ADOPTION OF GOOD AGRICULTURAL PRACTICES (GAP) AMONG VEGETABLE FARMERS OF PALAKKAD DISTRICT

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By

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THESIS

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DECLARATION

I, Nagadevi G (2019-11-026) hereby declare that the thesis entitled **"Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad District"** is a bonafide record of research done by me during the course of research and that it has not previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

Certified that this thesis entitled **"Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad District"** is a record of research work done independently by **Ms. Nagadevi G (2019-11-026)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

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(NAGADEVI G)

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Abbreviations	Expansion
CAC	Codex Alimentarius Commission
GAP	Good Agricultural Practices
GHP	Good Hygienic Practices
GMP	Good Manufacturing Practices
GOK	Government of Kerala
HACCP	Hazardous Analysis Critical Control Point
PGS	Participatory Guarantee System
QCI	Quality Council of India
UN	United Nations
VFPCK	Vegetable and Fruit Promotion Council Keralam

Introduction

Chapter 1

INTRODUCTION

India is the world's second largest vegetable producer next to China. The country had a diversified range of agro-climatic zones and seasons which allows for the cultivation of wide varieties of vegetables (National Horticultural Database, 2015). Vegetables are the rich sources of vitamins and minerals that contribute to the fight against malnutrition. They are the most affordable source of natural protective tools and also referred as functional foods

Vegetable cultivation would be approximately 4-5 times more profitable than cereals and other field crops and also provides more job opportunities. India had achieved a spectacular level of vegetable production, with 188.91 million tons from 103 lakh hectares of land (GOI, 2020). India's fresh vegetable exports have a value of 4,383.41 crores, while processed vegetables have a value of 2,760.57 crores (APEDA, 2020).

Considering the importance of vegetable production, United Nations had declared the year 2021 as the "International Year of Fruits and Vegetables". It's a chance to increase the awareness about the importance of fruits and vegetables in human nutrition, food security and health, as well as in achieving United Nations Sustainable Development Goals. Farmers would benefit more economically from vegetable cultivation that has a shorter duration and a higher yield.

Good Agricultural Practices (GAP)

Modern agriculture had succeeded with the growing population's increased food demands. However, issues related to modern farming technologies such as high cost of inorganic inputs *viz.*, fertilizers and crop protecting chemicals leads to diminishing soil fertility and yield. In recent years increased levels of environmental pollutions have compelled many scientists and farmers to concentrate their efforts on eco-friendly and sustainable agriculture.

The idea of Good Agricultural Practices (GAP) emerged recently in response to the widespread concern about food quality and safety as well as ecological sustainability. GAP provides benefits to producers and consumers by assisting them in achieving specific goals such as food quality, food security, production efficiency, livelihood and environmental conservation. For the promotion of GAP products, the Quality Council of India (QCI) had created the INDGAP certification system.

GAP is defined as a "Collection of principles to apply for on-farm production to post-harvesting processes, resulting in safe and healthy food and non-food agricultural products, while taking economic, social and environmental sustainability into account" (FAO, 2011).

Under Codex Alimentarius, a specific version of GAP is used to reduce or prevent food spoilage. The Codex Alimentarius Commission (CAC) had developed and adopted guidelines, standards and related texts on all aspects of food quality and safety, reflecting international consensus. Codex standards serve as a starting point for developing and harmonizing national standards. While the Code of Practice (General Principles of Food Hygiene) and other more specific codes address Good Agricultural Practices in both primary production and value addition. Development of vegetable supply chain programmes and adherence to GAPs, GMPs, GHPs and Hazardous Analysis Critical Control Point (HACCP) techniques had reduced the microbial contamination and improved the quality of vegetables throughout the production chain.

Good Agricultural Practices strive to provide healthy, safe and high-quality food items to consumers in a way that allows for sustainable yields and guarantees the livelihoods of farmers and processors while also enriching the environment. Farmers who had choose Good Agricultural Practices (GAP) for hygiene and food safety in their production system will get access to guaranteed new markets, reliable quality inputs, improved skills in eco-friendly farming operations and raised farm value in both domestic and global markets. Globalization also created new opportunities as well as challenges in meeting rising quality and food safety standards.

Due to the diverse climatic conditions that prevail in different parts of the State, a variety of vegetable crops are cultivated in Kerala. More number of small and marginal farmers, as well as landless agricultural workers, rely on vegetable cultivation for their livelihood. There has been substantial progress achieved in crop improvement, crop production, crop protection and post-harvest handling of numerous tropical vegetables in the State.

Important vegetables cultivated in Kerala include amaranthus, vegetable cowpea, bitter gourd, snake gourd, bhindi, brinjal, cucurbits, drumstick, green chillies and other cool-season vegetables, which are grown mainly in the districts of Palakkad, Idukki and high-altitude villages in Wayanad district. The Kerala government has increased its emphasis on vegetable cultivation in response to reports of pesticide residues in vegetables.

Reports from the Kerala Agricultural University's Pesticides Residue Testing Laboratory indicated that the residues are higher than the permissible levels in most of the vegetables available in the markets. The residue levels in curry leaf, green chilies, yard long bean, cabbage and other vegetables were found to be quite high. Kerala Agriculture University has developed a number of strategies for safe to eat production of vegetables and other crops also. Considering the importance of the production of good quality vegetables and ensuring safe vegetables to consumers, the present study entitled “Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad district” was undertaken.

Objectives of the study

- To analyze the various socio-economic and personal characteristics of vegetable farmers
- To examine the awareness level of farmers on Good Agricultural Practices (GAP) in selected vegetables
- To assess the extent of adoption of Good Agricultural Practices (GAP) in vegetable cultivation
- To determine the factors affecting the adoption of Good Agricultural Practices (GAP) in vegetable cultivation

- To identify the constraints faced by the farmers in the adoption of Good Agricultural Practices (GAP) in vegetable cultivation

Significance of the study

Agriculture production is determined by how far farmers are adopting new agricultural innovations. The introduction of Good Agricultural Practices initiated the transformation of Indian agriculture and thereby creating a huge potential for increasing good quality produce. The study will be extremely beneficial to the Kerala State Department of Agriculture and other Development Departments in developing strategies for the promotion of Good Agricultural Practices (GAP). This study might be greatly beneficiary to administrators, planners, researchers and extension functionaries in developing and implementing relevant policies for sustainable agriculture development in Kerala as well as India. And also, the current study provides valuable information about the awareness and adoption of Good Agricultural Practices and the constraints faced by the farmers in the adoption of GAP in vegetable cultivation in the Palakkad district.

Limitations of the study

Despite the fact that the inquiry was conducted with good care in order to make the study more thorough and accurate, there were some limitations. Because the current study was part of a master's degree program, it was subjected to the usual inherent restrictions that a student researcher faces. The following are the limitations of the study:

1. Because the study was limited to only 120 respondents, who represented the entire community of vegetable farmers in Kerala, the study's findings may not be generalizable
2. The investigation is also suffered from the typical limitations of a student researcher's constraints like lack of time, money and other resources
3. The study's findings were based on the responses of the vegetable farmers and its precision was dependent on whether the farmers responses were biased or unbiased
4. The study was limited to only three vegetables namely Bitter gourd, Vegetable cowpea and Bhindi and despite the fact that honest and deliberate attempts were made in selecting the variables for the current study, certain variables may still be missing

Organization of the study

The report of the research study on the "Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad district" had divided into six chapters.

The first chapter, depicted the statement of the problem under consideration. The significance of the study, objectives of the study and limitations of the study were also revealed.

The second chapter, namely 'Review of Literature' included review of relevant literature as well as the findings of previous research studies conducted in various locations on the similar topic.

The third chapter 'Methodology,' described the research methods, techniques and tools used, as well as the procedure had followed in the current investigation.

The fourth chapter 'Results and Discussion', had focused on the current study's findings and pertinent discussion.

The fifth chapter contains a 'Summary and Conclusion' of the investigation and also findings from the study.

The sixth chapter was presented with Cited literature, Appendices and Abstract.

Review of literature

Chapter 2
REVIEW OF LITERATURE

A comprehensive literature review is a vital aspect of research. The current study is the first of its kind in Kerala and it examines Good Agricultural Practices in vegetable cultivation. As a result, there are only a few research findings in this new sector. In light of this, a thorough assessment of prior research studies on the research topic has been conducted in accordance with the study objectives. The subheads below provide a chronological overview of relevant studies in this field of study.

2.1 Definition of Good Agricultural Practices

2.2 Necessity of Good Agricultural Practices

2.3 GAP proponents in Kerala

2.4 Profile characteristics of vegetable farmers

2.5 Extent of awareness about Good Agricultural Practices (GAP)

2.6 Extent of adoption of Good Agricultural Practices (GAP)

2.7 Factors affecting the adoption of Good Agricultural Practices in vegetable cultivation

2.8 Constraints in the adoption of Good Agricultural Practices (GAP)

2.1 Definition of Good Agricultural Practices

FAO (2003) reported that Good Agricultural Practices referred to the on-farm processes that are environmentally, economically and socially sustainable process, resulting in safe and high-quality food and other agricultural products.

Ellis *et al.* (2004) expressed that GAPs are a set of guidelines for improving the safety and quality of agricultural products. Such type of general recommendations could be applied to all kinds of production systems. GAPs focused mainly for both production and processing components *viz.* soil, hands, water and surfaces sanitization.

Nagel (2004) found that Good Agricultural Practices programs include the entire agricultural farming, starting from seedling planting to harvesting of crops.

2.2 Necessity of Good Agricultural Practices (GAP)

Mc Cluskey and O"Rourke (2000) reported that food safety is becoming increasingly important to produce growers. They began by claiming that fee-structured certification systems would restrict some of the small farmers from participating in the market.

Viaene *et al.* (2000) revealed that consumer behaviour was highly influenced by aspects such as safety, quality, health and particularly in the case of fresh foods.

According to Garbutt and Hofmans (2001) a well-known government certifying authority, teaching smallholders to acquire Europe GAP certification by not only the government organizations, some other non-Governmental Organizations, colleges, multinational enterprises and the private sectors also involved in creating awareness on GAP certification.

Jaffee (2003) stated that in underdeveloped countries, GAPs can act as a catalyst for bettering agricultural practices and supply chain management.

Maharashtra State Agricultural Marketing Board (2005) found that GAP farmers in India may reap long-term benefits such as a more engaged workforce as a result of enhanced facilities, training and working conditions, as well as it helps to rise in living standards.

Garcia Martinez *et al.* (2007) reported that consumers needed more confidence about the safety of the food they consumed. There were concerns that excessively stringent regulation would hinder innovation and restrict agriculture and food trade.

Ag-Network-Chile (2008) revealed that GAP programs aided farmers in self-auditing their operations for the production, processing and distribution of plant and animal-based goods in order to protect food, the environment and the people who ate the products.

Davis (2008) found that GAPs could aid in tracing tainted foods back to the "handlers and farmers" who are accountable for dangerous agricultural products.

2.3 GAP proponents in Kerala

In Kerala, many agencies, policies and programs are promoting GAPs in various crops. They are given below.

2.3.1 Government of Kerala

Paul (2004) reported that the State government is planning to float a marketing company under the Department of Agriculture to give farmers the much-needed edge to market their produce under the brand name "Kerala Natural" (those produced through good agricultural practices) in the national and international markets by eliminating intermediaries. The company had apex bodies in all districts with three collection centers under each of them. The farmers will be paid on the spot itself.

2.3.2 Vegetable and Fruit Promotion Council Keralam (VFPCK)

VFPCK was a state government-sponsored company for promoting GAP in a big way. The council had reached an understanding with the Dutch agency, 'Foodcert' to secure certification for eco-friendly produced vegetables and fruits. The Dutch agency would help in training farmers and officials to improve quality and determine the new standards. The council is taking steps to reduce the use of pesticides and fungicides.

2.3.3 Kuttanad GAP Project

The Kuttanad initiative aims to promote creative approaches *viz.*, use of seed drums, transplanting machinery and *in-situ* crop residue, weed composting. This project was initiated as part of the Kerala State Government's Haritha Keralam effort. The introduction of good agricultural practices will include the creation of a Codex Alimentarius Commission for cultivation of rice, the training of master trainers among agricultural officers and farmers, the nomination of a Geographical Indication Registry for Kuttanad rice and the certification of farm produce were also practiced by using Good Agricultural Practices (GAP).

2.3.4 Scheme on organic farming and Good Agricultural Practices

In 2015, the State Agriculture Department began working towards the Organic State goal by adopting GAP (Good Agricultural Practices) for safe-to-eat output, with a budget of Rs.106.7 lakh. Kasargod is home to six of Kerala's 152 total blocks. The government is currently attempting to establish a PGS (Participatory Guarantee System) for organic certification, in which farmers certify one another. This sort of certification is free of charge and focuses primarily on organic consumption in the state. GAP-certified agricultural areas' products would be labeled as "safe to eat."

2.4 Profile characteristics of vegetable farmers

2.4.1 Age

George *et al*. (2012) conducted research on adoption of integrated pest management practices in vegetable crops at Karnataka discovered that most of vegetable farmer (45.60 per cent) are middle age category.

Gopichand and Banerjee (2017) stated that most of the vegetable farmers (54.16 %) categorized to the middle age group, followed by old age category (32.17%) and young age category (13.70 %) of the vegetable farmers.

According to Wongnaa *et al.* (2017) factors affecting the adoption of maize production technologies in Ghana reported that 56.9% of the maize growing farmers were young age category of 18-45 years followed by 31.2 % of respondents belonged middle age category of 46-60 years and only 11.8 % of the vegetable farmers are old age category of more than 60 years.

According to Shambarker *et al.* (2018) Perceived attributes of Integrated Pest Management technologies among *Bacillus thrungensis* cotton farmers discovered that 44.00 % of the farmers belonged to the age category of 36 to 50 years. In addition, 34.67 per cent of farmers were above the age of 50 years and 22.33 per cent were below the age of 25 years.

According to Khan *et al.* (2020) nearly half of the vegetable farmers (47.50 per cent) are in the middle age category of 30 to 55 years followed by 20.83% were belong to the old age category of above 55 years and 31.67 % of the farmers belongs to young age category of below 30 years.

2.4.2 Education

A study on the marketing behaviour of mango growers specified that 35.83 % of the mango growers had studied secondary school education, 32.51% of the mango growers had graduated while 23.33 % had higher secondary education. And only 8.33 per cent had primary school education (Joshi, 2014).

According to Dheeraj and Kalyan (2015) socio-economic profile of vegetable growers in Uttar Pradesh discovered that majority (35.61 per cent) of the vegetable growers had high school education followed by 17.08 per cent had middle school education, 15.61 per cent were categorized as intermediate level, 10.24 per cent had their primary school education, 11.71 per cent were illiterate and only 9.75 per cent of the vegetable farmers had education up to college level.

Bagheri and Shabanali (2016) found that 66.20 per cent of the potato farmers had their secondary school education, 10.50 per cent of potato farmers were graduated and 23.30 per cent of potato farmers had their high school education.

Victoria *et al.* (2016) conducted a study on pesticide exposure from fresh tomatoes and its relationship with pesticide application practices in Meerut district described that 2.00 % of the tomato farmers are graduates, 26 % were completed secondary school education while, 66.00 per cent completed primary and 6 % of the tomato farmers are illiterate.

Research study on factors affecting the adoption of maize production technologies at Ghana district revealed that 35.9 % of the maize growers were doesn't received any formal education followed by 34.7 % of farmers who are educated middle school education and 14.6 % of the farmers were received primary school level education (Wongnaa *et al.*, 2017).

2.4.3 Experience in vegetable cultivation

Firas (2014) directed a study on the adoption range of integrated pest management (IPM) techniques by greenhouse vegetable growers in Jordan discovered that majority of the growers (39%) had of farming experience of 7.26 years and 36 % had of experience of 16.72 years. While only 10 % of growers have had experience above 30 years.

Dheeraj and Kalyan (2015) held research on the socio-economic profile of vegetable growers at Uttar Pradesh showed that most of vegetable growers (61.50 %) had a medium level farming experience followed by 22.40 % had a low level of farming experience and 16.10 % had a high level of farming experience.

Ram (2015) in their work on the Paddy farmers' perspectives of environmental effects caused by inappropriate use of chemical compounds in rice production revealed that less than half of growers 46.66% had a low range of experience, 40 % had medium and 13.34 % had high level of farming experience.

Issa and Hamm (2017) conducted a study on awareness about the market facility by fruit and vegetable growers in Pune revealed that 27.40 % of the farmers have organic farming experience less than 19 years. 42.47 % are had experience ranging 20-30 years and 29.7 % of the farmers had experienced more than 30 years.

Maya *et al.* (2018) observed that more than half (68.00%) of the turmeric growers had a medium range of farming experience over improved turmeric cultivation practices, while 17 % had a high range of farming experience and 15.00 % had a low range of farming experience.

2.4.4 Area under vegetable cultivation

Joshi (2014) reported that the majority (60 per cent) of the mango growers had a medium area under mango cultivation, while 26.67 per cent of them had large area mango cultivation and 13.33 per cent had a low area under mango cultivation.

Ram (2015) observed that nearly half (40.66 %) of rice growers had the medium size of landholdings under rice cultivation, while 34.67 % of the farmers had small size of landholding and 16.67 % had marginal landholdings. Only 8 % of the respondents were grouped into large size of landholdings.

Islam *et al.* (2019) conducted research on knowledge and adoption of recommended package of practices by pomegranate growers reported that most of the farmers (92.90%) were had marginal to small landholding.

Kaur *et al.* (2020) revealed that nearly 30.50 per cent of tomato farmers had marginal to small landholdings, while 26.50 per cent had semi-medium and 9.50 per cent had medium to large size of landholdings under tomato cultivation.

Khan *et al.* (2020) conducted a study on Socio-Economic Profile of Vegetable farmers under Horticulture based Module of vegetable growers FIRST Project in Palakkad district found that 38.33 % of the vegetable growers had less than one hectare of land holdings belongs to marginal farmers category. Small and medium farmers categories accounted for 9.17 % and 52. 30 % respectively.

2.4.5 Annual income of vegetable cultivation

Venkatachalam *et al.* (2016) affirmed that 46.00 % of coffee growers had income with in Rs.10001 to 25000 per annum, 40.00 per cent of farmers income lies between Rs.25001 to Rs.40000 while 8 % of the farmer's income was less than Rs.10000 and only 6 % of the farmers had an income of above Rs.40000.

Kadam (2016) held a study on the attitude of the vegetable growers towards IPM technology programme on cotton observed that 64.00 % of the farmers fall in the medium range of annual income between Rs.55001 to 92500 while, 22.00 % cotton farmers had high annual income range of above Rs. 92500 and only 14 % respondents are low annual income of less than Rs.55,000.

Aldosari and Noor (2017) conducted a study on farmers' perception regarding the use of information and communication technology stated that 36.60 % of vegetable growers have received an annual income of 16-20 thousand in Vegetable cultivation, 21.90 per cent respondents have received income range of 11 to 15 thousand per year.

Wang *et al.* (2018) indicated that about 30.31 %of rice growers had a medium income range of 1 to 2 lakh while 25.09 % of farmers had a high annual income above two lakhs, 22.30 per cent rice growers had a low annual income level of below 1 lakh.

Kavyasree *et al.* (2021) held research on the adoption behavior of farmers about recommended technologies for soybean described that 43.33 % of farmers had medium range of annual income and 41.67 % of the farmers had high range of annual income in soybean cultivation.

2.4.6 Training received

Jaganathan (2004) stated that 57 per cent of vegetable farmers had a medium level of training, with the rest having a low level of training. Only 10 per cent of the farmers had a high level of training. The medium level of extension orientation could be the reason for the medium level of training attended.

Shinde (2011) revealed that 44.16 per cent of cotton growers received only one training, whereas 31.67 per cent, 14.17 per cent and 10.00 per cent have received two, three and more than three times of training respectively.

Chaudhary (2013) led a study on the role of farm women in agriculture operation described that majority (70.83 %) of farm women have received training and the rests of them (29.17 %) were not received any training.

Shelake (2015) informed that all (100 per cent) agricultural input dealers had received training on various aspects related to fertilizers, seeds, insecticides, pesticides, implements and their use.

Maya *et al.* (2018) reported that majority of the turmeric farmers (68.00 %) had received only up to one level of training in improved turmeric cultivation practices. 17 per cent of farmers had not received any training, while 2 % of the farmers received more than three training sessions.

2.4.7 Social participation

Gopichand and Banerjee (2017) revealed that the majority of vegetable farmers (41.66 per cent) were not members of any organization, followed by rythu bazar members (19.16 per cent), other organizations (18.33 per cent), panchayat members (14.16 per cent), socio-cultural organizations (10 per cent), religious organizations (4.16 per cent), school management and co-operative society (3.33 per cent).

Sindhuja and Shanthasheela (2017) observed that a low level of social participation was found in 58.05 % of the precision farming beneficiaries, while a high level of social participation was found in 41.95 per cent of the precision farming beneficiaries.

Papnai *et al.* (2017) conducted a study on awareness among vegetable growers regarding the effect of pesticide residues observed that 31.67 per cent of vegetable farmers were involved in socio-political institutions such as panchayat, followed by 23.33 per cent in co-operative societies, 13.33 per cent in farmers forums and 11.67 per cent in various youth clubs such as Yuvak Mangal dal and Yuvan Mangal dal.

Khan *et al.* (2020) 45.83 per cent of vegetable farmers were members of one organization, while 34.17 per cent were members of seven to ten organizations. As a result, 80 per cent of vegetable farmers were involved with organizations such as panchayats, cooperatives, youth clubs and political organizations. It is also possible to conclude that only 4.39 per cent of vegetable farmers held office in one or more organizations.

2.4.8 Mass media exposure

Kaur and Shindu (2015) reported that marketing of potato in Jalandhar district of Punjab revealed that the majority (65.00%) of the farmers had a medium exposure of mass media contact followed by 16.67 % of farmers who had a high exposure of mass media contact and 10 % of farmers who had a low exposure of mass media contact. Only 5.83 % farmers had very high exposure of mass media contact and 2.50 % farmers had very low exposure of mass media.

Anju and Padmanabhan (2016) reported that the most of the vegetable farmers (71.11 per cent) were having a medium level of exposure to mass media contact. while 17.78 percent of respondents were having high exposure to mass media contact and only 13.33 % of the vegetable growers found to be a low exposure of mass media in the adoption of recommended KAU Varieties in vegetable cultivation.

Lokesh *et al.* (2017) led research on socio-economic factors affecting the awareness of farmers towards the effect of pesticides on human health stated that the most of the farmers (59.16%) had a medium exposure to mass media contact. while 20 % of vegetable farmers had a high exposure to mass media contact. only 20.83 % of the farmers had low exposure to mass media in the entrepreneurial behavior of potato farmers.

Phukan *et al.* (2018) observed that the most of the (23 per cent) vegetable growers obtained market information from their local community radio channels followed by progressive farmers (18 per cent) and newspapers (18 per cent). However, farmers obtained market information from other sources such as input dealers (10 per cent), marketing agencies (7 per cent) and 2.5 per cent getting information from internet.

Singh (2020) reported that post-harvest management practices in mango cultivation described that 61.66 % of the farmers had a low media exposure while 25.00 % of the farmers had a medium exposure to media and only 13.34 % of farmers had a low exposure of media.

2.4.9 Extension orientation

Shaikh *et al.* (2015) conducted a study on farmer's attitude towards using agrochemicals in rice production in the laxmipur district of Bangladesh revealed that half of the vegetable farmers (50 per cent) had a medium level of extension contact with extension personnel from various organizations, whereas 28.00 and 21.66 per cent had a low and high level of extension contact, respectively.

Angadi *et.al* (2016) awareness knowledge of farmers about improved cultivation practices of groundnut. found that the majority of respondents (73.34 per cent) had a medium level of extension contact. whereas 14.16 per cent of respondents had a low level of extension contact and only 12.50 per cent of brinjal farmers were found to have a high level of extension contact.

Gujar *et al.* (2017) in their study of potato farmers entrepreneurial behaviour, indicated that more than half of the respondents (60.83 %) were in the medium category of extension participation, followed by the low category (21.66 %), and 17.50 % were in the high category.

Islam *et al.* (2019) held a study on farmers' knowledge on climate change effects in agriculture stated that the majority (79 %) of the respondents had medium to high exposure towards extension contact and remaining 21 % of the respondents are had low exposure towards extension contact.

Singh (2020) stated that more than half of the brinjal farmers (55.83 %) were in the low category of extension contacts, followed by the medium category (23.34 %) and 20.83 % were in the high category in the study of knowledge and adoption of post-harvest management practices in mango cultivation.

2.4.10 Risk taking ability

Kumar *et al.* (2015) discovered that approximately half (45.00 per cent) of grape farmers belonged to the medium category, while high and low-risk orientations were 31.00 per cent and 24.00 per cent respectively.

Kadam (2016) stated that 61.67 % of integrated weed management vegetable growers had a medium risk orientation, while 24.16 % had a high integrated weed management farmers and 14.17 % had a low-risk orientation of high integrated weed management farmers.

According to Devde (2017) majority 70.84 % of the vegetable growers had a medium risk orientation, while 11.66 % had low-risk orientations in vegetable cultivation and 17.50 % high-risk orientations in vegetable cultivation.

Masudkar *et al.* (2017) discovered that 21.33 % groundnut farmers preferred low risk, while 18.67 % of groundnut farmer's preferred high risk and 60.00 % of groundnut farmer's preferred medium range of risk-taking ability.

Maurya *et al.* (2017) indicated that 23.75 and 16.25 per cent of respondents were found to be low and high levels of risk orientation respectively. Whereas, 60 % of the farmers were found to be medium category of risk orientation in cauliflower cultivation.

2.4.11 Economic motivation

Mengistie *et al.* (2013) conducted a study on pesticide use practices among smallholder vegetable farmers in Ethiopian central rift valley observed that nearly half (45.83 per cent) of the respondents had medium level of economic motivation, whereas one fourth (25.00 per cent) of them had high level of economic motivation, remaining 16.66 and 12.50 per cent of them had low and very low level of economic motivation, respectively.

Ram (2015) revealed that slightly more than half (52.00 per cent) of the rice farmers had a medium degree of economic motivation, followed by a high, very high and low degree of economic motivation with 44.00 per cent, 2.67 per cent and 1.33 per cent, respectively. None of the respondents was found in the category of a very low level of economic motivation.

Gopichand and Banerjee (2017) reported that nearly half (47.50 %) of the vegetable farmers had a medium economic motivation, which could be due to their careful use of resources vegetable farmers.

Sindhuja and Shanthasheela (2017) stated that 62.06 per cent of respondents had a high level of economic motivation, 21.26 per cent had a low level and 16.68 per cent had a medium level of economic motivation. A farmer's basic instinct is to earn more money from their farming, regardless of the farming approach they use. Farmers had embarked on this venture with only a sliver of a chance of making a profit from precision farming.

Gupta *et al*. (2018) conducted a study on pesticide handling practices among smallholder vegetable farmers in Oyo state Nigeria observed that 60.00 per cent of farmers had a medium level of economic motivation, while 20.83 per cent and 19.17 per cent had a high and low level of economic motivation respectively.

2.4.12 Environmental orientation

Jaganathan (2004) observed that more than half of the respondents (60 per cent) had high environmental orientation, followed by low (28 per cent) and medium (12 per cent) level of environmental orientation because of their high level of education and mass media exposure.

Bhatta *et al.* (2015) reported that more than half of the tomato farmers (56.33 per cent) had a high level of environmental orientation. while 15.53 per cent and 28.14 per cent had a high and low level of environmental orientation respectively.

2.4.13 Market perception

According to Basera and Bhadrdwaj (2017) more than half of the respondents (61.25 per cent) had a high level of market orientation, whereas 36.25 per cent had a low level of market orientation.

Gurjar *et al.* (2017) discovered that the vast majority of respondents (74.16 per cent) had a medium level of market orientation, whereas 15.00 and 10.83 per cent had a low and high level of market orientation, respectively

According to Maratha *et al.* (2018) the majority of respondents (65.00 per cent) had a medium level of market orientation, whereas 21.67 per cent and 13.83 per cent had a high and low level of market orientation, respectively.

Phukan *et al.* (2018) observed that the majority of vegetable farmers (48 per cent) sell their produce immediately after harvest for whatever price is offered, followed by immediately after harvest if prices are favorable (35 per cent) and if prices are low, they will be stored for one or two months (16 per cent).

2.5 Extent of awareness about Good Agricultural Practices (GAP)

Vihariya (2017) revealed that more than half (54.17 %) of vegetable farmers had a medium level of awareness about the harmful effects of pesticide residues in vegetable cultivation followed by 25.83 % had high level of awareness about the harmful effects of pesticide residues in vegetable cultivation, 9.17 % who had a low level of awareness about the harmful effects of pesticide residues in vegetable cultivation, 6.67 % who had a very high degree of awareness about the harmful effects of pesticide residues in vegetable cultivation and 4.17% who had low degree of awareness about the harmful effects of pesticide residues in vegetable cultivation.

Hardik (2015) reported that majority (52.00 per cent) of the respondents had a high level of awareness regarding global warming, whereas 43.00 per cent and 5.00 per cent of the respondent had very high and low levels of awareness respectively, none of the respondents had a low and very low level of awareness regarding global warming respectively.

Rahimi (2018) found that 70.83 % of farmers reported a medium degree of overall awareness about pesticide residues, whereas 17.50 % had a low degree of awareness about pesticide residues and 11.67 % had high degree of awareness about pesticide residues.

Jayakumar and Pasupathi (2019) stated that only 37.8 per cent of the farmers were aware on different organic food products, while the remaining 62.2 per cent were unaware of organic food products. It appears that the majority of respondents are unaware of the benefits of purchasing organic products.

Maru *et al.* (2019) mentioned that there is 58.75 per cent of farmers have a high degree of awareness of sprinkler irrigation systems, followed by 28.75 per cent, 10 per cent and 2.50 per cent who have a very high, low and very low level of awareness about sprinkler irrigation systems respectively.

2.6 Extent of adoption of Good Agricultural Practices (GAP)

Anju and Padmanabhan (2016) mentioned that 60 per cent of the Amaranthus farmers and 57.78 per cent of vegetable cowpea farmers had a medium level of adoption followed by 22.22 per cent of the Amaranthus farmers and 24.44 per cent of vegetable cowpea farmers belonged to low level of adoption on recommended practices of KAU varieties and 17.78 per cent of the respondents belonged to high adopter category.

Suramwad and Kolgane (2017) stated that majority of the grape farmers (63.33%) were medium-level adopters, while 20.00% of the respondents were high adopters and 16.67% of grape farmers were low adopters.

Chigadolli *et al.* (2019) concluded that the distribution of turmeric cultivators in terms of overall adoption of improved turmeric cultivation practices shows that 47.50% of the turmeric farmers had a medium level of adoption while 32.50% had a high level of adoption and 20.00% had a low level of adoption.

Borah *et al.* (2020) discovered that the majority of farmers (45.00%) had a medium extend of adoption, while 30.00% had a low extend of adoption of recommended practices for selected major vegetables and only 25.00% of the respondents belonged high extent of adoption.

Virender Singh *et al*. (2020) discovered that 48.34 per cent of the respondents had a high level of adoption, followed by 38.33 per cent who had a medium level and 13.33 per cent of the farmers had a low level of adoption on the post-harvest management measures for mango.

Justus Ochieng *et al*. (2021) observed that improved vegetable varieties, mineral fertilizers and manures are being adopted by the farmers at a rate of 32 per cent, 67 per cent and 58 per cent, respectively. In their vegetable farms, only 21 per cent of farmers used three or more pest management measures.

Ravi *et al*. (2021) revealed that in the adoption of Agro-waste management techniques the majority of farmers (45.80 %) belonged to a medium adoption group, followed by low (27.50 %) and high (26.70 %) adoption categories.

2.7 Factors affecting adoption of Good Agricultural Practices vegetable cultivation

Anju and Padmanabhan (2016) discovered that in the case of amaranthus and vegetable cowpea farmers, scientific orientation and innovativeness had a significant and positive relationship with the adoption. In the case of vegetable cowpea farmers, education had a significant and positive relationship with adoption. In the case of amaranthus farmers, scientific orientation, innovativeness, contact with extension agents, and mass media exposure all had a significant and positive relationship with adoption. this is because of majority of the farmers had contact with extension agencies attended Krishi Bhavan training and took part in various extension programs.

According to Kumari *et al.* (2017) age, farming experience, fatalism, and attitude toward indigenous agricultural practices are positively significant at the 1% level of significance and family size is significant at the 5% level of significance. At the 1% level of significance, education, extension contact, innovativeness, achievement motivation, scientific orientation, and economic orientation were found to have a negative and significant relationship with the extent of adoption of indigenous agricultural practices. Farm size, family income, social participation, and market orientation all had a positive but insignificant relationship with the extent to which indigenous agricultural practices were adopted.

Rana *et al.* (2017) stated that majority of the farmers (95.4 per cent were enthusiastic about growing organic vegetables. The educational level, extension contact, mass media contact and agricultural training obtained all exhibited a positive and substantial link with their attitude score, according to the correlation analysis.

Chandran and Podikunju (2019) discovered that among the selected independent variables, education and economic motivation were positively and significantly correlated to the knowledge level on organic farming technologies at 5% level of significance.

Kasinath *et al.* (2019) identified that respondents' knowledge level in various aspects of vegetable cultivation practices was positively correlated with socio-economic parameters such as age, education and annual income. According to the findings, the knowledge level of respondents increased in direct proportion to their level of education and annual income.

According to Bhattacharjee *et al.* (2021) age, education, farming experience, annual income, extension participation, mass media exposure, economic motivation, market perception and adoption are significant and positively related to the achievement motivation of organic farmers.

Ravi *et al.* (2021) conducted a study on factors influencing the adoption of Agri-waste management practices discovered that a correlation analysis between the extent of adoption of Agri-waste management practices and the profile characteristics of respondents revealed that information-seeking behavior had a positive and significant relationship with adoption at the 1 % level of significance. At the 5% level of significance, the variables education, cropping pattern, infrastructure facilities, innovativeness, achievement motivation, and training received had a positive significant relationship with adoption, while farming experience found to be negatively significant.

2.8 Constraints in the adoption of Good Agricultural Practices (GAP)

Resmy *et al.* (2001) observed that farmers in the coconut and banana industries were not implementing sustainable agricultural methods due to a lack of knowledge, technical guidance and information sources.

Berdegue *et al.* (2003) reported that in several developing nations, poor public extension services are a major barrier to GAP adoption.

Chand *et al*. (2003) concluded that the absence of market intelligence, insufficient physical facilities in the market, fluctuation in market price and lack of suitable support prices are the primary challenges in vegetable marketing.

Garrett *et al.* (2003) revealed that the cost of the Good Agricultural Practices (GAP) program is costly and difficult to predict. It differed depending on the (i) number of size of acres, (ii) the number of water sources used, (iii) growers' ability to develop food safety program documentation themselves, (iv) increased labor charges, (v)capital equipment costs to ensure that people, water and soil amendments do not contaminate the agricultural produce.

Koomen *et al.* (2011) reported that lack of awareness of good agricultural practices, insufficient information regarding horticultural schemes, raise in the cost of production of Good Agricultural Practices, lack of better pricing for GAP, lack of access to specialized market for GAP, unavailability of post-harvest storage facilities in the market and lack of market knowledge are the major constraints of good agricultural practices in horticultural crops.

Becot *et al.* (2012) investigated the economic costs of good agricultural practises (GAP) and discovered that infrastructure, equipment, and labour costs influenced audits of small and medium-sized farms. The study examined all of the certification criteria and calculated the costs of GAPs from the initial planning stages to daily record-keeping more than a year after certification.

Sahu *et al.* (2013) reported that the main challenge of vegetable production was a lack of knowledge on enhanced variety, seed rate and sowing time followed by IPM technologies, improved vegetable seeds, irrigation facilities, remunerative price, scientific vegetable production technology training, subsidy and high-cost pesticides.

Divya and Sivakumar (2014) concluded that the main constraints of low adoption of GAP in chili cultivation are lack of awareness, high cost of production and less land holding of vegetable farmers.

Krishnamoorthy *et al*. (2016) identified that farmers' main constraints included high labour costs and labour scarcity, unpredictable electricity supply, high plant protection chemical costs and the lack of a minimum price policy for vegetable crops.

Zaw and Myint (2016) reported that major constraints in the adoption of good agricultural practices in rubber cultivation are outdated planting recommendations, lack of planting legume cover crop, lack of awareness about improved tapping systems and usage of unproven cultivars as a seedling material.

Choudary and Khodifad (2017) revealed that the majority of farmers encountered limits due to the complicated, lengthy and costly certification process as a major constraint. Lack of marketing facilities, increasing in the cost of production, lack of awareness of Good Agricultural Practices and low market expertise were ranked second, third, fourth, fifth and sixth respectively.

Pandit uday *et al.* (2017) found that basmati rice farmers viewed groundwater depletion as the first key concern, followed by soil health sustainability and finances. Lack of infrastructure and machinery availability, low institutional support and tiny landholdings are the other substantial roadblocks in adoption of Good Agricultural Practices.

Das *et al.* (2019) found that high pest and disease incidence, unavailability of post-harvest storage facilities, lack of quality planting material and lack of technical knowledge for crop production are the major challenges in the adoption of GAP in pineapple cultivation.

Borate *et al.* (2020) reported that banana farmers faced challenges such as a lack of timely technical support for good agricultural practices, lack of packing and grading facilities and lack of market information in the adoption of Good Agricultural Practices.

Vani and Bhindu (2021) reported that pest and disease prevalence, water scarcity, price volatility, high labour charges, high cultivation costs, labour shortages, non-availability of inputs on time and no guarantee of premium prices for GAP products, lack of knowledge about post-harvest handling, lack of storage facilities and inadequate extension support were the major constraints in adoption of GAP among vegetable farmers in Kerala.

Research methodology

Chapter 3
RESEARCH METHODOLOGY

Research methodology is a specific and planned approach to solving research problems. The research study's objectives should be systematically assessed using a well-structured and organized research methodology. It is necessary for the researcher to not only know and understand the research methods but also to use the appropriate tools to find meaningful solutions for the field-level problems. In this chapter the methodology used for the current study was presented under the following sub-heads:

3.1 Research design

3.2 Description of the study area

3.3 Sampling procedure used

3.4 Variables and their empirical measurement

3.5 Methods of data collection

3.6 Analytical framework of the research

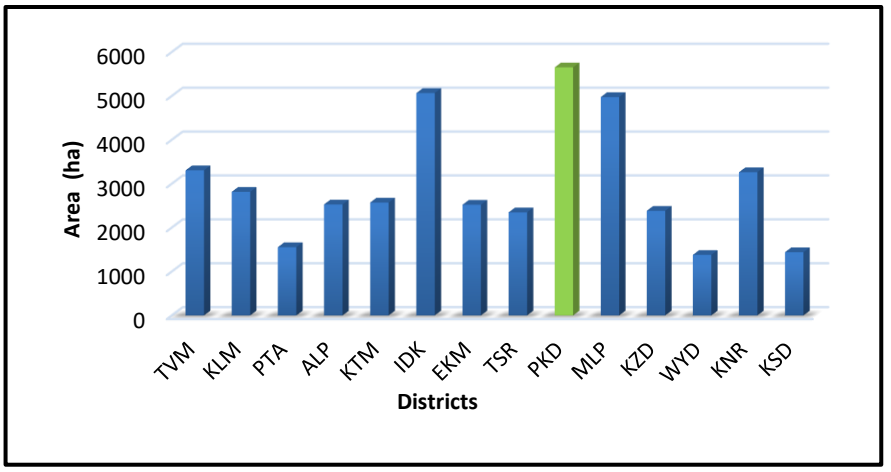
3.1 Research design

In the present study, *ex-post facto* research design was employed. This design was considered appropriate because the phenomenon has already occurred. It is a systematic empirical study in which the researcher does not have direct control over independent variables because their manifestations have already occurred in the study.

3. 2 Description of the study area

The Palakkad district was purposefully chosen for the research because it has the highest area under vegetable cultivation in Kerala. Palakkad district contributed 13.52 % of the overall vegetable production in Kerala (Figure 3.1). Vegetable cultivation accounted for 41,809.11 ha of total food crop area in 2018-19, accounted for 4.42 % of the overall food crop area.

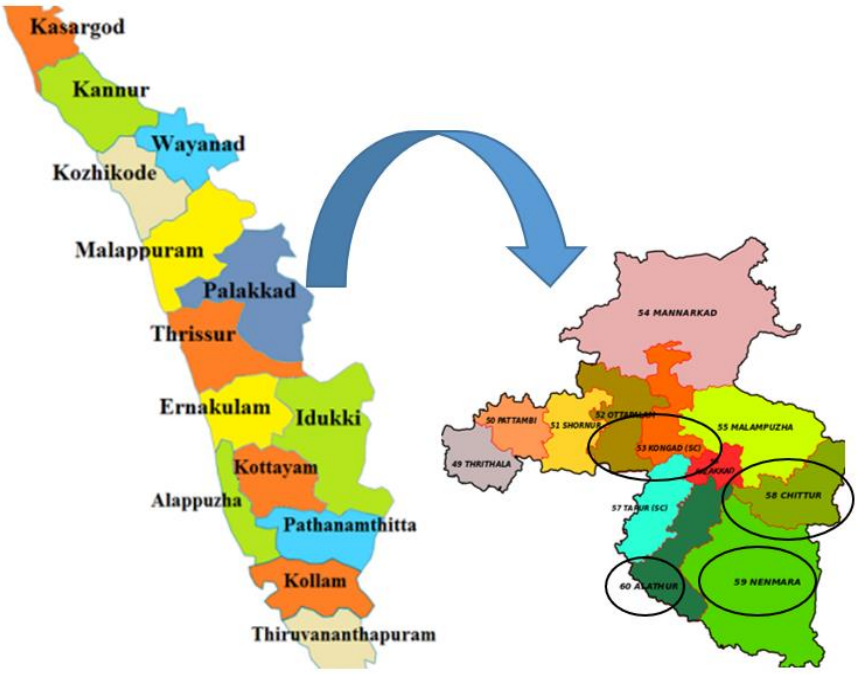
Figure 3.1 Area under vegetable cultivation in Kerala (2019-2020)



3.2.1 Profile of the Palakkad district

Palakkad is one of Kerala's fourteen district with no coastline. The district is also known as "Kerala's Granary." It has unique climatic conditions and many tourism hotspots. Furthermore, its economy primarily depends on agricultural activities, both cash and food crops are cultivated here. The present research was undertaken to assess the awareness and adoption level of GAP in major vegetables (bitter gourd, vegetable cowpea and bhindi) of Palakkad district and also to identify the factors affecting the adoption of GAP as well as the constraints in the adoption of GAP in vegetable cultivation.

Figure 3.2 Map showing the study area of Palakkad district



3.2.2 Location of the Palakkad district

Palakkad district had an overall geographical area of 4,480 square kilometers, accounting for approximately 11.55 % of the overall state's geographical area. It was located in the state's central region, encompassing the midland plains and mountainous highlands. Based on altitude, rainfall, soil and topography, the Kerala state has been delineated into five agro-ecological zones and twenty-three agro-ecological units. Four blocks namely Nenmara, Chittur, Kolengode and Alathur were selected for the study. Among these four blocks Alathur and Nenmara coming under the northern foothill zone of agro-ecological units and Chittur, Kolengode blocks were coming under the Palakkad Eastern plain of the agro-ecological unit.

3.2.3. Salient features of Palakkad district

3.2.3.1 Land utilization pattern

Land utilization pattern followed in Palakkad district (2018-19) was depicted in Table 3.1. The district's total cropped area was approximately 2,72,975 ha and the forest land area was approximately 1,36,200 ha, accounted for 30.44 per cent of the total geographical area. The table inferred that net sown area and land under non-agricultural uses accounted for 2,06,139 ha (46.06 per cent) and 48,460 ha (3.35 per cent) respectively.

Table 3.1 Land utilization pattern followed in Palakkad district 2018-19

Land usage pattern	Area (ha)	Total percentage
Total geographic region	447584	-
Forest area	136257	30.44
Land laid to non-agricultural uses	48460	10.82
Current fallow land	8838	1.97
Fallow other than current fallow	10918	2.44
Cultivable wasteland	19200	4.29
Net area sown	206139	46.06
Area is sown more than once	67125	14.99
Social forestry	404	0.09
Total cropped area	**272975**	**60.98**

Source: Directorate of Economics & Statistics, GOK (2018-19)

3.2.3.2 Literacy rate

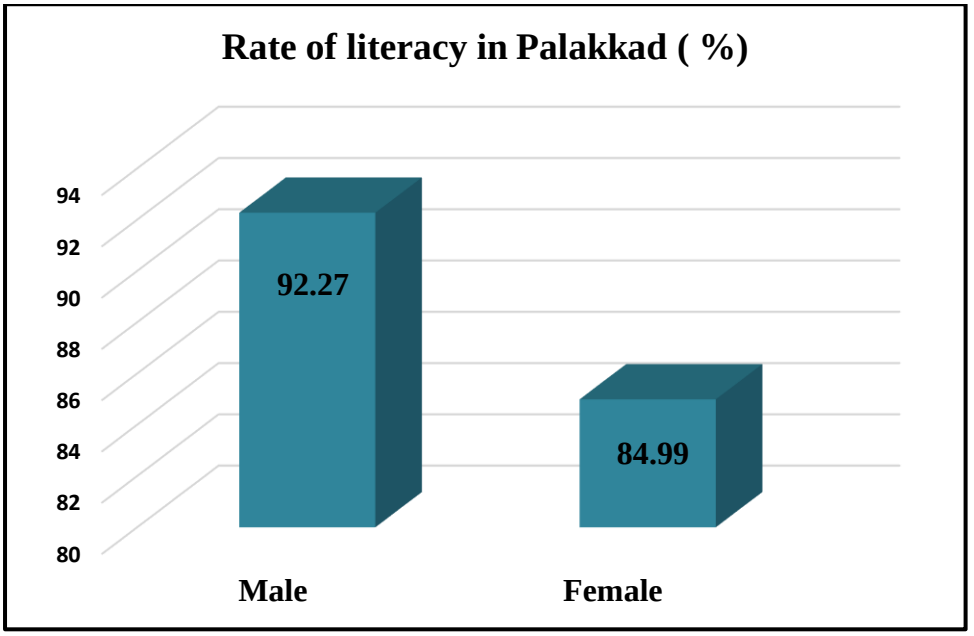
The district's literacy rate was observed to be 22,39,492 (88.63 per cent) lesser than the state literacy of 2,81,35,824 (93.91 per cent). The district's literacy rates were similarly less below the state's literacy rates for both males and females. In both the district and the state, male literates were found to be more numerous than female literates. Table 3.2 shows the current status of literacy rates of the Palakkad district.

Table 3.2 Status of Palakkad district literacy rate

S. No.	Category	Overall
1	**Literate people**	**Total number of people**
	Male	1122600
	Female	1116892
	Total	2239492
2	**Rate of literacy**	**Percentage (%)**
	Male	92.27
	Female	84.99
	Total	88.63

Source: Department of Economics and Statistics, GOK (2011)

Figure 3.3 Status of Palakkad district literacy rate



3.2.3.3. Landholding size

Table 3.3 depicts the landholding distribution in the Palakkad district depending on the number, area and average size of the holdings. The farmers generally in the district (94.56 per cent) had an average landholding size of 0.23ha, reflecting that most of the farmers landholdings were marginal.

Table 3.3 size of landholding of farmers

Size of landholding	Number	Area (ha)	Average size (ha)
Marginal farmers (< 1 ha)	574079	68954.75	0.12
Small farmers (1-2 ha)	21500	29431.68	1.37
Semi-medium farmers (2-4 ha)	9197	23932.34	2.60
Medium farmers (4-10 ha)	2091	11169.20	5.34
Large farmers (> 10 ha)	228	5621.45	24.66
Total	**607095**	**139109.42**	**0.23**

Source: Department of Economics and Statistics, GOK (2011)

3.2.3.4 Irrigation sources

The different irrigation sources of Palakkad district were described in table 3.4. The data reveals that minor streams irrigate the majority of the district's land, which totals 38,856.67 acres (48.44 per cent of total irrigated area). Wells contribute for almost 13 per cent of the total area, with government and private wells contributed irrigation water for 5.3 ha and 10,270.43 ha, respectively. Ponds, lift irrigation, rivers and lakes, and other sources irrigated 3,333.28 ha (4.16 per cent), 825.63 ha (1.03 per cent), 6,136.94 ha (7.65 per cent) and 8,823.22 ha (10.99 per cent) of the land, respectively. Tube wells have been used to irrigate an additional 15 per cent of the total irrigated area (11,963.85 ha).

Table 3.4. Irrigation sources

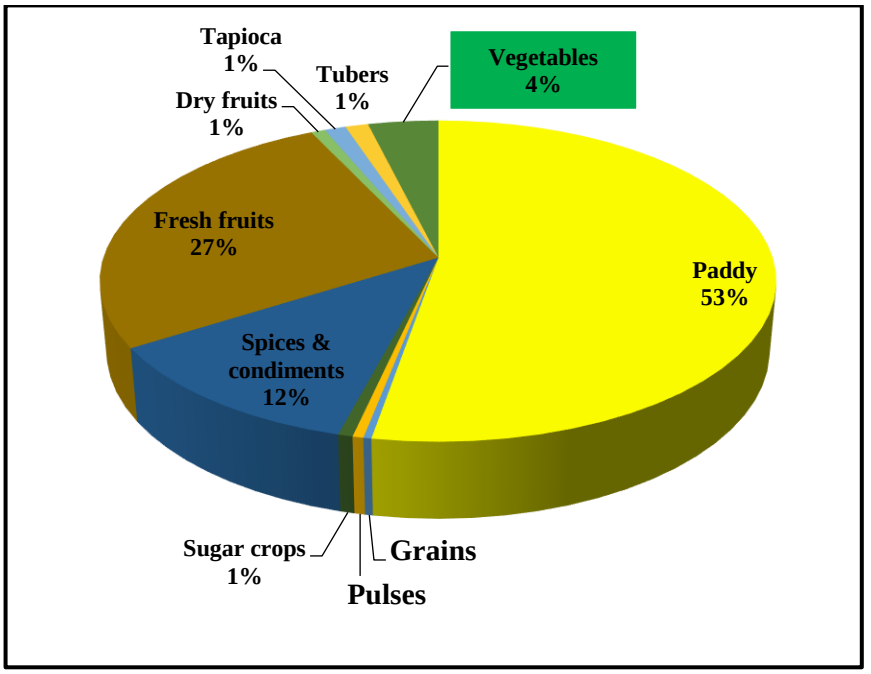
S. No	Irrigation sources	Area (ha)	Total percentage
1	Minor streams (Thodu/Canal)	38856.67	48.44
2	Overall ponds	3333.28	4.16
	a. Government ponds	102.66	
	b. Private ponds	3230.62	
3	Overall wells	10275.73	12.81
	a. Government wells	5.3	
	b. Private wells	10270.43	
4	Tube wells	11963.85	14.92
5	Lift irrigation	825.63	1.03
6	Rivers and lakes	6136.94	7.65
7	Other sources of irrigation	8823.22	10.99
Total		**80215.32**	**100.00**

Source: Department of Economics and Statistics, GOK (2018-19)

3.2.3.5 Area under vegetable cultivation in Palakkad (2019-20)

The distribution of cultivable land in the district for various food crops during 2018-19 is depicted in figure 3.4. The total area cultivated for vegetable production during the year 2018-2019 is 41,809.11 Ha. It accounted for 4.42 per cent area of the overall food crops. The total area under vegetable production had decreased by 9.82 per cent in the year 2018-2019 than the previous year 2017-2018. Drumstick, amaranthus, bitter gourd, snake gourd, bhindi, brinjal, green chilies, bottle gourd, little gourd (koval), ash gourd, pumpkin, cucumber, payar are the important vegetables cultivated in the district. Palakkad (13.52 per cent) Idukki (12.12 per cent) and Malappuram (11.90 per cent) districts respectively had 1st, 2nd and 3rd positions in area under the cultivation of vegetables during the year 2018-2019.

Figure 3.4 Area under vegetable cultivation in Palakkad (2019-20)



3.2.3.6 Marketing structure for selected vegetables in the study area

The marketing channels of various agricultural commodities were comprised of the chain of intermediaries through which they exchange the commodities from producers to consumers. Agricultural products' marketing channels differ from one another. Figure 3.5 showed the channels used for the marketing of selected vegetables in the Palakkad districts. The most commonly used marketing channel by vegetable farmers was through VFPCK to wholesalers, retailers and consumers.

Figure 3.6 depicts the marketing channels available for GAP Vegetables. GAP products were marketed through Eco-shops and weekly markets functioned under several panchayats in Kerala. Through the vegetable clusters, farmers could transport their produce to Weekly markets where they sell GAP vegetables directly to the consumers. Even these marketing facilities are available for GAP vegetables they procure only less quantity of vegetables, which forces the farmers to sell their whole GAP commodities in the open markets.

Figure 3.5 Marketing channels used for vegetables in Palakkad district

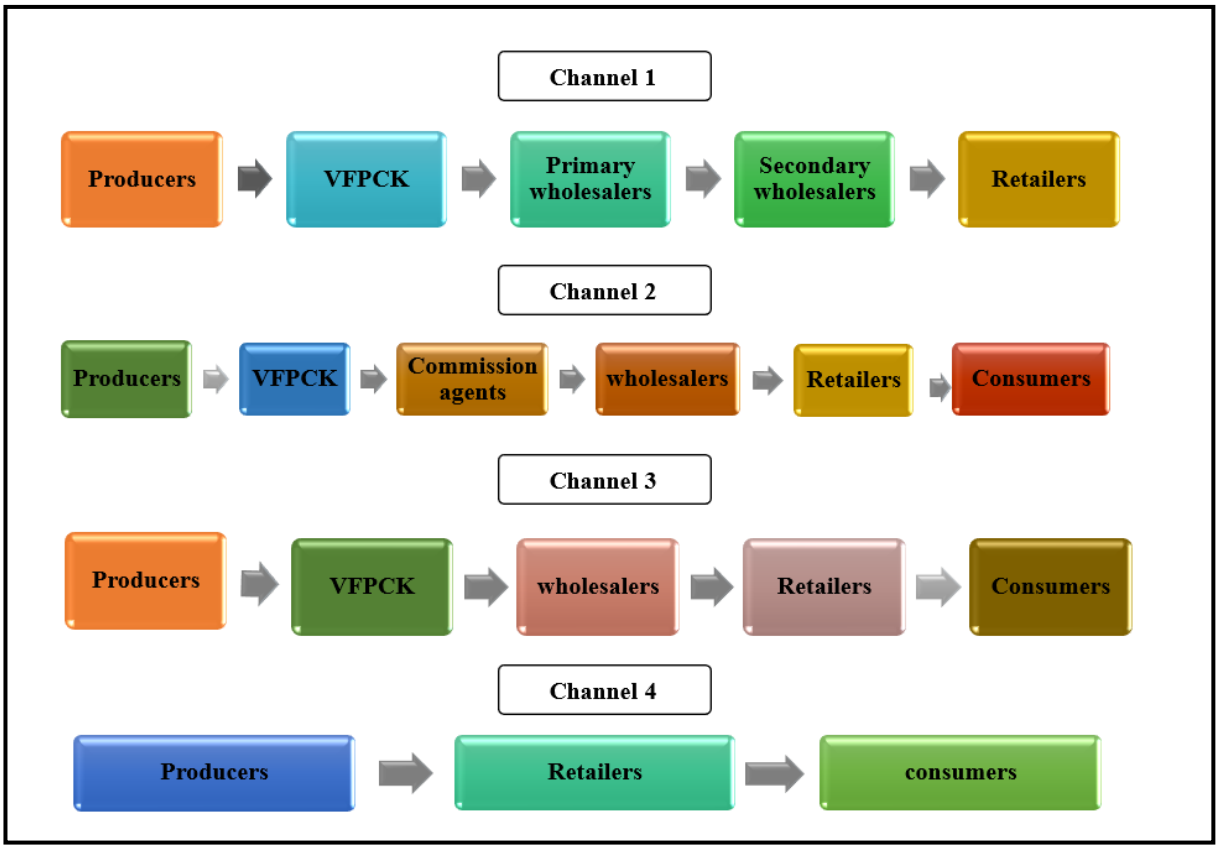
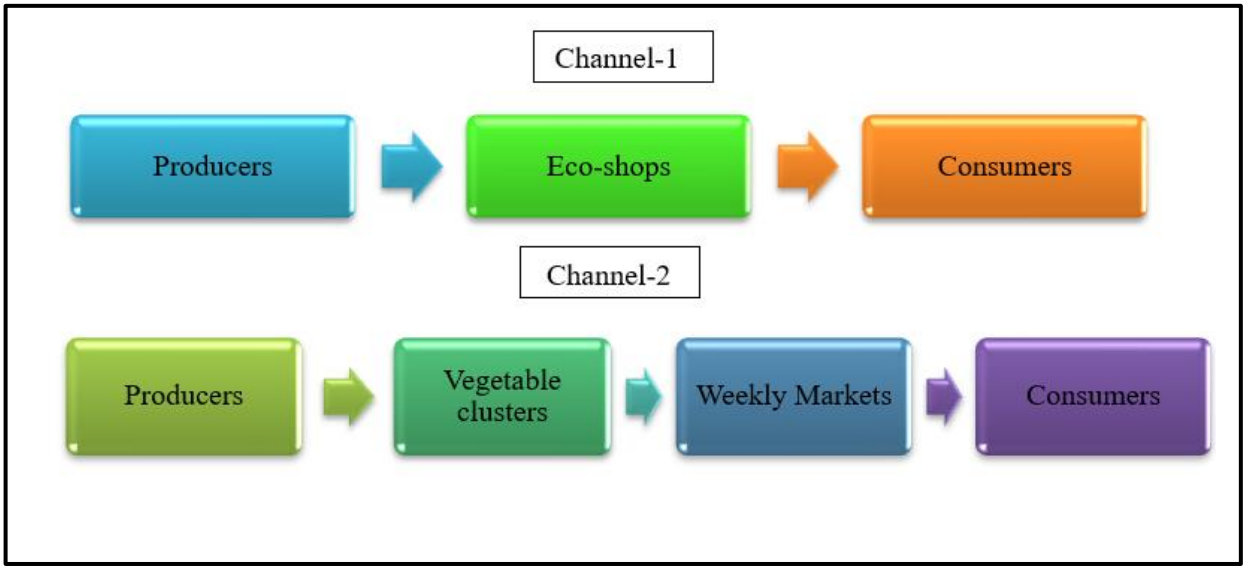


Figure 3.6 Available marketing channels for GAP vegetables in Palakkad district



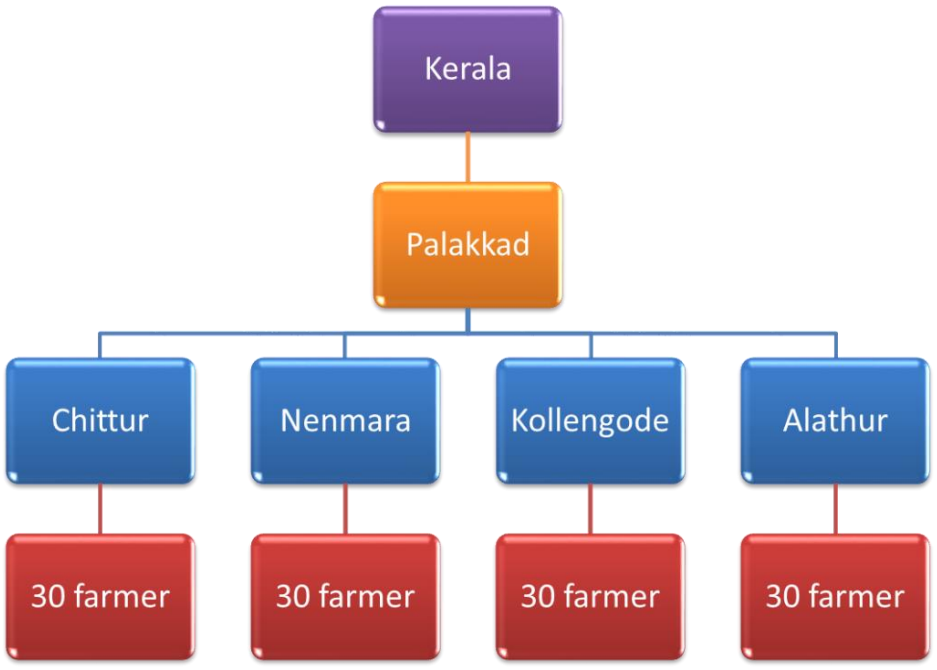
3.3. Sampling procedure employed

Sampling is defined as the process of choosing a portion of a population in such a way that the sample resembles the entire population. For the selection of samples in the study, a multistage proportional random sampling method was employed. It means at each stage smaller sampling units had taken.

3.3.1 Selection of the respondents

Palakkad district had selected for the study due to its highest area of vegetable cultivation. Four blocks representing the most area of vegetable cultivation had selected and 30 farmers with a minimum of 30 cents of vegetable cultivation had selected randomly from each of the blocks to make a total sample size of 120. The study had conducted on three major vegetables in the Palakkad district. *Viz.* Bitter gourd, Vegetable cowpea and Bhindi.

Fig. 3.7 Flow chart of sampling method employed in research



4 blocks * 3 vegetables * 40 farmers for each vegetable = 120 respondents

Total sample size = 120 farmers

Table 3.5. Vegetables selected for the study

S. No.	Vegetables selected for study	Number of respondents selected
1	Bitter gourd	40
2	Vegetable cowpea	40
3	Bhindi	40
	Total	120

3.3.2 Description of the selected vegetables

3.3.2.1 Bitter gourd

During the 2018-19 growing season bitter gourd had cultivated around 2258.43 hectares. In Kerala bitter gourd cultivation was highest in the Idukki district, covered 20.64 per cent followed by Palakkad and Wayanad districts ranked second and third in bitter gourd cultivation, with 17.3 per cent and 11.2 per cent, respectively. Bitter gourd cultivation in Kasargod district was the least percentage, accounted for only 2.16 per cent of the overall state.

3.3.2.2 Vegetable cowpea

Vegetable cowpea cultivation had covered 5803.05 hectares in 2018-19. It accounted for 13.88 % of all vegetables consumed with an area of 910.11 hectares. Palakkad district was ranked first in cowpea cultivation, accounted for 15.68 per cent of the total cropped area of cowpea. The districts of Ernakulam and Malappuram were ranked second and third, with 15.37 % and 12.22 % of the total cropped area respectively. Kasargod district accounted cowpea cultivation for only 1.64%.

3.3.2.3 Bhindi

In Palakkad 2018-19 bhindi had cultivated around 1403.05 hectare. It occupied 8.88 per cent of all vegetables consumed. With an area of 190.11 hectares, Palakkad district ranked second in bhindi cultivation, accounted for 9.68 percent of the total bhindi area. With an area of 11.37 per cent and 9.22 per cent, the districts of Malappuram and Idukki were ranked first and third, respectively. Kannur district had the least amount of bhindi cultivation, contributed to 0.64 percent of the total area.

3.4 Variables and their empirical measurement

The parameters for this study are chosen through a review of the available literature, similar research and conversation with experts in the field. The selected factors were submitted to 30 judges, who are asked to rate their relevance on a five-point continuum from most to least relevant. The judges were selected from diverse fields, including vegetable science and other disciplines. The relevancy index of each item was calculated using the response from 30 judges.

Table 3.6. Variables selected for the study

S. No	Variables
A	**Independent variables**
1	Age of the respondents
2	Experience in vegetable cultivation
3	Area under Vegetable cultivation
4	Educational status
5	Annual income of the farmers
6	Training
7	Social participation
8	Mass media exposure
9	Extension contact
10	Risk-taking ability
11	Economic motivation
12	Environmental orientation
13	Market perception
B	**Dependent variables**
1	Awareness level on GAP among vegetable farmers
2	Adoption level on GAP among vegetable farmers

3. 4. 1 Independent variables

3.4.1.1 Age

It was defined as the age group of vegetable farmers at the period of the research in years. Yet again, the responses were divided into three categories.

Table 3.7. Age category

S. No	Age group	Age (years)
1	Young age	< 35
2	Middle age	36-55
3	Old age	> 55

3.4.1.2 Vegetable cultivation experience

It was described as the participants' completed years of vegetable cultivation. The scoring process were as follows:

Table 3.8. Vegetable cultivation experience

S. No	Farming experience (Years)	Score
1	1-2 years	1
2	3-4years	2
3	5-6 years	3
4	> 6 years	4

3.4.1.3 Vegetable cultivation area

It describes the number of acres cultivated by vegetable farmers at the time of the survey. Table 3.9 showed that farmers were categorized based on the following parameters.

Table 3.9. Vegetable cultivation area

S. No	Area (acres)	Score
1	< 1 acre	1
2	1-2 acres	2
3	3-4 acres	3
4	> 4 acres	4

3.4.4.4. Educational status of vegetable farmers

The term education focused on the level of formal training received by the respondents. The method followed by Trivedi (2018) was used to measure the variable along with some modifications had taken. Respondents were requested to indicate their educational level, which were divided into six categories.

Table 3.10. Education status of vegetable farmers

S. No	Educational status	Score
1	Uneducated	1
2	Primary schooling	2
3	Secondary education	3
4	High school education	4
5	Graduate level and above	5

3.4.4.5. Annual income of vegetable farmers

Annual income was the sum of a farmer's income from all sources over the last years, voiced in rupees. Based on their mean and standard deviation, the farmers were partitioned into 3 groups.

Table 3.11. Farmer's annual income

S. No	Categorization	Income range (Rupees)
1	Low	<1,00,000
2	Medium	1,00,000 – 2,00,000
3	High	> 2,00,000

3.4.4.6. Training received

It was described as an intensive learning process for a set of known vegetable farmers over a specified period of time. The method followed by Shivacharan (2014) was adopted with appropriate modifications to measure the training acquired by vegetable farmers. Farmers who have undergone GAP training was rated 1, whereas farmers who had not received any training regarding GAP was rated as 0**.**

Table 3.12. Training received

S. No	Category	Score
1	Training not received	0
2	Training received	1

3.4.4.7 Social participation

The extent to which vegetable farmers were involved in different social organizations and activities were known as social participation. Farmers were defined as either non-members or members and their level of participation were characterized as either regularly attended, occasionally attended or not attended. The following was the scoring system used for this variable:

Table 3.13. Social participation

S. No	Social participation	Score
1	Never	0
2	Occasionally	1
3	Regular	2

3.4.4.8 Mass media exposure

It refers to how far the farmers were exposed to various kinds of mass media, like radio, newspapers and the internet, were exposed by vegetable farmers. The survey's vegetable farmers were asked how frequently they socialize with the media. The method followed by Krishnan (2019) was adopted with appropriate modifications for measuring 'mass media interaction'. The vegetable farmers' responses to every question were noted and scores were assigned as follows:

Table 3.14. Mass media exposure

S. No	Mass media exposure	Score
1	Never	1
2	Occasionally	2
3	Regular	3

3.4.4.9 Extension contact

Extension contact refers to a farmer's amount of interaction with various extension agencies, as well as his participation in different extension activities or programs coordinated by these agencies, such as meetings, seminars, field days, exhibitions and so on.

Table 3.15 Extension agency contact

S. No	Frequency of contact	Score
1	Never	0
2	Occasionally	1
3	Regular	2

Table 3.16 Extension participation

S. No	Frequency of participation	Score
1	Never	1
2	Occasionally	2
3	Regular	3

3.4.4.10 Risk-taking ability

The degree to which vegetable farmers were oriented towards risk and uncertainty and also the courage to face problems in the production and marketing of vegetables was defined as risk-taking ability. The method followed by Sreeram (2013) was adopted with appropriate modifications for measuring 'Risk-taking ability'. Five of the seven statements claim on the scale were positive, while the other two statements were negative. The responses of the farmers were assessed on a five-point score, with scores of 5, 4, 3, 2 and 1 indicated strong agreement, agreement, uncertainty, disagreement and strong disagreement, respectively. Farmers were grouped into three types based on their quartile scores as a quality indicator.

3.4.4.11. Economic motivation

It was characterized as the occupational excellence of vegetable farmers was based on profit maximization and relative values placed on economic purposes. The five statements on the measurement scale had scored on a five-point scale: strongly agree, agree, undecided, disagree and strongly disagree. They were given weightage of 5,4,3,2 and 1 for positive responses and weights of 1,2,3,4,5 for negative statements. The most extreme and least extreme scores were 25 and 5 respectively. Farmers were classified into three types based on their quartile scores as a quality indicator.

3.4.4.12. Market perception

The extent to which vegetable farmers were oriented towards perception in the marketing of vegetables is described as market perception. The method followed by Sreeram (2013) was adopted with appropriate modifications for measuring the market perception. The scale was made up of seven statements, five of which were positive and two of which were negative. Farmers' responses were scored on a five-point scale, with scores of 5, 4, 3, 2 and 1 for strongly agree, agree, uncertain, disagree and strongly disagree respectively.

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Positive	5	4	3	2	1
Negative	1	2	3	4	5

3.4.4.13. Environmental orientation

This was characterized as farmers perceived responsibility towards environmental health. The method followed by Jaganathan (2004) was adopted with appropriate modifications. The scale had six statements on it and the respondents were asked to specify whether they agreed or disagreed with each one. The responses of the farmers were assessed on a five-point scale, with scores of 5, 4, 3, 2 and 1 indicated strong agreement, agreement, uncertainty, disagreement and strong disagreement, respectively. By adding all of the responses together, the environmental orientation score was computed.

Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Positive	5	4	3	2	1
Negative	1	2	3	4	5

3.4.2 Measurement of dependent variables

3.4.2.1 Awareness on Good Agricultural Practices among vegetable farmers

The degree to which respondents were familiar with GAP in vegetable cultivation was operationalized as awareness. In this research, respondents rated their level of awareness about various Good Agricultural Practices on a three-point scale of not aware, partially aware and fully aware, with scores of 1, 2 and 3 were assigned to each. The respondent's overall awareness score was computed by summing the awareness scores for all Good Agricultural Practices. The method followed by Malkanthi *et al.* (2020) was adopted with appropriate modifications used for measuring the awareness level on GAP.

Table 3.17 Measurement of awareness on GAP

Category	Score	Description
Fully aware	3	Farmers who are well-versed in the practices
Partially aware	2	Farmers have only a partial understanding of the practices
Not aware	1	Farmers have no understanding of the practices

$$\text{Awareness score} = \frac{\text{Score obtained by the farmer}}{\text{Maximum possible score}} \times 100$$

Table 3.18 Categorization of respondent's awareness score on GAP

S. No.	Category	Range of scores
1	High	> (Mean + SD)
2	Medium	(Mean ± SD)
3	Low	< (Mean - SD)

3.4.2.2.1 Adoption on Good Agricultural Practices among vegetable farmers

Adoption was a continuous process that entails learning, making decisions and taking action. Awareness, information collection, conviction, trial and adoption are the elements in the adoption. In this study, adoption meant the degree to which a farmer had actually adopted a Good Agricultural Practice. The extend of adoption of Good Agricultural Practices in vegetable cultivation was assessed using the Adoption Good Agricultural Practices (GAPA) Index developed for the study. GAPA Index with seven components namely, preparation of land and soil, seed/seedling quality parameters, sowing and intercultural operations, nutrient management, plant protection measures, irrigation management & drainage and harvesting and post-harvest handling were computed in this study. Adoption of each Good Agricultural Practice of vegetable cultivation was graded on a 4-point scale with scores of 4, 3, 2 and 1. The method followed by Divya and Sivakumar (2014) was adopted with appropriate modifications for computing the GAPA index.

The GAP practices were differed in their contribution to yield and environmental safety. So equal weightage for all practices was not meaningful. Hence a weighted average method was adopted for computing the weightage. The weightages for various components of Good Agricultural Practices were attached in the Appendix V.

Table 3.19 Measurement of Adoption on GAP

Category	Score	Description
Fully adopted	4	Technology was implemented to its fullest
Partially adopted	3	The technology in its totality was not adopted
Replaced/ discontinued	2	After adoption, the technology was phased out
Not adopted	1	There has been no adoption of technology

$$\text{Adoption score} = \frac{\text{Score obtained by the farmer}}{\text{Maximum possible score}} \times 100$$

$$\text{Composite Index} = \frac{\sum x}{(M \times N \times S)} \times 100$$

∑x=Sum of total scores of all statements (sum of total scores multiplied by weightage of the components)

M=Maximum score

N=Number of respondents

S= Number of statements

Table 3.20 Categorization of respondents Adoption score on GAP

S. No.	Category	Range of scores
1	High	> (Mean + SD)
2	Medium	(Mean ± SD)
3	Low	< (Mean - SD)

3.4.3 Factors affecting the adoption of GAP

Previous research showed that a person's coefficient was irregular in a variety of circumstances. Taking this into account, an effort is made to assess the correlation between the indicated independent and dependent variables. To assess the relationship, the correlation coefficient (r) was used.

3.4.4 Constraints faced by the vegetable farmers in adoption of GAP in vegetable cultivation

Constraints are the challenges that farmers face when implementing good agricultural practices. Through a structured schedule, the difficulties experienced by vegetable farmers in adopting good agricultural practices were identified. For the study, the scale used by Chaturvedani *et al.* (2017) was adopted with appropriate modifications.

Farmers were asked to assess how difficult it was for them to adopt good agricultural practices on a three-point scale of most serious, serious and least serious, with weights 3, 2 and 1 was assigned to each response. The constraint score of the respondent was computed using the formula

$$\textbf{Constraint score} = \frac{\textbf{Total score obtained by the respondent}}{\textbf{Maximum possible score}} \textbf{ X 100}$$

To identify the major constraints experienced by vegetable farmers the constraint score was computed and ranked in descending order. Kendal's co-efficient of concordance (W) was computed to test respondents' agreement on the rating the variables.

3.5 Data collection procedure

A detailed interview schedule was created in accordance with the study's objectives. A pilot study was conducted among vegetable farmers at Palakkad district using a pre-planned interview schedule. Some changes were made to the interview schedule based on the responses of selected respondents. Appendix VI contains the modified interview schedule used for the study.

3.5.1 Method of data collection

The study relied on both primary and secondary data. Primary data on various socio-economic aspects, awareness and adoption of Good Agricultural Practices was collected from 120 vegetable farmers using pre-structured interview schedules. Secondary data were collected from the VKPCKs, Farm guide and Directorate of Economics and Statistics, Government of Kerala and so on.

3.6 Statistical tools employed for analysis of the data

The following statistical parameters were included for analysis and drawing the inferences. The parameters used were defined as under.

3.6.1 Frequency

To determine the distribution pattern of respondents based on variables, frequency distribution and percentages were utilized.

3.6.2 Percentage

Percentages were used to standardize the sample by determining the number of people who would fall into the specified group.

3.6.3 Arithmetic mean

It is calculated by dividing the total number of observations by the sum of all observation values. The arithmetic mean is denoted by the letter X.

$$\text{Arithmetic mean (X)} = \frac{\boldsymbol{x1} + \boldsymbol{x2} + \boldsymbol{x3} + \cdots + \boldsymbol{xn}}{N}$$

Where,

n = Total number of observations

x1, x2, xn = Individual scores

3.6.4 Standard deviation

Standard deviation is the square root of the mean of the sum of squares of the deviation taken from the mean of the distribution. It is used to understand the distribution pattern of the independent variables selected in the study.

$$\sigma = \sqrt{\frac{\sum_i^n (xi - X)^2}{(n-1)}}$$

Where,

σ = Standard deviation

xi = Score of i^{th} respondents

$\sum$ = Mean

n = Number of respondents

3.6.5 Karl Pearson's coefficient of correlation

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[\, n\Sigma x^2 - (\Sigma x)^2 \,][\, n\Sigma y^2 - (\Sigma y)^2 \,]}}$$

Where,

r = Co-efficient of correlation

x = Independent variable

y = Dependent variable

3.6.6 Kruskal - Wallis One Way Analysis of Variance by ranks

This test was used to determine the significant difference on the overall adoption of Good Agricultural Practices among three categories of vegetable farmers.

$$H = \frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{R_j^2}{n_j} - 3(N+1)$$

$k = number\ of\ samples$

$n_j = number\ of\ cases\ in\ the\ j^{th}\ sample$

$N = \sum n_j,\ the\ number\ of\ cases\ in\ all\ samples\ combined$

$R = sum\ of\ ranks\ in\ the\ j^{th}\ sample(coloumn)$

$\sum_{j=1}^{k} directs\ to\ sum\ over\ k\ samples\ (columns)$

3.6.7 Kendall's coefficient of concordance (W)

It was used to find the correlation between K sets of ranks. The sum of rankings (Rj) in each column of a K/N table is used to determine 'W.' The formula for calculating 'W' is as follows:

$$W = \frac{12\ S}{K^2(N^3-N)}$$

S = Sum of squares of the observed deviations from the mean of Rj

$$S = \sum \left(Rj - \frac{\sum Rj}{N} \right)^2$$

K = number of rankings

N = number of objects or entities ranked

3.6.8 Software used for statistical analysis

The data were coded and analysed using the SPSS - 19 version which is available at the College of Agriculture in Vellanikkara. The findings and outcomes of the data analysis are reported in the next chapter, along with a discussion.

Results and Discussion

Chapter 4

RESULTS AND DISCUSSION

The current chapter is dealing with the presentation of data analysis and results. Based on the objectives of the study, data were collected using a well-structured and pre-tested interview schedule from three categories of vegetable farmers in the Palakkad district. To achieve the research objectives, the data were analyzed and concluded into valid and significant inferences using relevant analytical tools. The results are presented in the following sub-sections:

4. 1 Profile characteristics of the vegetable farmers

4. 2 Awareness of vegetable farmers on Good Agricultural Practices (GAP)

4. 3 Adoption of Good Agricultural Practices among vegetable farmers

4. 4 Factors affecting adoption of Good Agricultural Practices

4. 5 Constraints faced by the vegetable farmers in adoption of GAP

4.1 Profile characteristics of the vegetable farmers

The investigator would be able to interpret the data if he or she had a clear understanding of the respondents' socioeconomic and psychological characteristics. Data were collected from 120 respondents comprising 30 each of vegetable, bhindi and bitter gourd farmers from four blocks of the Palakkad district.

Thirteen independent variables representing the socio-economic and personal characteristics were selected and included in the study. The results of data analysis on the profile characteristics are given below:

4.1.1 Age Category

The age group of vegetable farmers included in the present study is given in Table 4.1. It could be observed that the majority of the respondents (67.00 per cent) fall under the middle age group of 36 to 55 years followed by 17.00 per cent of respondents belonging to the old age category of above 56 years and only 16.00 per cent of respondents belong to the young age group of below 35 years.

This indicates that all age groups of farmers were engaged in vegetable cultivation in the study area. The results are found to be in tune with the natural trend of majority of farmers under the middle and old age categories.

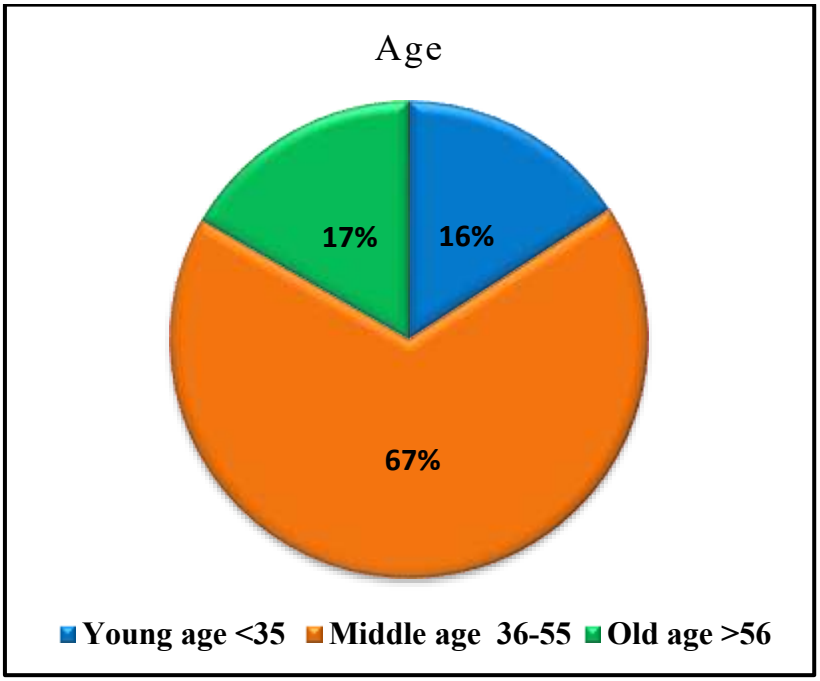
Table 4.1 Distribution of vegetable farmers according to their age

(n=120)

S. No	Age group (years)	No. of respondents
1	Young age (up to 35 years)	18 (16)
2	Middle age (36-55)	80 (67)
3	Old age (> 56 years)	22 (17)
	Total	**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.1 Distribution of vegetable farmers according to their age



4.1.2 Experience in vegetable cultivation

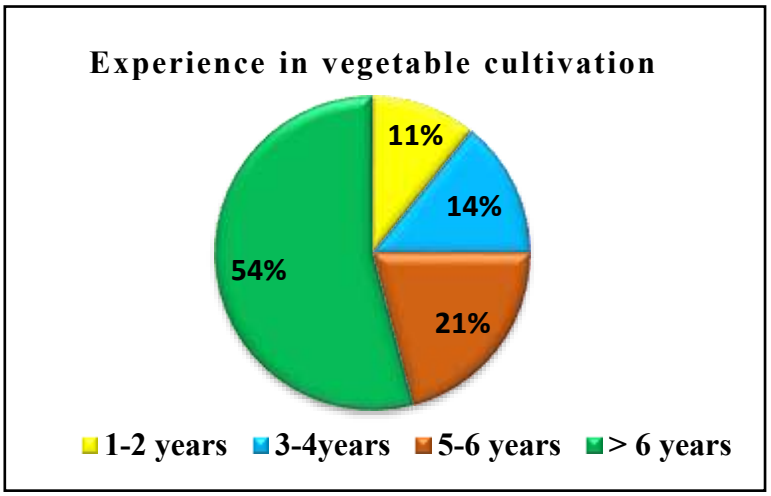
The vegetable farmers were grouped into four categories based on their experience in vegetable cultivation as given in Table 4.2. The majority of the farmers (54.00 per cent) had more than six years' experience in vegetable cultivation. Twenty-one per cent of the farmers had farming experience between 5 to 6 years followed by 14.00 per cent of the respondents having experience between 3-4 years and only 11.00 per cent of them had less than 2 years of experience in vegetable cultivation. The probable reason might be that the main occupation of the farmers in the study area might be vegetable cultivation.

Table 4.2 Farming experience of vegetable farmers (n=120)

S. No	Categories (years)	No. of respondents
1	1-2 years	13 (11)
2	3-4years	17 (14)
3	5-6 years	25 (21)
4	> 6 years	65 (54)
	Total	**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.2 Farming experience of vegetable farmers



4.1.3 Educational level of the vegetable farmers

It is apparent from Table 4.3 that 42.50 per cent of respondents were found to have their education at the secondary level, followed by HSC (26.66) and primary education with 22.50 per cent and 8.33 per cent of respondents were found to be degree holders. The probable reason for a fair level of education among farmers might be the higher literacy level in Kerala**.**

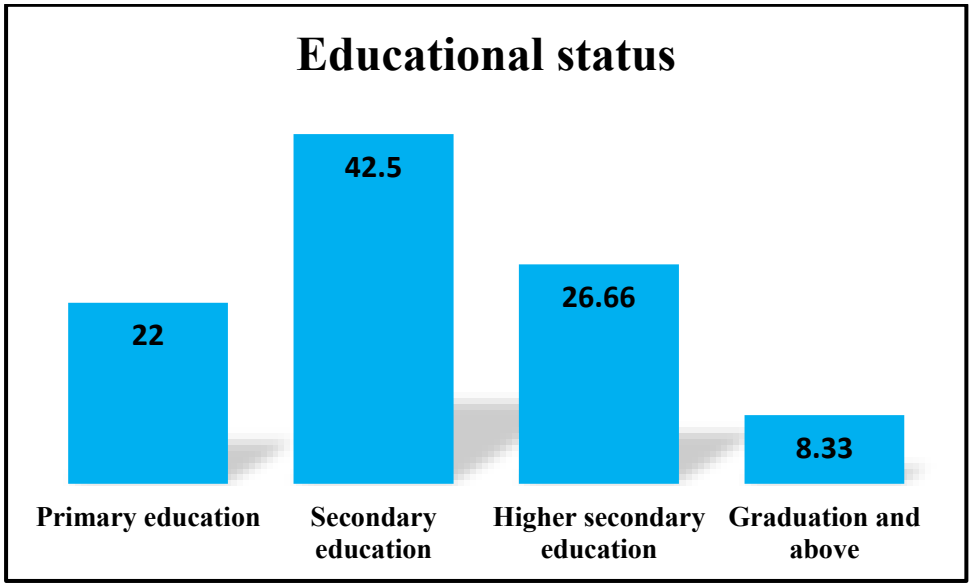
Table 4.3 Distribution of vegetable farmers based on educational status

(n=120)

S. No	Educational status categories	No. of respondents
1	Primary education	27 (22.00)
2	Secondary education	51 (42.50)
3	Higher secondary education	32 (26.66)
4	Graduation and above	10 (8.33)
Total		**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.3 Distribution of vegetable farmers based on educational status



4.1.4 Annual income of vegetable farmers

From the results in Table 4.4, it was found that 65.00 per cent of the farmers earned a medium range of annual income of between 1 to 2 Lakh followed by 20.00 per cent of farmers earned an income below 1 Lakh and only 15.00 per cent of the farmers earned income of more than 2 Lakh as annual income from agriculture in the study area.

The probable reason for a medium range of annual income may be that majority of the farmers are having small to medium size landholdings in vegetable cultivation.

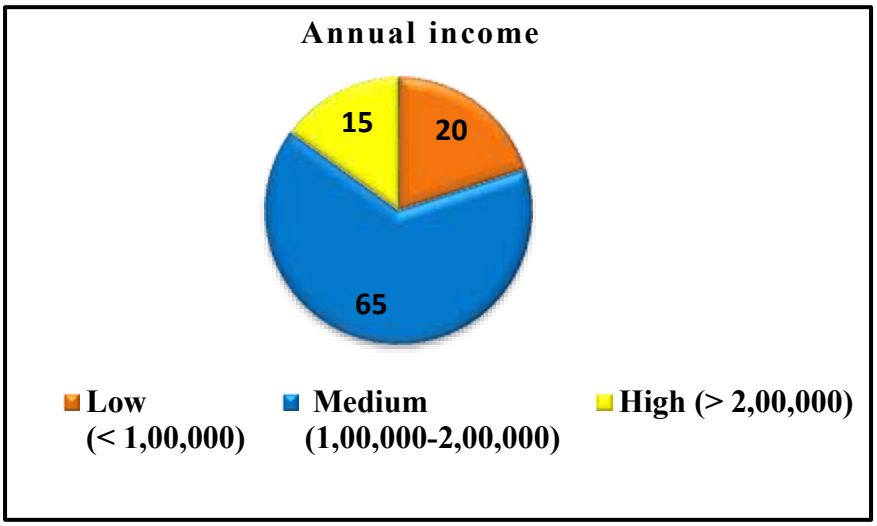
Table 4.4 Distribution of farmers according to their annual income

(n=120)

S. No	Income range categories (Rs. /Annum)	No. of respondents
1	Low (< 1,00,000)	24 (20)
2	Medium (1,00,000-2,00,000)	78 (65)
3	High (> 2,00,000)	18 (15)
Total		**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.4 Distribution of farmers according to their annual income



4.1.5 Income source of vegetable farmers

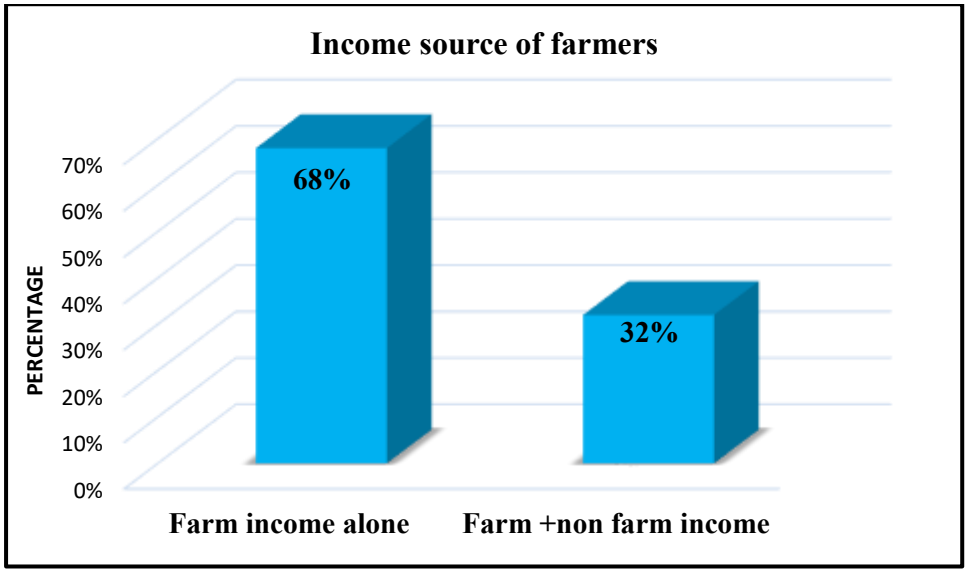
It could be observed from the results in Table 4.5 that majority (68.00 per cent) of the farmers were found to be dependent on farm income alone While 32.00 per cent of respondents were engaged with other income-generating activities.

Table 4.5 Distribution of farmers according to their income sources (n=120)

S. No	Income source of farmers	No. of respondents
1	Farm income alone	82 (68)
2	Farm + non-farm income	38 (32)
Total		**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.5 Income sources of the vegetable farmers



4.1.6 Area under vegetable cultivation

The data in Table 4.6 shows the distribution of vegetable farmers based on the area under vegetable cultivation i.e., bitter gourd, vegetable cowpea and bhindi. The classification was made with four categories of landholding size (acres) under vegetable cultivation. It is evident from table 4.6 that 56.00 per cent of the farmers fell under the group of landholdings less than one acre, whereas 34.00 per cent of the farmers fell under the group of landholdings 1 to 2 acres followed by 14. 00 per cent of farmers with 3-4 acres of land under vegetable cultivation and only 2 per cent of them had 4 acres and above land in vegetable cultivation.

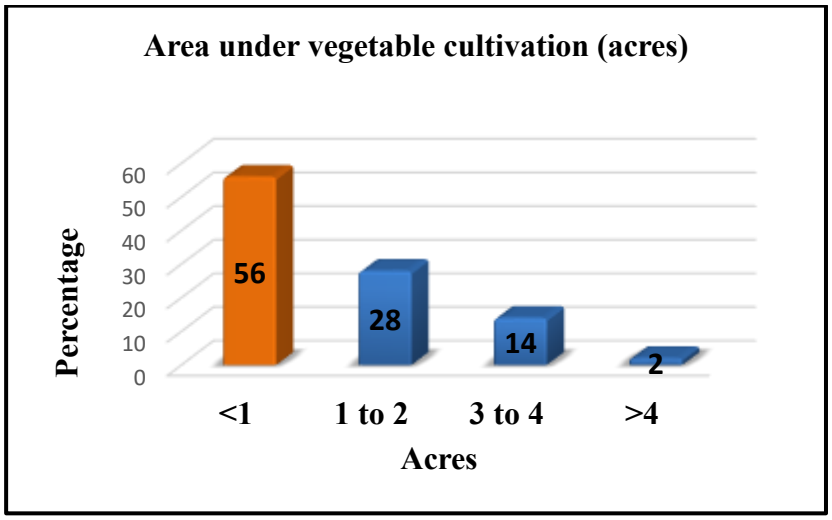
The probable reason for such a result might be that most of the farmers have marginal landholding in Kerala.

Table 4.6 Respondents area under vegetable cultivation (n=120)

S. No	Area in vegetable cultivation (acres)	No. of respondents
1	< 1 acre	67 (56)
2	1-2 acres	34 (28)
3	3-4 acres	17(14)
4	> 4 acres	2 (2)
	Total	**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.6 Respondents area under vegetable cultivation



4.1.7 Land ownership status

Vegetable cultivation in the study area was done in both leased as well as owned land and the farmers were categorized into three groups as presented in Table 4.7. It could be observed from the results that around 55.00 per cent of respondents were found cultivating vegetables in their own land and 28.00 per cent and 17.00 per cent of farmers were cultivating in owned plus leased-in land and leased-in land respectively.

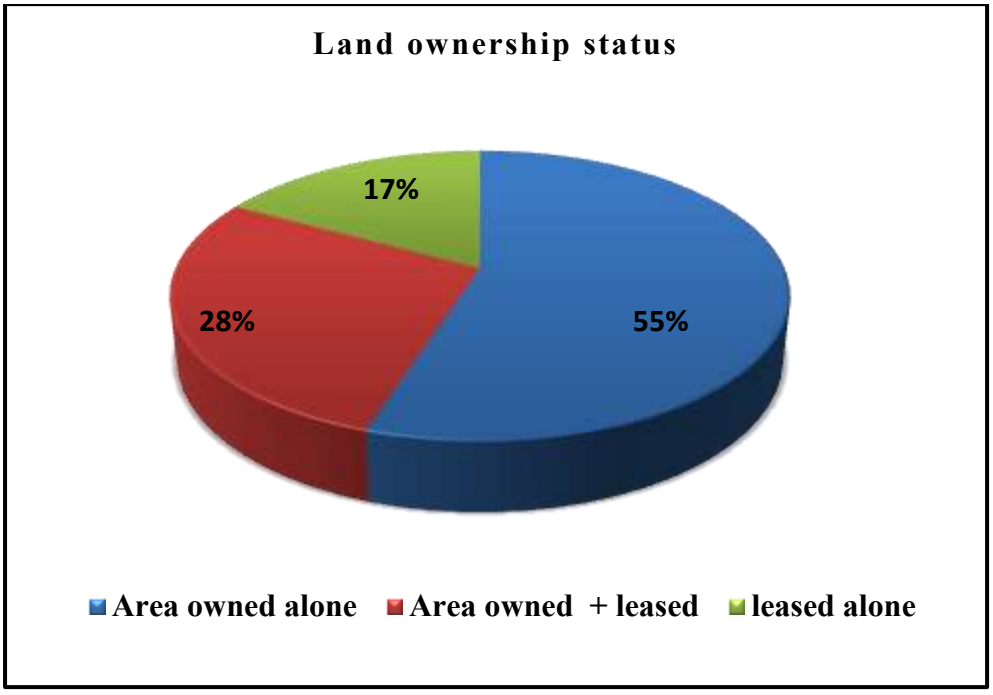
Table 4.7 Land ownership status of vegetable farmers

(n=120)

S. No	Land ownership status	No. of respondents
1	Owned land	66 (55)
2	Owned land + leased inland	34 (28)
3	Leased in land alone	20 (17)
	Total	**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.7 land ownership status of vegetable farmers



4.1.8 Training received

The results in table 4.8 shows that the majority (89.00 per cent) of the respondents were undergone training related to Good Agricultural Practices and only 11.00 per cent of the respondents were not attended the training.

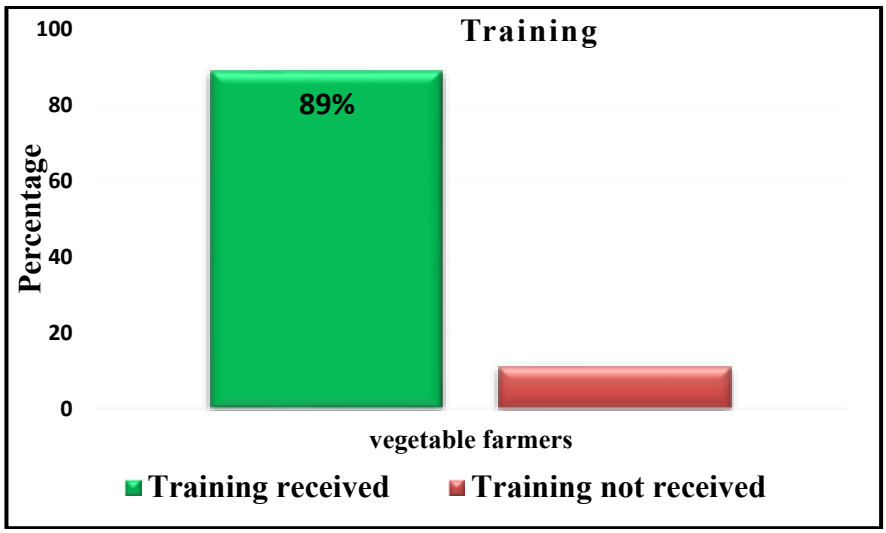
The possible reason for the result could be that in the study area most of the farmers were literates and had at least primary education. So, they were willing to participate in the training programs regarding new technologies.

Table 4.8 Distribution of vegetable farmers according to training received (n=120)

S. No	Category	No. of respondents
1	Training received	108 (89)
2	Training not received	12 (11)
Total		**120 (100)**

(Figures in parentheses indicate total percentage)

Figure 4.8 Distribution of vegetable farmers according to training received



4.1.9 Mass media exposure

The results in table 4.9 showed that 57 per cent of the respondents belonged to the medium category concerning mass media exposure followed by the high (28 per cent) and low (15 per cent) categories. The probable reason for such result might be that a good number of vegetable farmers had at least primary education and the majority of vegetable farmers subscribed to one newspaper, possessed radio and television which enabled the farmers to utilize various mass media.

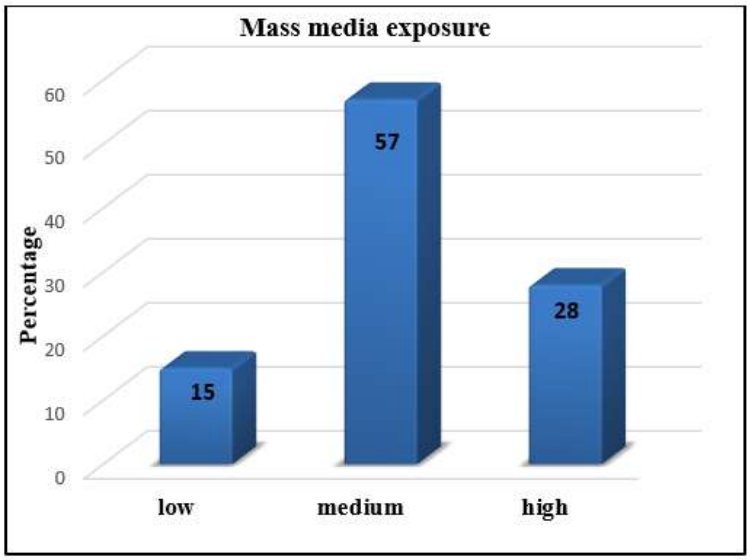
Table 4.9 Distribution of farmers according to their Mass media exposure

(n=120)

S. No	Categories of Mass media exposure	Range of indices	No. of respondents
1	Low	< 62.31	18 (15)
2	Medium	62.31-80.00	69 (57)
3	High	> 80.00	33 (28)
Interquartile range: 17.65			

(Figures in parentheses indicate total percentage)

Figure 4.9 Distribution of farmers according to their Mass media exposure



4.1.10 Social participation

Table 4.10 revealed that the distribution of vegetable farmers on their social participation. Results showed that the majority of the vegetable farmers (58 per cent) were having a medium level of social participation followed by a high (25 per cent) and low levels (17 per cent) of social participation. The likely reason for the result might be that most of the farmers in the study area were members of Vegetable and Fruit Promotion Council Kerala or any of the vegetable clusters functioning in the locality.

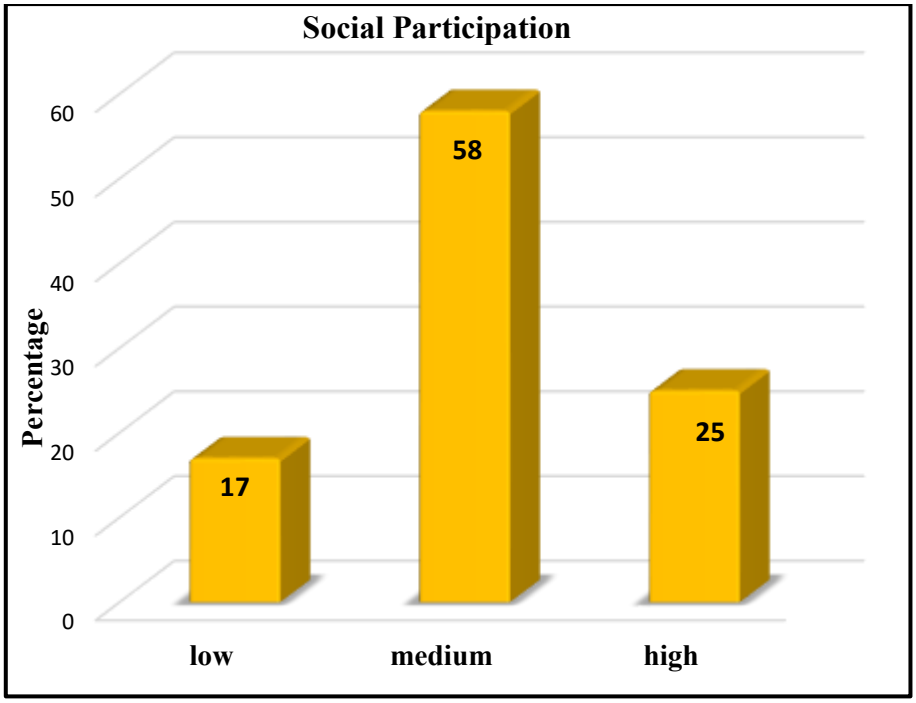
Table 4.10 Social participation of the vegetable farmers

(n=120)

S. No	Categories of Social participation	Range of indices	No. of respondents
1	Low	< 76.17	20 (17)
2	Medium	76.17-90.47	70 (58)
3	High	> 90.47	30 (25)
Interquartile range: 14.30			

(Figures in parentheses indicate total percentage)

Figure 4.10 Social participation of the vegetable farmers



4.1.11 Extension contact

The results in Table 4.11 showed that more than half of the vegetable farmers (52.00 per cent) had medium extension contact followed by high (28.00 per cent) and low levels (20.00 per cent) of extension contact.

The probable reason for the result might be that selected respondents from the study area were members of VFPCK and vegetable clusters in the State Department of Agriculture and the majority of them had frequent extension contact with the officials of these organizations and also participated in their activities.

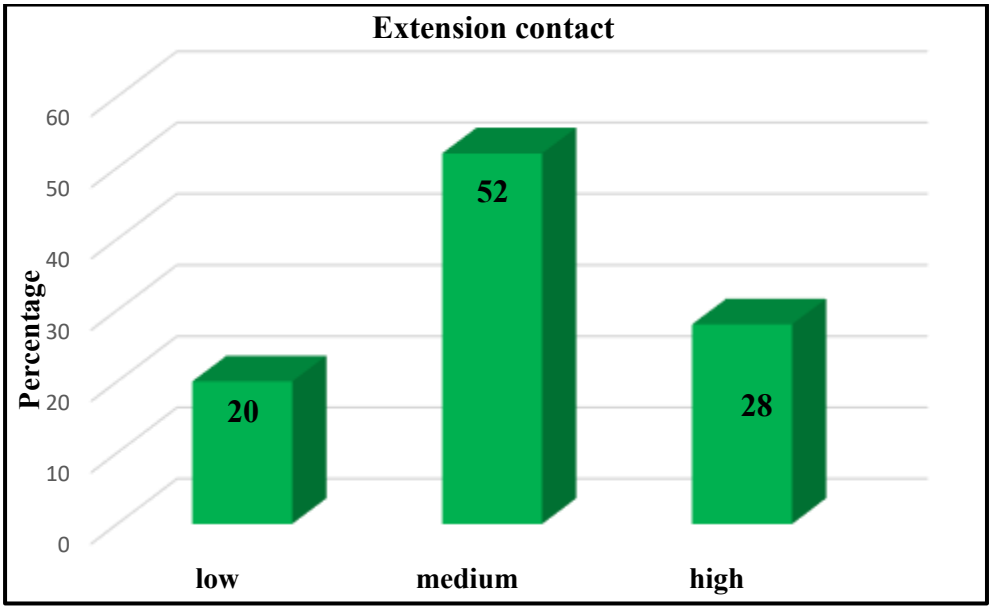
Table 4.11 Extension contact of the vegetable farmers

(n=120)

S. No	Categories of Extension contact	Range of indices	No. of respondents
1	Low	< 70.00	25 (20)
2	Medium	70.00-85.21	62 (52)
3	High	> 85.21	33 (28)
Interquartile range: 15.21			

(Figures in parentheses indicate total percentage)

Figure 4.11 Extension contact of the vegetable farmers



4.1.12 Risk taking ability

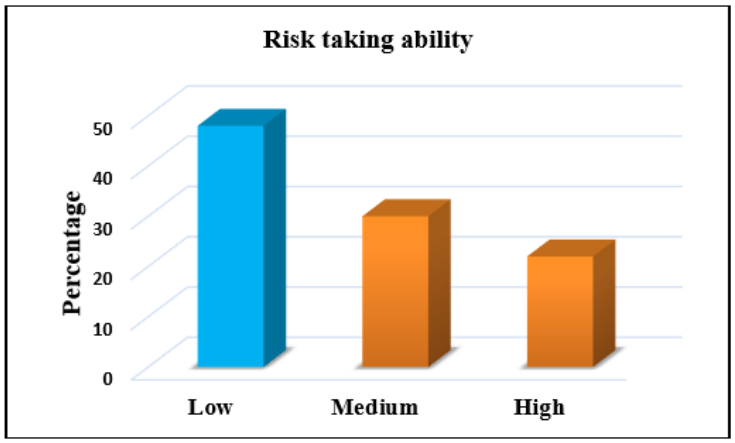
Table 4.12 depicts the distribution of vegetable farmers based on their risk-taking ability. Nearly half of the vegetable farmers (48.00 per cent) were having a low level of risk-taking ability followed by a medium (15 per cent) and high level (34 per cent) of risk-taking. Risk-taking behavior was essential for the adoption of GAP in vegetable cultivation. Farmers had to take certain type of risks like spending more on inputs for GAP which may result in increased cost of cultivation of vegetables while there are no guaranteed markets for GAP produces. All these factors must have contributed to the low level of risk-taking ability of vegetable farmers regarding GAP.

Table 4.12 Risk-taking ability of the vegetable farmers
(n=120)

S. No	Categories of leadership ability	Range of indices	No. of respondents
1	Low	< 63.25	58 (48)
2	Medium	63.25-80.00	36 (30)
3	High	> 80.00	26 (22)
Interquartile range: 16.75			

(Figures in parentheses indicate total percentage)

Figure 4.12 Risk-taking ability of the vegetable farmers



4.1.13 Economic motivation

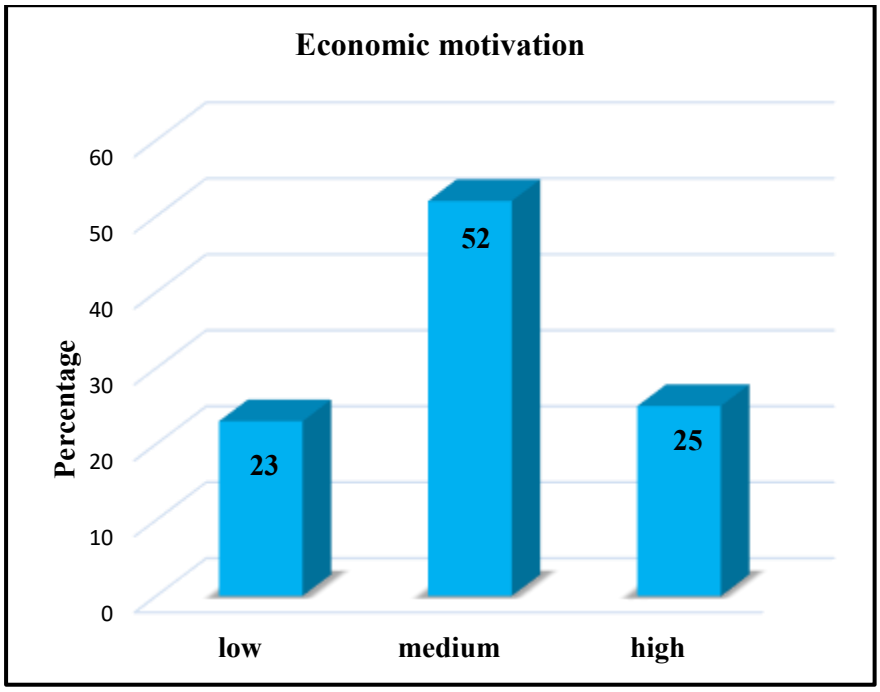
From the results in table 4.13, it was observed that the majority of the vegetable farmers (52.00 per cent) were having a medium level of economic motivation followed by a high (25 per cent) and low level (23 per cent) of economic motivation. It could be inferred that vegetable farmers are more concerned about profit-making.

Table 4.13 Distribution of farmers according to their Economic motivation (n=120)

S. No	Categories of Economic motivation	Range of indices	No. of respondents
1	Low	< 65.25	28 (23)
2	Medium	65.25-85.25	63 (52)
3	High	> 80.25	29 (25)
Interquartile range: 15.00			

(Figures in parentheses indicate total percentage)

Figure 4.13 Distribution of farmers according to their Economic motivation



4.1.14 Market Perception

The results in Table 4.14 showed the distribution of vegetable farmers based on their market perception. It could be observed that 47.00 per cent of the respondents had a medium level of market perception followed by low (28.00 per cent) and high (25.00 per cent) levels of market perception.

The probable reason for the medium level of market perception might be that the farmers are more concerned about the market opportunities available for vegetables and the possibility to get remunerative price for GAP vegetables.

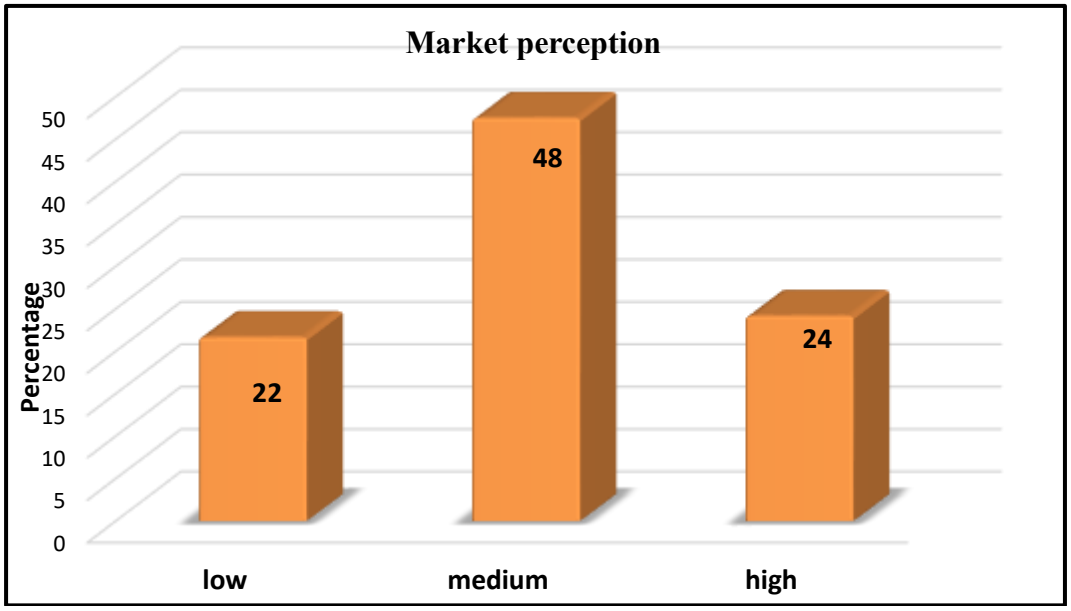
Table 4.14 Distribution of farmers according to Market perception

(n=120)

S. No	Categories of Market perception	Range of indices	No. of respondents
1	Low	< 68.00	33 (28)
2	Medium	68.00-85.00	57 (47)
3	High	> 85.00	30 (25)
Interquartile range: 17.00			

(Figures in parentheses indicate total percentage)

Figure 4.14 Distribution of farmers according to Market perception



4.1.15 Environmental orientation

It could be inferred from the results in table 4.15 that the majority of the vegetable farmers had a high level of environmental orientation (58.00 per cent) followed by 25 per cent of them had medium and 17 per cent of respondents had a low level of environmental orientation.

The probable reason for such result might be that the higher educational level and mass media exposure of the farmers which contributed towards achieving high environmental orientation among vegetable farmers.

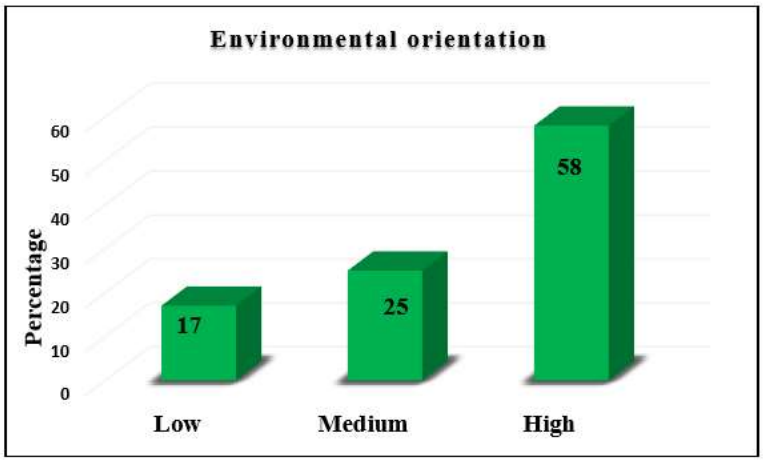
Table 4.15 Environmental orientation of the vegetable farmers

(n=120)

S. No	Categories of environmental orientation	Range of indices	No. of respondents
1	Low	< 64.10	20 (17)
2	Medium	64.10-82.33	30 (25)
3	High	> 82.33	70 (58)
Interquartile range: 18.23			

(Figures in parentheses indicate total percentage)

Figure 4.15 Environmental orientation of the vegetable farmers



4.2 Awareness level of vegetable farmers about Good Agricultural Practices (GAP)

The extent of awareness level of farmers on various Good Agricultural Practices in vegetable cultivation was discussed in this section. Table 4.16 reveals the distribution of vegetable farmers based on their awareness level on GAP. It could be inferred that about 73.00 per cent of the respondents had medium level of awareness, 17.00 per cent of them had high awareness level and only 10.00 per cent of them had low level of awareness on GAP.

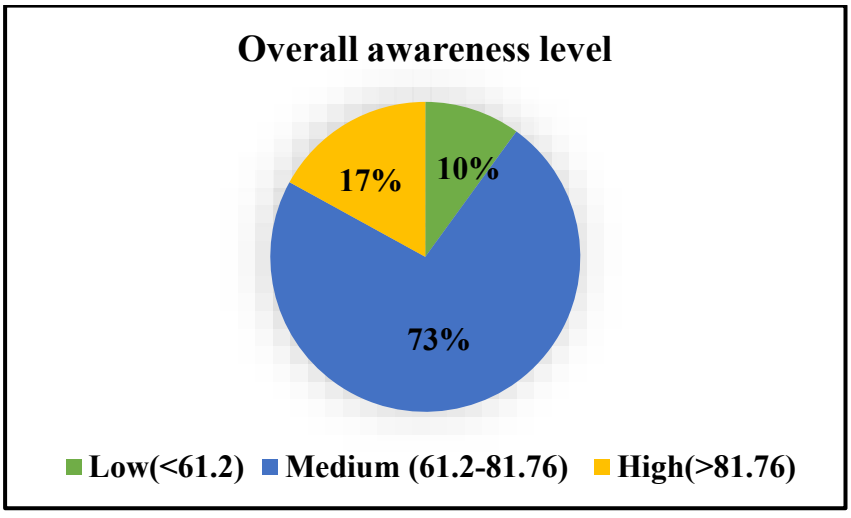
Table 4.16 Distribution of vegetable farmers according to their awareness level on GAP

(n=120)

S. No.	Level of Awareness	No. of respondents
1	Low (<61.20)	12 (10)
2	Medium (61.20-81.76)	88 (73)
3	High (>81.76)	20 (17)
Mean = 71.48	**SD= 10.28**	

(Figures in parentheses indicate total percentage)

Figure 4.16 Distribution of vegetable farmers according to their awareness level on GAP



4. 2 Awareness level of vegetable farmers about Good Agricultural Practices (GAP)

Table 4.17 shows component-wise awareness level on GAP among vegetable farmers. It could be observed that the overall Awareness Score on GAP among vegetable farmers (79.06) was medium level. Components like preparation of land and soil and harvesting and post-harvest handling gained high range of awareness scores of 81.42 & 84.32 respectively. Good Agricultural Practices awareness score on the practices like seed/seedling quality (74.20), sowing and intercultural operations (80.99), nutrient management (78.53), irrigation management & drainage (76.10), plant protection measures (77.89) were found to be medium level. This means that the farmers had a fairly well awareness about GAP, but they are not fully aware about all the aspects of technology. The results are in conformity with the findings of Jayakumar and Pasupathi (2019).

Table 4.17 Component wise Awareness level on GAP among vegetable farmers

S. No	Components of GAP	Awareness Score
1	Preparation of land and soil	81.42 (High)
2	Seed/seedling quality parameters	74.20 (Medium)
3	Sowing and intercultural operations	80.99(Medium)
4	Nutrient management	78.53 (Medium)
5	Irrigation management & drainage	76.10 (Medium)
6	Plant protection measures	77.89 (Medium)
7	Harvesting and post-harvest handling	84.32 (High)
8	Overall Awareness score	79.06 (Medium)

4.2.5 Component wise Awareness level on GAP among three categories of vegetable farmers

Table 4.18 Component wise Awareness level of GAP among three vegetables farmers

Components	Bitter gourd (n=40)	Vegetable cowpea (n=40)	Bhindi (n=40)
Preparation of land and soil	82.14 (High)	80.97 (High)	81.16 (High)
Seed/seedling quality parameters	63.88 (Medium)	78.61 (Medium)	80.13 (Medium)
Sowing and intercultural operations	78.45 (Medium)	82.36 (High)	82.16 (Medium)
Nutrient management	80.20 (Medium)	74.58 (Medium)	80.83 (Medium)
Irrigation management & drainage	75.83 (Medium)	76.16 (Medium)	76.33 (Medium)
Plant protection measures (Pest and disease control)	76.94 (Medium)	79.25 (Medium)	77.5 (Medium)
Harvesting and post-harvest handling	86.25 (High)	83.66 (High)	83.05 (High)
Overall awareness score	77.67 (Medium)	79.37 (Medium)	80.16 (Medium)

It is evident from the table 4.18 that the overall awareness level of GAP among bitter gourd farmers (77.67), vegetable cowpea (79.37) and bhindi (80.16) farmers were found to be medium level. The results clearly indicated that in bitter gourd cultivation components like preparation of land and soil and harvesting and post-harvest handling had high range of awareness score, 82.14 & 86.25 respectively. Remaining all practices gained medium range of awareness score.

In vegetable cowpea, awareness score was high with respect to land and soil preparation (80.23), harvesting and post-harvest handling (83.66) and sowing and intercultural operations (83.66). Remaining practices gained medium range of awareness score.

Bhindi farmers were highly aware about preparation of land and soil 81.16 (High) and harvesting and post-harvest handling 83.05 (High) while the remaining practices gained medium range of awareness score.

Table 4.19 Distribution of bitter gourd farmers according to their awareness level on GAP

(n=40)

S. No.	Level of Awareness	No. of respondents
1	Low (< 63.57)	4 (11)
2	Medium (63.57-82.34)	31 (77)
3	High (>82.34)	5 (12)
Mean= 73.84	**SD=11.20**	

(Figures in parentheses indicate total percentage)

Table 4.19 shows the distribution of bitter gourd farmers on their awareness level on GAP. About 77.00 per cent of the respondents were had medium level awareness followed by 12.00 per cent of them had high awareness level and only 10.00 per cent of them had a low level of awareness concerning GAP in bitter gourd cultivation.

Figure 4.17 Distribution of bitter gourd farmers according to their awareness level on GAP

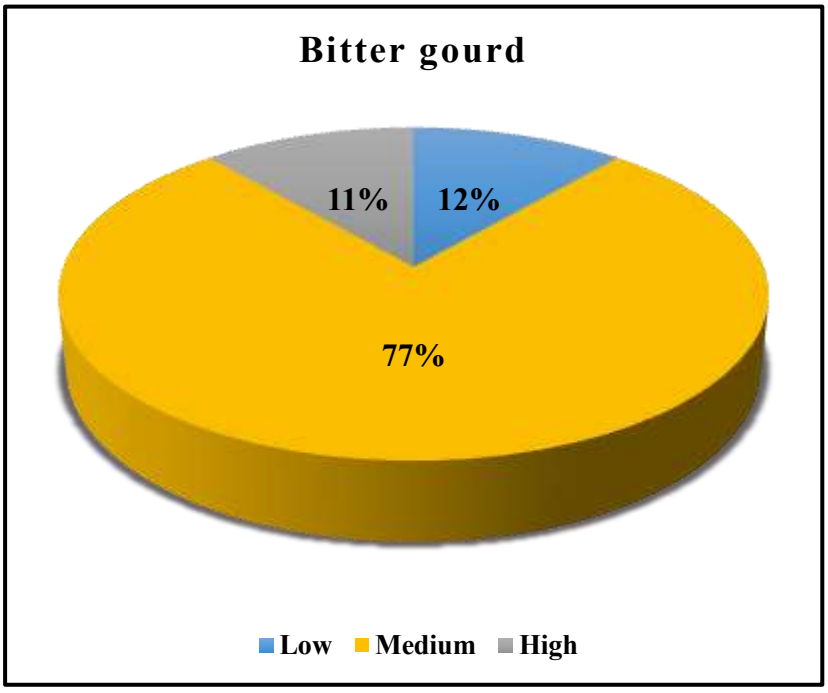


Table 4.20 Distribution of vegetable cowpea farmers based on the awareness level on GAP

(n=40)

S. No.	Level of Awareness	No. of respondents
1	Low (<58.97)	7 (18)
2	Medium (58.97-79.47)	27 (66)
3	High (>79.47)	6 (16)
Mean= 69.23 SD=10.16		

(Figures in parentheses indicate total percentage)

From Table 4.20 it was found that more than half (66.00 per cent) of the vegetable cowpea farmers were found to have a medium level of awareness followed by 18.00 per cent of them had a low level of awareness and the remaining 16.00 per cent of the vegetable cowpea farmers had a high level of awareness on GAP.

Figure 4.18 Distribution of vegetable cowpea farmers based on the awareness level on GAP

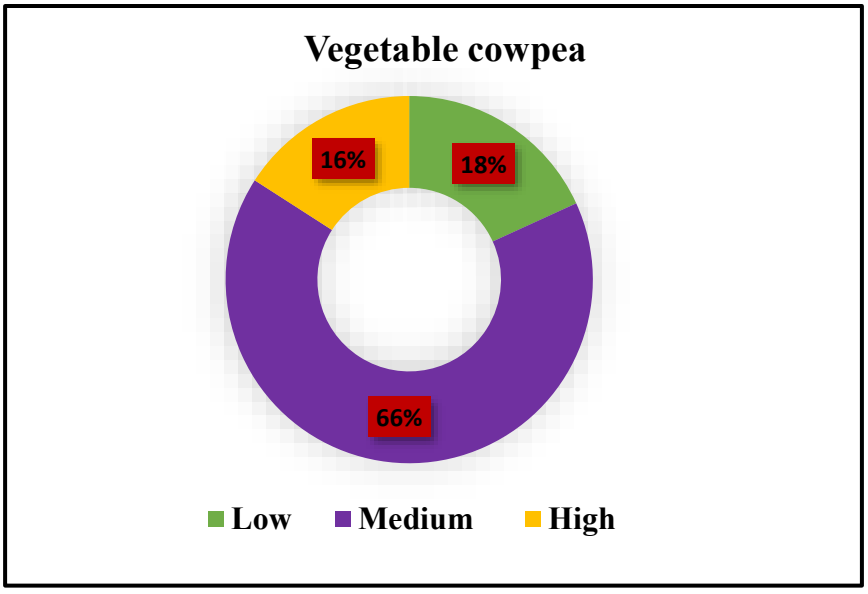


Table 4.21 Distribution of bhindi farmers according to their awareness level on GAP

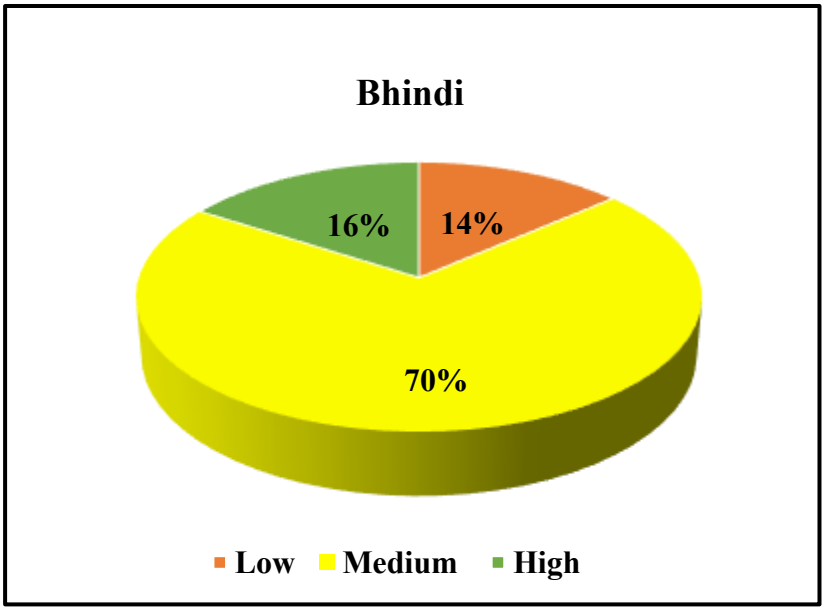
(n=40)

S. No.	Level of Awareness	No. of respondents
1	Low (<65.27)	5 (14)
2	Medium (65.27-83.01)	28 (70)
3	High (83.01)	7 (16)
Mean= 73.14 SD=9.72		

(Figures in parentheses indicate total percentage)

The data presented in table 4.21 highlighted that nearly three by forth (70.00 per cent) of the bhindi farmers were found to have a medium level of awareness and 16.00 per cent of them had a high level of awareness regarding GAP and about 14.00 per cent of the bhindi farmers were having a low level of awareness.

Figure 4.19 Distribution of bhindi farmers according to their awareness level on GAP



4.3 Adoption level of Good Agricultural Practices among vegetable farmers

Table 4.22 Component wise overall Adoption level of GAP among vegetable farmers

S. No	Components of GAP	Adoption Score (n=120)
1	Preparation of land and soil	79.56 (High)
2	Seed/seedling quality parameters	71.83 (Medium)
3	Sowing and intercultural operations	75.36 (Medium)
4	Nutrient management	74.31 (Medium)
5	Irrigation management & drainage	54.04 (Low)
6	Plant protection measures	70.80 (Medium)
7	Harvesting and post-harvest handling	81.05 (High)
8	Overall Adoption Index	73.21 (Medium)

The extent of adoption on Good Agricultural Practices among vegetable farmers was measured with a Good Agricultural Practices Adoption (GAPA) Index of 73.21. Among the listed seven components of GAPA Index, preparation of land and soil and harvesting & post-harvest handling gained the highest range of adoption scores, 79.56 and 81.05 respectively. The probable reason for the result could be that the farmers were benefited from the adoption of Good Agricultural Practices related to land preparation like summer plouging for effective control of the pest pupae and improved soil health. Adoption of GAP related to post-harvest handling practices like cleaning, grading and packing for better market price and quality of products might be more beneficial to the farmers.

It was found that adoption scores for remaining practices viz. seed/seedling quality parameters (71.83), sowing and intercultural operations (75.36), nutrient management (74.31) and plant protection measures (70.80) were medium. It could be noted that irrigation management & drainage component in GAPA Index gained low level of adoption score (54.04) even though the farmers had medium level of awareness about the practices. This might be due to the fact that in Palakkad district there are no facilities available for testing of irrigation water and the farmers were not able to manage the quality of irrigation water. It was also found that most of the farmers were only willing to adopt the micro-irrigation and fertigation practices when government provided subsidies. Discontinuation of micro-irrigation practices in later period was

also noticed. The results are in line with the findings of Anju and Padmanabhan (2016).

4.12 Distribution of vegetable farmers according to their adoption level on GAP

The Table 4.23 indicated that majority (64 per cent) of the farmers had medium level of adoption of Good Agricultural Practices in vegetable cultivation while 19 per cent of them had low level and 17 per cent of them had high level of adoption. The results are in conformity with the findings of Yadav et al. (2014).

The possible reason for such result could be that in the study area, the State Department of Agriculture has been implementing schemes on organic farming and Good Agricultural Practices, which might have created an awareness about GAP among the farmers.

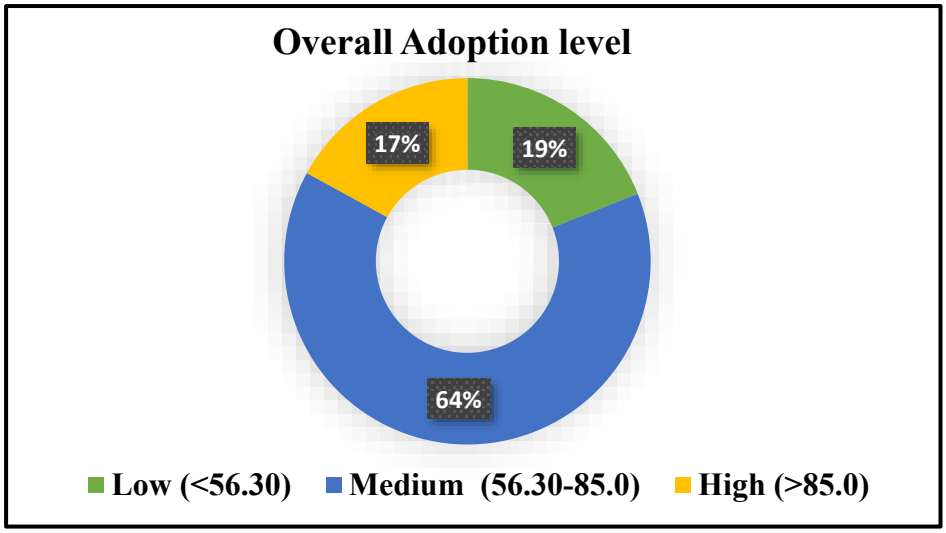
Table 4.23 Distribution of vegetable farmers according to their Adoption level on GAP

(n=120)

S. No.	Level of Adoption	No. of respondents
1	Low (<56.30)	23 (19)
2	Medium (56.30-85.00)	77 (64)
3	High (>85.00)	20 (17)
Mean = 76.33 SD=14.35		

(Figures in parentheses indicate total percentage)

Figure 4.20 Distribution of vegetable farmers according to their Adoption level on GAP



4.3.5 Component wise Adoption level of GAP among three categories of vegetable farmers

Table 4.24 Component wise overall Adoption level of GAP among three vegetables farmers

Components of GAP	Bitter gourd (n=40)	Vegetable cowpea (n=40)	Bhindi (n=40)
Preparation of land & soil	80.08 (High)	66.04 (Medium)	79.87 (High)
Seed/seedling quality parameters	70.20 (Medium)	70.10 (Medium)	75.20 (Medium)
Sowing & intercultural practices	70.08 (Medium)	78.02 (High)	78.00 (Medium)
Nutrient management	71.71 (Medium)	74.21 (Medium)	77.03 (Medium)
Irrigation management & drainage	48.87 (Low)	60.5 (Low)	52.75 (Low)
Plant protection measures	63.88 (Low)	70.31 (Medium)	78.22 (Medium)
Harvesting & post-harvest handling	80.20 (High)	76.75 (Medium)	81.77 (High)
Overall Adoption Score	67.85 (Medium)	72.75 (Medium)	74.23 (Medium)

It is evident from table 4.24 that the overall adoption score of GAP among bitter gourd (67.85), vegetable cowpea (72.75.37), and bhindi (74.23) farmers were found to be medium. The results indicated that in bitter gourd cultivation, components like preparation of land and soil and harvesting and post-harvest handling gained high adoption scores of 80.08 & 80.20 respectively. Irrigation management and plant protection measures (63.88) were found to have a low adoption score.

In vegetable cowpea, sowing and intercultural practices (78.02) were gained high adoption score. Irrigation and drainage management (60.50) was found to have a low adoption score. This might be due to a lack of facilities and subsidies for these practices. Remaining practices like land and soil preparation, harvesting and post-harvest handling, seedling quality parameters were found to have a medium adoption score. It was inferred that the farmers followed the practice of cultivating cowpea as a fallow crop after bitter gourd and hence they were using the same pandal systems for cultivating cowpea. So, they were not concentrating on land preparation aspects in cowpea cultivation.

In the case of bhindi, cultivation practices like land and soil preparation and harvesting and post-harvest handling gained high adoption scores of 79.87 & 81.77 respectively. Remaining practices like seed/seedling quality parameters, sowing, and intercultural operations, nutrient management, plant protection measures were found with a medium level of adoption scores.

Table 4.25 Distribution of bitter gourd farmers according to their Adoption level on GAP

(n=40)

S. No.	Level of Adoption	No. of respondents
1	Low (<65.14)	7 (17)
2	Medium (65.14-73.74)	29 (73)
3	High (>73.74)	4 (10)
Mean=69.44	**SD=4.30**	

(Figures in parentheses indicate total percentage)

The results tabulated in table 4.25 documented the categorization of bitter gourd farmers according to their Adoption level of GAP. It was observed that the majority (73 per cent) of the farmers belonged to the medium category of adoption level on GAP, while 17 per cent of the respondents showed a low level of adoption, and 10 per cent of the farmers were found with a high level of adoption.

Figure 4.21 Distribution of bitter gourd farmers according to their Adoption level on GAP

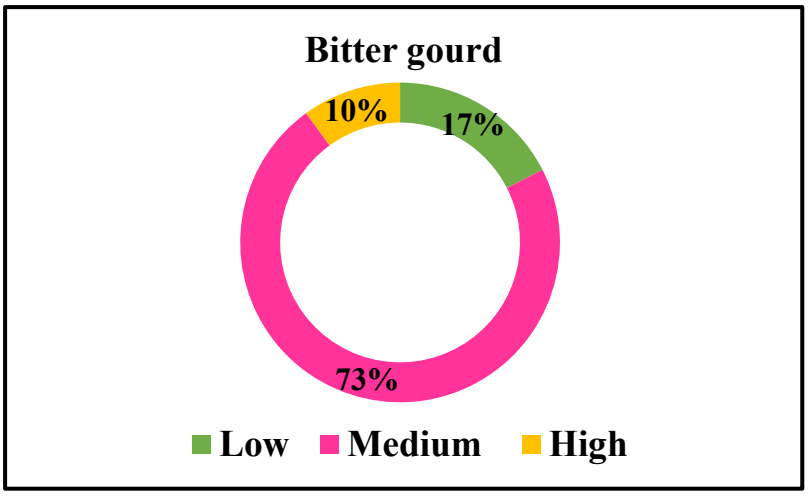


Table 4.26 Distribution of vegetable cowpea farmers according to their Adoption level on GAP

(n=40)

S. No.	Level of Adoption	No. of respondents
1	Low (<64.76)	9 (22)
2	Medium (64.76-78.26)	26 (65)
3	High (>78.26)	5 (13)
Mean=71.51 SD=6.74		

(Figures in parentheses indicate total percentage)

The data are given in table 4.26 delineated that more than half (65.00 percent) of the cowpea farmers had a medium level of adoption on GAP followed by 22 per cent respondents with low and 13 per cent, respondents, with high adoption level respectively.

Figure 4.22 Distribution of vegetable cowpea farmers according to their Adoption level on GAP

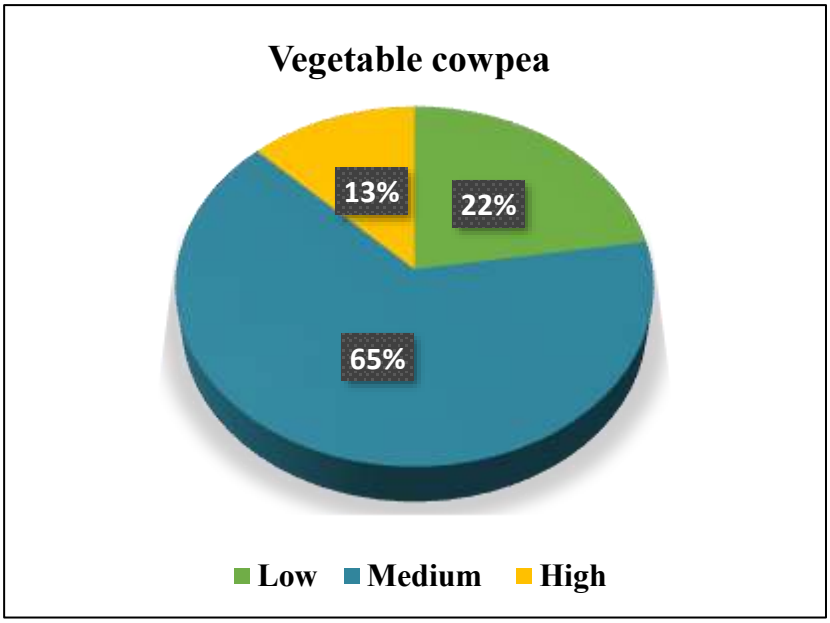


Table 4.27 Distribution of bhindi farmers Adoption level on GAP

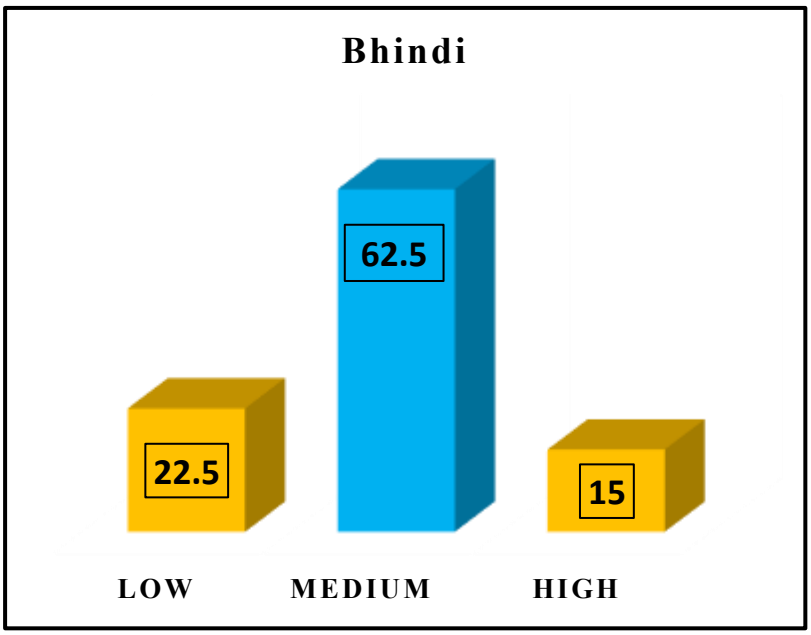
(n=40)

S. No.	Level of Adoption	No. of respondents
1	Low (<65.35)	9 (22.50)
2	Medium (65.35-79.70)	25 (62.50)
3	High (>79.7)	6 (15)
Mean = 72.56		**SD = 7.20**

(Figures in parentheses indicate total percentage)

The details of the Adoption level of GAP among bhindi farmers are presented in table 4.27. It could be concluded that more than sixty per cent of them had a medium level of adoption, followed by 22.50 per cent of the respondents with low and 15 per cent of them with a high level of adoption.

Figure 4.23 Distribution of bhindi farmers according to their Adoption level on GAP



4.4 Factors affecting the extent of adoption of Good Agricultural Practices

The results presented in table 4.28 pointed out that out of thirteen independent variables, eight variables namely experience in vegetable cultivation, the area under vegetable cultivation, training received by the farmers, extension contact, economic motivation, environmental orientation, and market perception had a positive and significant relationship (at 0.01 level of significance) and mass media exposure had a positive and significant relationship (at 0.05 level of significance) with the adoption of GAP in vegetable cultivation

Table 4.28 Relationship between independent variables and adoption of GAP

S. No	Independent variables	Correlation coefficient (r)
1	Age	-0.083 NS
2	Experience in vegetable cultivation	0.574**
3	Vegetable cultivation area	0.272**
4	Educational status	0.031 NS
5	Annual income	-0.101 NS
6	Training	0.285**
7	Social participation	0.178 NS
8	Mass media exposure	0.207*
9	Extension contact	0.321**
10	Risk-taking ability	-0.093 NS
11	Economic motivation	0.251**
12	Environmental orientation	0.710**
13	Market perception	0.435**

* Correlation is significant at the 0.05 level (2 tailed)

** Correlation is significant at the 0.01 level (2 tailed)

NS – Not significant

Experience in vegetable cultivation and adoption of GAP exhibited a significant and positive relationship. Farmers who had more experience in vegetable cultivation had more knowledge and skill and also, they had more concern about environmental health. This would have promoted greater adoption of GAP.

The area under vegetable cultivation also showed a significant and positive relationship with the adoption of GAP. Those farmers who are cultivating vegetables in their own land in large areas were found investing more money for procuring bio-inputs for the improvement of soil health. This might be reflected in their higher adoption score.

Training attended was found to have a significant and positive relationship with adoption. Training could have reinforced the farmers' active involvement in the adoption of GAP.

A significant and positive relationship was found to exist between adoption of GAP and mass media exposure. The likely reason could be that mass media plays a major role in the dissemination of new technologies.

Extension contact was found to have a significant and positive relationship with the adoption of GAP. Participation in various extension activities might have benefited farmers in gaining more knowledge about GAP and motivated them to adopt GAP.

A significant and positive relationship was found between economic motivation and the adoption of GAP. This could be due to farmers' willingness to gain more profit through the adoption of GAP in vegetable cultivation.

It could be substantiated that a significant and positive relationship existed between environmental orientation and the adoption of GAP. Farmers' concern for preventing the environmental pollution and toxic residues in vegetables might have led to a high-level adoption of Good Agricultural Practices.

Market perception and adoption had a significant and positive relationship. It could be inferred that the farmers' ultimate goal is to sell his or her produce at remunerative price and they expect more marketing opportunities for GAP produce.

4.5 Comparison of overall Adoption level of GAP among vegetable farmers

Kruskal Walli's One Way Analysis was performed to compare the overall adoption level of Good Agricultural Practices among three categories of vegetable farmers in the Palakkad district. The result showed that the p-value is greater than 0.01 and hence there is no significant difference between the adoption of GAP among the bhindi, vegetable cowpea and bitter gourd farmers. This meant that some similar practices of GAP like land and soil preparation, nutrient management and harvesting and post-harvest handling were adopted among all three categories of vegetable farmers.

Table 4.29 Results of Kruskal Wallis One Way Analysis of test among vegetable farmers

VA	N	Mean rank
Variable 1	40	57.44
2	40	65.28
3	40	58.79
Total	120	
Rank variable 1	40	57.44
2	40	65.28
3	40	58.79
Total	120	

Test statistics

Category	Chi-square	Degrees of freedom	Asymp. Sig
Variable	1.174	2	0.556
Rank variable	1.174	2	0.556

4. 5 Constraints faced by the vegetable farmers in adoption of GAP

Constraints faced by the farmers in the study area were analyzed and categorized into 4 dimensions. The items under each dimension were rated using a 3-point scale namely most serious, serious, and less serious. The percentage score was calculated for each item and was ranked in descending order based on their perception of importance and Kendall's Coefficient of Concordance was (W) computed to measure the degree of agreement among respondents in rating the constraints in the adoption of GAP.

Table 4.30 Dimensions of constraints faced by the farmers in adoption of GAP

S. No.	Dimensions of constraints	Percentage score	Mean Rank
1	Production and labor	79.62	4
2	Financial constraints	76.66	3.28
3	Marketing constraints	72.26	2.83
4	Information and extension	67.26	1.56

Kendall's w=0.856 Significant at 1% level

Table 4.30 showed that the value of Kendall's coefficient of concordance (W) is 0.856 which means that there is a strong agreement among the respondents in rating the constraints at 1 % significant level. Production and labour related aspects were found to be the most important dimension of the constraints experienced by vegetable farmers, followed by financial aspects, lack of marketing facilities and information and extension related constraints.

4.5.1 Item wise constraints in the adoption of GAP as perceived by the vegetable farmers

The results in table 4.31 revealed that increased difficulty in management of pest and disease, costly and lengthy certification process of GAP products, and high cost of bio-inputs were found to be the top three important constraints in the adoption of GAP in vegetable cultivation.

The value of Kendall's coefficient of concordance (W) is 0.69 at 1 % significant level, which means that the farmers were in strong agreement in rating the various constraints faced by them in the adoption of GAP in vegetable cultivation.

Table 4.31 Item wise constraints in the adoption of GAP as perceived by the vegetable farmers

S. No	Constraints	Mean score	Rank
1	Increased difficulty in the management of pest and disease incidence	20.45	1
2	GAP certification process is too complicated, lengthy and costly	18.45	2
3	High cost of bio-inputs	18.05	3
4	Lack of access to specialized market for GAP	17.78	4
5	Lack of transportation facilities	17.28	5
6	Increased labor and land management requirements	16.85	6
7	Increase in cost of production of Good Agricultural Practices	15.31	7
8	Lack of better pricing for GAP	15.01	8
9	Unavailability of post-harvest storage facilities in the market	14.98	9
10	Management of wild animals	13.89	10
11	Insufficient information regarding horticultural schemes	12.56	11
12	Lack of technical guidance	12.01	12
13	The decline in income during conversion of conventional farming to good agricultural practices	11.88	13
14	Unavailability of bio inputs like fertilizers, biopesticides, herbicides, *etc.*	11.05	14
15	Less landholding	10.58	15

It is evident from the above table 4.31 that the most important constraint is difficulty in the management of pests and diseases. One way to combat this problem is promoting group action of the farmers. Resorting to various biological methods of control by the farmers as a group would enable them to eradicate the pests or diseases problem as a whole in that area. Farmers also have to follow stringent measures under GAP to control pests and diseases The support of an extension system and government policy for group action would be necessary for tackling this problem.

Difficulty in getting the GAP certificate was found to be the second most important constraint in adoption of Good Agricultural Practices. GAP certification is a lengthy and costly method. The farmers had to spend more money for getting GAP certification. Without a GAP certificate, the farmers are unable to sell their products in global markets. Promoting a cost-effective Participatory Guarantee System (PGS) for GAP products may help to solve this problem.

The third important constraint was high cost of bio-inputs like biofertilizers, biopesticides and biocontrol agents. Quality of many of the bio inputs available at local level could not be ensured. Farmers mostly depend on various government institutions at distant places to get the biocontrol agents which is not found to be viable for them.

Other constraints like lack of access to specialized markets and transport facilities for GAP products, increased cost of cultivation including labor and management charges, lack of better pricing for GAP produce, unavailability of post-harvest storage facilities in the market, management of wild animals, lack of technical guidance regarding schemes, low income during the GAP conversion period, non-availability of bio-inputs and very small land holding were also reported by the selected respondents in the study area.

Plate 1: Field survey

a. Pandal system in Bitter gourd and vegetable cowpea cultivation

b. Grading in Bitter gourd and vegetable cowpea cultivation

Plate 2: Good Agricultural Practices in vegetable cultivation

Summary and Conclusion

Chapter 5

SUMMARY AND CONCLUSION

India is the second-largest producer of vegetables after China in the world. Vegetables play a major role in human health and nutrition. Vegetables contain the most important health-building and-protecting substances, such as vitamins and minerals, when consumed on a regular and balanced basis. Quality of food will ensure the healthy life of human beings. People are now focused on the benefits of consumption of fresh and residue-free fruits and vegetables. Quality of vegetables greatly depends on the production system as well as handling procedures before and after harvest. The concept of Good Agricultural Practices (GAP) emerged recently as a result of widespread concern about food safety, quality, and the ecological sustainability of agriculture. The study entitled "Adoption of Good Agricultural Practices among vegetable farmers of Palakkad district" was aimed to examine the extent of awareness and adoption of GAP in vegetables.

Palakkad district was purposefully chosen for the study because it has more area under vegetable cultivation in Kerala. The respondents were selected using the multistage proportional random sampling method. Four blocks namely Nenmara, Alathur, Chittur and Kollengode representing more areas of vegetable cultivation were selected from the district and 30 farmers with a minimum of 30 cents of vegetable cultivation were randomly chosen from each block. Based on the total area of cultivation of vegetables in the district, bitter gourd, vegetable cowpea and bhindi were selected for the study. Thus, a total of 120 vegetable farmers in Palakkad district constituted the sample for the study.

Based on the objectives of the study, data were collected using a well-structured interview schedule from three categories of vegetable farmers in Palakkad district. To achieve the research objectives, the data were analyzed using appropriate analytical tools and concluded into valid and significant inferences.

Salient findings of the research study:

Analysis of the socio-economic profile characteristics of vegetable farmers showed that majority of the vegetable farmers (67 per cent) belonged to middle age category of 36 to 55 years. Most of the vegetable farmers (42.50 per cent) had secondary school education. Fifty-four per cent of the farmers were having more than 6 years of experience in vegetable cultivation. Most of the respondents (56 per cent) belonged to marginal farmers category with respect to area under vegetable cultivation. Majority of the farmers had the annual income range of one to two Lakh (65 per cent). Around 89 per cent of the vegetable farmers had undergone training in GAP. Fifty-seven per cent of the vegetable farmers belonged to medium category with respect to mass media exposure. More than half of the vegetable farmers (52 per cent) had medium level of extension contact. Most of the farmers belonged to medium category of social participation (58 per cent), economic motivation (52 per cent) and market perception (48 per cent) followed by 48 per cent of the farmers under the category of low risk-taking ability. Nearly sixty per cent of the respondents (59 per cent) had high environmental orientation.

Assessment of the Awareness level of GAP among vegetable farmers showed that majority of the respondents had medium (77 per cent) level of awareness, while 12 per cent of them had low level of awareness and 11 per cent had high level of awareness. Regarding the awareness level on various components of GAP, vegetable farmers were found to be highly aware about land preparation and soil management (81.42) as well as harvesting and post-harvest handling (84.32) practices. Awareness level on the remaining practices *viz.* seed quality parameters, sowing and intercultural operations, irrigation management and drainage, nutrient management and plant protection measures were found to be medium.

The Good Agricultural Practices Adoption (GAPA) Index in vegetable cultivation was found to be medium (73.21). The Adoption Score on components of GAP *viz.* land preparation and soil management (79.56) and harvesting and post -harvest handling (81.05) was high, while that on seed quality parameters, sowing and intercultural operations, nutrient management and plant protection measures were medium. The component that had lowest level of Adoption Score was irrigation management and drainage (54.04).

Comparing the overall adoption of GAP among three categories of vegetable farmers by using Kruskal Wallis One way Analysis, it was found that there was no significant difference between bitter gourd, vegetable cowpea and bhindi farmers. The socio-economic and psychological characteristics of vegetable farmers played a vital role in determining their adoption of GAP. The results of Karl Pearson correlation analysis showed that area under cultivation, experience in vegetable cultivation, extension contact, training received, mass media exposure, market perception, economic motivation and environmental orientation had a positive and significant relationship with the adoption of GAP.

Major constraints in adoption of GAP were identified as difficulty in management of pests and diseases, high cost and the complicated process involved in GAP certification and increased cost of bio-inputs.

Policy recommendations

- Creating more awareness regarding GAP products would be required among producers as well as consumers. This will increase the demand for GAP products and thereby contribute to higher income to the farmers.
- More intensive training and capacity-building programs are required to the farmers for enhancing awareness and skill on Good Agricultural Practices
- Adoption of Good Agricultural Practices may result in escalation of cost of production of farming and hence more incentives to be given for ensuring the continuous adoption of Good Agricultural Practices.
- Marketing and export of GAP products requires a GAP certificate. Present GAP certification system is costly and lengthy process and farmers are unable to gain certificates. To overcome this problem, farmers have to be motivated to adopt a cost-effective PGS certification system.

- ❖ As there are not many specialized markets for GAP certified products, farmers are not getting remunerative prices for GAP vegetables. Strengthening of Weekly markets and Eco-shops as specialized markets in the State for large scale procurement and sale of GAP certified vegetables, will be a viable option for effective supply chain management of GAP products.

Other suggestions put forth in the study is given below:

1. Development of model GAP plots with institutional support
2. Financial support during the transition of GAP products
3. Assuring availability of quality bio-inputs at reasonable prices
4. Supportive role of the government in marketing; subsidies and loans
5. Guilds of skilled and experienced GAP farming experts to guide new entrants to GAP farming
6. Processing of GAP produce as a key area of development
7. Establishment of public warehouses for separate storage of GAP produce.
8. Creation of networks of GAP practiced farmers to facilitate the exchange of ideas, technology, inputs, and experience
9. More studies on Good Agricultural practices especially on the marketing aspects

Future line of work

- The perceptions of extension personnel and scientists related to the implementation of Good Agricultural Practices in vegetable cultivation may be studied.
- Extension strategies of government and non-government organizations for promoting Good Agricultural Practices may be studied.
- Similar studies could be conducted on other crops such as plantation, medicinal, fruits and aromatic plants etc.
- Similar research studies could be carried out in other districts to generalize the findings, as the current study was limited to only one district.

References

Chapter 6

REFERENCES

Ag-network-chile. 2008. Good Agricultural Practices, farm performance and input usage by smallholders: Emprical evidence from Nepal. *Agribus*. 35: 471-491.

Aldosari, F. and Noor, M. A. 2017. Farmers perception regarding the use of information and communication technology (ICT) in khyber pakhtunkhwa, Northern Pakistan. *J. Saudi. Soc. Agri. Sci.*18(2): 211-217.

Anju, K. K. and Padmanabhan, V. B. 2016. Adoption of Kerala Agricultural University Recommended Practices of Amaranthus and vegetable cowpea. *J. Ext. Edu*. 28 (2): 5651-5658.

Angadi, J. G., Jahagirdar K.A. and Shinde, P. S. 2016. Awareness knowledge of farmer about improved cultivation practices of groundnut. Maharashtra. *J. Ext. Edu*. 12: 356-358.

APEDA [The Agricultural and Processed Food Products Export Development Authority]. 2020. Export report on principal commodities. Available at: http://agriexchange.apeda.gov.in/indexp/18headgenReportmonth_combine.aspx.

Bagheri, S. and Shabanali, B. 2016. Adoption pattern of vegetable cultivation practices in river bed areas. *Archives*. 15 (2): 827-832.

Basera, M. I. and Bhadrdwaj, V. 1996. Adoption of integrated pest management practices for cotton by the farmers. *J. Ext. Edu.* 7: 134-138.

Becot, P. H. 2012. A multi-dimensional analysis of self-employment among farm women. M.Sc. (Ag.) thesis, Kerala Agricultural University, Thrissur. 105p.

Bhatta, S., Salame. A and Jahangirali, M. 2015. Comparative analysis of marketing behaviour of wheat and tomato growers in Dharwad district of Karnataka. M.Sc. (Agri) Thesis, University of Agricultural Sciences GKVK, Bengaluru. 145p.

Borah, F. A., Nickerson, V., Conner, D. S., and Kolodinsky, J. M. 2020. Costs of food safety certification on fresh produce farms in Vermont. *Hort. Tech.* 22(5): 705-714.

Chand, T., Shivamurthy, M. and Gangadharan, K. K. 2003. Adoption of improved agricultural practices by pepper growers of Idukki district. M.Sc. (Ag.) Thesis, Kerala Agricultural University, Thrissur. 150p.

Chaudhary, H. 2013. Farm women in agriculture operation. *Agric. Ext. Review*. 15(1): 21-23.

Chandran, K. M. and Podikunju, K. 2019. Marketing Behaviour of Coffee Growers in Kodagu District of Karnataka. M.Sc. (Agri.) Thesis. Mahatma Phule Krishi Vidyapeeth, Ahmednagar, Maharashtra, India. 123p.

Chadurvedani, K., Chendake, A. D. and Bhauhan, P. M. 2017. Marketing strategy of greenhouse vegetable and flower growers in Sabarkantha, district of Gujarat. *J. Agric. Res.* 53(2): 277-285

Chigodolli, A. M., Yamgar, A. S. and Barange, P. K. 2019. Adoption behavior of turmeric growers about post-harvest technologies. *Int. J. Tropical Agric*. 33(2): 1647-1651.

Choudary, M. A. and Khodifad, D. M. 2017. Entrepreneurial Behaviour of Vegetable Growers. *Agric. Sci. Digest*. 33(2): 85-91.

Das, R. D., Pisure, B. L. and Jamadar, C. R., 2019. Relationship between socio-economic characteristics of brinjal growers with their adoption gap in production practices. *Biosci. Trends*. 7(19): 2903-2906.

Davis. 2008. A study on the Entrepreneurial Behaviour of Vegetable grower of Cuttack district. M.Sc. (Agri) Thesis, Orissa University of Agriculture and Technology Bhubaneswar, Odisha. 140p

Devde, P. U. 2017. Marketing Behaviour of Vegetable Growers. M.Sc. (Agri) Thesis, Vasantrao Naik Marathwada Agricultural University. College of Agriculture, Latur. 173p.

Dheeraj, M. and Kalyan, G. 2015. Socio-economic profile of vegetable farmers in Eastern Uttar Pradesh. *Indian J. Agric. Allied. Sci*. 1(2): 26-28.

Divya, K. and Sivakumar, S. D. 2014. Adoption of Good Agricultural Practices (GAP) in chillies cultivation by farmers in southern districts of Tamil Nadu. *Agric. Update*. 9(2): 178-18.

Ellis, O., Jat, P., Tiwari A., Choudhary, S. and Swarnakar, V. 2004. Production technology and availability of marketing facilities Of Onion in Dewas district of Madhya Pradesh. *Indian. J. Res. Agric. Ani. Sci.* 2(6): 10-13.

FAO [Food and Agriculture Organization]. 2003. Responsible Banana Production and Trade, Good Agricultural Practices for Sustainable Agriculture and Rural Development: Case Studies. Food and Agriculture Organization of the United Nations, http://www.fao.org/wssd/SARD/ sardgap/cs.htm. Downloaded 7-Sept-03.

FAO [Food and Agriculture Organization]. 2011. Development of a framework for Good Agricultural Practices. Committee on Agriculture (COAG) 31 March to 4 April. Rome. Italy.

Firas, A. 2014. Adoption range of integrated pest management (IPM) techniques by greenhouse vegetable growers in Jordan. *J. Agric. Sci*. 14(3): 504-525.

Garbutt P. B. and Hofmans, K. 2016. Knowledge of integrated weed management practices by the farmers in Marathwada region. *Int. J. For. Crop Improv*. 7: 108-113.

Garcia martinez, B., Sana, G. and Himen, M. R. 2007. Adoption behaviour of commercial potato growers in district Ghaziabad (Uttar Pradesh) . *J. Extn. Edu.* 23: 489-489

Garet, S. 2003. Existing cultivation practices followed by the Turmeric growers in Sindhudurg district. M.Sc. (Agri.) Thesis, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. 125p.

George, B., Saju, G. and Hegde, M. R. 2007. Adoption of IPM practices by vegetable growers in Karnataka. *J. Extn. Edu.* 24(3): 4892-4896.

GoK [Government of Kerala]. 2011. Population Census. Panchayat Level Statistics (Palakkad district), Department of Economics and Statistics, GoK.

GoK [Government of Kerala]. 2019. Agricultural Statistics (2018-19), Directorate of Economics and Statistics, GoK. 199p.

GoK [Government of Kerala]. 2019. Agricultural Statistics. Directorate of Economics and Statistics, Government of Kerala.

GoK [Government of Kerala]. 2019. Farm Guide, Farm Information Bureau, GoK. 256p.

GoK [Government of Kerala]. 2020. Report on cost of cultivation of important crops in Kerala (2017-18), Directorate of Economics and Statistics, GoK. 164p.

GoI [Government of India]. 2020. Agriculture at a glance. Directorate of Economics and Statistics, Government of India. 496p.

Gopichand, B. A. and Banerjee, D. S. 2017. Knowledge and adoption correlation of onion production technology in Dhule district. *Int. J. Agric. Sci. Vet. Med*. 2: 17-23.

Gupta, N. N., Kudari, M. B. and Pareek, A. 2014. A study on perception of precision farming by the farmers. M.Sc. (Agri.) Thesis, University of Agricultural Science Dharwad, Karnataka, India. 166p.

Gujar, Y. K. 2017. Entrepreneurial Behaviour of Vegetable growers in Navsari district. M.Sc. (Agri) Thesis, N. M. College of Agriculture Navsari Agricultural University, Gujrat.

Hardik, N. P. 2015. Comprehensive awareness about global warming among extension functionaries. M.Sc. (Agri). Thesis. Anand Agricultural University. Gujarat.

Issa, G. and Hamn, S. 2015. Impact of Good Agricultural Practices (GAP) on small farm development: knowledge and adoption levels of farm women in rain fed areas. *Indian Res. J. Ext. Educ*. 15(4):153-156pp.

Islam, S., Kabir, M. H., Ali, S., Sultana, S. and Mahasin, M. 2019. Farmer's knowledge on climate change effects in Agriculture. *J. Agric. Sci*. 386-394.

Jaffee S. 2003. From Challenge to Opportunity: Transforming Kenyan Fresh Vegetable Trade in the Context of Emerging Food Safety and Other Standards. Agriculture and Rural Development. Working Paper 10, the International Bank for Reconstruction and Development, Agriculture and Rural Development Department, Washington DC.

Jaganathan D. 2004. Analysis of organic farming practices in vegetable cultivation in Thiruvananthapuram district. M.Sc. Thesis, Kerala Agricultural University, Thrissur, India. 115 p.

Jayakumar, T. and Pasupathi, G. (2019). A Study of Analysis of Awareness among Consumers towards Organic Food products with Special Reference to Tiruchirappalli City. *J. Compos. Theo.* 12 (9): 1321-1328.

Joshi, A. M. 2014. Marketing behaviour of mango growers. Thesis. M.Sc. (Agri.), Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. 145p.

Justus Ochieng., Victor Afari-Sefa., Francis, M., Monica, K., Irmgard Hoeschle-Zeledon., Mateete, B. and Dubois, T. (2021). Adoption of sustainable agricultural technologies for vegetable production in rural Tanzania: trade-offs, complementarities and diffusion. *Int. J. Agri. Sci.* 14(7): 256-265.

Kadam, P. 2016. Attitude of the farmers towards integrated pest management technology programme on cotton. *Int. J. Agri. Sci.* 12 (2): 294-297.

Kaur, A. and Sidhu, M. S. 2015. Marketing of potato in Jalandhar district of Punjab. *Indian J. Econ.* 11 (4): 823-832.

Kasinath, Y. B. and Narasimha, N. 2019. Marketing behaviour of onion growers in Chitradurga district of Karnataka, Mysore. *J. Agri. Sci*. 46 (4): 874-879.

Kavyasree, A., Pavitra Kumar, D. and Indrajit, B. 2021. A Study of Adoption Pattern of Recommended Practices for Major Vegetable Crops in Flood Prone Areas of Lakhimpur District of Assam. India. *Int. J. Curr. Microbiol. App. Sci.* 9 (06): 3686-3694. doi: https://doi.org/10.20546/ijcmas.2020.906.435.

Khan, M. I., Sharad, B. and Gaurav, M. 2020. Socio-Economic Profile of Vegetable Growers under Horticulture based Module of Farmer FIRST Project in Balaghat (M.P.), India. *Int. J. Curr. Microbiol. App. Sci*. 9(03): 3252-3257. doi:https:// doi.org/10.20546/ijcmas.2020.903.372.

Koomen, I., Boselie, D., Dewayanti, R., Zulkarnain, I. and Suleaman, A. (2011) Analysis of constraints for compliance to Good Agricultural Practices by the horticultural sector in Indonesia, Project Report for 2010. Centre for Development Innovation, Wageningen University & Research Centre. 22p.

Krishnan, A. 2019. Analysis of post-harvest loss in supply chain of peas and tomato in Nainital district. M.B.A Thesis, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. 44p.

Krishnasamy, D. K., Singh, B. K., Yadav, V. P. and Singh, L. 2016. Adoption Behaviour of Commercial Vegetable Growers in District Ghaziabad (UP). *Indian Res. J. Ext. Edu.* 10 (3): 66-70.

Kumar, P. 2015. Communication and Marketing Behaviour of Tribal Vegetable Growers: A Study in Ranchi District of Jharkhand State. Ph.D. Thesis. (Agri.), Banaras Hindu University, Varanasi, 82p.

Kumar, R., Bhatia, A. K. and Singh, D. (2017). Present status of vegetable production and their impact in human nutrition. *Int. J. Agri. Sci.* 9 (55): 4945-4949.

Kumari, M., Bairwa, S. L. and Singh, R. G. 2015. An Economic Analysis of Demand, Supply Prospects and Post-Harvest Losses of Major Fruits and Vegetable in Bihar. *Annals of Agri-Bio Res.*, 20(2): 235-240.

Lokesh Babu, S., Sudhakar, D. D. and Dhage, S. V. 2017. Socio- economic factors affecting the awareness of farmers towards effect of pesticide of human health. *J. Pharm. Phytoche*. Sabaramuwa University, Sri Lanka. 8 (1): 79-89.

MC clusky, and O “Rourke .2000. Marketing analysis and consumption pattern of tomato in Oyo state, Nigeria. *Int. J. Agric. Innov. Res*. 2(5): 811-817.

Maharashtra State Agricultural Marketing Board. 2005. Eurep GAP certification for Good Agricultural Practices. Ramanathapuram.10p.

Malkanthini, M. J., Mashau, M. E., Moyane, J. N. and Jideani, I. 2020. Production and marketing management of leafy vegetables in North Karnataka. M.Sc. Thesis, University of Agricultural Sciences, Dharwad. 127p.

Maratha, P., Kumar, N. and Badodiya, S. K. 2018. Study on Marketing Behaviour and Other Attributes of Vegetable Growers at Kota Block of Kota District in Rajasthan. *Int. J. App. Biosci*. 5 (1): 329-337. .

Masudkar, D. D., Kamble, V. B. and Anarase, M. S. 2017. Socio-economic status of the farmers in adopted village. *J. Pharmacogn. Phytochem*. 6 (1): 1117-1119.

Maurya, V. 2017 Constraints in production and marketing of organic vegetable growers in Belagavi district of Karnataka. *Int. J. Cur. Res.* 7(12): 24816-24819.

Maya, P., Bheemappa, A., Angadi, J. G. and Guledgudda, S. S. 2018. A critical analysis on economics and constraints in adoption of organic vegetable cultivation in Belgaum district. Karnataka. *J. Agric. Sci.* 27(4): 539-541.

Mengistie, B. T., Mol, A. P. and Oosterveer, P. 2017. Pesticide use practices among smallholder vegetable farmers in Ethiopian central rift valley. *Environ. Dev. Sustain.* 19 (1): 301-324.

Nagel, G .2004. Extent of adoption of market intelligence among the summer cabbage growers of Sardarkrushinagar district in Gujarat. *J. Ext. Edu*. 24: 9-13.

Pandit, U., Nain, N. S., Reshmi, S., Kumar, S. and Chahal, V. P.2017. Adoption of Good Agricultural Practices in basmati rice: A study of prospects and retrospect’s. *Indian. J. Agric. Sci*. 87(1):31-36pp.

Papni, A., Rituraj, B., Borua, S., Deka, C. R. and Borah, D. 2017. Production, Value Addition and Marketing Behavior of Maize growers in Tamil Nadu – A critical analysis. M.Sc. (Agri) Thesis, Centre for agricultural and rural development studies Tamil Nadu Agricultural University, Coimbatore. 158p.

Paul, C. 2004. Government to Float Company to Market Farm Produce. *The Indian Express*. February 10.

Rahimi, V. K. 2018. Study on adoption of eco-friendly management practices by vegetable growers in Indore block of Indore district (MP). *J. Agric. Veterinary Sci*. 2(4): 22-25.

Rana, B. L., Suresh Kumar, P., Chargotra, M., Meena, R. K. and Pareek, A. 2017. Entrepreneurial behavior of tribal winter vegetable growers in Jorhat district of Assam. *Indian Res. J. Extn. Edu*. 15 (1): 65-69.

Ram, K. (2015). Perception of paddy growers about environmental hazards caused through injudicious use of chemicals in paddy cultivation, M.Sc. (Agri) Thesis, Anand Agricultural University, Anand. 175p.

Ravi, G., Savitha, B., Sreenivasulu, M. and Vidyasagar, C. G. (2021). A Study on Extent of Adoption of Agri Waste Management Practices by the Farmers of Medak District of Telangana, India. *Asian J. Agri. Ext. Socio*. *39*(4): 125-133. https://doi.org/10.9734/ajaees/2021/v39i430567.

Reshmi, K., Yadav, S., Prajapati, R. H. and Prajapati, M. R. 2014. Knowledge and adoption of tomato growers about improved tomato production technology, Gujarat. *J. Ext. Edu*. 25: 172-174.

Sahu, R. P., Sachan, V. K., Singh., Raman, J. and Khilendra. 2013. Knowledge gap of farm women in vegetables cultivation. *J. Commun*. 27 (2): 83-87.

Shambarker, B. K., Dhiraj, K. S., Yadav, V. P. and Lotan, S. 2018. Perceived attributes of Integrated pest management technologies among Bt cotton farmers. *Indian Res. J. Ext. Edu*. 10 (3): 5-9.

Shelake, M. 2015. Marketing behaviour of onion growers in flood prone Eastern plain zone of Rajasthan. *J. Com. Studies*, 31: 164-171.

Shinde, C. 2013. Adoption of improved potato cultivation practices. *Veg. Sci*. 40 (1): 55-60.

Sinduja, K. K. and santhasheela, J. G. 2017. Adoption behaviour of vegetable growers towards improved technologies. *Indian Res. J. Ext. Edu.* 11 (1): 62-65.

Singh, D. M. 2020. A study on knowledge and adoption of post-harvest management practices among mango growers of northern Karnataka. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka. 138p.

Sivachandran, R., Shongwe, M. I., Motsa, N. M. and Shongwe, V. D. 2017. Adoption of post-harvest technologies used by smallholder farmers in Swaziland. *African J. Agric. Res.* 7 (35): 4983-4995.

Sreeram, N. 2013. Supply Chain Efficiency: An Insight from Fruits and Vegetables Sector in India. *J. Operat. Supply Chain Managt*. 7(2): 154-167.

Suramwad, S.R and Kolgane, B. T. 2017. A Study of Adoption of Improved Grape Production Technology Followed by Grape Growers. *Indian Res. J. Ext. Edu.* 17(3): 101-104.

Trivedi, B. S. 2018. Comparative economic analysis of post-harvest losses in vegetables and food-grain crops in Chhattisgarh. *Indian. J. Agri. Econ*. New Delhi. 63(3): 376.

Vani, D. and Bhindu, K. 2021. Analysing the constraints associated with the adoption of scientific vegetable cultivation practices. *Int. J. Sci. Res*. 4(5): 753-755.

Vihariya, M. D. 2012 A study on knowledge and adoption of recommended cultivation practices of onion by farmers. M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka, India. 105p.

Victoria, L., Srivasalu, R., Victo, A. S. and Benedicto, K. 2016. Analysis of Good Agricultural Practices in an integrated maize-based farming system. *Int. J. Veg. Sci*. 23(6): 598-604 pp.

Virender singh, G. 2020. Study on roasted date seed non caffeinated coffee powder as a promising alternative. *Asian. J. Soc. Sci.* 6(6): 1387-1394.

Wang, J., May, C. and Yuting, M. 2017. Measuring rice farmer's pesticide overuse practice and the determinants: A statistical analysis based on data collected in Jiangsu and Anhui Provinces of China. *Sustain*. 1-17.

Wongnaa, C.A., Awunyo-Vitor, D. and Bakang, E.A. 2017. Factors affecting adoption of maize production technologies in Ghana. *J. Agri. Sci*. Aug-Nov: 16- 24.

Zaw, S. and Myint, S. 2016. Awareness, knowledge and adoption level of recommended tomato cultivation practices. M.Sc. (Ag.) Thesis, Tamil Nadu Agricultural University, Coimbatore, 127p.

Appendices

APPENDIX I

KERALA AGRICULTURAL UNIVERSITY
College of Agriculture,
Vellanikkara, Thrissur – 680651

Dr. Smitha baby
Assistant professor
Dept. of. Agricultural Extension
Vellanikkara

Vellanikkara
Date: 9-3-2021

Sir/ Madam,

Sub: PG Education – M.Sc. Research Project – Judges opinion requested – regarding

I would like to bring your kind notice that Ms. Nagadevi G (Ad. No. 2019-11-026) is committed to undertake a research study as part of her Post Graduate programme entitled "**Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad district"** under my guidance.

The objective of the study is to assess the awareness level of farmers on Good Agricultural Practices (GAP) in selected vegetables and construct a GAP Adoption Index to analyse the extent of adoption. Further, it will identify the factors affecting the adoption of GAP and also the constraints faced by the farmers in adoption of GAP in vegetable cultivation.

For this purpose, based on the available literature, the student has listed out a number of personal, social, psychological and economic variables which may influence the awareness and adoption of Good Agricultural Practices (GAP).

Hence, I request you to kindly spare some time from your busy schedule to rate the listed variables by putting a tick mark (✓) in the appropriate column. You can also suggest variables which you feel important for the study and also rate them under the appropriate column. Your kind and quick response will help us to complete the study in time.

Thanking you

Yours faithfully,
Sd/-
Smitha Baby

Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad district

Major vegetables - Bitter gourd, Vegetable cowpea & Ladies finger

Objectives:

- To assess the awareness level and adoption of Good Agricultural Practices (GAP) in selected vegetables cultivated in Palakkad district
- To study the factors affecting the adoption of Good Agricultural Practices in selected vegetables cultivation.
- Constraints faced by the farmers in adoption of Good Agricultural Practices (GAP) among vegetable farmers in Palakkad district

Following independent variables are identified for the study: Please (√) mark the relevancy of the variables in the study in terms of MOR- Most Relevant, MR- More Relevant, R-Relevant, LR- Least Relevant and NR- Not Relevant against the appropriate column:

INDEPENDENT VARIABLES

S.No.	Variables	MOR	MR	R	LR	NR
1	**Age:** Refers to the number of calendar years completed by the farmer at the time of interview					
2	**Gender:** It refers to social or cultural distinctions Associated with being male or female.					
3	**Experience in vegetable cultivation:** Refers to the total number of years the farmer has been engaged in vegetable cultivation					
4	**Family type:** Family is the basic unit of a society. It can be nuclear or joint family					
5	**Education:** Refers to the extent of literacy obtained by the farmer at the time of interview					
6	**Scientific orientation:** Refers to the degree to which a farmer is relatively ready to adopt scientific ideas					
7	**Farm size:** Refers to the extent of area possessed by the farmer					

8	**Area under vegetable cultivation:** Refers to the area under vegetable cultivation measured in cents.					
9	**Risk orientation:** Refers to the degree to which the farmer is oriented towards the risks and uncertainty in adopting new ideas in farming					
10	**Annual income of the family:** It is the total income earned by all the members of a family from major and subsidiary occupational components.					
11	**Innovativeness:** Refers to the degree to which the farmer is relatively earlier in adopting new ideas					
12	**Information seeking behavior:** Refers to the degree to which the farmer is seeking information from different communication sources					
13	**Mass media exposure:** Refers to the degree to which the different mass media are utilized by the farmer for getting information about different Good Agricultural Practices (GAP).					
14	**Self-confidence:** Defined as the extent of feeling about one's own powers, abilities, and resourcefulness to perform any activity which the farmer desires to undertake					
15	**Main occupation:** Refers to whether agriculture is the farmer's chief occupation or not					
16	**Training received:** It indicates the number of Trainings attended by the farmers on Good Agricultural Practices (GAP)					
17	**Livestock possession:** Refers to the number of animals possessed by an individual					
18	**Social participation:** Refers to the degree of involvement of farmer in formal and informal social organizations either as member or as office bearer which also includes the extent of participation in organizational activities					
19	**Extension contact:** Refers to the extent of contact a farmer has with different extension agencies and also his participation in various extension activities or programmes like meetings, seminars, *etc*.. organized by these agencies					

20	**Cosmopoliteness:** Refers to the tendency of the farmer to be in contact with outside village on the belief that all the needs of an individual cannot be satisfied within his own village					
21	**Economic motivation:** Refers to the drive of the farmer for occupational sources in terms of profit making and the relative value placed on economic ends					
22	**Market perception:** Defined as the degree to which a farmer is oriented towards the market in terms of the demand and price of his produce					
23	**Credit orientation:** Refers to the favourable and positive attitude of a vegetable grower towards obtaining credit from institutional sources					
24	**Leadership:** It is defined as the ability of a person to influence people to cooperate in achieving a goal					
25	**Environmental orientation:** Refers to the degree to which the farmer is concerned about his environment					
26	**Availability of farm inputs:** Refers to the inputs available to the farmer either by his own possession or by hiring it					
27	**Other variables, if any please specify and explain**					

Name:

Signature:

Designation:

APPENDIX II

Relevancy indices of independent variables

S. No.	Variables	Relevancy indices
1	Age	86.26*****
2	Gender	76.07
3	Experience in vegetable cultivation	87.23*****
4	Family type	80.16
5	Educational status	91.33*****
6	Scientific orientation	81.43
7	Farm size	80.00
8	Area under vegetable cultivation	89.73*****
9	Risk orientation	91.66*****
10	Annual income of the family	92.25*****
11	Innovativeness	79.43
12	Information seeking behaviour	70.22
13	Mass media exposure	91.33*****
14	Self-confidence	76.72
15	Main occupation	81.13
16	Trainings received	94.36*****
17	Livestock possession	63.03
18	Social participation	85.83*
19	Extension agency contact	93.33*
20	Cosmopoliteness	70.42
21	Economic motivation	86.36*
22	Market perception	94.16*
23	Credit orientation	82.45
24	Leadership	80.52
25	Environmental orientation	87.03*****
26	Availability of farm inputs	81.73

*** Variables selected for the study**

APPENDIX III

KERALA AGRICULTURAL UNIVERSITY
College of Agriculture,
Vellanikkara, Thrissur – 680651

Dr. Smitha Baby
Assistant professor
Dept. of. Agricultural Extension

Date: 9-3-2021

Sir/ Madam,

Sub: PG Education – M.Sc. Research Project – Judges opinion requested – regarding

I would like to bring your kind notice that **Ms. Nagadevi G** (Ad. No. 2019-11-026) is committed to undertake a research study as part of her Post Graduate programme entitled "**Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad district"** under my guidance.

The objective of the study is to assess the awareness level of farmers on Good Agricultural Practices (GAP) in selected vegetables and construct a GAP Adoption Index to analyse the extent of adoption. Further, it will identify the factors affecting the adoption of GAP and also the constraints faced by the farmers in adoption of GAP in vegetable cultivation.

For this purpose, based on the available literature, the student has listed out a number of Good Agricultural Practices (GAP) in vegetable cultivation which would be used to construct Good Agricultural Practices Adoption (GAPA) Index

Hence, I request you to kindly spare some time from your busy schedule to rate the relevancy of the listed variables by putting a tick mark (✓) in the appropriate column. You can also suggest variables which you feel important for the study and also rate them under the appropriate column. Soliciting your kind and quick response which would help us to complete the study in time.

Thanking you

Yours faithfully,

Sd/-

Smitha Baby

Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad district

Major vegetables - Bitter gourd, Vegetable cowpea & Bhindi

Objectives:

- To assess the awareness level and adoption of Good Agricultural Practices (GAP) in selected vegetables cultivated in Palakkad district
- To study the factors affecting the adoption of Good Agricultural Practices in selected vegetables cultivation.
- Constraints faced by the farmers in adoption of Good Agricultural Practices (GAP) among vegetable farmers in Palakkad district

DEPENDENT VARIABLES

Dependent variable for the study is Good Agricultural Practices Adoption Index. Following are the good agricultural practices in vegetable cultivation identified for the study: Please (√) mark the relevancy of the practices in the study in terms of MOR- Most Relevant, MR- More Relevant, R-Relevant, LR- Least Relevant and NR- Not Relevant against the appropriate column:

S.No	Good Agricultural practices	MOR	MR	R	LR	NR
1	**Preparation of land and soil**					
	Ploughing followed by digging					
	Application of rotten FYM is mixed with soil					
	Incorporation of other organic materials into soil - crop residues - green leaf manure					
	Assessing soil health using Soil Health Card					
	Regular Soil testing					
	Growing cover crops/green manures to avoid soil erosion					
	Soil acidity corrected by liming/ alkaline soil corrected by sulphur (gypsum)					

	Any other practices, please specify					
2	**Seed/seedling quality parameters**					
	Use of own seed with genetic & physical purity					
	Keep seeds in sealed containers and store in a cool and dry place					
	Seed treatment method - pseudomonas - biofertilizers					
	Use of improved variety					
	Procurement of seed/seedling from a certified/authorised source					
	Use of pest and diseases resistant varieties					
	Any other practices, please specify					
3	**Sowing/transplanting parameters**					
	Adoption of recommended seed rate					
	Use of seedlings raised in appropriate growing medium					
	Planting at recommended spacing					
	Regular weed control					
	Any other practices, please specify					
4	**Nutrient management**					
	Application of required quantity of organic manure					
	Nutrient application based on soil testing report					
	Application of recommended dose of fertilizers					
	Application of straight fertilizers					
	Lime application one to two weeks before planting					
	Application of Bio fertilizer					
	Application of micronutrients					

	Any other practices, please specify					
5	**Irrigation management & drainage**					
	Ensuring water quality – EC & PH					
	Avoiding usage of untreated sewage water					
	Water conservation – farm and percolation ponds					
	Avoid uneven application of water					
	Mulching					
	Mid-season drainage					
	Adopt fertigation					
	Adopt micro-irrigation methods such as drip or sprinkler to save water					
	Any other practices, please specify					
6	**Plant protection measures (Pest and disease management)**					
	Summer ploughing					
	Use of biocontrol agents - trichoderma to control diseases - beauveria/verticellium to control pests					
	Adopting crop rotation					
	Planting trap crops (crops with pest deterring value in the border or as intercrop					
	Instant removal of infected/diseased plants/plant parts					
	Adopt physical control measures like simple hand-picking					
	Erecting traps- light traps/yellow sticky traps/Tulasi or fruit trap					
	Soil solarisation					
	Regular use of bio-pesticides					
	Avoid application of pesticides during strong winds					
	Strictly adhere to the withholding period (i.e. the lag between pesticide application and harvesting)					

	on the pesticide label					
	Hold pesticides in original containers and keep them tightly closed in a cool, well-ventilated location					
	Do not recycle or re-use pesticide containers for other usage					
	Protection of natural enemies of pests and disease					
	Maintain the field weed free					
	Clear of litter in the fields					
	Application of recommended dose of pesticides at appropriate stage					
	Avoid use of banned chemicals					
	Use of protective clothing and equipment while pesticide spraying					
	Use of green labelled pesticides					
	Safe disposal of waste and pollutants					
	Any other practices, please specify					
7	**Harvesting and post-harvest handling**					
	Harvest at the right stage of maturity					
	Harvest during the coolest part of the day - either early morning or late afternoon					
	Temperature and humidity control for storage					
	Harvested produce should be washed with clean water					
	Excessive water should be removed before packing or storing					
	Wash hands with soap before and after handling produce					
	Always keep containers, tools, equipment, packing and storage areas clean and tidy					
	New, unused bags to pack product for further transport and sale					
	Any other practices, please specify					

8	**Special practices**					
8.1	**Bitter gourd**					
	Adopt Pandhal System - Provide stakes to reach the pandal (2 m)					
	Stalking and trellishing					
	Pruning					
	Hormone application -spray Ethrel 100 ppm (1 ml dissolved in 10 lit of water) four times from 15th day after sowing at weekly intervals – inducing female flowers					
	Enhance pollination using beehives					
	Use of pheromone trap to control fruitfly					
	Not using copper and sulphur dust, as these are phytotoxic					
	Follow Grade Specification at harvesting- 20-25 cm long green fruits with short neck and tubercles					
8.2	**Vegetable cowpea**					
	Pinching - Before flowering, the tendrils should be pinched thrice for getting bushy plants					
	Control of cowpea mosaic virus					
	Spraying of specific biopesticide to control pod bugs					
8.3	**Bhendi**					
	Control of mites					
	Follow correct harvest specification - pods with hairy or tender smooth surface, 5-ridged medium length and remain tender for a longer period					
	Any other practices, please specify					

Kindly also assign scores to each component according to its relative importance in deciding the Good Agricultural Practice Adoption Index. Kindly make sure that the total score does not exceed 100, if any addition of new component is felt, please add them to the list and assign scores to that component also restricting the total to 100.

S.No	Components of Good Agricultural Practices	Score
1	Preparation of land and soil	
2	Seed/seedling quality parameters	
3	Sowing/transplanting parameters	
4	Nutrient management	
5	Irrigation management & drainage	
6	Plant protection measures (Pest and disease control)	
7	Harvesting and post-harvest handling	
	TOTAL	**100**

Name:

Signature:

Designation:

APPENDIX IV

Relevancy indices of dependent variables

S.No	Components	Relevancy indices
1	Preparation of land and soil	89.33*
2	Seed/seedling quality parameters	87.33*
3	Sowing/transplanting parameters	88.66*
4	Nutrient management	86.66*
5	Irrigation management & drainage	85.92*
6	Plant protection measures	90.66*
7	Harvesting and post-harvest handling	88.66*

*** Variables selected for the study**

APPENDIX V

Components of Good Agricultural Practices and their weightage

S.No	COMPONENTS	Weightage
1.	Land preparation	10.06
2.	Seed quality parameters	13.03
3.	Sowing parameters	12.13
4.	Nutrient management	17.06
5.	Irrigation management	9.09
6.	Pest and disease management	25.13
7.	Harvest and Post-harvest handling	12.66

APPENDIX VI

KERALA AGRICULTURAL UNIVERSITY
College of Agriculture,
Vellanikkara, Thrissur – 680651

DEPARTMENT OF AGRICULTURAL EXTENSION

Adoption of Good Agricultural Practices (GAP) among vegetable farmers of Palakkad district

INTERVIEW SCHEDULE

District: Palakkad Block: Panchayath:

1. Name:

   Address:

   Contact No.

2. Age: Up to 35 years ☐ 36-55 years ☐ above 55 years ☐

3. Gender: M / F

4. Experience in vegetable farming:

   Below 2 years ☐, 2-4 years ☐, 4-6 years ☐, above 6 years ☐

5. Area under vegetable cultivation ----------

6. Annual income --------

7. Education

S.No.	Education	
1.	Illiterate	
2.	Primary education	
3.	Secondary education	
4.	Higher Secondary education	
5.	Graduate and above	

8. Training received

Have you attended any training programme on Good Agricultural Practices (GAP): Yes / No If yes,

Title of training	Duration	Name of the agency, which provided training

9. Social participation

Are you a member in any of the organization? If yes give details

S.No	Name of organization	Frequency of contact		
		Regularly	Occasionally	Never
1.	Farmer associations / Farmers club			
2.	VFPCK's			
3.	Agriculture co-operatives			
4.	Youth club			
6.	NGO			
7.	Any other (Mention)			

10. Mass media exposure

S.No	Medium	Regularly	Occasionally	Never
1.	Newspapers			
2.	Magazines			
3.	Agricultural publications			
4.	Leaflets/ folders			
5.	Radio			
6.	Television			

11. Extension orientation

a. Extension agency contact

S.No	Extension agency	Frequency of contact		
		Regularly	Occasionally	Never
1.	Master farmer			
2.	Agricultural officers			
3.	Scientists			
4.	VFPCK's officer			
5.	ATMA staff			
6.	NGO worker			

b. Extension participation

S.No.	Activities	Frequency of participation		
		Regularly	**Occasionally**	**Never**
1.	Study tours			
2.	Seminars			
3.	Exhibition			
4.	Group farming meetings			
5.	Demonstrations			
6.	Farmer's day			

12. Risk taking ability

(**SA**- Strongly Agree, **A**-Agree, **UD**-Undecided, **D**-Disagree, **SD**-Strongly Disagree)

S.No	Statements	SA	A	UD	D	SD
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 Good Agricultural Practices, unless most others in the locality have used it with success					
6.	Trying an entirely Good Agricultural Practices by a farmer involves risk but it is worth					

13. Economics motivation

(**SA**- Strongly Agree, **A**-Agree, **UD**-Undecided, **D**-Disagree, **SD**-Strongly Disagree)

S.No	Statements	SA	A	UD	D	SD
1.	A farmer should work towards larger yields and economic returns					
2.	The most successful farmer is one who makes the most profit					
3.	A farmer should try any new farming idea which may earn him more income					
4.	It is difficult for the farmer's children to make a good start unless he provides them with economic assistance					
5.	A farmer must earn his living, but the most important thing in life cannot be defined in economic terms					

14. Environmental orientation

S.No	Statements	SA	A	UD	D	SD
1.	Indiscriminate use of pesticides cause environmental hazards					
2.	Man is exploiting the earth too much					
3.	Man has to be greatly concerned about environmental issues like soil pollution, air pollution, water pollution etc					
4.	There is truth in what environmental activists claim and we should lend our support to them					
5.	The present trend is to reduce the use of chemical control measures. Now do you agree that older methods of farming were more safer than the present ones					
6.	Agricultural produce obtained without use of chemicals are more tastier and healthier					

15. Market perception

S.No	Statements	SA	A	UD	D	SD
1.	Adoption of GAP in vegetable cultivation increases the quality thereby price will also increase for GAP products					
2.	More demand for GAP vegetables compared to conventional farming methods					
3.	Market information plays an important role for farmers for selling their GAP vegetables					
4.	One should select the proper market channel for selling the GAP produced vegetables					
5.	A good farmer should keep in touch with current market information regarding GAP					
6.	High cost of cultivation for GAP produce will increase the market price of the vegetables					

16. Awareness and adoption of farmers about Good Agricultural Practices (GAP) in vegetable cultivation

S.No	Good Agricultural Practices	Awareness			Adoption			
		High	Medium	Low	Full	Partial	Replaced / Disenchantment	No adoption
A	**Land and soil preparation**							
1	Ploughing and digging							
2	Applying FYM and other organic materials							
3	Soil testing & SHC							
4	Crop rotation – avoid same crop in same location							
5	Correction of Soil acidity / alkalinity							

B	**Seed / seedling quality parameters**							
1	Seed/ seedling treatment							
2	Procurement of seeds from certified/ authorized source							
3	Pest and disease-free seedlings							
4	Usage of resistant varieties of natural calamities &risks							
5	Usage of own seeds with physical and genetic purity							
6	Keep seeds in sealed containers and store in a cool place							
C	**Sowing / transplanting parameters**							
1	Adoption of recommended seed rate							
2	Planting at recommended spacing							
3	Regular weed control							
4	Transplanting at correct age of seedlings							
5	Using appropriate growing medium							
D	**Nutrient management**							
1	Nutrient application based on soil testing report							
2	Application of bio fertilizers							
3	Recommended dose of fertilizers							
4	Application of micronutrients							

E	**Irrigation management**							
1	Ensuring water quality – EC& PH							
2	Adoption of micro-irrigation methods							
3	Adopt fertigation							
4	Avoid uneven application of water							
5	Mulching							
F	**Pest and disease management**							
1	Instant removal of infected plant parts							
2	Planting trap crops							
3	Use of bio control agents / bio pesticides							
4	Applications of recommended dose of chemicals							
5	Use of green labeled chemicals							
6	Strictly adhere to the withholding period							
7	Avoid use of banned chemicals							
8	Safe handling of chemicals and pesticides							
G	**Harvesting and post-harvest handling**							
1	Harvest at the right stage of maturity							
2	Harvest produce should be washed with clean water							

3	Excessive water should be removed							
4	Temperature and humidity control for storage							
5	Use new and unused bags for packing							
H	**Special practices**							
A	**Bitter gourd**							
1	Pandal system – 2m							
2	Stalking and trellishing							
3	Hormone application – etherl 100 ppm							
4	Enhance pollination – bee hives							
5	Pheromone trap - fruitfly							
6	Grading 20-25 cm long fruits with short neck and tubercles							
B	**Vegetable cowpea**							
1	Pinching							
2	Control of cowpea mosaic virus							
3	Control of pod bugs							
C	**Bhendi**							
1	Control of mites							
2	Control of bhendi mosaic virus							
3	Follow correct harvest specification – pods with hairy and tender smooth surface, 5- ridged medium length							

17. Constraints

Constraints faced by the farmers in adoption of Good Agricultural Practices (GAPs) in vegetable cultivation

(**MS**- More serious, **S**- Serious, **LS**- Less serious)

S.No	Constraints	MS	S	LS	Reason
A	**Information and publicity**				
1.	Lack of awareness of good agricultural practices				
2.	Lack of knowledge & skill in use of good agricultural practices				
3.	Lack of technical guidance				
4.	Insufficient information regarding horticultural schemes				
5.	Any others (specify)				
B	**Marketing**				
1.	Lack of market knowledge				
2.	Lack of access to specialized market for GAP				
3.	Lack of local market demand				
4.	Unavailability of post–harvest storage facilities in market				
5.	Lack of better pricing for GAP				
6.	Any others (specify)				
C	**Financial**				
1.	Increase in cost of production of Good Agricultural Practices				
2.	Certification process too complicated, lengthy and costly				
3.	Decline in income during conversion of conventional farming to good agricultural practices				
4.	Inadequate loan/credit facility				
5.	Any others (specify)				

D	**Production and labour**				
1.	Unavailability of bio inputs like fertilizers, plant protection chemicals, herbicides etc.				
2.	High cost of bioinputs				
3.	Increased labour and land management requirements				
4.	Increased difficulty in management of pest and disease incidence				
5.	Less land holding				
6.	Any others (specify)				

18. Have you acquired India Good Agriculture Practices (INDGAP) Certification? (Yes/No)
If yes,
Details of certification

19. Have you acquired Organic farming and Good Agriculture Practices (GAP) scheme?
If yes, Details

20. Suggestions

1.
2.

ADOPTION OF GOOD AGRICULTURAL PRACTICES (GAP) AMONG VEGETABLE FARMERS OF PALAKKAD DISTRICT

By

NAGADEVI G
(2019-11-026)

ABSTRACT OF THE THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Science in Agriculture

Faculty of Agriculture

Kerala Agricultural University, Thrissur

DEPARTMENT OF AGRICULTURAL EXTENSION

COLLEGE OF AGRICULTURE VELLANIKKARA,

THRISSUR – 680656

KERALA, INDIA

2021

Abstract

Quality of food will ensure the healthy life of human beings. Vegetables play a major role in human health and nutrition. People are now focused on the benefits of consumption of fresh and residue-free fruits and vegetables. Quality of vegetables greatly depends on the production system as well as handling procedures before and after harvest. The concept of Good Agricultural Practices (GAP) evolved recently as a result of the big concern about food safety and quality and the environmental sustainability of agriculture. The study entitled "Adoption of Good Agricultural Practices among vegetable farmers of Palakkad district" was aimed to examine the extent of adoption of GAP in vegetables.

Palakkad district was purposively selected for the study based on the highest area under vegetable cultivation in Kerala. The respondents were selected using multistage proportional random sampling method. Four blocks namely Nenmara, Alathur, Chittur and Kollengode representing more area of vegetable cultivation were selected from the district and 30 farmers with a minimum of 30 cents of vegetable cultivation were selected randomly from each block. Based on the total area of cultivation of vegetables in the district, bitter gourd, vegetable cowpea and bhindi were selected for the study. Thus, a total of 120 vegetable farmers in Palakkad district constituted the sample for the study.

Analysis of the profile characteristics of vegetable farmers showed that majority of the vegetable farmers (67 per cent) belonged to middle age category. Most of the vegetable farmers (42.50 per cent) had secondary school education. Fifty-four per cent of the respondents were having high level of experience in vegetable cultivation. Most of the vegetable farmers (56 per cent) belonged to marginal farmers with respect to area under vegetable cultivation. Majority of the farmers had medium level of annual income (65 per cent). Around 89 per cent of the vegetable farmers had undergone training in GAP. Fifty-seven per cent of the vegetable farmers belonged to medium category with respect to mass media exposure. More than half of the vegetable farmers (52 per cent) had medium level of extension contact. Most of the farmers belonged to medium category of social participation (58 per cent), economic motivation (52 per cent) and market perception (47 per cent) followed by forty-eight per cent of the farmers belonged to the category of low risk-taking ability. Nearly sixty per cent of the respondents (59 per cent) had high environmental orientation.

Assessment of the Awareness level of GAP among vegetable farmers showed that majority of the respondents had medium (77 percent) level of awareness, while 12 per cent of them had low level of awareness and 11 per cent had high level of awareness. Regarding the awareness level on various components of GAP, farmers were highly aware about land preparation and soil management (81.42) as well as harvesting and post -harvest handling (84.32) practices. Awareness level on the remaining practices viz. seed quality parameters, sowing and intercultural operations, irrigation management and drainage, nutrient management and plant protection measures were found to be medium level.

Overall Adoption Index of GAP in vegetable cultivation was found to be medium (73.21). The Adoption Score on components of GAP viz. land preparation and soil management (79.56) and harvesting and post -harvest handling (81.05) was high, while that on seed quality parameters, sowing and intercultural operations, nutrient management and plant protection measures were medium. The component that had lowest level of Adoption Score was irrigation management and drainage (54.04). Comparing the overall adoption of GAP among three categories of vegetable farmers by using Kruskal Wallis One way Analysis, it was found that there was no significant difference between bitter gourd, vegetable cowpea and bhindi farmers. The socio-economic and psychological characteristics of vegetable farmers played a vital role in determining their adoption of GAP. The results of Karl Pearson correlation analysis showed that area under cultivation, experience in vegetable cultivation, training received, mass media exposure, extension contact, economic motivation, market perception and environmental orientation had positive and significant relationship with the adoption of GAP.

Major constraints in adoption of GAP were identified as difficulty in management of pests and diseases, high cost and the complicated process involved in GAP certification and increased cost of bio-inputs. It could be concluded that adoption of GAP will be a viable option for the vegetable farmers, if their awareness and capacity building is enhanced and ensure specialized markets for GAP products. Increased access to subsidized bio inputs and motivating farmers in following cost-effective certification process like Participatory Guarantee System (PGS) will also contribute to improved adoption of Good Agricultural Practices.