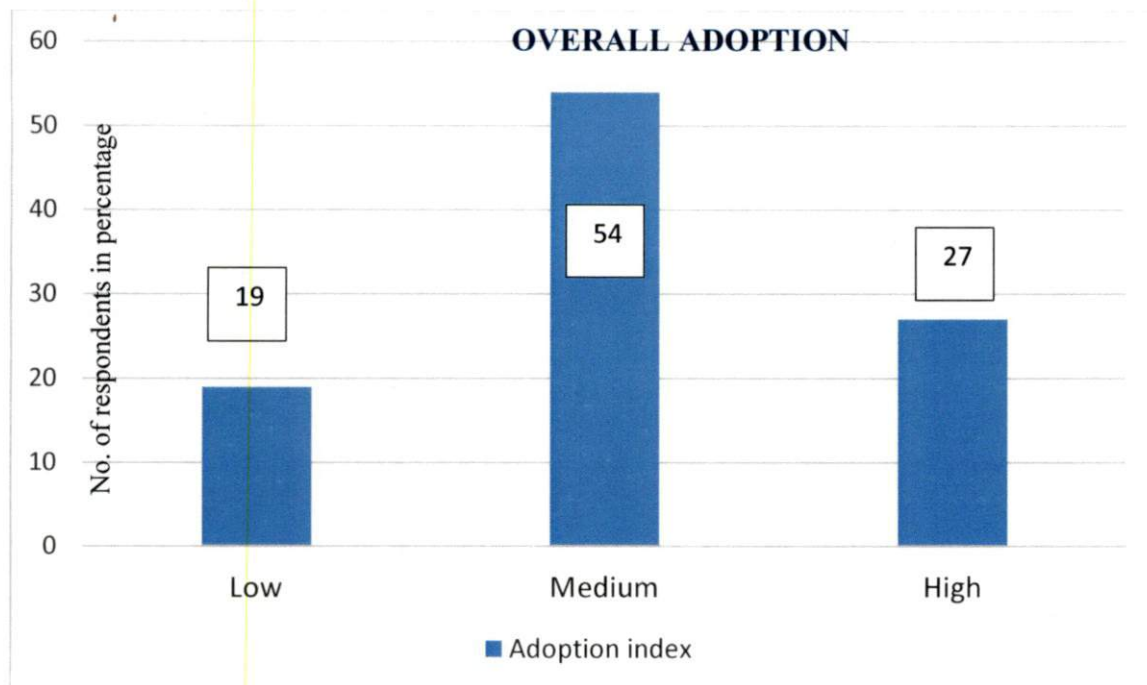


Figure 8. Distribution of respondents according overall adoption.

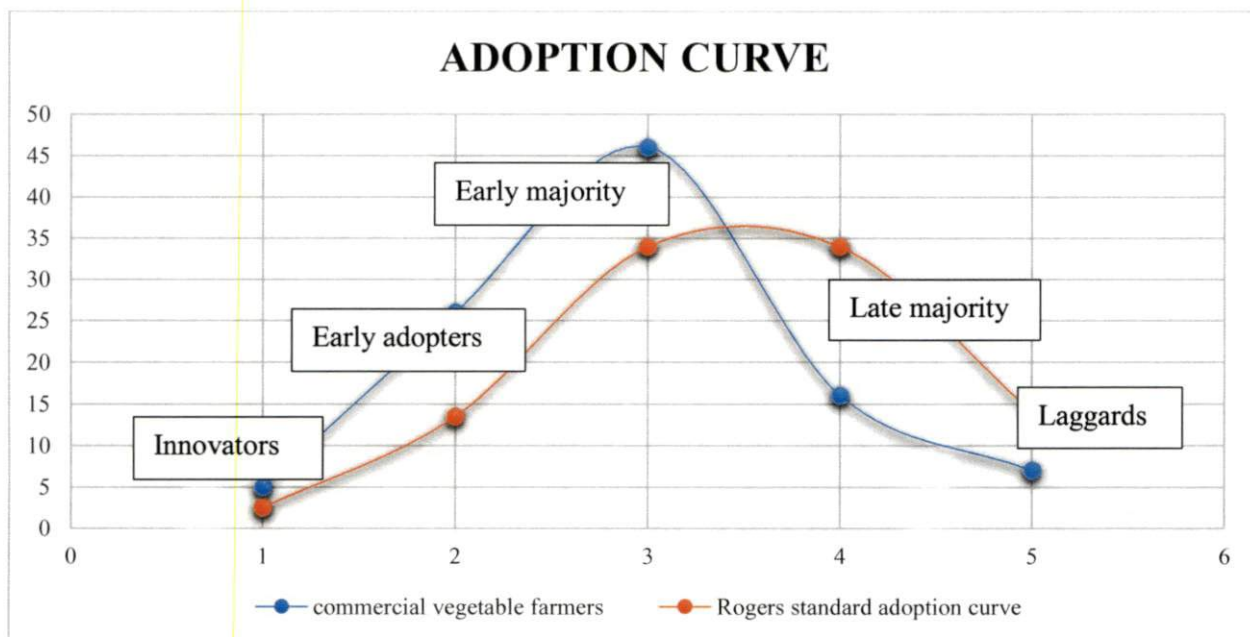


Figure 9. Adopter categorization of commercial vegetable cultivators

category of early majority. Only seven per cent of the respondents fall into the category of laggards where as it was 16 per cent in the case of standard Rogers curve. Higher per cent of respondents in the innovators, early adopters and early majority category is a strong indication of adoption of improved practices of KAU in amaranthus, cowpea and bitter gourd.

Similar result was reported by Kamalakkannan (2003) and Noobiya (2016).

4.3. PERCEPTION ABOUT THE FEASIBILITY OF COMMERCIAL ORGANIC VEGETABLE CULTIVATION

Table 15. Distribution of respondents based on the perception about the feasibility of commercial organic vegetable cultivation.

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|--------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low (<Q1) | 6 | 24.00 | 5 | 20.00 | 5 | 20.00 | 7 | 28.00 | 23.00 |
| Medium (Q1 –Q3) | 13 | 52.00 | 17 | 67.00 | 16 | 64.00 | 12 | 48.00 | 58.00 |
| High(Q3) | 6 | 24.00 | 3 | 12.00 | 4 | 16.00 | 6 | 24.00 | 19.00 |

$Q_1 = 16, Q_3 = 26$

Expected score range = 8 – 40, Data score range = 10-36

In the case of perception about the feasibility of commercial organic vegetable cultivation 58 per cent of the respondents belonged to medium category whereas only 19 per cent of the respondents had higher level of perception about the feasibility of commercial organic vegetable cultivation.

Perception about the feasibility of commercial organic vegetable cultivation was operationally defined as the farmer's opinion towards the feasibility of commercial organic vegetable cultivation

Only 19 % of the total respondents shows high perception about commercial organic vegetable cultivation. This trend was mainly due to the non-assurance of premium price for the organic products. Organic products are lagging behind the chemically treated vegetables in their shape and appearance which reduces their marketability. Hence majority of the farmers are not interested to cultivate vegetables completely organic even though they know the nutritional and health benefits of organically produced vegetables. Moreover most of the organic practices available are not scalable for commercial cultivation of vegetables which again has influenced the perception of commercial vegetable growers towards organic cultivation.

There are various schemes and programmes for promoting the organic vegetable cultivation from Government as well as from various private agencies. But the diffusion of organic cultivation practices, crop protection measures etc. among the farmers are not up to mark. The cost of cultivation of organic vegetables is comparatively higher than the conventional methods, which holds back the farmers from organic vegetable cultivation. These results are a reflection of the importance of economic dimension of sustainability. The licensing of farm as organic is also another major problem in organic cultivation. Hence there is a need for improved extension delivery system for popularizing various organic cultivation practices, pest and disease management and marketing of organic products. Government should take initiative for marketing organic vegetables through various outlets and thus ensure premium price for the organically produced vegetables.

Similar result was reported in the study of Rural Economy Research Centre (RERC) (2008). The study reveals that, under current circumstances, large scale conversion to organic farming was uncertain.

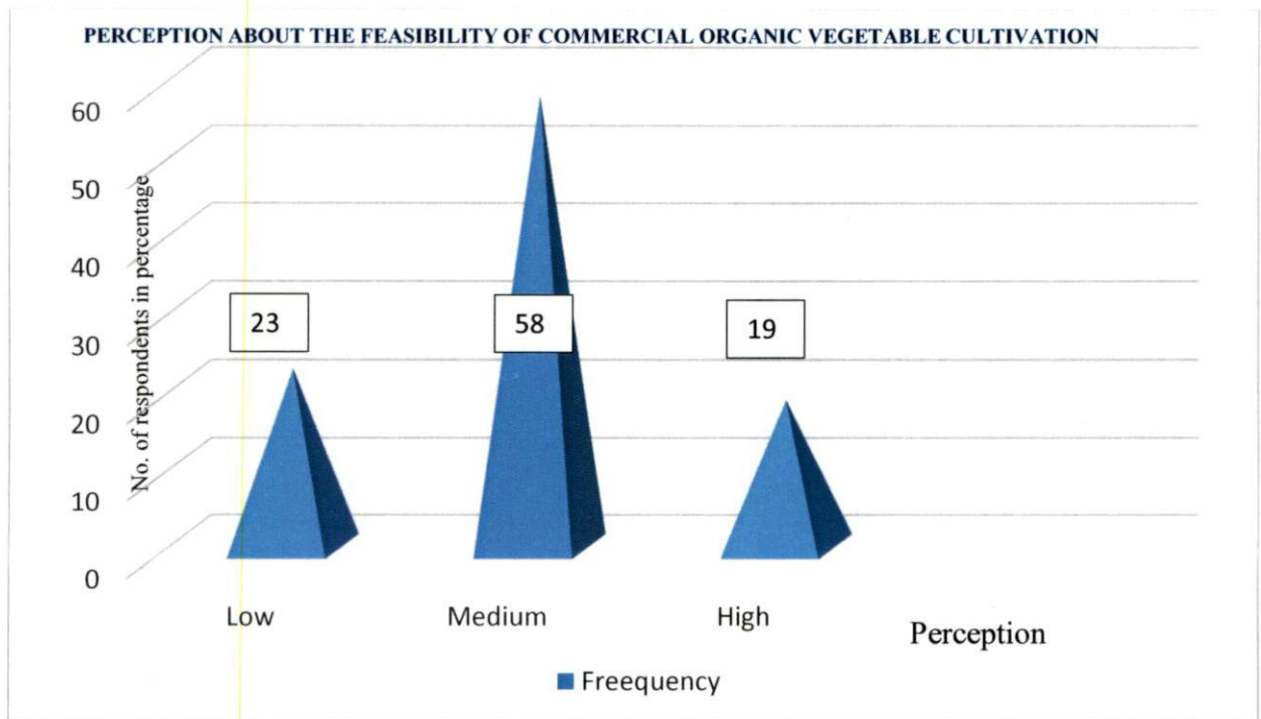


Figure 10. Distribution of respondents based on the perception about the feasibility of commercial organic vegetable cultivation.

4.4. DISTRIBUTION OF RESPONDENTS ACCORDING TO THEIR PROFILE CHARACTERISTICS

The distribution of commercial vegetable growers based on their personal and social characteristics selected through judges rating are presented below.

4.4.1 AGE

Table 16. Distribution of commercial vegetable cultivators according to their age

(N = 100)

| Category (years) | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) | |
|---------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|-------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| <35 | 3 | 12.00 | 3 | 12.00 | 3 | 12.00 | 1 | 4.00 | 10 | 10.00 |
| 35 – 55 | 10 | 40.00 | 12 | 48.00 | 14 | 56.00 | 12 | 48.00 | 48 | 48.00 |
| >55 | 12 | 48.00 | 10 | 40.00 | 8 | 32.00 | 12 | 48.00 | 42 | 42.00 |

Table 16, revealed that 48 percent of the farmers surveyed belonged to middle age category, followed by old age (42%) and young commercial vegetable farmers are only 10 percent.

In the case of Panchayath wise distribution of respondents based on age, 56 per cent of the commercial vegetable growers of Kottukal Panchayat belongs to middle age category, whereas it was 48 per cent in Kalliyoor and Venganoor Panchayat. Only 40 per cent of the respondents belonged to middle age in Pallichal Panchayat. Respondents belonging to young age category were very less in all the Panchayat, with 4 percent in Venganoor Panchayat, and 12 per cent in the remaining three Panchayats. Hence it was concluded that majority of the commercial vegetable farmers belonged to the category of middle age and old age and only less than 15 percent of the respondents were young farmers. Even though

young farmers are venturing more and more into vegetable farming their contribution is not yet predominantly visible.

Agriculture is gamble of many factors. There is no constant return all over the year. This is the main reason for the low percentage of young farmers in agriculture. Youngsters of Kerala are highly educated and thus they prefer white collar jobs which gives constant income and standard of living. Farmers who belonged to middle and old age category is more in agriculture, because majority of them were born and brought up in agricultural background and due to the lack of opportunity to exploit further beyond their villages. As a solution to bring more youngsters in agriculture, an agrarian culture should be inculcated in every child through formal educational programmes and subsequent training programmes for youngsters, fruitful policy refinement and extension and marketing support to encourage younger generation. This findings is in agreement with the findings of Anju(2016) and Noobiya (2016).

4.4.2. Education

Table 17. Distribution of commercial vegetable cultivators according to their education

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) | |
|-------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|-------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Illiterate | 1 | 4.00 | 2 | 8.00 | 1 | 4.00 | 1 | 4.00 | 5 | 5.00 |
| Write and read | 1 | 4.00 | 2 | 8.00 | 3 | 12.00 | 2 | 8.00 | 8 | 8.00 |
| Primary school | 4 | 16.00 | 8 | 32.00 | 9 | 36.00 | 8 | 32.00 | 29 | 29.00 |
| High school | 14 | 56.00 | 10 | 40.00 | 10 | 40.00 | 10 | 40.00 | 44 | 44.00 |
| Higher secondary | 3 | 12.00 | 2 | 8.00 | 1 | 4.00 | 2 | 8.00 | 8 | 8.00 |
| College education | 2 | 8.00 | 1 | 4.00 | 1 | 4.00 | 2 | 8.00 | 6 | 6.00 |

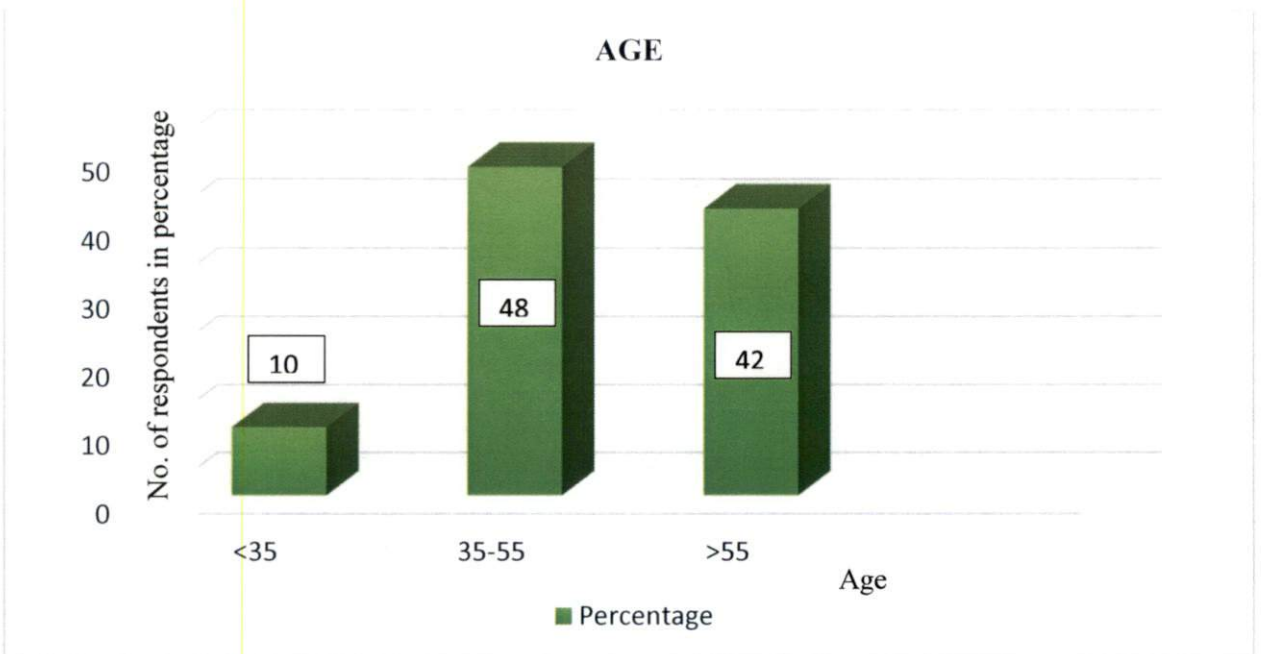


Figure 11. Distribution of respondents according to age

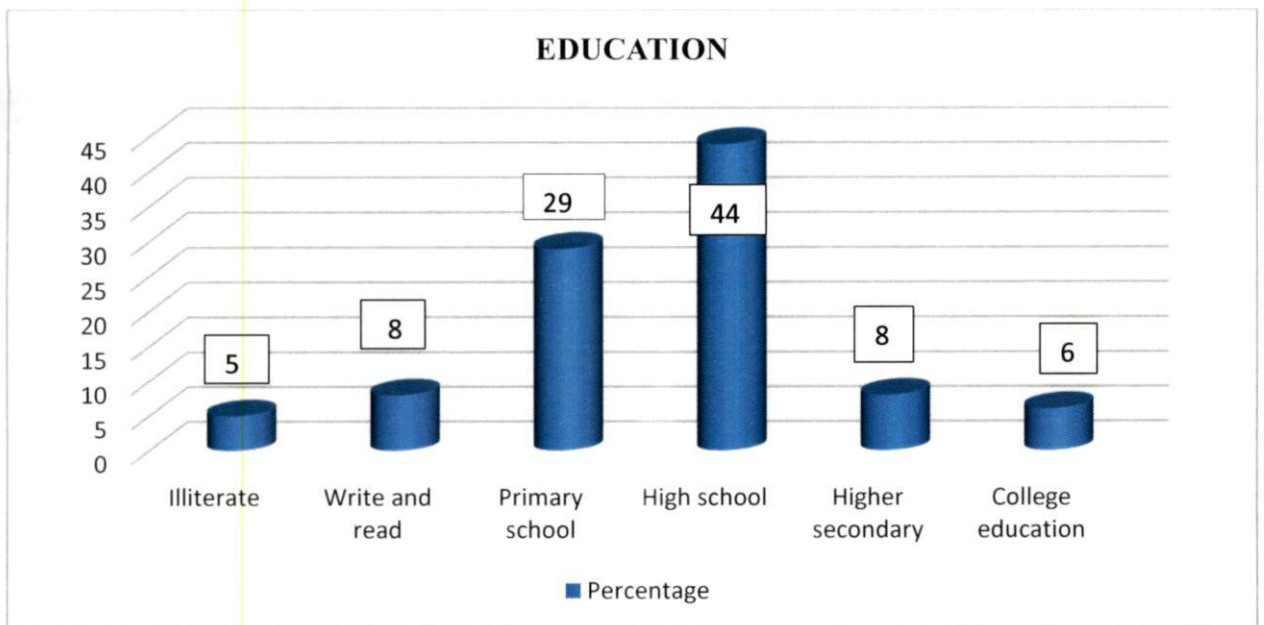


Figure 12. Distribution of respondents according to education.

Data in Table 17 showed that majority (44%) of the respondents had high school education followed by primary school (29%) education. This is logical, because Kerala is a state with high literacy rate. Five percentage of illiteracy was noticed among commercial vegetable farmers. This may be because the proportion of aged farmers was more in the respondent group. Eight per cent of the farmers could read and write which is also very less compared to the rate of educated commercial vegetable farmers. It is worth mentioning that eight per cent and six per cent of the farmers who cultivate vegetable commercially had higher secondary and college level of education. It reflects that commercial vegetable cultivation is much popular among all level of farmers irrespective of their age and education.

This results are in conformity with the conclusion drawn by Jaganathan (2004) and Sujitha (2015).

4.4.3. Annual Income

Table 18. Distribution of respondents according to their annual income

(N=100)

| Annual income | Frequency | Percentage |
|--------------------|-----------|------------|
| Up to 50,000 | 21 | 21.00 |
| 50,001-1,00,000 | 32 | 32.00 |
| 1,00,001 and above | 47 | 47.00 |

The result depicts that majority of the respondents (47%) earn an annual income of more than one lakh whereas twenty one percent of the respondents were earning only income up to fifty thousand.

Annual income refers to the earnings of respondent from the farm per annum.

The result depicts that majority of the respondents were getting an annual income of more than one lakh from commercial vegetable cultivation, which

validates the economic dimension of sustainability of commercial vegetable growers.

This result is in agreement to the result of Boruah et al., (2015). They reported that the income of vegetable growers started from Rs. 50,000, and more number of them had more than 1 lakh income.

4.4.4. Farming Experience

Table 19. Distribution of respondents according to farming experience

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|----------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| 5-10 | 4 | 16.00 | 5 | 20.00 | 6 | 24.00 | 5 | 20.00 | 20.00 |
| 10-25 | 12 | 48.00 | 14 | 56.00 | 13 | 52.00 | 12 | 48.00 | 51.00 |
| >25 | 9 | 36.00 | 6 | 24.00 | 6 | 24.00 | 8 | 32.00 | 29.00 |

Farming experience refers to the number of completed years the respondent had been engaged in commercial vegetable cultivation at the time of enquiry. In this study we had selected those farmers who had at least five years of experience in commercial vegetable cultivation.

Thus the above table reveals that more than fifty percent (51%) of the respondents had 10 – 25 years of experience in vegetable cultivation followed by 29 percent of the respondents had more than twenty five years of experience. The results depicts that majority of the respondents are traditionally vegetable growers and majority of them belonged to middle and old age category and they have rich experience in vegetable cultivation. Along with that it can also inferred that the higher level of economic and social advantage experienced by the farmers through

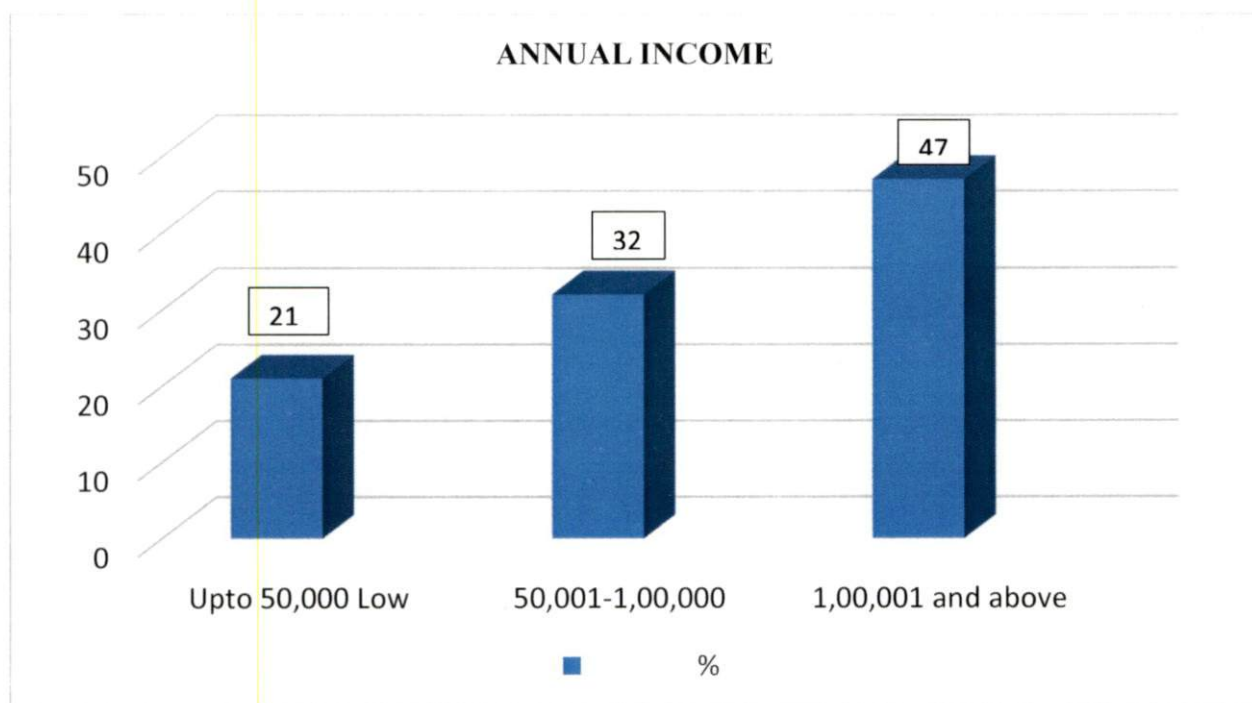


Figure 13. Distribution of respondents according to annual income.

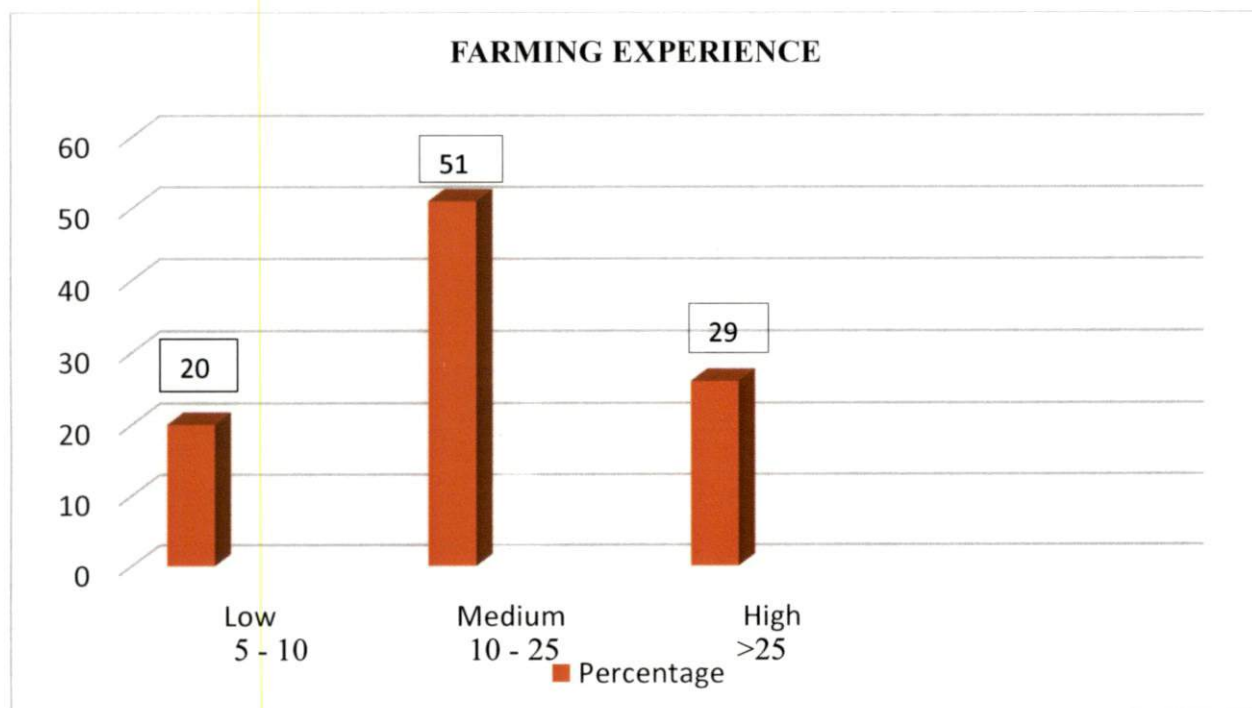


Figure 14. Distribution of respondents according to farming experience.

commercial vegetable cultivation promoted him to stay in commercial vegetable cultivation. Similar result was reported by Jaganathan (2004)

4.4.5. Credit Orientation

Table 20. Distribution of respondents according to credit orientation

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|-------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low(<Q1) | 3 | 12.00 | 3 | 12.00 | 3 | 12.00 | 4 | 16.00 | 13.00 |
| Medium (Q1-Q3) | 18 | 72.00 | 14 | 56.00 | 19 | 76.00 | 18 | 72.00 | 69.00 |
| High (>Q3) | 4 | 16.00 | 8 | 32.00 | 3 | 12.00 | 3 | 12.00 | 18.00 |

Q1 = 9, Q3 = 14

Credit orientation refers to the orientation to avail credit by the respondent for commercial vegetable cultivation.

Table 20 revealed that sixty nine per cent of the commercial vegetable growers shows medium level of credit orientation followed by high level (18 %) of credit orientation. Very little part (13%) of them had low level of credit orientation.

The results are an understanding of increased use of capital through credit borrowing and it is an indication of the easy availability and better treatment of farmers by the financial institutions. This might have influenced their credit orientation.

4.4.6. Economic Motivation

Table 21. Distribution of respondents according to economic motivation

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total |
|---------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|-------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low(<Q1) | 5 | 20.00 | 6 | 24.00 | 7 | 28.00 | 5 | 20.00 | 23.00 |
| Medium (Q1 – Q3) | 12 | 48.00 | 14 | 56.00 | 12 | 48.00 | 14 | 56.00 | 52.00 |
| High(>Q3) | 7 | 28.00 | 6 | 24.00 | 6 | 24.00 | 6 | 24.00 | 25.00 |

Q1 = 16, Q3 = 23

Expected score range = 6-30, Data score range = 10-28

The result depicts that 52 per cent of the respondents had medium level of economic motivation followed by 25 per cent with high economic motivation and 23 per cent with low economic motivation.

Economic motivation was operationally defined as the extent to which respondent is oriented towards profit maximization and relative value he/she places on monetary gain.

Fifty six per cent of the respondents from Kalliyoor and Venganoor Panchayats had medium level of economic motivation, whereas it was 48 per cent in the case of Pallichal and Kottukal Panchayats. The medium to high rate economic motivation of all the four Panchayat are found to be on par. This may be due to the existence of various markets like VFPCCK- market, *Sanghamyithri* and Anayara world market which provide assured market for the produce, and good returns from commercial vegetable cultivation.

The result implies that commercial vegetable growers are oriented towards profit maximization. The higher level of economic motivation prompts the commercial vegetable growers to perform efficiently and effectively for increasing the returns from their commercial farms, which is a desirable trend.

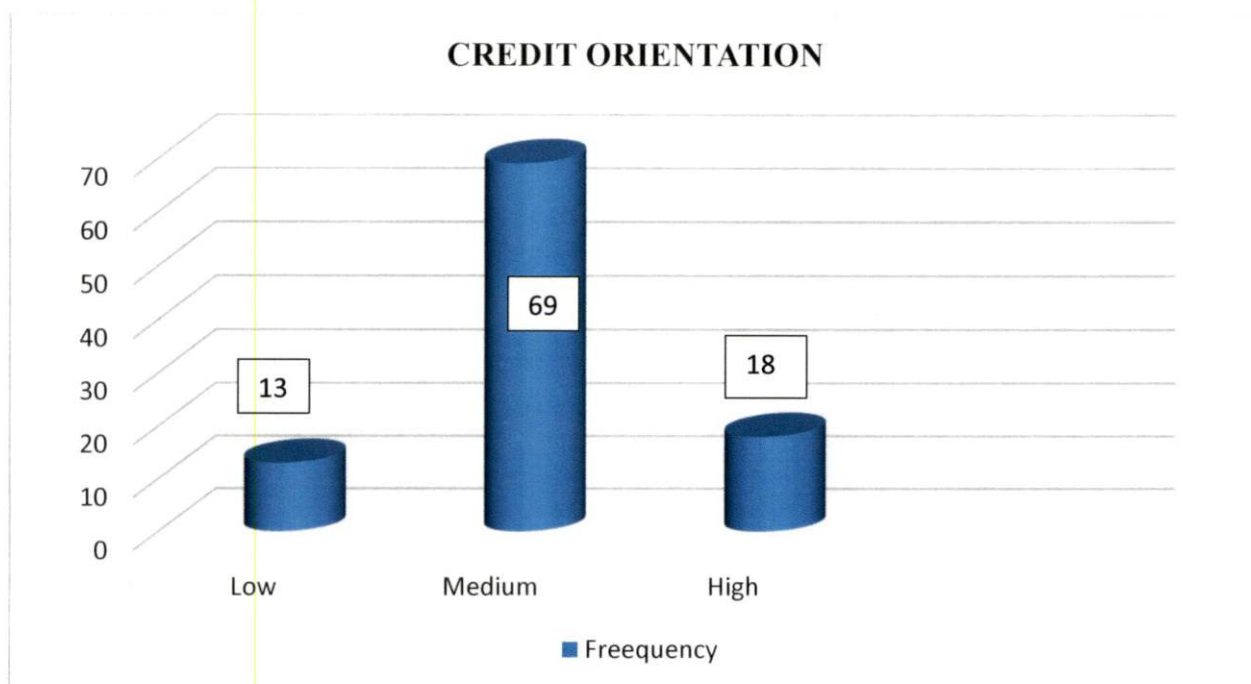


Figure 15. Distribution of respondents according to credit orientation.

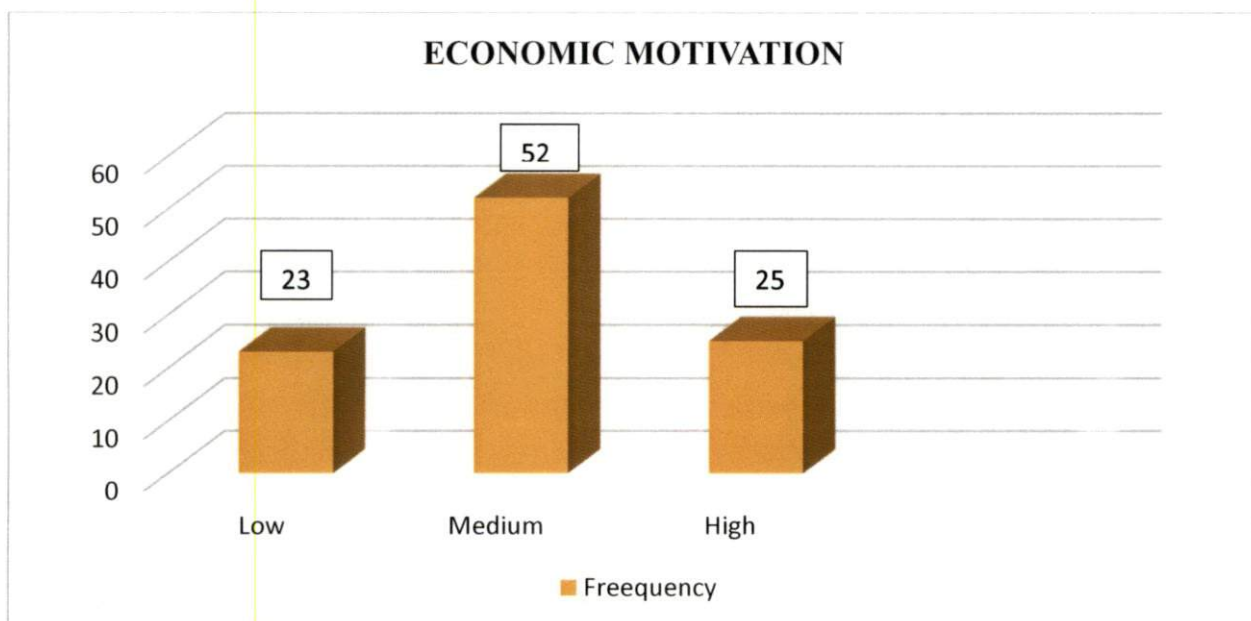


Figure 16. Distribution of respondents according to economic motivation.

The similar result was found in Suthan (2003) who reported that more than half of the vegetable growers were having medium to high level of economic motivation.

4.4.7. Market Orientation

Table 22. Distribution of respondents according to market orientation

(N= 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|-----------------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low (<Q1) | 5 | 20.00 | 5 | 20.00 | 5 | 20.00 | 7 | 28.00 | 22.00 |
| Medium (Q1 – Q3) | 14 | 56.00 | 15 | 60.00 | 14 | 56.00 | 12 | 48.00 | 55.00 |
| High(>Q3) | 6 | 24.00 | 5 | 20.00 | 6 | 24.00 | 6 | 24.00 | 23.00 |

Q1 = 9, Q3 = 11

Expected score range = 6-12, Data score range = 6-12

In this study market orientation was operationally defined as the degree to which farmers are oriented towards marketing to obtain reasonable gains from selling of the produce.

The result depicts that 55 per cent of the respondents had medium level of market orientation followed by 23 per cent with high level and 22 per cent with low level of market orientation.

Sixty per cent of the respondents from Kalliyoor Panchayat shows medium level of market orientation, whereas it was 56 per cent in the case of Pallichal and Kottukal and 40 per cent in Venganoor Panchayat. Taken together respondents from the district shows medium to high level of market orientation

This medium to high level of market orientation of commercial vegetable farmers in the districts may be due to the existence of various markets like VFPC market, *Sanghamyathi*, Anayara world market and Chalai market. And they were more eager to incorporate high value and demand oriented crops in their farm with a market motive.

This result is controversial to the result of Noobiya(2016) , where she reported that market orientation bitter gourd farmers in Thiruvananthapuram district was high.

4.4.8. Entrepreneurial Behaviour

Table 23. Distribution of respondents according to entrepreneurial behaviour

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|---------------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low ($< Q_1$) | 2 | 8.00 | 3 | 12.00 | 5 | 20.00 | 3 | 12.00 | 13.00 |
| Medium ($Q_1 - Q_3$) | 17 | 68.00 | 16 | 64.00 | 15 | 60.00 | 16 | 64.00 | 64.00 |
| High($>Q_3$) | 6 | 24.00 | 6 | 24.00 | 5 | 20.00 | 6 | 24.00 | 23.00 |

$Q_1 = 9, Q_3 = 11$

Expected score range = 6-12, Data score range = 7-12

Table 23 pointed out that 64 per cent of the respondents had medium level of entrepreneurial behaviour followed by 23 per cent with high level and 13 per cent with low level of entrepreneurial behaviour. In the case of Pallichal Panchayat 68 per cent of the respondents had medium level of entrepreneurial behaviour , where as it is 64 per cent in the case of Kalliyoor and Venganoor Panchayats and 60 per cent in the case of Kottukal Panchayat. Twenty four per cent of the respondents from Pallichal, Kalliyoor and Venganoor had high level of

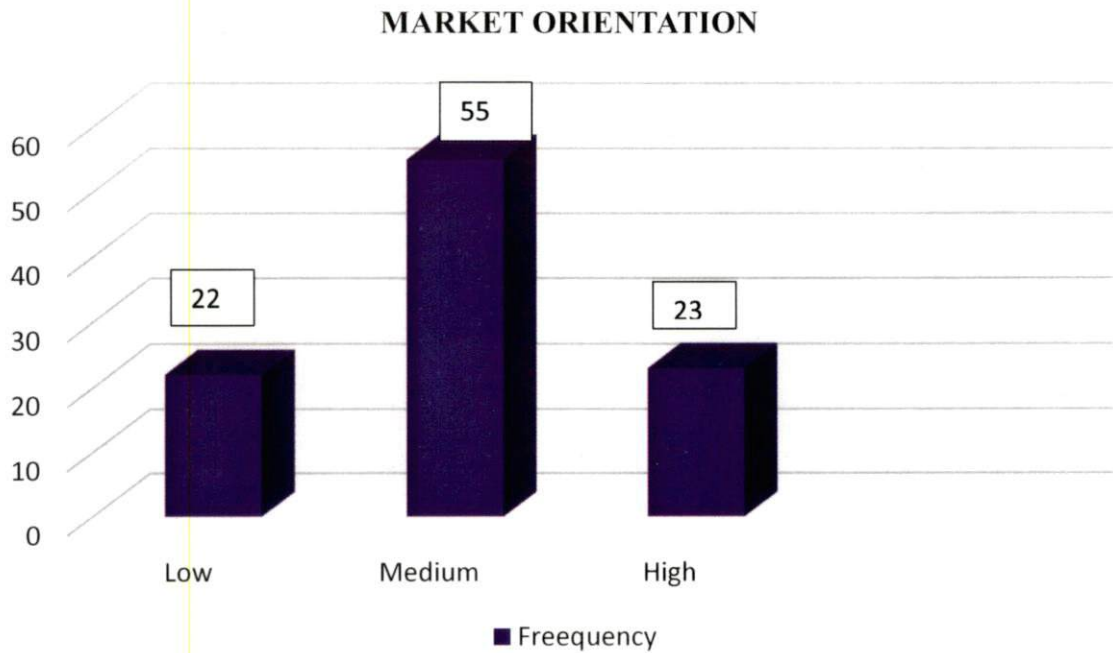


Figure 17. Distribution of respondents according to market orientation.

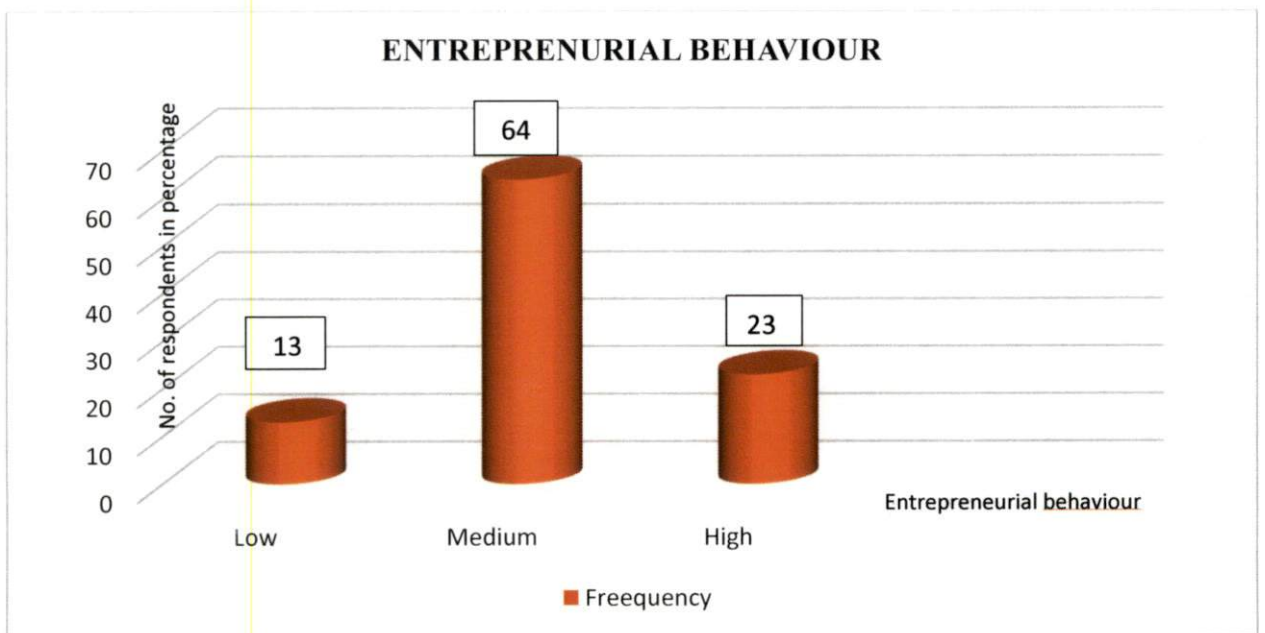


Figure 18. Distribution of respondents according to entrepreneurial behaviour.

entrepreneurial behaviour and it was 20 per cent in the case of Kottukal Panchayat.

Entrepreneurial behaviour was operationally defined as the ability of the respondent to exploit the opportunities and initiate an enterprise of his/her own for income generation.

This medium to high rate of entrepreneurial behaviour of commercial vegetable farmers indicates that majority of them had the ability to exploit the opportunities and initiate an enterprise of his/her own for income generation. The respondents were already adopting many of the innovative farming practices in irrigation and plant protection measures.

This result was in agreement with the result of Suma Rose (2016).

4.4.9. Risk Orientation

Table 24. Distribution of respondents according to risk orientation

(N = 100)

| Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total (%) |
|-------------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|--------------|
| | No. | % | No. | % | No. | % | No. | % | |
| Low ($<Q1$) | 5 | 20.00 | 5 | 20.00 | 4 | 16.00 | 5 | 20.00 | 19.00 |
| Medium ($Q1 - Q3$) | 13 | 52.00 | 14 | 56.00 | 17 | 68.00 | 13 | 52.00 | 57.00 |
| High($>Q3$) | 7 | 28.00 | 6 | 24.00 | 4 | 16.00 | 7 | 28.00 | 24.00 |

$Q1 = 15, Q3 = 22$

Expected score range = 6-30, Data score range = 8-26

From the table 24, it was clear that more than half (57%) of the commercial vegetable cultivators had medium level of risk orientation followed by high (24%) and low (19%) level of risk orientation.

Risk orientation refers to the degree to which the farmer is oriented towards encountering risk and uncertainty in adopting new ideas in farming.

Based on the above data it was evident that majority of the respondents had medium level of orientation towards risk. This is logical and desirable because commercial vegetable growers are entrepreneurs who have to bear risk and uncertainty. This fairly good orientation of the respondents towards risk is desirable for the adoption of improved practices in commercial vegetable cultivation and for exploring new markets and marketing strategies.

Similar results were reported by Fayas (2003) and Thasneem (2016).

4.4.10. Extension Agency Contact

Table 25. Distribution of respondents according to extension agency contact

(N = 100)

| Sl no. | Category | Regularly | | Occasionally | | Rarely | |
|--------|-----------------------------------|-----------|-------|--------------|-------|--------|-------|
| | | No. | % | No. | % | No. | % |
| 1 | Agricultural scientist | 27 | 27.00 | 54 | 54.00 | 19 | 19.00 |
| 2 | Agricultural officer | 62 | 62.00 | 29 | 29.00 | 9 | 9.00 |
| 3 | Agricultural assistant | 51 | 51.00 | 36 | 36.00 | 13 | 13.00 |
| 4 | Private extension agencies | 15 | 15.00 | 27 | 27.00 | 58 | 58.00 |
| 5 | Block technology manager | 14 | 14.00 | 25 | 25.00 | 61 | 61.00 |
| 6 | Assistant director of agriculture | 14 | 14.00 | 21 | 21.00 | 65 | 65.00 |
| 7 | SMS of KVK | 12 | 12.00 | 26 | 26.00 | 62 | 62.00 |
| 8 | NGO | 15 | 30.00 | 20 | 20.00 | 65 | 65.00 |
| 9 | VFPCCK | 49 | 49.00 | 26 | 26.00 | 25 | 25.00 |

Table 25 indicate that most of the respondents had regular contact with extension agencies like Agricultural Officers (62%), Assistants (51%) and VFPCCK (49 %).

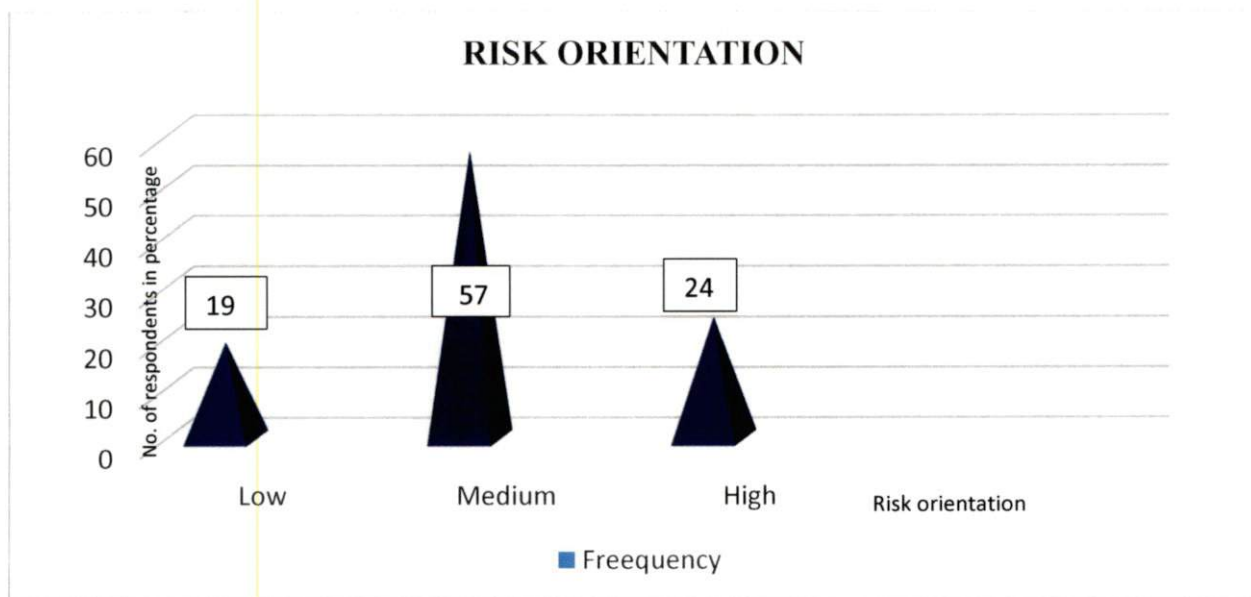


Figure 19. Distribution of respondents according to risk orientation.

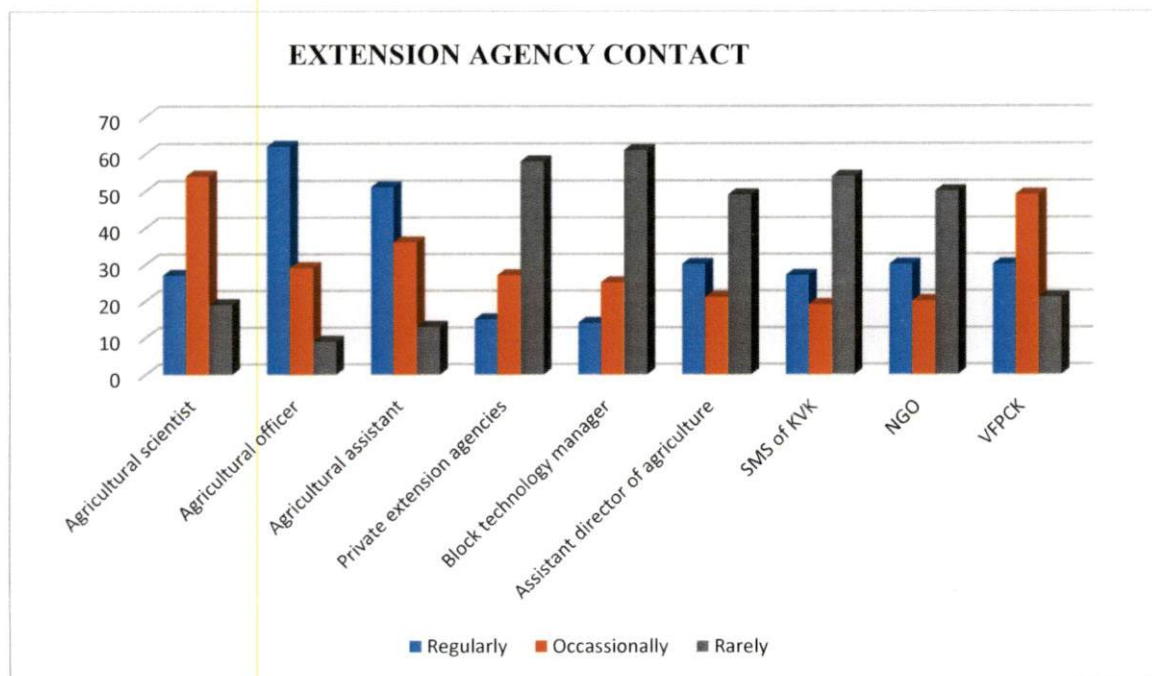


Figure 20. Distribution of respondents according to extension agency contact.

Extension agency contact was operationalized as the degree to which an individual have contact with research and extension agency for the purpose of obtaining information and advices regarding commercial vegetable cultivation.

The result clearly indicate that majority of the respondents had strong extension agency contact. The main reason for this was the dedicated support and services extended by the extension officials of the survey area. Along with that the higher literacy rate of the respondents prompted them to regularly contact with the expert and extension officers for the purpose of obtaining information and advices regarding commercial vegetable cultivation. Also being commercial growers they are compelled to update technical know – how by keeping contact with extension agencies.

These results are in line with the findings of Kamalakannan (2001) and Sobha (2013).

4.4.11. Exposure to Mass Media

Table 26. Distribution of respondents based on exposure to mass media

(N = 100)

| Sl no. | Category | Regularly | | Occasionally | | Rarely | |
|--------|-------------------|-----------|-------|--------------|-------|--------|-------|
| | | No | % | No | % | No | % |
| 1 | TV | 56 | 56.00 | 29 | 29.00 | 15 | 15.00 |
| 2 | Radio | 45 | 45.00 | 38 | 38.00 | 17 | 17.00 |
| 3 | News paper | 72 | 72.00 | 16 | 16.00 | 10 | 10.00 |
| 4 | Internet | 28 | 28.00 | 33 | 33.00 | 39 | 39.00 |
| 5 | Magazine | 43 | 43.00 | 39 | 39.00 | 18 | 18.00 |
| 6 | Bulletin | 15 | 15.00 | 36 | 36.00 | 49 | 49.00 |
| 7 | Information kiosk | 12 | 12.00 | 28 | 28.00 | 60 | 60.00 |
| 8 | Mobiles | 61 | 61.00 | 25 | 25.00 | 14 | 14.00 |

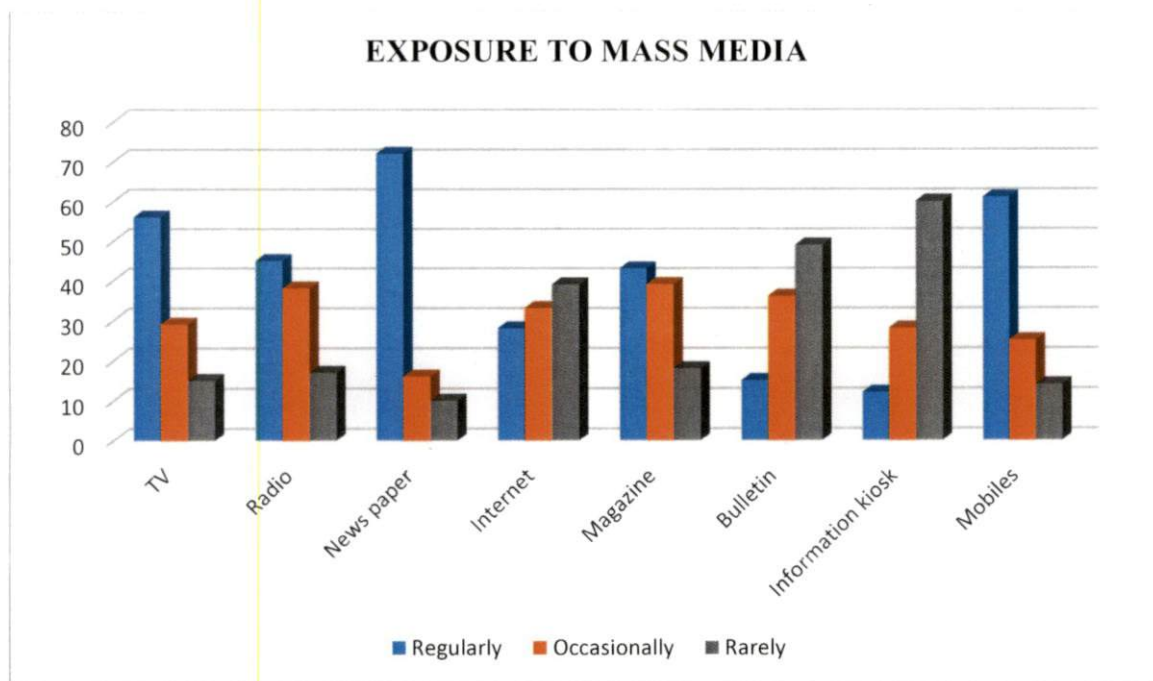


Figure 21. Distribution of respondents according to exposure to mass media.

The table 26 reveal that most of the respondents use newspapers (72 %), mobiles (61%) and TV (56 %) regularly for getting information regarding commercial vegetable cultivation.

Exposure to mass media was operationalized as the extent to which respondent was using the support of mass media for developing his/her knowledge and skills for the improvement of commercial vegetable cultivation.

Majority of the respondents of this study are educationally forward, hence they were more exposed to various mass media like newspapers, television, mobiles, internet, radio and magazines etc. the use of mobiles and information and communication technology (ICT) by the farmers was also getting momentum. And this higher rate of exposure of respondents to various mass media shows the progressive behaviour of commercial vegetable farmers, which is an encouraging trend.

This result was in line with the result of Sobha (2013).

4.4.12. Trainings Undergone

Training undergone was operationalized as the total number of trainings undergone by the respondents regarding commercial vegetable cultivation

The respondents were distributed based on the number of training they attended, subject of training, agency responsible for training, and the duration of training.

4.4.12.1. Number of Training Attended

Table 27. Distribution of respondents according to the number of training they attended.

The respondents were categorized into three category based on the number of training they attended. The category include no training, one training, two training and more than two training.

(N = 100)

| Sl. no | Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total |
|--------|--------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|-------|
| | | No. | % | No. | % | No. | % | No. | % | |
| 1 | no training | 4 | 16.00 | 2 | 8.00 | 3 | 12.00 | 4 | 16.00 | 13.00 |
| 2 | One training | 12 | 48.00 | 14 | 56.00 | 10 | 40.00 | 10 | 40.00 | 46.00 |
| 3 | Two training | 5 | 20.00 | 6 | 24.00 | 8 | 32.00 | 6 | 24.00 | 25.00 |
| 4 | >2 training | 5 | 20.00 | 4 | 16.00 | 4 | 16.00 | 5 | 20.00 | 18.00 |

From the above table 27, it was clear that 46 per cent of the respondents had undergone at least one training regarding commercial vegetable cultivation.

In the case of Kalliyoor Panchayat majority of the respondents got at least one training due to the fairly good extension contact and support from Krishi Bhavan and College of Agriculture, Vellayani. The respondents from this Panchayat had fairly good extension contact also.

Moreover majority of the respondents from the surveyed area were aware about the importance of training, and they were interested in participating such trainings. This implies the effectiveness of the extension system in organizing need based training programmes in the surveyed areas.

4.4.12.2. Subject of Training

Table 28. Distribution of respondents according to the subject of training they attended.

(N =100)

| Sl. no | Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total |
|--------|---|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|-------|
| | | No. | % | No. | % | No. | % | No. | % | |
| 1 | Crop management | 7 | 28.00 | 8 | 32.00 | 6 | 24.00 | 4 | 16.00 | 25.00 |
| 2 | Plant protection | 14 | 56.00 | 15 | 72.00 | 16 | 64.00 | 19 | 76.00 | 64.00 |
| 3 | Organic vegetable production – safe to eat vegetables | 15 | 60.00 | 18 | 60.00 | 19 | 76.00 | 17 | 68.00 | 69.00 |
| 4 | Processing & value addition | 5 | 20.00 | 4 | 16.00 | 6 | 24.00 | 5 | 20.00 | 20.00 |

From the table it was clear that the major topic majority (69%) of them attended was 'Organic vegetable production – safe to eat vegetables'. This shows the perception of the commercial vegetable growers about the relevance and importance of environmental protection and conservation during commercial vegetable cultivation.

4.4.12.3. Agency Responsible For Training

Table 29. Distribution of respondents according to the agency responsible for the training

(N = 100)

| Sl. no | Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total |
|--------|----------|--------------------|-------|--------------------|-------|-------------------|-------|--------------------|-------|-------|
| | | No | % | No | % | No | % | No | % | |
| 1 | KB | 14 | 56.00 | 20 | 80.00 | 17 | 68.00 | 19 | 76.00 | 70.00 |
| 2 | KAU | 10 | 40.00 | 14 | 56.00 | 17 | 68.00 | 15 | 60.00 | 56.00 |
| 3 | KVK | 5 | 20.00 | 6 | 24.00 | 3 | 12.00 | 4 | 16.00 | 18.00 |
| 4 | VFPCCK | 12 | 48.00 | 17 | 68.00 | 14 | 56.00 | 15 | 60.00 | 58.00 |

The trainings regarding commercial vegetable cultivation was mainly conducted by Krishi Bhavan (70 %) and VFPCCK (58 %) followed by KAU. The contribution of KB, VFPCCK and KAU were found high in the case of Kalliyoor Panchayat. This may be due to the existence and active participation of these agencies in commercial vegetable cultivation in the same Panchayat.

Similar result was reported by Namitha (2016).

4.4.12.4. Duration of Training

Table 30. Distribution of respondents according to the duration of the training

(N = 100)

| Sl no. | Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total |
|--------|----------|--------------------|-------|--------------------|-------|-------------------|-------|--------------------|-------|-------|
| | | No. | % | No. | % | No. | % | No. | % | |
| 1 | 1 day | 18 | 72.00 | 15 | 60.00 | 20 | 80.00 | 16 | 64.00 | 69.00 |
| 2 | 2 days | 4 | 16.00 | 3 | 12.00 | 3 | 12.00 | 20 | 80.00 | 30.00 |
| 3 | 1 week | 6 | 24.00 | 7 | 28.00 | 8 | 32.00 | 6 | 24.00 | 27.00 |
| 4 | 1 month | 0 | 0 | 1 | 4.00 | 0 | 0 | 1 | 4.00 | 2.00 |

The above table (30) revealed that, in the case of duration of training, more than half (69%) of the respondents had undergone at least one day training regarding commercial vegetable cultivation. This result also evidences the fairly good extension contact in the surveyed areas and the awareness of the farmers

about the importance of attending training as well as the effectiveness of such training in pursuing commercial vegetable cultivation.

The result was in line with the result of Thasneem (2016).

4.4.13. Incentives Received for Commercial Vegetable Cultivation

Incentives received for commercial vegetable cultivation was operationalized as the number of incentives received by the farmer from government and other agencies for promoting commercial vegetable cultivation.

The respondents were distributed based on the type of incentives received and the source of incentive.

4.4.13.1. Type of Incentives Received

Table 31. Distribution of respondents based on type incentives received for commercial vegetable cultivation

(N = 100)

| Sl. no | Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total |
|--------|---------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|-------|
| | | No. | % | No. | % | No. | % | No. | % | |
| 1 | Cash | 11 | 44.00 | 10 | 40.00 | 14 | 56.00 | 13 | 52.00 | 48.00 |
| 2 | Inputs | 17 | 68.00 | 15 | 60.00 | 16 | 64.00 | 15 | 60.00 | 63.00 |
| 3 | Awards | 2 | 8.00 | 3 | 12.00 | 2 | 8.00 | 3 | 12.00 | 10.00 |
| 4 | No incentives | 4 | 16.00 | 3 | 12.00 | 4 | 16.00 | 4 | 16.00 | 15.00 |

Cash, inputs for commercial vegetable cultivation and awards are the major incentives received by the respondents in commercial vegetable cultivation. Sixty three percentage of them had received inputs as incentives for commercial vegetable cultivation, whereas 48 percent received cash as incentives and 10 percent received awards as incentives for their performance in commercial vegetable cultivation. Fifteen percent of the respondents reported that, they were not receiving any incentives for the commercial cultivation of vegetables.

4.4.13.2. Source of Incentives

Table 32. Distribution of respondents based on source of incentives received for commercial vegetable cultivation.

(N = 100)

| Sl. no | Category | Pallichal (25 No.) | | Kalliyoor (25 No.) | | Kottukal (25 No.) | | Venganoor (25 No.) | | Total |
|--------|------------------------------|-----------------------|-------|-----------------------|-------|----------------------|-------|-----------------------|-------|-------|
| | | No | % | No | % | No | % | No | % | |
| 1 | Government (KB, Dept.) | 18 | 72.00 | 20 | 80.00 | 17 | 68.00 | 17 | 68.00 | 72.00 |
| 2 | Private input agencies | 16 | 64.00 | 17 | 68.00 | 15 | 60.00 | 14 | 56.00 | 62.00 |
| 3 | NGO | 8 | 32.00 | 10 | 40.00 | 7 | 28.00 | 8 | 32.00 | 33.00 |

The major source of incentives for commercial vegetable cultivation was provided by Government, mainly through Krishi Bhavan and Department of agriculture. Seventy two percent of the respondents received incentives from the Government agencies followed by Private extension agencies (62%).

Incentives are those things which motivate or encourage someone to do something. From the table 32, it was clear that majority of the respondents received incentives for commercial vegetable cultivation, which motivate them to invest more in commercial vegetable farming and it is to be helped that more and more young farmers will get attracted to the commercial vegetable cultivation. Similar result was reported by Diannacahn (2015), where she reported that government incentives make farming viable.

4.5. RELATIONSHIP OF SUSTAINABILITY OF COMMERCIAL VEGETABLE CULTIVATION WITH PROFILE CHARACTERISTICS OF RESPONDENTS.

Correlation analysis was done to assess whether there is any significant relationship between the sustainability and selected independent variables.

Table 33. Correlation between sustainability and independent variables

| Independent variables | Correlation co – efficient |
|--|-----------------------------------|
| Age | -0.122 |
| Annual income | 0.27** |
| Educational status | 0.11 |
| Knowledge about KAU practices | 0.25** |
| Adoption of KAU practices | 0.24* |
| Perception about the feasibility of commercial organic vegetable cultivation | -0.22* |
| Farming experience | 0.23* |
| Economic motivation | 0.21* |
| Credit orientation | -0.19 |
| Extension agency contact | -0.13 |
| Market orientation | 0.22* |
| Exposure to mass media | 0.20* |
| Entrepreneurial behaviour | 0.27** |
| Risk orientation | 0.16 |
| Trainings undergone | 0.25** |
| Incentives received | 0.22 * |

* Significant at 5 per cent level

** Significant at 1 per cent level

Sustainability of commercial vegetable cultivation was positively and significantly correlated with annual income, knowledge about KAU practices, adoption of KAU practices, farming experience, economic motivation, market orientation, exposure to mass media, entrepreneurial behaviour, training undergone and incentives received for commercial vegetable cultivation and it was negatively and significantly correlated with perception about the feasibility of

commercial organic vegetable cultivation. The result also showed that annual income, knowledge about KAU practices, entrepreneurial behaviour, trainings undergone in vegetable cultivation were positively and significantly correlated to sustainability at 1 percent. But the independent variables like adoption of KAU practices, farming experience, economic motivation, market orientation, exposure to mass media, incentive received in commercial vegetable cultivation were positively and significantly correlated with dependent variable sustainability only at 5 percent level, whereas the perception about the feasibility of commercial organic vegetable cultivation was found to be negative but significant at 5 percent level. The independent variables like age, credit orientation and extension agency contact was found to be negative and non-significant with sustainability and it was positive but non – significant with educational status and risk orientation.

There was a significant and positive correlation between sustainability and annual farm income. Cultivation of vegetables in large scale, or vegetable grown for market is called commercial vegetable cultivation. The commercial farms are thus intended toward more economic returns and profit thus ultimately it will increase the income per annum of commercial vegetable growers. The increase in annual income will stabilize the economic well-being of the commercial vegetable farmer. Along with that farmers get more social acceptance as a commercial vegetable grower which will help the farmers to continue in commercial cultivation of vegetables. A similar result was reported by Binder et al.,(2012).

A significant and positive correlation was found between sustainability and knowledge about KAU practices. The knowledge regarding various KAU practices of vegetables like varieties, innovative cultivation practices and plant protection measures etc. will motivate the farmers to adopt them in their fields. The success of these practices will enhance the credibility of the source which will encourage the farmer to acquire more knowledge about improved practices and thus it ultimately lead to the continuation of farmers in commercial vegetable cultivation with economic profitability.

There was a significant and positive correlation between sustainability and adoption of KAU practices. The adoption of improved practices help the farmers to perform efficiently in commercial vegetable cultivation. Thus it will increase the returns of the farmer. As well as they were considered as opinion leaders by fellow farmers. So the adoption of KAU practices is a key factor for the enhanced continuation of farmers in commercial vegetable cultivation.

Farming experience was found to be positively and significantly correlated with sustainability. Because majority of the respondents are traditionally vegetable growers and majority of them belonged to middle and old age category. Hence they have rich experience in vegetable cultivation. This will help them to continue in commercial vegetable cultivation.

Economic motivation plays an important role in commercial vegetable cultivation. High level of economic motivation prompts the commercial vegetable growers to perform efficiently and effectively for increasing the returns from their commercial farms. Economically motivated farmers would be very keen to utilize all the available avenues and thus it might have resulted in sustainability of commercial vegetable cultivation.

There was a significant and positive correlation between sustainability and market orientation. This might be due to the fact that marketing the product is the ultimate motive of a commercial vegetable farmer. The better the market orientation, a farmers chances of exploring and utilizing the market increases, thereby leading to better returns. So market orientation led to the sustainability of farmers in commercial vegetable cultivation.

A significant and positive relationship existed between mass media exposure and sustainability of commercial vegetable cultivation. Mass media plays a crucial role in the dissemination of information and creating awareness among farmers about scientific commercial vegetable cultivation. This indirectly influences their knowledge and adoption of scientific practices which contributes to better yield, more income thus influencing the sustainability.



Entrepreneurial behaviour of respondents was found to be positively and significantly correlated with sustainability. A farmer with more innovativeness, decision making ability and other entrepreneurial traits would be keen to use all improved practices related to commercial vegetable cultivation and thus he would have the ability to exploit the opportunities and initiate an enterprise of his own for income generation. This gives him confidence and gets encouraged to continue in commercial vegetable cultivation. This explains the positive significant relationship of entrepreneurial behaviour with sustainability.

Trainings attended showed a significant and positive relationship between sustainability due to the fact that more the training more would be the awareness and knowledge of scientific commercial vegetable cultivation by the farmers. It will help the farmers to acquire the knowledge and skill needed also get motivated to continue in commercial vegetable cultivation due to the higher returns they get by adopting better management practices.




Incentives are those things which motivate or encourage someone to do something. Incentives received was positively and significantly correlated with sustainability of commercial vegetable cultivation. Because incentives will encourage the farmers to invest more in commercial vegetable cultivation in terms of time and money and brings more youth in commercial vegetable cultivation. Ultimately it leads to the sustainability of commercial vegetable farms.

Perception about the feasibility commercial organic vegetable cultivation was found to be negatively but significantly correlated with sustainability. The probable reason is that commercial vegetable cultivation is mainly market and profit oriented, hence practically it is not possible to cultivate vegetables completely as organic in large scales. This is mainly because the inputs required for raising crop organically is not available in plenty as well as pest and disease management cannot be done economically if one goes by organic measures alone. Since farmers are mainly concentrating on economic side of



EMPIRICAL MODEL OF THE STUDY

Figure 22. Empirical model of the study

-  Positively and significantly correlated
-  Negatively and significantly correlated
-  Non significant

commercial farms, it is not possible to profitably maintain the vegetable production over time as completely organic.

4.6. CONSTRAINTS FACED IN COMMERCIAL VEGETABLE CULTIVATION

Constraints faced by respondents during commercial vegetable cultivation were categorized into crop management constraints and economic constraints. The constraints were ranked in subheads as well as total based on the total score obtained.

Table 34. Constraints faced by the respondents in commercial vegetable cultivation.

| Sl no: | Constraints | Frequency | Rank over class | Rank over total |
|------------------------------------|---|-----------|-----------------|-----------------|
| Crop management constraints | | | | |
| 1 | Incidence of pest and diseases | 77 | 4 | 4 |
| 2 | Scarce water resources | 85 | 1 | 1 |
| 3 | Extremity in weather conditions | 80 | 2 | 2 |
| 4 | Lack of knowledge about improved practices | 42 | 9 | 14 |
| 5 | Labour shortage | 53 | 7 | 11 |
| 6 | Inadequacy of capital | 49 | 8 | 12 |
| 7 | Poor marketing facility | 62 | 5 | 7 |
| 8 | Non assurance of premium price for organic products | 79 | 3 | 3 |
| 9 | Inadequate extension support | 56 | 6 | 10 |
| Economic constraints | | | | |
| 1 | High cost of input | 59 | 4 | 9 |
| 2 | High labour charges | 65 | 2 | 6 |
| 3 | Price fluctuation | 72 | 1 | 5 |
| 4 | High transportation cost | 45 | 5 | 13 |
| 5 | Inadequate facilities of value addition | 60 | 3 | 8 |

The major constraints they had experienced during commercial vegetable cultivation were scarce water resources, extremity in weather conditions, non-assurance of premium price for organic products, incidence of pest and diseases, price fluctuation in the market, high labour charges, poor marketing facility, inadequate facilities of value addition, high cost of input, and Inadequate extension support.

Among the crop management constraints, scarce water resources, extremity in weather conditions, non-assurance of premium price for organic products, incidence of pest and diseases were the major constraints. The prevalence of severe drought at the time of survey affected the farmers. Majority of them were affected by crop failure. Along with that non assurance of premium price for their organic vegetable demotivate them to cultivate vegetables as organic and thus it forced them to do chemical practices in commercial vegetable cultivation. Incidence of pest and disease and the non-effectiveness of recommended dosages, varieties for the management of pest and diseases were found to be same of the major constraints they faced during the cropping season. Similar results was reported by Sujitha (2015) and Thasneem (2016).

In the case of economic constraints price fluctuation, high labour charges, inadequate facilities of value addition, high cost of input, high transportation cost were the major constraints faced by the farmers. Commercial cultivation of vegetables requires considerable inputs and labours which are expensive. But farmers reported that they cannot afford this expense, because they were not getting remunerative price for their produce especially for organic vegetables. They had also reported that the facilities for value addition was not available and hence suffer due to the loss of excess vegetables during the surplus seasons. This should be taken into consideration while evolving Government policies. Similar results was reported by Jaganathan (2004) and Thasneem (2016).

Considering the total rank, the major constraints experienced by commercial vegetable growers were scarce water resources, extremity in weather conditions, non-assurance of premium price for organic products, incidence of pest and diseases and price fluctuation in the market.

4.7. SUGGESTION FOR OVERCOMING THE CONSTRAINTS AS PERCEIVED BY FARMERS.

Suggestions for overcoming the constraints were collected from the farmers and these were prioritized.

Table 35. Suggestion for overcoming the constraints as perceived by farmers.

(N=100)

| Sl no | Suggestions | Frequency | Percentage |
|-------|---|-----------|------------|
| 1 | Support from the extension agents for the adoption of improved practices | 42 | 42 |
| 2 | Inclusion of accessible and low cost technologies | 55 | 55 |
| 3 | Promotion of value addition technologies and facilities | 48 | 48 |
| 4 | Ensuring of premium price for the product especially for organic vegetables | 64 | 64 |
| 5 | Improve the marketing and transport facilities without intermediaries | 46 | 46 |
| 6 | Providing training programmes to youth | 45 | 45 |

The suggestions put forward by farmers for overcoming the constraints identified were ranked and the majority of them suggested that the inclusion of

accessible and low cost technologies followed by ensuring market and premium price for the vegetables especially for organically produced vegetables. They had also put forward the promotion of value addition of vegetables and training programmes to youth for ensuring the entry of youth in commercial vegetable cultivation.

Commercial cultivation of vegetables require improved technologies for cultivation as well as pest and disease management. The available technologies are not satisfactory to the farmers, because they are expensive in nature. Hence majority of the respondents suggested the development and inclusion of low cost technologies in cultivation and plant protection practices in Package of Practice of KAU.

Availability of market and premium price for safe vegetables was reported as another major problem. In the recent past more than sixty percent of the state vegetable requirement is met from our neighbouring states which is having good colour and appearance due to the use of hazardous amount of pesticide. It reduce the demand of vegetables produced in the state which are safe for consumption according to report of Pesticide Residue Laboratory of Kerala Agricultural University. There are many schemes and programmes implemented by Government through state department of agriculture. But beneficiaries are not getting any follow up activities. Hence this should also be taken into consideration while evolving government policies regarding marketing of vegetables especially in the case of organically produced vegetables.

Farmers also suggested the need and importance of value addition of vegetables, because they face heavy loss due to the wastage of vegetables in the surplus time. They are forced to sell their produce at low price during surplus production. Hence there the need for improving the value addition facility of vegetables need to be addressed urgently.

The involvement of youth in commercial vegetable cultivation was found to be low during the survey. Even though some young farmers are venturing in to

commercial vegetable farming, their contribution is not yet predominantly visible. Hence the respondents emphasised the need for organizing training programmes for youth to ensure the entry of more youth in commercial vegetable cultivation

Summary

5. SUMMARY

Commercial vegetable cultivation can be defined as the large scale production of vegetables for sale or vegetables grown for market. In Kerala, vegetables are being cultivating as a commercial crop mainly in the recent past. Hence there is a need for analysing the sustainability of the commercial vegetable farms. In this context the study was conducted with the following objectives.

- Assess the sustainability of commercial vegetable cultivation in Thiruvananthapuram district
- Measure commercial vegetable cultivators scale of knowledge and rate of adoption of KAU practices in selected vegetables
- Study the perception about the feasibility of commercial organic vegetable cultivation
- Study the constraints faced in commercial vegetable cultivation

The study was carried out in the four Panchayats of Thiruvananthapuram district (Pallichal, Kalliyoor, Kottukal, and Venganoor) from two blocks having maximum area under commercial vegetable cultivation. A sample size of 100 was selected for the study with 25 farmers from each Panchayat. The selected vegetables were amaranthus, cowpea and bitter gourd.

Sustainability was the independent variable of the study. The five dimensions of sustainability namely economic dimension, socio – psychological dimension, environmental dimension, technological dimension and temporal dimension were analysed. Sixteen independent variables were selected for the study and the relationship between sustainability and the independent variables were calculated.

The major findings of the study include

1. Fifty percent of the respondents belonged to medium category in respect to sustainability of commercial vegetable cultivation.
2. Among the five dimension of sustainability, economic dimension of sustainability contributed 72 % of the total sustainability followed by socio – psychological dimension (36%), environmental dimension (7%), technological dimension (5 %) and temporal dimension (4%).
3. In the case of total sustainability 55 % of the respondents belonged to the medium category followed by 23 % in high category and 22 % in low category.
4. With respect to knowledge about the KAU practices in amaranthus, cowpea and bitter gourd 60 % of the respondents were having higher level of knowledge whereas only 40 % of respondents belonged to low knowledge category.
5. In the case of adoption of KAU practices in amaranthus, cowpea and bitter gourd 54 % respondents belonged to medium category whereas only 27 % had high rate of adoption.
6. Only 19% respondents had higher level of perception about the feasibility of commercial organic vegetable cultivation, whereas 58 % of them belonged to medium category.
7. Forty eight percentage of the respondents belonged to medium age category.
8. Forty four percent of the respondents had high school level of education.
9. Forty seven percent of the respondents had annual income above 1 lakh.
10. Fifty one percent of the respondents had 10 – 25 years of experience.

11. Majority of them had a medium level of credit orientation (69%), economic motivation (52%), market orientation (55%), entrepreneurial behaviour (64%) and risk orientation (57%).
12. Most of the respondents had regular contact with Agricultural Officers (62%), Assistants (51%) and VFPCCK (49 %).
13. Most of them use newspapers (72 %), mobiles (61%) and TV (56 %) regularly for getting information regarding commercial vegetable cultivation.
14. As to the trainings undergone 46 % of the respondents had undergone at least one training regarding commercial vegetable cultivation and the major topic majority (69%) of them attended was 'Organic vegetable production – safe to eat vegetables'.
15. The trainings was mainly conducted by Krishi Bhavan (70 %) and VFPCCK (58 %).
16. Sixty three percentage of them had received inputs as incentives for commercial vegetable cultivation mainly from Government (KB, Dept.) (72 %) and from private input agencies (62%).
17. Sustainability of commercial vegetable cultivation was positively and significantly correlated with annual income, knowledge about KAU practices, adoption of KAU practices, farming experience, economic motivation, market orientation, exposure to mass media, entrepreneurial behaviour, training undergone and incentives received for commercial vegetable cultivation.
18. Sustainability of commercial vegetable cultivation was negatively and significantly correlated with perception about the feasibility of commercial organic vegetable cultivation.

19. Scarce water resources, extremity in weather conditions, non-assurance of premium price for organic products, incidence of pest and diseases, were the important constraints faced by the commercial vegetable growers.
20. The suggestions put forward by the farmers were inclusion of accessible and low cost technologies, ensuring of premium price for the product especially for organic vegetables, improve the marketing and transport facilities without intermediaries, promotion of value addition technologies, providing training programmes to youth and support from the extension agents for the adoption of improved practices.

Implication for the study

The implications of the study are as follows.

The study would provide data for further researches in sustainability of commercial vegetable cultivation. The present study was confined only to a particular district and further studies in similar line can be done in other districts. The result of the study is expected to help the commercial vegetable farmers to analyse their situation and profitably maintaining the vegetable production over time.

This study may also help to identify the constraints faced in commercial vegetable cultivation and proper suggestions to overcome them. Hence it can be taken in to consideration while formulating new schemes and programmes for commercial vegetable cultivation.

Suggestions for future research

Further studies can be done to maintain the profitable production commercial vegetable farms by considering the economic, socio – psychological, environmental, technological and temporal dimensions. An extensive study can be conducted regarding the sustainability of commercial vegetable cultivation in different districts of Kerala.



Plate 1. Interviewing a cowpea farmer in Kalliyoor panchayath



Plate 2. At the Amaranthus field of a farmer at Pallichal panchayath



Plate 3. In conversation with a farmer at venganoor panchayath



Plate 4. A farmer at work in venganoor panchayth



Plate 5. A farmer of Kottukal panchayath describing the constraints he faced in Amaranthus cultivation



Plate 6. A Cowpea and Amaranthus farmer of Pallichal panchayath speaking about the sustainability of vegetable cultivation

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**SUSTAINABILITY OF COMMERCIAL VEGETABLE
CULTIVATION IN THIRUVANANTHAPURAM DISTRICT:
A MULTIDIMENSIONAL ANALYSIS**

by

NAMITHA K

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ABSTRACT

Sustainability of Commercial Vegetable Cultivation in Thiruvananthapuram District: A Multidimensional Analysis

The present study entitled 'Sustainability of commercial vegetable cultivation in Thiruvananthapuram district: a multidimensional analysis' was conducted in the two blocks of Thiruvananthapuram district with objectives : to assess the sustainability of commercial vegetable cultivation in Thiruvananthapuram district, measure the commercial vegetable grower's scale of knowledge and rate of adoption of KAU practices in selected vegetables, measure the perception about the feasibility of commercial organic vegetable cultivation and to identify the constraints faced by the commercial vegetable cultivators. The selected vegetables were amaranthus, cowpea and bitter gourd. The study was carried out in the four Panchayats of Thiruvananthapuram district (Pallichal, Kalliyoor, Kottukal, Venganoor) from two blocks having maximum area under commercial vegetable cultivation. A sample size of 100 was selected for the study with 25 farmers from each Panchayat.

The findings of the study revealed that more than 50 percent of the respondents belonged to medium category in respect to sustainability of commercial vegetable cultivation. Among the five dimension of sustainability, economic dimension of sustainability contributed 72 % of the total sustainability followed by socio – psychological dimension (36%), environmental dimension (7%), technological dimension (5 %) and temporal dimension (4%). In the case of total sustainability 55 % of the respondents belonged to the medium category followed by 23 % in high category and 22 % in low category. With respect to knowledge about the KAU practices in amaranthus, cowpea and bitter gourd 60 % of the respondents were having higher level of knowledge whereas only 40 % of respondents belonged to low knowledge category. In the case of adoption of KAU practices in amaranthus, cowpea and bitter gourd 54 % respondents belonged to

medium category whereas only 27 % had high rate of adoption. Only 19% respondents had higher level of perception about the feasibility of commercial organic vegetable cultivation, whereas 58 % of them belonged to medium category.

Sustainability of commercial vegetable cultivation was positively and significantly correlated with annual income, knowledge about KAU practices, adoption of KAU practices, farming experience, economic motivation, market orientation, exposure to mass media, entrepreneurial behaviour, training undergone and incentives received for commercial vegetable cultivation and it was negatively and significantly correlated with perception about the feasibility of commercial organic vegetable cultivation.

Scarce water resources, extremity in weather conditions, non-assurance of premium price for organic products, incidence of pest and diseases, were the important constraints faced by the commercial vegetable growers. The suggestions put forward by the farmers were inclusion of accessible and low cost technologies, ensuring of premium price for the product especially for organic vegetables, improve the marketing and transport facilities without intermediaries, promotion of value addition technologies, providing training programmes to youth and support from the extension agents for the adoption of improved practices.

The study therefore revealed that, economic dimension of sustainability stands first among the various dimensions affecting sustainability of commercial vegetable cultivation. To maintain the sustainability of commercial vegetable cultivation in Thiruvananthapuram district a comprehensive strategy is needed focusing on productivity enhancement, market - led extension approach with less number of intermediaries, which will have an impact on the economic side of sustainability. More investment in research and extension should also be undertaken to meet the upcoming challenges of commercial vegetable cultivation especially for pest and disease incidence.

സംഗ്രഹം.

തിരുവനന്തപുരം ജില്ലയിലെ വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയുടെ നിലനിൽപ്പ്:

വിവിധ ഘടകങ്ങളുടെ ഒരു അവലോകനം

“തിരുവനന്തപുരം ജില്ലയിലെ വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയുടെ നിലനിൽപ്പ് : വിവിധ ഘടകങ്ങളുടെ ഒരു അവലോകനം” എന്ന ഈ പഠനം തിരുവനന്തപുരം ജില്ലയിലെ രണ്ടു ബ്ലോക്കുകളിലാണ് നടത്തിയത്. പഠനത്തിന്റെ പ്രധാന ഉദ്ദേശ്യങ്ങൾ ഇവയാണ്. തിരുവനന്തപുരം ജില്ലയിലെ വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയുടെ നിലനിൽപ്പിനെക്കുറിച്ചുള്ള അവലോകനം, വാണിജ്യാടിസ്ഥാനത്തിൽ പച്ചക്കറികൃഷി ചെയ്യുന്ന കർഷകർക്ക് കേരള കാർഷികസർവ്വകലാശാലയുടെ നിർദ്ദിഷ്ട കൃഷിരീതികളെക്കുറിച്ചുള്ള അറിവും, അവയുടെ സ്വീകാര്യതയും, വാണിജ്യാടിസ്ഥാനത്തിലുള്ള ജൈവപച്ചക്കറികൃഷിയുടെ സാധ്യതകളെക്കുറിച്ചുള്ള കർഷകരുടെ കാഴ്ചപ്പാട്, വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷി ചെയ്യുമ്പോൾ കർഷകർ നേരിടുന്ന പ്രധാന പ്രശ്നങ്ങൾ എന്നിവയാണ്. ചീര, പയർ, പാവൽ എന്നീ ഒട്ടനൂറു വിളകളാണ് പഠനത്തിനുവേണ്ടി തിരഞ്ഞെടുത്തിരിക്കുന്നത്. തിരുവനന്തപുരം ജില്ലയിൽ കൂടുതൽ പച്ചക്കറികൃഷി ചെയ്യുന്ന രണ്ടു ബ്ലോക്കുകളിൽ നിന്നും നാല് പഞ്ചായത്തുകളിലായാണ് (പള്ളിച്ചൽ, കല്ലിയാറ്റൂർ, കോട്ടുകാൽ, വെങ്ങാനൂർ) പഠനം നടത്തിയത്. ഓരോ പഞ്ചായത്തിൽ നിന്നും 25 കർഷകരെ ഉൾപ്പെടുത്തി ആകെ 100 കർഷകരിലായാണ് പഠനം നടത്തിയത്.

ഈ പഠനത്തിന്റെ പ്രധാന കണ്ടെത്തലുകൾ താഴെപ്പറയുന്നവയാണ്. പഠനത്തിൽ ഉൾപ്പെട്ട 50% ൽ കൂടുതൽ കർഷകരും വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയിൽ നിലനിൽപ്പുള്ളവരാണ്. നിലനിൽപ്പിന്റെ 5 ഘടകങ്ങളിൽ 70% തേന്താളം പക്വത വഹിക്കുന്നത് സാമ്പത്തിക വശമാണ്. കൂടാതെ സാമൂഹികവശം 36% വും, പാരിസ്ഥിതിക വശം 7% വും സാങ്കേതിക വശം 5% വും കാലികവശം 4% വും പങ്കുവഹിക്കുന്നു. പഠനം നടത്തിയ 100 കർഷകരിൽ 55% പേരും വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയിൽ ഏറെക്കുറെ നിലനിൽപ്പുള്ളവരാണ്. ഒട്ടുമിക്ക കർഷകരും കേരള കാർഷിക സർവ്വകലാശാലയുടെ നിർദ്ദിഷ്ട കൃഷിരീതികളെക്കുറിച്ച് അറിവുള്ളവരും ആ കൃഷിരീതികൾ സ്വന്തം കൃഷിയിടത്തിൽ സ്വീകരിക്കുന്നവരുമാണ്. എന്നാൽ വെറും 19% പേർ മാത്രമേ വാണിജ്യാടിസ്ഥാനത്തിലുള്ള ജൈവ പച്ചക്കറികൃഷിയുടെ സാധ്യതകളെക്കുറിച്ച് നല്ലൊരു മനോഭാവം വച്ചുപുലർത്തുന്നുള്ളൂ.

വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയുടെ നിലനിൽപ്പ് പൂർണ്ണമായും ബന്ധപ്പെട്ടിരിക്കുന്നത് കർഷകരുടെ വാർഷികവരുമാനം, കേരള കാർഷിക സർവ്വകലാശാലയുടെ നിർദ്ദിഷ്ട കൃഷിരീതികളെക്കുറിച്ചുള്ള അവരുടെ അറിവും, അവയുടെ സ്വീകാര്യതയും, കാർഷികപരിജ്ഞാനം, കൃഷിയിൽ നിന്നുള്ള സാമ്പത്തിക പ്രചോദനം, വിപണിയുടെ ലഭ്യത, ബഹുജനരാജ്യങ്ങളുടെ ഉപയോഗം, സംരംഭകത്വസ്വഭാവം, പച്ചക്കറികൃഷിയുമായി ബന്ധപ്പെട്ടുള്ള വിവിധ പരിശീലന പരിപാടികളിൽ പങ്കെടുക്കലും, അതുമായി പന്ധപ്പെട്ടുള്ള വിവിധ പ്രോത്സാഹനങ്ങൾ വരി

കുറുകുന്നിവയുമാണ്. എന്നാൽ വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷി പൂർണ്ണമായും ജൈവിക രീതികളിൽ സാദ്ധ്യമല്ല എന്നും പഠനത്തിൽ കണ്ടെത്താനായിട്ടുണ്ട്.

ജലസ്രോതസ്സും, കാലാവസ്ഥാവ്യതിയാനം, ജൈവപച്ചക്കറിക്ക് ആവശ്യമായ വിവിധ ലഭിക്കാത്തത്, രോഗകീടങ്ങളുടെ ആക്രമണം എന്നിവയാണ് വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയിൽ കർഷകർ നേരിടുന്ന പ്രധാന പ്രശ്നങ്ങൾ.

അഭികാര്യമായും എന്നാൽ താരതമ്യേന വിപകുതവുള്ളതുമായ സാങ്കേതിക വിദ്യകൾ ഉൾക്കൊള്ളിച്ചും, പച്ചക്കറിക്ക്, പ്രത്യേകിച്ച് ജൈവപച്ചക്കറിക്ക് ആവശ്യമായ വിവിധ നൽകിയും, വിപണി-വാഹനസൗകര്യങ്ങൾ മെച്ചപ്പെടുത്തിയും, ഇടനിലക്കാരുടെ കടന്നുകയറ്റം ഒഴിവാക്കിയും ഈ പ്രശ്നങ്ങൾക്ക് പരിഹാരം കണ്ടെത്താവുന്നതാണ്. കൂടാതെ മൂല്യവർദ്ധിത ഉല്പന്നങ്ങൾ പ്രോത്സാഹിപ്പിക്കുകയും, യുവാക്കൾക്ക് പ്രത്യേക കാർഷിക പരിശീലനം നൽകി അവരെ കൃഷിയിലേക്ക് താല്പര്യമുള്ളവരാക്കുകയും ചെയ്യുന്നതോടൊപ്പം കർഷകർക്ക് കാർഷിക രീതികൾ സ്വീകരിക്കുന്നതിനുള്ള സഹായങ്ങൾ അതത് സമയങ്ങളിൽ നൽകുന്നതും ഈ പ്രശ്നങ്ങളെ ദൂരീകരിക്കുന്നതിന് സഹായിക്കുന്നു.

തിരുവനന്തപുരം ജില്ലയിലെ വാണിജ്യാടിസ്ഥാനത്തിലുള്ള പച്ചക്കറികൃഷിയുടെ നിലനിൽപ്പിനായി ഉല്പാദന ക്ഷമതകൂട്ടി, വിപണി കേന്ദ്രീകരിച്ച്, ഇടനിലക്കാരെ ഒഴിവാക്കി ഒരു നൂതന തന്ത്രം ആവിഷ്കരിക്കേണ്ടതുണ്ട്. അതു മൂലം പച്ചക്കറികൃഷിയുടെ സാമ്പത്തിക വശത്തിൽ ഓറ്റം സൃഷ്ടിക്കാവുന്നതാണ്. കൂടാതെ ഗവേഷണ-വിജ്ഞാപന മേഖലകളിലെ കൂടുതൽ കാര്യക്ഷമമായ പ്രവർത്തനങ്ങൾ കീടരോഗനിയന്ത്രണരീതികളിലെ നൂതന പ്രശ്നങ്ങളെ നേരിടുന്നതിന് ഉൾപ്പെടുത്തേണ്ടതുമാണ്.

Appendices

APPENDIX I



KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF AGRICULTURE

Department of Agricultural Extension

VELLAYANI - 695 522

THIRUVANANTHAPURAM

☎(O) 0471 2435151

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Dr. B.Seema

Professor

Department of Agricultural Extension

seemamousam@yahoo.co.in

email:

Date: 04-10-2016

Sir/Madam,

Ms. Namitha K. (Ad. No. 2015-11-071), the post graduate scholar in the Department of Agricultural Extension, College of Agriculture, Vellayani is undertaking a research study entitled “ **Sustainability of commercial vegetable cultivation in Thiruvananthapuram district: A multidimensional analysis**” as part of her research work. Variables supposed to have close association with the study have been identified after extensive review of literature.

Considering your vast experience and knowledge on the subject, I request you to kindly spare some of your valuable time for examining the questionnaire critically as a judge to rate the relevancy of the variables. Kindly return the list duly filled at the earliest in the self-addressed stamped envelope enclosed with this letter.

Thanking you

Yours faithfully

Dr. B.Seema

OBJECTIVES OF THE STUDY

This study will assess the sustainability of commercial vegetable cultivation in Thiruvananthapuram district. The commercial vegetable grower's scale of knowledge and rate of adoption of KAU practices in selected vegetables, perception about the feasibility of commercial organic vegetable cultivation and the constraints will also be studied

In this study on commercial vegetable cultivation, sustainability, the dependent variable is operationally defined as the ability of commercial vegetable growers to profitably maintain vegetable production over time.

Variables are given in bold cases and their respective meaning is explained for easy understanding of intended meaning. You may please rate the statement with a tick mark in the appropriate column against the statement with special reference to its importance to meet the objectives of the study.

MR- Most relevant R- Relevant LR- least relevant IR- irrelevant

| Sl. no. | Variable | Operational definition | MR | R | LR | IR |
|---------|------------------|---|----|---|----|----|
| 1 | Age | Refers to the number of calendar years completed by the respondent at the time of enquiry. | | | | |
| 2 | Sex | It refers to the gender of the respondents who are involved in commercial vegetable cultivation | | | | |
| 3 | Education | Refers to the highest academic qualification possessed by the respondent through formal and informal education. | | | | |
| 4 | Knowledge | Defined as the quantum of technical know - how possessed | | | | |

| | | | | | | |
|----|--|--|--|--|--|--|
| | | by the respondent about KAU practices on commercial vegetable cultivation of selected vegetables | | | | |
| 5 | Awareness about commercial vegetable schemes | Defined as the awareness possessed by the respondent about various vegetable cultivation practices and schemes promoting commercial vegetable cultivation. | | | | |
| 6 | Attitude towards commercial vegetable cultivation | Defined as the degree of positive or negative feeling possessed by the respondent about commercial vegetable cultivation. | | | | |
| 7 | Adoption | Defined as extend to which the various popular practices of vegetable cultivation were put into practice by the respondent | | | | |
| 8 | Land ownership pattern | Measured as extend of area owned/leased for commercial vegetable cultivation | | | | |
| 9 | Area of cultivation | Measured as the extend of area under commercial vegetable cultivation in cents | | | | |
| 10 | Cultivation practices | Refers to the extent to which the farmer is adopting organic practices or chemical practices for commercial vegetable cultivation | | | | |
| 11 | Stability in yield | Refers to the condition of obtaining stable yield from commercial vegetable cultivation | | | | |
| 12 | Productivity | Refers to the output from unit square area cultivated. | | | | |
| 13 | Annual Farm income | Refers to the earnings of respondent from the farm per annum. | | | | |
| 14 | Profitability | Perception about the profitability of commercial vegetable cultivation | | | | |

| | | | | | | |
|----|--------------------------------------|---|--|--|--|--|
| 15 | Farming experience | Referred the number of completed years the respondent has been engaged in commercial vegetable cultivation at the time of enquiry | | | | |
| 16 | Credit orientation | Refers to the orientation to avail credit by the respondent for commercial vegetable cultivation | | | | |
| 17 | Market orientation | The degree to which farmers are oriented towards marketing to obtain reasonable gains from selling the produce is operationalized as market orientation | | | | |
| 18 | Market intelligence | Refers to the availability of right information at the right time about vegetable market | | | | |
| 19 | Price fluctuation | Refers to the change in price of vegetables in the markets | | | | |
| 20 | Cosmopolitaness | Refers to the degree to which respondent is oriented to his/her surrounding social system. | | | | |
| 21 | Exposure to mass media | Refers to the extent to which respondent was using the support of mass media for developing his/her knowledge and skills for the improvement of commercial vegetable cultivation. | | | | |
| 22 | Extension agency contact | The degree to which an individual have contact with research and extension agency for the purpose of obtaining information and advices | | | | |
| 23 | Extension participation | Defined as the number and frequency of extension agencies with which the farmer has contact | | | | |
| 24 | Information seeking behaviour | Measures the extent to which the respondent is seeking information from different communication source | | | | |

| | | | | | | |
|----|----------------------------------|---|--|--|--|--|
| 25 | Training attended | Defined as the number of trainings undergone by the respondent in commercial vegetables cultivation from different institutions | | | | |
| 26 | Entrepreneurial behaviour | Refers to the ability of the respondent to exploit the opportunities and initiate an enterprise of his/her own for income generation. | | | | |
| 27 | Scientific orientation | Refers to the degree to which respondent is oriented to the use of scientific techniques for decision making in crop selection and its management | | | | |
| 28 | Economic motivation | Refers to the extent to which respondent is oriented towards profit maximization and relative value he/she places on monetary gain. | | | | |
| 29 | Innovation proneness | Refers to the behaviour pattern of respondent who have interest and desire to bring in sustainability in his/her jurisdiction by introducing new techniques in crop selection and management. | | | | |
| 30 | Progressiveness | Extent to which one is relatively early in venturing or putting the innovation in to practice | | | | |
| 31 | Social participation | Refers to one's degree of participation in a community or society | | | | |
| 32 | Rational orientation | Extent of rationality and scientific belief of respondents | | | | |
| 33 | Achievement motivation | Defined as the need for success or the attainment of excellence | | | | |
| 34 | Risk orientation | Refers to the degree to which the farmer is oriented towards encountering risk and uncertainty in adopting new ideas in farming | | | | |

| | | | | | | |
|----|--------------------------------|---|--|--|--|--|
| 35 | Competitiveness | It refers to respondents strong desire to succeed | | | | |
| 36 | Time utilization | Efficient utilization of time by the respondent | | | | |
| 37 | Environmental soundness | Extent to which respondent were interested in environmental sanitation and ecological concern | | | | |
| 38 | flexibility | Degree to which respondents cope up with unforeseen situations like crop loss, drought , flood etc. | | | | |
| 39 | Farmers satisfaction | It can be defined as the pleasure derived by the respondent from commercial vegetable cultivation | | | | |
| 40 | Any other (specify) | | | | | |

APPENDIX II



KERALA AGRICULTURAL UNIVERSITY

COLLEGE OF AGRICULTURE

Department of Agricultural Extension

VELLAYANI - 695 522

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Date: 10-11-2016

Sir/Madam,

Ms. Namitha K. (Ad. No. 2015-11-071), the post graduate scholar in the Department of Agricultural Extension, College of Agriculture, Vellayani is undertaking a research study entitled “**Sustainability of commercial vegetable cultivation in Thiruvananthapuram district: A multidimensional analysis**” as part of her research work under my guidance.

In this study on commercial vegetable cultivation, sustainability, the dependent variable is operationally defined as the ability of commercial vegetable growers to profitably maintain vegetable production over time. Based on review of literature the researcher has identified four dimensions of sustainability – Economic dimension, Social dimension, Environmental dimension and farmer empowerment dimension.

Considering your vast experience and knowledge on the subject, I request you to kindly spare some of your valuable time for examining the dimensions critically as a judge and to assign weightage in percentage to each dimensions considering the importance and relevance of each dimension to sustainability.

Kindly return the list duly filled at the earliest in the self-addressed stamped envelope enclosed with this letter.

Thanking you

Yours faithfully

Dr. B.Seema

Dimensions are given in bold cases and their respective meaning is explained for easy understanding of intended meaning. You may please assign weightage in percentage to each dimension considering the importance and relevance of each dimension to sustainability in appropriate column.

| Sl no: | Dimension | Operational definition | Weightage (out of 100) |
|--------|--------------------------------------|---|----------------------------|
| 1 | Economic dimension | Defined as the degree of the situation as perceived by the farmer which support an optimum level of production with continuous stable per capita income and efficiency in the eco-friendly use of resources and assured market for his economic wellbeing | |
| 2 | Socio-psychological dimension | Defined as the degree of perceived social situation in which the social processes and structures which help in meeting socio- psychological needs of the farmer which influence his enhanced continuation of | |

| | | | |
|---|--------------------------------|---|--|
| | | commercial vegetable cultivation | |
| 3 | Environmental dimension | Defined as the degree to which relevance and importance of environmental conservation and protection are internalized by the farmer in continuing his commercial vegetable cultivation | |
| 4 | Technological dimension | Defined as the degree of importance perceived by the farmer about the adoption of new technologies based on its perceived attributes to maintain the continuation of commercial vegetable cultivation | |
| 5 | Temporal dimension | Defined as the degree of availability of supplies and services for commercial vegetable cultivation at the right time and the rapidity of returns from commercial vegetable cultivation | |

Economic dimension

Defined as the degree of the situation as perceived by the farmer which support an optimum level of production with continuous stable per capita income and

efficiency in the eco-friendly use of resources and assured market for his economic wellbeing

1. Inputs for commercial vegetable cultivation is available easily
2. Inputs for commercial vegetable cultivation is available at affordable prices
3. Recommended package of practices for vegetable cultivation is profitable for commercial vegetable cultivation
4. Integrated nutrient management, pest and disease management are economically feasible for commercial vegetable cultivation
5. Availability of family labours reduces the cost involved in commercial vegetable cultivation
6. It is easy to obtain credit from bank for commercial vegetable cultivation
7. Marketing of vegetables is not a problem for commercial vegetable cultivation
8. Premium price for safe vegetables grown is assured in the market
9. Government subsidy and incentives are promoting commercial vegetable cultivation
10. Commercial vegetable cultivation increases farmers income with less investment
11. Commercial vegetable cultivation provides year round steady income for the farm family
12. Commercial vegetable cultivation keeps the family members engaged

Socio- Psychological dimension

Defined as the degree of perceived social situation in which the social processes and structures which help in meeting socio- psychological needs of the farmer which influence his enhanced continuation of commercial vegetable cultivation

1. Commercial vegetable cultivation is a prestigious occupation
2. Commercial vegetable cultivation has the status of a business
3. Commercial vegetable growers are being recognized in the society by selecting them for best farmer and other similar awards

4. Farmers continue commercial vegetable cultivation in order to meet the expectations of the community members regarding the status ascribed as a result of involvement in commercial vegetable cultivation
5. The social satisfaction prompts the commercial vegetable growers to continue with commercial vegetable cultivation
6. Commercial vegetable growers appreciated by the community members, because they are ensuring availability of safe and fresh vegetables at reasonable price at the local market

Environmental dimension

Defined as the degree to which relevance and importance of environmental conservation and protection are internalized by the farmer in continuing his commercial vegetable cultivation

1. Commercial vegetable cultivation is feasible with INM, IPM and IDM which makes it safe and environmental friendly
2. Commercial vegetable cultivation does not affect ecosystem stability
3. Commercial vegetable cultivation promotes the use of on farm inputs
4. Commercial vegetable cultivation helps to maintain biodiversity of vegetables of our locality
5. Rotation of various vegetable crops helps in maintaining soil fertility and soil

Technological dimension

Defined as the degree of importance perceived by the farmer about the adoption of new technologies based on its perceived attributes to maintain the continuation of commercial vegetable cultivation

1. Improved technologies are available for commercial vegetable cultivation
2. Available technologies are practically useful for commercial vegetable cultivation

3. The technologies available for commercial vegetable cultivation are sustainable
4. Technologies available for commercial vegetable cultivation is based on farmers need
5. The technologies available for commercial vegetable cultivation are reliable

Temporal dimension

Defined as the degree of availability of supplies and services for commercial vegetable cultivation at the right time and the rapidity of returns from commercial vegetable cultivation

1. Inputs for commercial vegetable cultivation is available at right time
2. Suggestions and services from various extension agencies are available to commercial growers whenever needed
3. Procurement of farm products by the marketing agencies are timely
4. Optimal markets are available for vegetables immediately after harvest
5. Premium price for vegetables are obtained without delay

APPENDIX III

**KERALA AGRICULTURAL UNIVERSITY
COLLEGE OF AGRICULTURE, VELLAYANI, TRIVANDRUM
DEPT. OF AGRICULTURAL EXTENSION**

INTERVIEW SCHEDULE

Sustainability of commercial vegetable cultivation in Thiruvananthapuram district:

A multidimensional analysis.

No.

Date:

Name of Block:

Name of Panchayat:

Name and address of respondent:

1. Name :

2. Age:

3. Sex: Male ☐ Female ☐

4. Address:

5. Phone number:

6. Marital status : Single/ married/ divorcee/widow

7. Family type : Nuclear / Joint

8. Size of family : less than 3 / 3 to 4 / 4 to 5 / above 5

9. Annual income:

10. Educational status

Illiterate/ can read and write/primary/high school/ higher secondary/graduate and above

| | | |
|-----------------------|------------|------|
| 11. Farm size: | Area owned | Acre |
|-----------------------|------------|------|

| Area leased in | Acre |
|----------------|------|
|----------------|------|

12. Area under vegetable cultivation: Acre

Area owned: Acre

Area leased in: Acre

13. Major vegetables under cultivation

[illegible]

14. Knowledge about KAU practices

a) Knowledge test for Amaranthus farmers

1. What is the spacing needed for Amaranthus?
2. Name a high yielding variety of Amaranthus?
3. What is rate of NPK fertilizers to be applied for Amaranthus? (for 1 hectare)

4. During severe cases of leaf webber incidence, 0.1% of Malathion spray can be used. Yes/ No.
5. Which are the important pests and diseases of Amaranthus?
6. Name a neem based product used for pest control?
7. Spraying 1% urea immediately after each harvest will increase the yield. Yes/ No
8. Planting of red leaved varieties should be avoided during heavy rains. Yes/ No
9. Name two varieties of Amaranthus?
10. What is the seed rate of Amaranthus? (per hectare)

b) Knowledge test for Vegetable cowpea farmers

1. What is recommended spacing for vegetable cowpea?
2. What is recommended seed rate for vegetable cowpea? (per hectare)
3. Do you know the method of seed inoculation with rhizobium?
4. Name a high yielding variety of vegetable cowpea?
5. Mention the rate of NPK to be applied for vegetable cowpea? (Per hectare)
6. Critical irrigation period in vegetable cowpea is 15 days after sowing and at the time of flowering? Yes/No
7. Soil drenching with 1% Bordeaux mixture can prevent fungal diseases? Yes/ No
8. Which are the important pest and diseases of vegetable cowpea?
9. Name a neem based product used for pest control and its method of application?
10. Name a red pod variety of vegetable cowpea?

c) Knowledge test for Bitter gourd farmers

1. What is the spacing needed for Bitter gourd?
2. Name a high yielding variety of Bitter gourd?

3. What is the seed rate of Bitter gourd?(for 1 hectare)
4. What is rate of NPK fertilizers to be applied for Bitter gourd? (1 hectare)
5. Top dressing of N fertilizers in split doses at fortnightly intervals? Yes/ No
6. Weeding and raking at the time of fertilizer application? Yes/ No
7. Irrigation at 3-4 days interval and alternate days during flowering/ fruiting? Yes/No
8. Which are the important pest and diseases of Bitter gourd?
9. Vector control of mosaic by spraying Dimethoate? Yes/ No
10. Spraying 0.2% Mancozeb against Downy mildew? Yes/ No

15. Level of adoption

| Sl no | Vegetable practices - Amaranthus | Adopt | Partially adopt | Non adopt |
|-------|--|-------|-----------------|-----------|
| 1 | Avoid sowing of red leaved varieties during period of heavy rain | | | |
| 2 | Varieties : Red – Kannara local, Arun, Krishnasree Green – Co1, Co2, Co3, Mohini and Renusree | | | |
| 3 | Seed rate is 1.5 – 2.0 Kg/ ha | | | |
| 4 | Transplanting of 20-30 day old seedlings in shallow trenches | | | |
| 5 | 50 tonnes of FYM per ha as basal dose | | | |
| 6 | NPK : 50:50:50 Kg/ ha | | | |
| 7 | Top dressing of 50 Kg of N fertilizer at regular interval | | | |

| | | | | |
|----|---|--|--|--|
| 8 | Spraying of, 0.1% of Malathion during severe cases of leaf webber incidence | | | |
| 9 | Spraying 1% urea immediately after each harvest for increasing yield | | | |
| 10 | Avoid use of insecticide or fungicide if maximum possible | | | |

| Sl no | Vegetable practices – vegetable cowpea | Adopt | Partially adopt | Non adopt |
|-------|---|-------|-----------------|-----------|
| 1 | Spacing is 25× 15 cm for dibbling two seeds per hole 30× 15 cm for bush and 2 × 2 m for trailing on pandal@ 3 plants/ pit | | | |
| 2 | Varieties : Bushy- Bhagyalakshmi, Pusa Barsathi, Pusa Komal Semi trailing - Kairali, varun, Anaswara, Kanakamony, Arka Garima Trailing type – Sharika , Malika, KMV-1, Lola, Vyjayanthi, Manjeri Local , Vylathur Local, Kurutholapayar, Vellayani Jyothika | | | |
| 3 | Seed rate is 20-25Kg/ ha for bush cowpea 4-5 Kg/ha for trailing cowpea | | | |
| 4 | Soaking seeds in thiourea (500ppm) solution , followed by two sprays(vegetative stage and flowering stage) | | | |
| 5 | Seed inoculation with <i>Rhizobium</i> and pelleting with lime | | | |
| 6 | Application of 250 Kg/ ha Lime at the time of first ploughing | | | |

| | | | | |
|----|---|--|--|--|
| 8 | Half quantity of N, full P and K applied at the time of final ploughing | | | |
| 9 | Irrigation at critical periods- 15 days after sowing and at the time of flowering | | | |
| 10 | Soil drenching with 1% Bordeaux mixture to prevent fungal diseases | | | |

| Sl no | Vegetable practices – Bitter gourd | Adopt | Partially adopt | Non adopt |
|-------|--|-------|-----------------|-----------|
| 1 | Spacing is 2× 2 m | | | |
| 2 | Varieties are Preethi, Priyanka, Priya and Arka Harit | | | |
| 3 | Seed rate is 5-6 Kg/ ha | | | |
| 4 | Retain 3 plants/ pit | | | |
| 5 | Top dressing of N fertilizer in split doses at fortnightly interval | | | |
| 6 | Weeding and raking at the time of fertilizer application | | | |
| 7 | Irrigation at 3- 4 days interval and alternate days during flowering/ fruiting | | | |
| 8 | Carbaryl 10% DP in pit before sowing | | | |
| 9 | Spraying 0.2% Mancozeb against Downey mildew | | | |
| 10 | Vector control of Mosaic by spraying Dimethoate 0.05% | | | |

16. Perception about feasibility of commercial organic vegetable cultivation

Please give your degree of agreement or disagreement about each of the following statements

(SA – Strongly agree, A – Agree, UD – Undecided, DA – Disagree, SDA – Strongly disagree)

| Sl no | statements | SA | A | UD | DA | SDA |
|-------|--|----|---|----|----|-----|
| 1 | Adoption of commercial organic vegetable cultivation is practical | | | | | |
| 2 | Adoption of commercial organic vegetable cultivation is economically viable | | | | | |
| 3 | Organically produced vegetables have high demand in the market and fetch higher price | | | | | |
| 4 | Inputs for commercial organic vegetable cultivation are available in plenty | | | | | |
| 5 | Biological and mechanical pest and disease control methods are practically useful for commercial organic vegetable cultivation | | | | | |
| 6 | Animal husbandry component in organic farming makes organic vegetable cultivation more profitable | | | | | |
| 7 | Use of organic manures like FYM, compost are feasible for commercial organic vegetable cultivation | | | | | |
| 8 | Organic vegetables can be produced commercially to meet the requirement of society | | | | | |

17. Farming experience

| Sl no: | Experience (Years) | Response |
|--------|---------------------|----------|
| 1 | 5-10 | |
| 2 | 11-25 | |
| 3 | >25 | |

18. Economic motivation

Please give your degree of agreement or disagreement about each of the following statements

(SA – Strongly agree, A – Agree, UD – Undecided, DA – Disagree, SDA – Strongly disagree)

| Statements | SA | A | UD | DA | SDA |
|---|----|---|----|----|-----|
| A farmer should work towards larger yields and economic returns | | | | | |
| The most successful farmer is the one who makes the most profit | | | | | |
| A farmer should try any new farming idea which may earn him more income | | | | | |
| A farmer should grow cash crops to increase monetary profit in comparison to growing of food crops for home consumption | | | | | |

| | | | | | |
|--|--|--|--|--|--|
| It is difficult for the farmers children to make a good start unless he provides them with economic assistance | | | | | |
| A farmer must earn his living, but the most important thing in life cannot be defined in economic terms | | | | | |

19. Credit orientation

1. Do you think a farmer like you should borrow credit for agricultural purpose?
Yes (2) /no (1)
2. In your opinion, how difficult is to secure credit for agricultural purpose?
Very difficult (1) / difficult (2) / easy (3) / very easy (4).
3. How a farmer is treated when he goes to secure credit?
Very badly (1)/ badly (2) / fairly (3) / very fairly (4)
4. There is nothing wrong in taking credit from institutional sources for increasing farm production
SDA (1) /DA (2) /UD (3) /A (4) /SA (5)
5. Did you avail the credit in the last two years for crop production?
Yes /no

20. Extension agency contact

Please indicate how often you visit the following personnel in connection with agricultural activities

| Sl. No: | Category | Regularly | Occasionally | Rarely |
|---------|------------------------|-----------|--------------|--------|
| 1 | Agricultural scientist | | | |
| 2 | Agricultural officer | | | |
| 3 | Agriculture assistant | | | |

| | | | | |
|-----|-----------------------------------|--|--|--|
| 4. | Private extension agencies | | | |
| 5. | Block Technology Manager | | | |
| 6. | Assistant director of agriculture | | | |
| 7. | SMS of KVK | | | |
| 8. | Non-Governmental Organizations | | | |
| 9. | VFPCCK | | | |
| 10. | Any others | | | |

21. Market orientation

| Sl.No | Statements | Response | |
|-------|---|----------|----|
| | | A | DA |
| 1 | Market is not useful to farmer | | |
| 2 | A farmer can get good price by eliminating the middle man | | |
| 3 | One should sell his produce to the nearest market irrespective of price | | |
| 4 | One should purchase his inputs from shops where his friends or relatives are purchasing | | |
| 5 | One should grow those crops which have more market demand | | |
| 6 | Co-operatives can help a farmer to get better price for his produce | | |

22. Exposure to mass media

| Items | Regularly | Occasionally | Never |
|------------|-----------|--------------|-------|
| Television | | | |
| Radio | | | |
| Newspaper | | | |
| Internet | | | |

| | | | |
|-------------------|--|--|--|
| Magazine | | | |
| Bulletin | | | |
| Information Kiosk | | | |
| Mobiles | | | |
| Others | | | |

23. Entrepreneurial behaviour

| SL.no | Statements | Agree | Disagree |
|-------|--|-------|----------|
| 1 | I have enough faith in my own ability | | |
| 2 | I am hesitant about starting / running an enterprise | | |
| 3 | The key points of success should not be divulged to other entrepreneur | | |
| 4 | No one keep information on what others are doing. | | |
| 5 | It is only because of my own effort that I have acquired enough knowledge to start an enterprise | | |
| 6 | I will start an enterprise only if somebody prompt me. | | |

24.Risk orientation

Please give your degree of agreement or disagreement about each of the following statements

(SA – Strongly agree, A – Agree, UD – Undecided, DA – Disagree, SDA – Strongly disagree)

| Sl. No | Statements | SA | A | UD | DA | SDA |
|--------|------------|----|---|----|----|-----|
|--------|------------|----|---|----|----|-----|

| | | | | | | |
|---|---|--|--|--|--|--|
| 1 | A farmer should grow a large number of crops to avoid greater risks involved in growing one or two crops | | | | | |
| 2 | A farmer should take more chance in making a big profit than be content with smaller but less risky profit | | | | | |
| 3 | A farmer who is willing to take greater risk than the average farmer usually does better financially | | | | | |
| 4 | It is good for a farmer to take risk when he knows his chance of success is fairly high | | | | | |
| 5 | It is better for a farmer not to follow commercial vegetable cultivation unless most others in the locality have used it with success | | | | | |
| 6 | Trying an innovative farming technique is beneficial even though an element of failure is involved in it. | | | | | |

24. Training undergone for vegetable cultivation

- i. Have you undergone any training under vegetable cultivation?
- ii. If yes, How many trainings?
- iii. Subject of training?

iv. Agency responsible?

v. Duration of training?

25. Incentives received for vegetable cultivation

- i. Have you received any incentives for commercial vegetable cultivation?
- ii. If yes, how many incentives?

iii. Source of incentives?

- iv. Type of incentive? (Cash, inputs, awards, others – specify the amount and type of incentive among each)

26. Constraints faced in commercial vegetable cultivation

| Sl.No | Constraints | Rank |
|-------|---|------|
| 1 | High cost of cultivation | |
| 2 | Labour scarcity | |
| 3 | Non availability of good quality seeds | |
| 4 | Non availability of inputs in time | |
| 5 | Lack of awareness and knowledge about high yielding varieties | |
| 6 | Lack of awareness and knowledge about improved practices | |
| 7 | Inadequate extension support | |
| 8 | High labour charges | |
| 9 | Inadequacy of capital | |
| 10 | High transportation cost | |
| 11 | Lack of marketing facilities | |
| 12 | High perishability | |

| | | |
|----|---|--|
| 13 | Lack of storage facilities | |
| 14 | Price fluctuation | |
| 15 | Prevalence of pest and diseases | |
| 16 | Inadequate facilities for value addition | |
| 17 | Non assurance of premium price for organic products | |
| 18 | Others | |

27. Sustainability of commercial vegetable cultivation

Please give your opinion about each of the following statements

a. Economic dimension

| Statement | Sustainable | Not sustainable |
|--|-------------|-----------------|
| Inputs for commercial vegetable cultivation is available easily | | |
| Inputs for commercial vegetable cultivation is available at affordable prices | | |
| Recommended package of practices for vegetable cultivation is profitable for commercial vegetable cultivation | | |
| Integrated nutrient management, pest and disease management are economically feasible for commercial vegetable cultivation | | |
| Availability of family labours reduces the cost involved in commercial vegetable cultivation | | |
| It is easy to obtain credit from bank for commercial vegetable cultivation | | |
| Marketing of vegetables is not a problem for commercial vegetable cultivation | | |
| Premium price for safe vegetables grown is assured in the market | | |

| | | |
|--|--|--|
| Government subsidy and incentives are promoting commercial vegetable cultivation | | |
| Commercial vegetable cultivation increases farmers income with less investment | | |
| Commercial vegetable cultivation provides year round steady income for the farm family | | |
| Commercial vegetable cultivation keeps the family members engaged | | |

b. Socio- Psychological dimension

| Statement | Sustainable | Not sustainable |
|---|-------------|-----------------|
| Commercial vegetable cultivation is a prestigious occupation | | |
| Commercial vegetable cultivation has the status of a business | | |
| Commercial vegetable growers are being recognized in the society by selecting them for best farmer and other similar awards | | |
| Farmers continue commercial vegetable cultivation in order to meet the expectations of the community members regarding the status ascribed as a result of involvement in commercial vegetable cultivation | | |
| The social satisfaction prompts the commercial vegetable growers to continue with commercial vegetable cultivation | | |
| Commercial vegetable growers appreciated by the community members, because they are ensuring availability of safe and fresh vegetables at reasonable price at the local market | | |

c. Environmental dimension

| Statement | Sustainable | Not sustainable |
|---|-------------|-----------------|
| Commercial vegetable cultivation is feasible with INM, IPM and IDM which makes it safe and environmental friendly | | |
| Commercial vegetable cultivation does not affect ecosystem stability | | |
| Commercial vegetable cultivation promotes the use of on farm inputs | | |
| Commercial vegetable cultivation helps to maintain biodiversity of vegetables of our locality | | |
| Rotation of various vegetable crops helps in maintaining soil fertility and soil productivity | | |

d. Technological dimension

| Statement | Sustainable | Not sustainable |
|--|-------------|-----------------|
| Improved technologies are available for commercial vegetable cultivation | | |
| Available technologies are practically useful for commercial vegetable cultivation | | |

| | | |
|--|--|--|
| The technologies available for commercial vegetable cultivation are sustainable | | |
| Technologies available for commercial vegetable cultivation is based on farmers need | | |
| The technologies available for commercial vegetable cultivation are reliable | | |

e. Temporal dimension

| Statement | Sustainable | Not sustainable |
|--|-------------|-----------------|
| Inputs for commercial vegetable cultivation is available at right time | | |
| Suggestions and services from various extension agencies are available to commercial growers whenever needed | | |
| Procurement of farm products by the marketing agencies are timely | | |
| Optimal markets are available for vegetables immediately after harvest | | |
| Premium price for vegetables are obtained without delay | | |

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